GASTROPODS FROM THE JURASSIC NEPTUNIAN SILLS OF ROCCA BUSAMBRA (NORTH-WESTERN SICILY, ITALY): PATELLOGASTROPODA, PLEUROTOMARIOIDEA, SCISSURELLOIDEA, FISSURELLOIDEA AND EUCYCLOIDEA

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Abstract: The gastropods from Jurassic neptunian sills of Rocca Busambra (Sicily, Italy) represent an extraordinary assemblage for richness and extremely high degree of novelty, consisting of about 250 species, two thirds new, of twenty superfamilies. Thirty-eight species and 18 genera of Lottioidea, Pleurotomarioidea, Scissurelloidea, Fissurelloidea and Eucycloidea are described. Thirty species and nine genera are new, namely *Ramusatomaria nuda* gen. et sp. nov., *Trapanimaria gattoi* gen. et sp. nov., *Trapanimaria nicolosiensis* gen. et sp. nov., *Trapanimaria*? *pallinii* gen. et sp. nov., *Trochotomaria conoidea* sp. nov., *Trochotomaria polymorpha* sp. nov., *Laevitomaria babalusciae* sp. nov., *Pyrgotrochus vorosi* sp. nov., *Auritoma lenticula* gen. et sp. nov., *Busambrella fasciata* gen. et sp. nov., *Emarginula* (*Emarginula*) *burgioi* sp. nov., *Emarginula* (*Tauschia*) *acutidens* sp. nov., *Propeucyclus sicanus* gen. et sp. nov., *Propeucyclus obesus* gen. et sp. nov., *Propeucyclus*? *semireticulatus* gen. et sp. nov., *Eucyclomphalus*? *marenostrum* sp. nov., *Toronyella lineata* gen. et sp. nov., *Toronyella margaritata* gen. et sp. nov., *Zarnglaffia polygonalis* sp. nov., *Zarnglaffia palermitana* sp. nov., *Ambercyclus cratisculptus* sp. nov., *Elymicyclus alternatus* gen. et sp. nov., *Elymicyclus ietumensis* gen. et sp. nov., *Elymicyclus martae* gen. et sp. nov., *Elymicyclus garibaldii* gen. et sp. nov., *Jurassiscala sturanii* gen. et sp. nov., *Jurassiscala*? *tenuiretis* gen. et sp. nov., *Fischeriella sicula* sp. nov., *Retimusina poseidoni* gen. et sp. nov. and *Retimusina*? *tritoni* sp. nov. The new scissurelloidean family Auritomidae fam. nov. is erected. The palaeobiogeographical analysis indicates close relationships with coeval faunas from condensed pelagic carbonates of the central region of western Tethys.

Key words. Systematics, Gastropoda, Jurassic, neptunian sills, western Tethys, palaeobiogeography, Sicily.

DURING the Early Jurassic, wide shallow water and carbonate platform areas of the central part of western Tethys drowned as an effect of the westward progression of Neotethyan rifting (Channell *et al.* 1979; Ziegler 1988; Fourcade *et al.* 1996; Philip *et al.* 1996; Ricou 1996; Ziegler & Horváth 1996; Dercourt *et al.* 2000; Cavazza *et al.* 2004). In these areas the deposition of pelagic carbonate mud and shale started and persisted throughout the Jurassic period and, especially in topographically elevated areas that became scene of condensed pelagic sedimentation, gastropod communities developed which were profoundly different from those of the epicontinental seas and of the Tethyan shallow water carbonate platforms. Most of these faunas are known from Sinemurian to Pliensbachian and from Bajocian sediments of several palaeogeographical units, such as the Transdanubian Range (Hungary) (Szabó 1979, 1980, 1981, 1982, 1983, 1995, 1996, 2008,

2009, 2012, 2016; Conti & Szabó 1987, 1988; Galácz & Szabó 2001; Gatto *et al.* 2015*a*), Northern Calcareous Alps (Austria) (Stoliczka 1861; Vörös *et al.* 2003; Szabó 2009, 2016, 2017; Mandl *et al.* 2010), Venetian Southern Alps (northern Italy) (De Gregorio 1886*a–d*; Vacek 1886; Parona 1894; De Toni 1912; Conti & Fischer 1984*a*; Conti 1988; Conti & Szabó 1989; Gatto & Monari 2010), western Pontides (Turkey) (Conti & Monari 1991), Umbria-Marche zone (central Italy) (Conti & Fischer 1981, 1984*b*,*c*; Conti & Monari 1986, 1995, 2003; Conti & Szabó 1987, 1988; Gatto *et al.* 2015*a*), Calabrian Arc (southern Italy) (Greco 1899; Gemmellaro 1911; Monari *et al.* 2008), western Sicily (Gemmellaro 1874; De Gregorio 1886*e*; Kuhn 1934; Wendt 1968, 1971; Conti *et al.* 1993, 2004, 2007; Szabó *et al.* 1993; Monari *et al.* 1996) and from Callovian deposits of the Pieniny Klippen Belt (southern Poland) (Uhlig 1878, 1881).

This paper provides the first detailed results of the systematic study of the gastropods collected and preliminarily identified by one of us (JW) during the 1960s from the Toarcian–Kimmeridgian neptunian sills of Rocca Busambra massif (north-western Sicily, southern Italy) (Wendt 1971, 2017). For its excellent preservation, extraordinary richness and diversification, and for the extremely high degree of taxonomic novelty, this material represents one of the most important Jurassic gastropod faunas of western Tethys. Its study adds an enormous amount of new data contributing to the general systematics of the class and to the reconstruction of the evolutionary and the palaeobiogeographical history of the Jurassic gastropods. Moreover, it greatly enhances the knowledge on the diversity of this group in the areas of the central western Tethys characterized by condensed pelagic deposition and helps better understanding of the effects on the benthic macrofaunas of the major events driving the palaeoenvironmental history of this region, such as the Neotethyan rifting, the faunal turnover related to the Toarcian anoxic event and the Late Jurassic diffusion of the biosiliceous ooze. In this paper, the Patellogastropoda, Pleurotomarioidea, Scissurelloidea, Fissurelloidea and Eucycloidea are described in detail as first contribution of a series.

GEOGRAPHICAL LOCATION AND GEOLOGICAL SETTING

The neptunian sills yielding the gastropod faunas described here crop out at Piano Pilato (DMS grid 37° 51' 22.38"–46.68" N; 13° 19' 17.16"–20' 39.66" E) on the southern slope and western end of Rocca Busambra, a mountain range 8 km north-east of Corleone and 25 km south of Palermo (Fig. 1A). The Jurassic sedimentary succession of Rocca Busambra (Fig. 1B) has been described by numerous authors and an extensive review is reported in Wendt (2017) to which the reader is referred for details. Most of the data synthesized below come from that contribution.

The bulk of the massif consists of peritidal platform carbonates of the Inici Formation (Upper Triassic – Lower Jurassic) mainly organized in a cyclic sequence of sub- to intertidal deposits. The top of the unit is a very articulated erosional surface and corresponds to a distinct depositional unconformity that marks a major gap spanning the late Sinemurian (or early Pliensbachian?) to the early Bathonian. The surface is capped by a laminated ferromanganese oxyhydroxide crust which is the most conspicuous level in the Jurassic sequence of the Trapanese and Saccense zones. At Piano Pilato the crust is a few to about 60 cm thick and consists of wavy brownish to blackish laminae with intercalated iron-stained mudstones. Red crinoidal limestones overlie the ferromanganese crust. At Piano Pilato they can be absent or only a few decimetres thick and with the top also covered with a ferromanganese crust. This unit have not yielded any diagnostic fossils, but lines of evidence on similar deposits in western Sicily suggest a Pliensbachian age. The Middle to Upper Jurassic part of the sequence is represented by the Buccheri Formation, generally called Rosso Ammonitico, which consists of up to 10 m of thick-bedded red wackestone and packstone, commonly with a high amount of crinoid debris. The ammonites from the lowermost 80 cm document at least three intervals: Lower Bathonian – Middle Callovian, Upper Oxfordian and Lower Kimmeridgian. The occurrence of *Calpionella alpina* 7.5 m above the base indicates that the uppermost part of the unit is Lower Tithonian. White marly

limestones of the Lattimusa Formation disconformably overlie the Buccheri Formation and represent the youngest deposits cropping out at Piano Pilato.

Three aspects of exceptional geo-palaeontological interest make the Rocca Busambra a unique reference area. The first concerns the Sinemurian fossils from the upper part of the Inici Formation, a very rich fauna composed of brachiopods, bivalves, gastropods and few ammonites described by Gemmellaro (1878, 1879, 1882) and subsequent authors (De Gregorio 1886*f*; Carapezza & Taglierini 1895; Taglierini 1895; Fucini 1913). The second aspect is the very complex system of polyphase Toarcian–Miocene neptunian dykes and sills crisscrossing the upper tens of metres of the Inici Formation. The dykes are filled with red, pink or white structureless calcareous mudstone which is usually devoid of macrofossils. In contrast, the sills contain a highly abundant fauna. They can have a lateral extent of up to 300 metres, and are filled with thin-bedded to laminated, brick-red mudstone or packstone. Most of the knowledge on the neptunian dykes and sills of Rocca Busambra were acquired during the 1960s thanks to the intensive studies made by Wendt (1962, 1963, 1965, 1969). These studies culminated with a monograph (Wendt 1971) documenting an extremely condensed deposition over a very long time span. In one of the most extended and productive neptunian sill, less than one metre thick, Wendt (1971), based on the study of the ammonites, recognized 17 condensed stratigraphical intervals and corresponding faunal units from Lower Toarcian to Upper Kimmeridgian. Recently, Wendt (2017) has revised the biostratigraphy of the neptunian sills. The results of his analysis are synthetically reported here (Table 1) and are of direct interest for the stratigraphical collocation of the gastropods studied. Actually, the neptunian dykes and sills of Rocca Busambra represent the most extreme example of stratigraphical condensation currently known (Wendt 2017).

The third aspect obviously concerns the fossil content of the neptunian sills that is represented by excellently preserved and extraordinarily rich faunas both in number of specimens and taxonomic diversity. Ammonites are the most common fossils. About 5000 specimens of more than 400 species have been computed by Wendt (2017). Also the gastropods are very abundant (see below) (Fig. 2). Brachiopods (19 species and 172 specimens) and bivalves (36 species and about 200 specimens) are much less represented, even if locally the bivalves may constitute 20% of the total assemblage. Other invertebrate groups, such as corals, belemnites and aulacoceratids (see Weis *et al.* 2014 for details), scaphopods, crinoids, echinoids and crustaceans are also present but in small number of specimens and species.

THE GASTROPOD FAUNAS

The material consists of about 2800 specimens (Wendt 1971, 2017). Wendt (1968) studied in detail the species of the genus *Discohelix* Dunker, 1847 instituting the subgenus *Discohelix* (*Pentagonodiscus*) Wendt, 1968, and six new species. He also tentatively classified most of the specimens of the other groups (Wendt 1971). The Trochoidea, Turbinoidea and supposed Rissooidea were treated in subsequent papers concerning the systematics of the gastropods at higher taxonomic rank (Conti *et al.* 1993; Szabó *et al.* 1993; Monari *et al.* 1996). Conti *et al.* (2004) reported a synthesis of the knowledge acquired so far in the study of these faunas. Since then, numerous papers have improved the general systematic arrangement of the Class Gastropoda Cuvier, 1795 and of the Mesozoic groups (e.g. Bouchet & Rocroi 2005; Bandel 2007, 2009, 2010; Gründel 2008, 2011; Ponder & Lindberg 2008; Gründel & Nützel 2012, 2013; Bouchet *et al.* 2017) and this has made it necessary to update accordingly the computation of the taxonomic diversity of the faunas from Rocca Busambra (Fig. 3A).

Wendt (1971) identified about 130 species of gastropods but a subsequent preliminary analysis by Conti *et al.* (2004) increased their number to 224. Studies being carried out by the present authors lead to a current estimate of 252 species, two thirds of them are new. Other seven species are provisionally excluded because at the moment their poor preservation does not permit a safe identification. The taxonomic novelty is very high also at the genus level. A hundred-four genera/subgenera have been recognized of which about 50 are new.

More than 20 superfamilies are represented and a few others are perhaps present in part of the material provisionally considered as *Incertae sedis* (Conti *et al.* 2004). Almost half of the species belongs to vetigastropod groups (Pleurotomarioidea, Scissurelloidea, Fissurelloidea, Eucycloidea, Trochoidea and Turbinoidea). The Ataphridae and Proconulidae are most represented being approximately one third of the total number of species. Also the Eucycloidea show a high specific diversification. In the remaining part of the material, the Neritoidea, Coelostylinidae, Cerithioidea and Zygopleuroidea are the dominant groups (Fig. 3A).

Among the seventeen stratigraphical intervals defined by Wendt (1971), the Upper Toarcian (Fauna 3), condensed Aalenian – Lower Bajocian (Fauna 5) and Upper Bajocian (Fauna 10) deposits show the highest species diversity (Conti *et al.* 2004) (Fig. 3B). After a distinct Bathonian gap in the stratigraphical sequence of the neptunian sills (Wendt 1971, 2017) the diversity decreases abruptly.

MATERIAL AND METHODS

The material described here consists of about 160 specimens representing 38 species and is stored at the Institut und Museum für Geologie und Paläontologie, Universität Tübingen (Germany). It comes from condensed levels of neptunian sills, except three specimens, specified in the systematic part, that were collected in neptunian dykes. As far as the systematic arrangement at the highest taxonomic ranks is concerned, Ponder & Lindberg (1997), Bouchet & Rocroi (2005), Bouchet *et al.* (2017) and the online information reported in the Paleobiology Database (https://paleobiodb.org) and Fossilworks (fossilworks.org) have been taken into consideration. Other more specific contributions have also been considered and their references are reported in the remarks of the groups concerned. The taxonomic analysis and species comparisons benefited from the data and illustrations reported in the online catalogues of the Muséum national d'Histoire naturelle, Paris, France (https://science.mnhn.fr) and the British collections of the GB3D Type Fossils Online project (http://www.3d-fossils.ac.uk).

The most significant specimens are illustrated and measured. The photographs have been made with the focus stacking method and elaborated with Helicon Focus Pro 6.7.1 software. The specimens were preventively coated with ammonium chloride. The measurements of the specimens are reported in Tables 2 and 3, and the abbreviations of the dimensions are shown in Figure 4. The symbols reported in the synonymies are those listed in Matthews (1973). Most of the morphological terms applied in the systematic descriptions are defined by Cox (1960*a*). In that paper, the abapical part of inner lip is named as columellar lip. However, this term sounds incongruous when used in description of phaneromphalous shells, lacking a columella. The term umbilical lip is here introduced for these shells.

SYSTEMATIC PALAEONTOLOGY

Institutional abbreviations. BSPG, Bayerische Staatssammlung für Paläontologie und Geologie, Munich, Germany; GPIT, Institut und Museum für Geologie und Paläontologie, Universität Tübingen, Germany; MPUR, Museum of Palaeontology, Department of Earth Sciences, University "La Sapienza", Rome, Italy.

Class GASTROPODA Cuvier, 1795
Subclass PATELLOGASTROPODA Lindberg, 1986
? Superfamily LOTTIOIDEA Gray, 1840
? Family ACMAEIDAE Forbes, 1850

Genus PSEUDORHYTIDOPILUS Cox, 1960*b*

Type species. Pseudorhytidopilus lennieri Cox, 1960*b*, pro *Scurria* (*Pseudorhytidopilus*) *lennieri* Haber, 1932 *nom. nud.* (= *Helcion castellana* Lennier, 1868, non Thurmann & Étallon, 1861). Kimmeridgian, Seine Inférieure (France).

Pseudorhytidopilus? sp.
Figure 5A–E

v 1981 *Pseudorhytidopilus* sp.; Szabó, p. 55, pl. 1, fig. 1.

Material. One specimen, GPIT 1685/42, Aalenian – Lower Bajocian (*Leioceras opalinum – Sonninia propinquans* biozones).

Description. The shell is thin-walled, cap-shaped, quite high and bilaterally symmetrical. The peristome is ovate. The cross section in symmetry plane shows a slightly convex outline of one (posterior?) side and a somewhat concave outline of the other (anterior?) side. The muscle scar and shell structure are unknown. The outer shell surface is smooth. Only very weak growth lines and obscure radial lines are visible under strong magnification.

Dimensions. See Table 2.

Remarks. The specimen is a strongly incomplete shell lacking the apical part. Its shape and ornament are comparable to those of the shell described by Szabó (1981) as *Pseudorhytidopilus* sp., from the Bajocian beds of the Bakony Mountains (Hungary). It differs only in being slightly more asymmetrical. The preservation of the material does not permit a more precise identification.

Pseudorhytidopilus? *detonii* (Haber, 1932) (p. 218; Gatto & Monari 2010, p. 776, text-fig. 4A–G), from the Pliensbachian of Venetian Alps (Italy) has a lower shell and slightly elliptical peristome. *Pseudorhytidopilus conoideus* (Lepsius, 1878) (p. 367, pl. 7, fig. 3a–b; Haber 1932, p. 214), from the Toarcian of western Venetian Alps (Italy) has a bigger size, much lower shell and a distinctly elliptical peristome. Also in *Scurria tirolensis* (Tausch, 1890) (p. 34, pl. 1, fig. 6a–b), from the Early Jurassic of the western Venetian Alps (Italy), the size is bigger, the shell is lower and the peristome is more circular.

Distribution of the species. Lower Bajocian (*Stephanoceras humphriesianum* Biozone), Somhegy (Bakony Mts, Hungary); Aalenian – Lower Bajocian (*Leioceras opalinum – Sonninia propinquans* biozones), Rocca Busambra (north-western Sicily, southern Italy).

Subclass VETIGASTROPODA Salvini-Plawen, 1980
Superfamily PLEUROTOMARIOIDEA Swainson, 1840
Family STUORELLIDAE Bandel, 2009

Genus RAMUSATOMARIA nov.

LSID. urn:lsid:zoobank.org:act:XXXXXXXXX

Derivation of name. From Rocca Ramusa, a peak of Rocca Busambra massif. Gender feminine.

Type species. *Ramusatomaria nuda* sp. nov., by monotypy. Upper Toarcian, Rocca Busambra (north-western Sicily, southern Italy) (see below).

Diagnosis. Shell small, conoidal with slightly cyrtoconoidal outline. Adult whorls almost flat with extremely narrow sutural shelf. Selenizone slightly below mid-whorl, wide, flat to weakly impressed between two thin spiral threads. Periphery roundedly angular. Base flat. Early shell

phaneromphalous. Fully adult part of shell anomphalous or cryptomphalous. Umbilical lip callous and reflected towards axial region of base. Shell almost smooth or with obscure spiral threads. Selenizone almost smooth on latest whorls.

Remarks. *Ramusatomaria* gen. nov. has a shell shape approaching that of *Codinella* Kittl, 1899, a taxon accommodated by Knight *et al.* (1960) in the family Phymatopleuridae Batten, 1956, and moved by Bandel (2009) to the family Stuorellidae Bandel, 2009 on the basis of its similarity with *Stuorella* Kittl, 1891 (see also Bandel 1991). The type species, *Codinella generellii* (Stoppani, 1858) (p. 57, pl. 12, fig. 23; Kittl 1899, 16, pl. 1, figs 16–18), is ornamented by two shallow spiral cords, subsutural and peripheral, respectively. The selenizone is edged by relatively strong spiral threads. In contrast, *Ramusatomaria* is almost smooth and the selenizone is limited by thin spiral threads.

Included species and occurrence. The genus is represented only by the type species from the lower Upper Toarcian of Rocca Busambra (north-western Sicily, southern Italy).

Ramusatomaria nuda sp. nov.
Figure 5F–K

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v 1971 *Pleurotomaria sibylla* d'Orbigny; Wendt, p. 154.

Derivation of name. From the Latin adjective *nudus*, nude, referring to the poorly developed ornament.

Holotype. GPIT 1685/33 (Fig. 5F–K).

Type Locality. Piano Pilato, Rocca Busambra (north-western Sicily, southern Italy).

Type level. Upper Toarcian (*Haugia variabilis – Phlyseogrammoceras dispansum* biozones) neptunian sill limestone.

Additional material. None.

Diagnosis. As for genus.

Description. The shell is small and conoidal. Its outline is slightly cyrtoconoidal. The penultimate whorl is wide about four times of its height. The suture is incised and very slightly impressed. The whorl surface is almost flat or very slightly convex. It shows an extremely narrow, almost horizontal sutural shelf, which gives a slightly telescopical outline to the fully adult shell. The selenizone runs slightly below mid-whorl and is delimited by very thin spiral threads. It is flat and weakly impressed. Its width is about 25% of the height of the whorl surface. The slit extends about one quarter of the length of the last whorl (80–90° back from the peristome). The periphery is rounded. The base is flattened and has a weakly convex surface tending to become concave on its adaxial half. The broken surface of the early shell shows a rather wide umbilicus whereas the fully adult part of the shell is anomphalous or cryptomphalous. The umbilical lip is strong, callous and outward reflected. The basal shell wall becomes considerably thicker towards the axial region.

The surface of the whorls is almost smooth and only some obscure spiral lines are visible under magnification. The peripheral region of the last whorl and the base bear also very shallow, obscure spiral threads. The selenizone bears only weak growth lines. The growth lines are

moderately prosocline and prosocyrt above the selenizone, strongly opisthocline and prosocyrt between the selenizone and the abapical suture and parasigmoidal on the base.

Dimensions. See Table 2.

Remarks. The specimen lacks the apical part and shows numerous repaired fractures. In spite of its small size, the presence of a strong, callous umbilical lip and the crowded growth lines on the final part of the last whorl suggest that the specimen represents a fully adult shell. *Pleurotomaria sibylla* d'Orbigny, 1855 (p. 442, pl. 363, figs 1–7), a species considered by Fischer & Weber (1997, p. 168, pl. 34, fig. 14) a junior synonym of *Pyrgotrochus grasanus* (d'Orbigny, 1855) differs from *Ramusatomaria nuda* sp. nov. in having a higher and much bigger shell, lower whorls and swollen periphery.

Distribution of the species. Upper Toarcian (*Haugia variabilis – Phlyseogrammoceras dispansum* biozones), Rocca Busambra (north-western Sicily, southern Italy).

Family PLEUROTOMARIIDAE Swainson, 1840

Remarks. The genera ascribed here to the family Pleurotomariidae Swainson, 1840 share with *Pleurotomaria* Defrance, 1826 the earliest teleoconch whorls that are evenly convex, ornamented by a sharp and regular network of spiral threads and collabral riblets, and bearing a concave to flat selenizone at or slightly below mid-whorl (Monari & Gatto 2013). A very similar early teleoconch is present in other pleurotomariid genera, like *Bathrotomaria* Cox, 1956, *Leptomaria* E. Eudes-Deslongchamps, 1864, *Obornella* Cox, 1959 and *Szabotomaria* Monari, Gatto & Valentini, 2017 (Monari & Gatto 2014; Monari *et al*. 2018). A sharp reticulate ornament is typical also of the members of the family Phymatopleuridae Batten, 1956. However, unlike the Pleurotomariidae, in the Phymatopleuridae, including the type genus *Phymatopleura* Girty, 1939, the selenizone of the early teleoconch runs well below the middle of the whorl, almost in contact with the abapical suture and this position is retained on the adult shell (Batten 1956; Kues & Batten 2001 and references therein). This character is considered by Batten (1956) and Knight *et al.* (1960) as diagnostic of the family.

Genus TRAPANIMARIA nov.

LSID. urn:lsid:zoobank.org:act:XXXXXXXXX

Derivation of name. From Trapani, a town near the type locality of the type species. Gender feminine.

Type species. *Trapanimaria gattoi* sp. nov. Lower Kimmeridgian, Rocca Busambra (north-western Sicily, southern Italy) (see below).

Diagnosis. Shell depressed to moderately high, with subgradate-conoidal shape. Whorls bearing obtuse angulation below mid-whorl. Ramp wide and gently convex. Outer face of whorls concave. Selenizone on angulation, rather narrow to moderately wide, initially flat then concave, and bordered by two spiral threads or cords. Base distinctly convex, with wide umbilicus and encircled by variably prominent peripheral swelling or keel. Early spire ornamented by subregular network of sharp, evenly spaced spiral threads and dense collabral riblets. Collabral riblets persisting as subregular ridges on fully adult whorls. Spiral ornament of fully adult shell consisting of thin threads commonly more evident on outer face and peripheral region. Selenizone ornamented by sharp lunulae on early teleoconch gradually disappearing on subsequent whorls.

Remarks. *Trapanimaria* gen. nov. is close to *Bathrotomaria* Cox, 1956 in the general shell morphology and the position of selenizone on the angulation of the whorl surface. However, in *Bathrotomaria* the selenizone of the adult shell is convex and the shape of the shell is commonly more distinctly gradate. *Leptomaria* E. Eudes-Deslongchamps, 1864 differs from *Trapanimaria* in lacking a mid-whorl angulation. The selenizone of the adult shell is flush or slightly elevated in post-juvenile stage and edged by distinct striae whereas in *Trapanimaria* it is concave and sunken between two spiral cords or threads. Moreover, in *Leptomaria* the peripheral bulge is commonly absent (see Monari & Gatto 2014 for further details). In *Obornella* Cox, 1959 the adult shell is sublenticular with a cord-shaped selenizone running close to the abapical suture, a very narrow outer face almost completely covered by the subsequent whorl, and a much stronger ornament pattern. Also *Indomaria* Das, 2002 has a general shell morphology similar to that of *Trapanimaria*. It seemingly differs in having a convex selenizone and flatter base. The illustration of the type species (Das 2002, p. 104, text-figs 3, 4A–B) shows a very poorly preserved material which prevents more detailed comparisons. *Pleurotomaria* Defrance, 1826 has a more gradate shell and flatter base, the shoulder of the adult shell is provided with a row of nodes and the selenizone runs on the outer face (Monari & Gatto 2013).

Trapanimaria is also reminiscent of genera currently considered not belonging to the Pleurotomariidae, namely *Foveolaria* Szabó, 2016 and *Trachybembix* Böhm, 1895. *Foveolaria*, a genus from Sinemurian to Pliensbachian of central western Tethys and western Europe tentatively ascribed by Szabó (2016) to the family Pithodeidae Wenz, 1938, shares with *Trapanimaria* the ornament pattern, a flat to concave selenizone delimited by sharp marginal threads and placed below mid-whorl, and a slightly concave outer face. However, in *Foveolaria* the shell is much higher, reflecting a more sloping suture, the umbilicus is narrower and the selenizone is wider. *Trachybembix*, a genus from Middle Triassic of southern Alps assigned by Nützel (2017) to the family Eotomariidae Wenz, 1938 differs from *Trapanimaria* in having a distinctly concave ramp and a strong, nodose or corrugated subsutural spiral cord. Moreover, the selenizone runs on a much more prominent median angulation.

Included species and occurrence. The genus ranges from the Middle Oxfordian to the Tithonian and is represented by the following species, listed in stratigraphical order:

Trapanimaria eudora (d'Orbigny, 1860) (p. 554, pl. 417, figs 11–15; Fischer & Weber 1997, p. 204, pl. 37, fig. 10a–c), Middle – Upper Oxfordian, Vendée (western France);

Trapanimaria nicolosiensis sp. nov. (here), Upper Oxfordian – Upper Kimmeridgian, north-western Sicily (southern Italy);

Trapanimaria gattoi sp. nov. (type species, here), Lower – Upper Kimmeridgian, north-western Sicily (southern Italy);

Trapanimaria? *pallinii* sp. nov. (here), Lower – Upper Kimmeridgian, north-western Sicily (southern Italy);

Trapanimaria alba (Quenstedt, 1857) (p. 624, pl. 77, fig. 15; 1882, p. 359, pl. 199, figs 9–10; Sieberer 1907, p. 56, pl. 5, fig. 5, described as *Pleurotomaria eudora*), Lower Kimmeridgian, Swabia (southern Germany);

Trapanimaria? *neosolodurina* (Dacqué, 1905) (p. 141, pl. 16, figs 5–6), Kimmeridgian (exact stratigraphical level unknown), Ethiopia (eastern Africa);

Trapanimaria macromphalus (Zittel, 1873) (p. 454, pl. 50, figs 3–4), Tithonian (exact stratigraphical level unknown), Štramberk (Czech Republic).

Trapanimaria? *carpathica* (Zittel, 1873) (p. 455, pl. 50, figs 5–6), Tithonian (exact stratigraphical level unknown), Štramberk (Czech Republic).

Trapanimaria gattoi sp. nov.
Figure 5L–Z

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v 1971 *Leptomaria carpathica* Zittel; Wendt, p. 162.
v 1971 *Leptomaria* aff. *macromphalus* Zittel; Wendt, p 162.

Derivation of name. Species dedicated to Roberto Gatto, palaeontologist of the Department of Geosciences, University of Padua (Italy).

Holotype. GPIT 1685/23 (Fig. 5U–Z).

Type Locality. Piano Pilato, Rocca Busambra (north-western Sicily, southern Italy).

Type level. Lower – Upper Kimmeridgian (*Idoceras planula – Aulacostephanus eudoxus* biozones) neptunian sill limestone.

Additional material. Five specimens: paratypes GPIT 1685/26 and 27; specimens GPIT 1685/24, 25 and 28. Lower – Upper Kimmeridgian (*Idoceras planula – Aulacostephanus eudoxus* biozones).

Diagnosis. Last whorl almost two thirds of shell height. Outer face almost flat on last whorl. Periphery marked by shallow bulge at abapical edge of outer face. Selenizone narrow. Slit extending about one third of last whorl length. Ramp of early whorls ornamented by uniform riblets and thinner spiral threads. On subsequent whorls, spiral threads weakening on adapical half of ramp. Outer face of last whorls ornamented by marked spiral threads. Spiral threads edging selenizone finely duplicated on last whorls. Excepting peripheral belt, spiral ornament absent from base.

Description. The shell is subgradate-conoidal with slightly cyrtoconoidal outline of the spire and blunt apex. The teleoconch is composed of five to six whorls. The spire is low, and the last whorl is almost to two thirds of the height of the shell. The whorl surface is angular just below the mid-whorl. The ramp is rather wide, convex and steep, and shows a barely sloping, narrow subsutural shelf on the last whorl. The outer face is much narrower than the ramp, concave on the early spire and flat to feebly convex on the last whorl. The periphery is rounded-angular and coincides with a low spiral swelling. The selenizone runs at the angulation of whorl surface and is narrow, concave and sunken between two prominent spiral threads. The surface of the base is rather convex. The periumbilical region is evenly and strongly convex in the fully adult part of the shell and slightly angular in the earlier growth stages. The peristome is partly preserved and seems to have a simple umbilical lip. The slit is thin and long, being extended about one third of the length of the last whorl, i.e. 110–120° back from the peristome.

The early teleoconch whorls are ornamented by a network of fine spiral threads, three–four on the ramp and two–three on the outer face, and stronger collabral riblets. The collabral riblets are slightly thicker and denser on the outer face than on the ramp. During growth, the spiral threads increase in number and the collabral riblets become less regularly distributed and sized. On the last whorls, the collabral riblets change progressively into low, subregularly repeated ridges merging from the background of growth lines while the spiral threads weaken on the adapical half of the ramp and strengthen on the outer face and on a narrow peripheral belt of the base. These lines, representing five–six generations, are different in thickness. The spiral threads of the base weaken towards the umbilicus then become obscure and disappear within a short distance so that most of the base remains smooth. The spiral threads bordering the selenizone are stronger than the others and become finely duplicated on the last whorls. The lunulae are sharp and widely spaced on the early whorls and rapidly disappear on the following whorls. The growth lines are prosocline and evenly prosocyrt on the ramp, slightly opisthocline and prosocyrt on the outer face, parasigmoidal on the base between the periphery and the umbilical rim. The growth lines within the umbilicus strengthen and subregularly seamed as riblets.

Dimensions. See Table 2.

Remarks. The shape of the shell and the ornament pattern of *Trapanimaria gattoi* sp. nov. closely remind those of *Trapanimaria alba* (Quenstedt, 1857). However, *T. gattoi* shows a lower spire, the spiral angle being 25–30° wider than that of *T. alba*, more convex and lower early whorls, a narrower selenizone and a less angular periphery. Sieberer (1907) treated *Pleurotomaria alba* as junior synonym of *Pleurotomaria eudora* d'Orbigny, 1860. In contrast, Fischer & Weber (1997) maintained that these species are distinct. As a matter of fact, the type material of *P. eudora* illustrated by Fischer & Weber (1997) shows characters, such as a strong peripheral carina, ribbed base and clearly angular whorls, which justify this distinction. These authors regarded *P. eudora* as belonging to *Obornella* Cox, 1959. As explained above, in this genus the shell tends to be lenticular, the selenizone is convex and prominent, and the outer face is covered by the subsequent whorl. In *P. eudora* the spire is gradate, the selenizone is sunken between two spiral cords and the outer face is exposed on the spire. These are basically diagnostic characters of *Trapanimaria*. *Trapanimaria eudora* differs from *T. gattoi* in having a less convex ramp and the periphery marked by a prominent keel. *Trapanimaria*? *carpathica* (Zittel, 1873) differs from *T. gattoi* in having more convex whorls, a rounded periphery, and a seemingly not concave and more adapical selenizone. Moreover, the rim of the umbilicus of the fully adult shell is subangular. The poor preservation of the type material stored at the BSPG does not permit further comparisons and its safe attribution to the genus *Trapanimaria* gen. nov. *Trapanimaria macromphalus* (Zittel, 1873) has a lower spire, less convex ramp with more obtuse shoulder, and a more prominent peripheral swelling coupled with a weak spiral concavity of the outermost part of the base. Moreover, the surface of the base shows an obtuse angulation encircling the umbilicus, and the umbilical lip is less vertical.

Distribution of the species. Lower – Upper Kimmeridgian (*Idoceras planula – Aulacostephanus eudoxus* biozones), Rocca Busambra (north-western Sicily, southern Italy).

Trapanimaria nicolosiensis sp. nov.
Figure 6A–M

LSID. urn:lsid:zoobank.org:act:XXXXXXXXX

v 1971 *Leptomaria* aff. *macromphalus* Zittel; Wendt, p. 161, 162.

Derivation of name. From Pizzo Nicolosi, a peak of Rocca Busambra.

Holotype. GPIT 1685/29 (Fig. 6A–G).

Type Locality. Piano Pilato, Rocca Busambra (north-western Sicily, southern Italy).

Type level. Upper Oxfordian – Lower Kimmeridgian (*Epipeltoceras bimammatum – Idoceras planula* biozones) neptunian sill limestone.

Additional material. One specimen: paratype GPIT 1685/30, Lower – Upper Kimmeridgian (*Idoceras planula – Aulacostephanus eudoxus* biozones). A further specimen (BSPG 1932.P.23, Fig. 6K–M) coming from Casale (Rocca Busambra) and said to be Tithonian in age is stored at the Bayerische Staatssammlung für Paläontologie und Geologie (Munich, Germany) labelled as *Leptomaria montreuilensis* Hébert & E. Eudes-Deslongchamps, 1860.

Diagnosis. Last whorl about three quarters of shell height. Ramp about two times wider than outer face. Periphery sharply keeled. Selenizone covering whole adapical half of outer face on early

teleoconch whorls, its width decreasing to one quarter of outer face on last whorl. Base about as high as spire. Latest whorls ornamented by thin and dense spiral threads and subregularly spaced collabral riblets of different strength. Spiral threads more marked on outer face. Collabral riblets stronger on ramp and on base around umbilicus than on outer face.

Description. The shell is depressed gradate, with slightly cyrtoconoidal spire and is composed of about six whorls. The last whorl is about three quarters of the height of the shell. The whorl surface is angular somewhat below the mid-whorl. The ramp is gently convex and twice wider than the feebly concave outer face. The periphery is angular and strengthened by a high and rounded keel that is covered by the subsequent whorl on the spire. The selenizone is concave and sunken between two sharp spiral threads that become weaker on the fully adult part of the shell. The selenizone runs on the uppermost part of the outer face and its adapical edge corresponds to the angulation of the whorl surface. On the early whorls the selenizone is rather wide and covers the whole adapical half of the outer face. The width of the selenizone decreases in relation to whorl height during growth and becomes about one quarter of the outer face on the last whorl. The base is almost as high as the spire. It is widely phaneromphalous, with a broad, funnel-shaped umbilicus and a rounded periumbilical rim. Excepting a wide concave area along the periphery, the base is convex. The peristome is not preserved.

The early teleoconch is sculptured by a reticulate ornament of thin spiral threads intersected by much stronger collabral riblets. The spiral threads strengthen, and increase in number and density during growth. They are four–five on the ramp of the third whorl and seven on the ramp of the fourth whorl. The early riblets are sharp, evenly spaced and sized, and feebly parasigmoidal. The adult whorls bear thin, dense and equally spaced spiral threads that cover the whorl surface and the base, and are more marked on the outer face and on the peripheral keel. The early riblets gradually change into irregularly repeated and sized ribs. Collabral undulations appear on the ramp of the penultimate whorl and are reflected on the shell interior as furrows. The riblets of the outer face become also gradually irregular in strength during growth and nearly as thin as the spiral threads. The base of the last whorl also bears subregularly spaced and sized, low collabral ridges, or undulations, and strong ribs within the umbilical wall of the last whorl. The selenizone of the early teleoconch whorls is ornamented by sharp lunulae that are thinner than the collabral riblets but similarly dense. During the fully adult growth, the lunulae become gradually sparser and vanish on the penultimate whorl. The growth lines are moderately prosocline and evenly prosocyrt on the ramp, opisthocline and slightly prosocyrt on the outer face and presumably parasigmoidal on the base.

Dimensions. See Table 2.

Remarks. *Trapanimaria nicolosiensis* sp. nov. differs from *Trapanimaria gattoi* sp. nov. in its bigger size and lower spire. The periphery is more sharply angular and marked by a keel. The early whorls are ornamented by more regularly spaced and less marked collabral threads. The ramp of the last whorl and the base show collabral ribs and undulations that are lacking in *T. gattoi*. Moreover, in *T. gattoi* the spiral threads are much stronger and sparser than those of *T. nicolosiensis*. *Trapanimaria macromphalus* (Zittel, 1873) has a higher spire. The last whorls and the base lack collabral ribs. Moreover, the base bears a distinct periumbilical angulation.

Distribution of the species. Upper Oxfordian – Upper Kimmeridgian (*Epipeltoceras bimammatum – Aulacostephanus eudoxus* biozones), Tithonian?, Rocca Busambra (north-western Sicily, southern Italy).

Trapanimaria? *pallinii* sp. nov.
Figure 7A–E

LSID. urn:lsid:zoobank.org:act:XXXXXXXXX

v 1971 *Pleurotomaria michelottii* Gemmellaro; Wendt, p. 162.

Derivation of name. Species dedicated to Giovanni Pallini (1949-2003), Italian palaeontologist.

Holotype. GPIT 1685/22 (Fig. 7A–E).

Type Locality. Piano Pilato, Rocca Busambra (north-western Sicily, southern Italy).

Type level. Lower – Upper Kimmeridgian (*Idoceras planula – Aulacostephanus eudoxus* biozones) neptunian sill limestone.

Additional material. None.

Diagnosis. Shell slightly cyrtoconoidal, moderately high-spired. Angulation of whorls very obtuse, below mid-whorl. Ramp rather steep. Periphery subangular, marked by shallow bulge. Selenizone of last whorls very slightly concave. Abapical edge of selenizone on angulation of whorl. Umbilicus moderately wide, with rounded-angular periumbilical rim. Peristome nearly as high as wide. Slit length attaining about one quarter of last whorl. Earliest preserved whorls almost smooth. Ramp and peripheral bulge of latest whorls ornamented by dense spiral threads becoming progressively stronger during growth. Collabral ornament absent on fully adult whorls. Outer face with spiral lineation. Base and umbilical wall ornamented by dense, thin spiral threads.

Description. The shell preserves the last three whorls that suggest a moderately high spire with cyrtoconoidal outline. The whorls are separated by a feebly impressed suture and bear a very obtuse angulation below mid-whorl. This angulation becomes sharper on the last whorl. The ramp is slightly convex and rather steep, and the outer face is feebly concave. The periphery is subangular and marked by a shallow bulge. It is overlapped by the suture on the spire. Two spiral threads edge the selenizone; the abapical one corresponds to the ridge of the angulation of the whorl surface. The selenizone is narrow, seemingly flush on the earliest preserved whorl and feebly concave on the last whorl. The base is moderately convex as a whole and shows a moderately wide umbilicus encircled by a subangular rim. The aperture is nearly as high as wide, and has a subpentagonal peristome. The basal lip is feebly convex and the umbilical lip is straight. The slit is narrow and rather long, being extended one quarter of the length of the last whorl, i.e. 80–90° back from the peristome.

The antepenultimate whorl is basically smooth apart from the spiral threads edging the selenizone and two–three fine spiral threads close to the abapical suture. These threads extend to the penultimate and last whorls ornamenting the peripheral bulge. Weak spiral threads appear on the ramp of the penultimate whorl. They are about ten on the last whorl and become rather distinct and evenly distributed. The outer face of the last whorl bears only an obscure spiral lineation, except on its adapical part where two somewhat prominent spiral threads appear near to the peristome. The selenizone bears only fine growth lines. The base is ornamented by subequally spaced spiral threads which are shallower on its median part and stronger in the peripheral zone and on the umbilical wall. Rather strong growth lines make the spiral ornament finely granulated. They are prosocline and evenly prosocyrt on the ramp, slightly opisthocline and slightly prosocyrt on the outer face. On the base the growth lines are asymmetrically parasigmoidal, i.e. widely prosocyrt on the adaxial and median parts of the base and opisthocyrt, more deeply curved on its abaxial part. The umbilical wall shows strong, almost orthocline and straight growth lines.

Dimensions. See Table 2.

Remarks. *Trapanimaria*? *pallinii* sp. nov. exhibits the typical characters of *Trapanimaria* gen. nov., especially the selenizone placed on an obtuse angulation of the whorls and sunken between two sharp spiral threads. The uncertain genus attribution is due to its distinctly higher, conoidal and less gradate shell with respect to the other species of *Trapanimaria*. In addition to these characters, the type species of *Trapanimaria*, namely *Trapanimaria gattoi* sp. nov., differs from *T.*? *pallinii* in having lower whorls with wider ramp, more rounded aperture which is wider than high, and a much broader umbilicus. In *T. gattoi* the collabral riblets persist on the adult part of the shell as subregular ridges, and the spiral threads of the ramp weaken whereas those of the outer face become sharper and evenly distributed. Conversely, on the adult whorls of *T.*? *pallinii* the collabral ornament is absent, the spiral ornament of the ramp is sharp and the spiral threads of the outer face become obscure on most of its surface. *Pleurotomaria michelottii* Gemmellaro, 1869 (p. 98, pl. 5, figs 1–3) lacks the diagnostic characters of *Trapanimaria*, such as angulated whorls and selenizone sunken between marginal spiral threads. Moreover, the shell is conoidal with a spiral ornament on all the whorls whereas in *T.*? *pallinii* the shell is cyrtoconoidal and distinct spiral threads are present only on the last whorl and on the base.

Distribution of the species. Lower – Upper Kimmeridgian (*Idoceras planula – Aulacostephanus eudoxus* biozones), Rocca Busambra (north-western Sicily, southern Italy).

Genus TROCHOTOMARIA Conti & Fischer, 1981

Type species. *Trochotomaria tricarinata* Conti & Fischer, 1981, junior synonym of *Trochotomaria somhegyensis* (Szabó, 1980). Lower Bajocian (*Stephanoceras humphriesianum* Biozone), Umbria (central Apennines, Italy).

Emended diagnosis. Early shell conoidal, adult shell conoidal to subturbiniform. Protoconch depressed trochospiral and making apex blunt. Whorl surface convex, without distinct angulation. Selenizone wide, running at or slightly above mid-whorl on earliest teleoconch and shifting slightly below mid-whorl during growth. Selenizone edged by two spiral threads, concave on early whorls, concave to slightly convex on fully adult part of shell. Umbilicus broad. Whorl surface ornamented by regular and distinct network of spiral and collabral threads. Selenizone with distinct lunulae on adult whorls.

Remarks. The genus *Trochotomaria* Conti & Fischer 1981 has long been known only from its type species, *Trochotomaria somhegyensis* (Szabó, 1980) (p. 59, pl. 3, figs 1–3; Conti & Fischer 1981, p. 140, pl. 1, figs 1–3, described as *Trochotomaria tricarinata*; 1984*b*, p. 134, text-fig. 6, pl. 1, figs 14–15, described as *Trochotomaria tricarinata*; Conti & Szabó 1987, p. 45, text-fig. 1A), from the Bajocian of central Italy and Hungary. Szabó (2009) assigned to that genus an Upper Sinemurian species, *Trochotomaria lobitzeri* Szabó, 2009 (p. 35, text-fig. 28). The new species described below partially fills the gap of knowledge concerning the Pliensbachian–Aalenian time span and offered the opportunity to define better the characters of the genus.

Included species and occurrence. The genus ranges from the Upper Sinemurian to the lowermost Upper Bajocian and is represented by the following species, listed in stratigraphical order:

Trochotomaria lobitzeri Szabó, 2009 (see above for references), Upper Sinemurian, Northern Calcareous Alps (Austria);

Trochotomaria polymorpha sp. nov. (here), Lower Toarcian – lower Upper Toarcian, Rocca Busambra (north-western Sicily, southern Italy);

Trochotomaria conoidea sp. nov. (here), Aalenian – Lower Bajocian, Rocca Busambra (north-western Sicily, southern Italy);

Trochotomaria somhegyensis (Szabó, 1980) (= *Trochotomaria tricarinata* Conti & Fischer, 1981) (type species, see below), Aalenian – Lower Bajocian, Rocca Busambra (north-western Sicily,

southern Italy); uppermost Lower Bajocian, Umbria (central Italy); uppermost Lower Bajocian – lower Upper Bajocian, Bakony Mountains (Hungary).

Trochotomaria somhegyensis (Szabó, 1980)
Figure 7F–H

v 1971 *Pleurotomaria ajax* d'Orbigny; Wendt, p 156.
v* 1980 *Leptomaria somhegyensis* Szabó, p. 59, pl. 3, figs 1–3.
v 1981 *Trochotomaria tricarinata* Conti & Fischer, p. 140, pl. 1, figs 1–3.
v 1984*b* *Trochotomaria tricarinata* Conti & Fischer; Conti & Fischer, p. 134, text-fig. 6, pl. 1, figs 14–15.
v 1987 *Trochotomaria somhegyensis* (Szabó); Conti & Szabó, p. 45, text-fig. 1A.

Material. One specimen, GPIT 1685/1, Aalenian – Lower Bajocian (*Leioceras opalinum – Sonninia propinquans* biozones).

Description. The shell is conoidal with subgradate adult whorls, and rather broadly phaneromphalous. The whorls are somewhat low, with a subpentagonal adult cross section. Their outline draws a rounded, hardly observable angulation which is distinctly below the mid-whorl. The ramp is convex, rather steep and twice as wide as the outer face that is also convex. The selenizone is concave and runs fairly below the mid-whorl, on the adapical part of the outer face. It is rather wide, and covers nearly two fifth of the outer face.

The ornament is sharply reticulate, with the collabral riblets slightly stronger than the spiral threads. About ten spiral threads sculpture the ramp, and those placed on its abaxial third are stronger than the others. The collabral riblets are quite regularly spaced and as dense as the spiral threads. Only sharp lunulae ornament the selenizone.

Dimensions. See Table 2.

Remarks. The specimen differs from the type material of *Trochotomaria somhegyensis* (Szabó, 1980) only in having a slightly wider selenizone which is devoid of spiral ornament. *Pleurotomaria ajax* d'Orbigny, 1850 (p. 268; d'Orbigny 1856, p. 484, pl. 388, figs 1–5), a species subsequently revised and assigned by Fischer & Weber (1997, p. 183, pl. 31, fig. 9a–c) to the Recent genus *Perotrochus* P. Fischer, 1885, differs from *T. somhegyensis* in its much lower spire, narrower umbilicus, and in the ornament that is not reticulated but consists essentially of strong spiral threads.

Distribution of the species. Uppermost Lower Bajocian (*Stephanoceras humphriesianum* Biozone), Martani Mountains (Umbria, central Italy); uppermost Lower Bajocian – lower Upper Bajocian (*Stephanoceras humphriesianum* Biozone and condensed *Strenoceras niortense – Garantiana garantiana* biozones), Bakony Mountains (Hungary); Aalenian – Lower Bajocian (*Leioceras opalinum – Sonninia propinquans* biozones), Rocca Busambra (north-western Sicily, southern Italy).

Trochotomaria conoidea sp. nov.
Figure 7I–T

LSID. urn:lsid:zoobank.org:act:XXXXXXXXX

Derivation of name. Referred to the conoidal shape of the shell.

Holotype. GPIT 1685/3 (Fig. 7P–T).

Type Locality. Piano Pilato, Rocca Busambra (north-western Sicily, southern Italy).

Type level. Aalenian – Lower Bajocian (*Leioceras opalinum – Sonninia propinquans* biozones) neptunian sill limestone.

Additional material. Two specimens: paratype GPIT 1685/2, Aalenian – Lower Bajocian (*Leioceras opalinum – Sonninia propinquans* biozones); specimen GPIT 1685/4, Aalenian – Lower Bajocian (*Leioceras opalinum – Sonninia propinquans* biozones) neptunian dyke.

Diagnosis. Shell low conoidal. Height of last whorl about two thirds of shell height. Whorl surface moderately convex on early whorls, feebly convex on last whorls with feebly concave belt above periphery. Selenizone moderately wide, at mid-whorl on early teleoconch, flat on fully adult shell. Periphery rounded-angular, swollen. Base extremely low conoidal, much lower than spire. Surface of base feebly convex with feebly concave outermost region. Periumbilical rim subangular. Whorl surface and outer part of base ornamented by sharp network of spiral threads and collabral riblets. Base ornamented by flat spiral threads and thin collabral threads. Abapical part of umbilical cavity ornamented by spiral threads. Selenizone with median lira on last whorls.

Description. The shell is rather broadly conoidal, with a blunt apex, and is composed of about six–seven whorls. The last whorl is about two thirds of the height of the shell. The whorl surface is moderately convex on the early shell. Its convexity decreases during growth and the last whorl is just slightly convex. The suture is feebly impressed. The selenizone is moderately wide, being roughly one fifth of the height of the whorl surface. It is concave and at the mid-whorl on the early whorls but becomes progressively flat and shifts a little abapically on the last two whorls. The periphery is rounded-angular, swollen, and overlapped by the subsequent whorl. The surface of the whorl and of the base along the periphery are feebly concave. The base, as a whole, is low conoidal, much lower than the spire, with a slightly convex surface, excepting its concave peripheral region. The umbilicus is rather broad and has a subangular outer rim.

The whorl surface is ornamented by a regular network of sharp, evenly spaced and sized spiral threads and collabral riblets. The collabral riblets are slightly stronger than the spiral threads. The spiral threads increase in number during growth. The earlier whorls bear one–two spiral threads above the selenizone and one below the selenizone whereas the last whorl has about ten spiral threads above the selenizone and three–four below the selenizone. The same pattern ornaments the peripheral swelling and the outer region of the base. The remaining surface of the base is ornamented by variably wide, flat spiral threads separated by thinner interspaces and very thin collabral threads that are more evident in the spiral interspaces. Dense collabral threads are visible also on the umbilical wall and are crossed by two or three spiral threads near the periumbilical angulation. Regularly spaced, sharp lunulae ornament the selenizone which are as dense as the collabral riblets of the whorl surface. A thin median lira appears on the antepenultimate whorl. It strengthens progressively during growth and, on the last whorl it becomes as strong as the spiral threads of the whorl surface. The growth lines are slightly prosocline and slightly prosocyrt above the selenizone, feebly opisthocline and evenly prosocyrt below the selenizone and on the periphery. The base bears parasigmoidal growth lines, i.e. widely opisthocyrt on its adaxial and median parts, prosocyrt and slightly more deeply curved on its abapical part. The growth lines are gently opisthocyrt on the wall of the umbilical cavity.

Dimensions. See Table 2.

Remarks. *Trochotomaria conoidea* sp. nov. differs from *Trochotomaria somhegyensis* (Szabó, 1980) in having a much wider spiral angle, a flatter whorl surface, a narrower and more abapical selenizone and, consequently, a narrower whorl surface below the selenizone. *Trochotomaria*

lobitzeri Szabó, 2009 (p. 35, text-fig. 28), from Upper Sinemurian of Hierlatz Alpe (Austria), has a similar spiral angle but differs in its more convex whorls and base, in lacking a reticulate ornament on the adapical part of the whorls, and in having a wider selenizone. *Bathrotomaria submandoki* Conti & Szabó (1989, p. 31, pl. 1, figs 3–6) resembles *T. conoidea* in the general shape of the shell and ornament pattern. It differs in its almost flat selenizone on the early whorls, lower and feebly angular last whorls, and rounded periumbilical rim.

Distribution of the species. Aalenian – Lower Bajocian (*Leioceras opalinum – Sonninia propinquans* biozones), Rocca Busambra (north-western Sicily, southern Italy).

Trochotomaria polymorpha sp. nov.
Figure 8

LSID. urn:lsid:zoobank.org:act:XXXXXXXXX

v 1971 *Pleurotomaria subdecorata* Münster; Wendt, p. 153, 154.

Derivation of name. From the Greek *polys*, many, and *morfh*, shape, referring to the wide variability of the species.

Holotype. GPIT 1685/5 (Fig. 8A–D).

Type Locality. Piano Pilato, Rocca Busambra (north-western Sicily, southern Italy).

Type level. Upper Toarcian (*Haugia variabilis – Phlyseogrammoceras dispansum* biozones) neptunian sill limestone.

Additional material. Sixteen specimens: paratypes GPIT 1685/7, 15, Upper Toarcian (*Haugia variabilis – Phlyseogrammoceras dispansum* biozones); paratype GPIT 1685/12 and 14, Lower Toarcian – lower Upper Toarcian (*Harpoceras serpentinum – Haugia variabilis* biozones); paratype GPIT 1685/19, Lower Toarcian (*Harpoceras serpentinum – Hildoceras bifrons* biozones); specimens GPIT 1685/6, 8–11, 17, 18 and 21, Upper Toarcian (*Haugia variabilis – Phlyseogrammoceras dispansum* biozones); specimen GPIT 1685/13, Lower Toarcian – lower Upper Toarcian (*Harpoceras serpentinum – Haugia variabilis* biozones); specimen GPIT 1685/20, Lower Toarcian (*Harpoceras serpentinum – Hildoceras bifrons* biozones).

Diagnosis. Adult shell subturbiniform. Protoconch seemingly with coiling axis slightly deviated from that of teleoconch. Early teleoconch whorls slightly convex with narrow sutural shelf gradually vanishing during growth. Fully adult part of shell coeloconoidal with whorls more strongly and evenly convex. Teleoconch whorls high almost one quarter of their width. Selenizone wide about one quarter of height of whorl surface, placed above mid-whorl on early spire, concave, flat or feebly convex in fully adult stage. Slit short, about one seventh of last whorl length. Base distinctly convex on fully adult part of shell. Ornament of rather dense and equally strong spiral and collabral threads covering whorls, base and umbilical cavity on fully adult shell. Selenizone with a median lira on latest whorls and occasionally other two spiral threads.

Description. The early spire is conoidal with blunt apex. The protoconch is discoidal with the spire axis seemingly slightly deviated from that of the teleoconch. The adult part of the shell is coeloconoidal with convex whorls giving it a subturbiniform shape. The teleoconch is composed of seven–eight whorls. They are separated by a distinctly impressed suture and are high almost one quarter of their width. The first two teleoconch whorls are rather convex. On the subsequent part of the spire the whorl surface becomes less convex, tending to be flattened, and provided with a

narrow sutural shelf. On the latest whorls the sutural shelf gradually vanishes and the whorls become evenly convex. The selenizone is wide, being about one quarter of the height of the whorl surface, and edged by spiral threads. It runs above the mid-whorl on the early spire and rapidly moves slightly below the mid-whorl during growth. The surface of the selenizone is concave on the earliest whorls and concave, flat or slightly convex on the last whorls. The periphery is subangular in the early whorls and roundedly angular to evenly arched on the adult part of the shell. The base is broadly phaneromphalous. It is low, flat to slightly convex on the early shell and becomes increasingly convex towards the last whorl. The width of the umbilicus is one third to slightly less than half of the width of the base. The aperture is subquadrangular; the parietal lip is covered with a very thin inductura. The umbilical lip is simple, slightly inclined and passes smoothly to the basal lip. The slit is rather short, extending about 50° from the peristome.

A regular network of dense, equally sized and spaced spiral and collabral threads cover the whorl surface. On the last whorls, about ten spiral threads run on the shell surface above the selenizone and about six between the selenizone and the abapical suture. The base and the umbilical cavity of the early shell are ornamented by moderately strong, evenly spaced spiral threads crossed by thin collabral ridges. On the adult shell, the base and the umbilical cavity bear the same ornament pattern as that of the whorl surface, with the spiral threads of the periumbilical area commonly slightly wider. The two spiral threads edging the selenizone are significantly stronger than the others. The selenizone of the early whorls is ornamented only by distinct, regularly spaced lunulae. From about the third whorl onward, a lira appears in the middle of the selenizone and becomes slightly stronger during growth. Two additional spiral threads appear on the selenizone of the last whorl in some specimens. The growth lines are moderately prosocline and slightly prosocyrt on the shell surface above the selenizone, opisthocline and markedly prosocyrt below the selenizone and on the peripheral region. The base bears slightly parasigmoidal growth lines, i.e. opisthocyrt on its abaxial half and prosocyrt on its adaxial half and also on the wall of the umbilical cavity.

Dimensions. See Table 2.

Remarks. *Trochotomaria polymorpha* sp. nov. is a strongly variable species. The range of variation of the pleural angle approaches 40° and also the coeloconoidal outline of the adult part of the shell is rather variable. The variation of the umbilicus seems to be related to these characters. Commonly, the specimens with a wider spiral angle and more coeloconoidal outline have also a wider umbilicus. The last whorl is moderately to distinctly convex and the periphery can be roundedly angular or evenly rounded. The last part of the selenizone bears one to three spiral threads. The selenizone is concave on the early shell. It may keep this shape or may become flat to feebly convex during the growth of the adult shell. Only the paratype GPIT 1685/19 (Fig. 8V–Z) shows a prominent, carina-like selenizone on the last whorl. However, this specimen is also affected by some repaired fractures preceding the change in shape of the selenizone. Considering that the shape of the selenizone and its ontogenetic changes are commonly rather stable characters in pleurotomarioidean species, most probably this difference reflects an anomalous growth rather than a further aspect of the species variability.

Trochotomaria lobitzeri Szabó, 2009 is reminiscent of *T. polymorpha* in the general characters of the shell, i.e. a conoidal early teleoconch, coeloconoidal fully adult part of the shell, and whorls separated by a markedly impressed suture. In *T. polymorpha* the whorls are lower and more numerous, the selenizone is narrower and placed slightly higher on the whorl surface, and the reticulate ornament is denser. *Trochotomaria somhegyensis* (Szabó, 1980) differs in having a conoidal shell, higher spire, lower and less convex whorls, more angular periphery, and less dense reticulate ornament. Moreover, the base is less convex and less ornamented, and has a subangular periumbilical rim. *Szabotomaria subdecorata* (Münster in Goldfuss, 1844) (p. 71, pl. 185, fig. 3a–b; Kuhn 1936, p. 274, pl. 8, fig. 15; Monari *et al*. 2018, p. 456), from the Upper Pliensbachian of Franconia (southern Germany), shows a clearly gradate spire and the selenizone of the last whorls

runs on the outer face much below mid-whorl, whereas in *T. polymorpha*, the whorls lack any angulation and the selenizone is placed very slightly below the mid-line of the last whorls.

Distribution of the species. Lower Toarcian – lower Upper Toarcian (*Harpoceras serpentinum – Phlyseogrammoceras dispansum* biozones), Rocca Busambra (north-western Sicily, southern Italy).

Genus LAEVITOMARIA Conti & Szabó, 1987

Type species. *Pyrgotrochus*? *problematicus* Szabó, 1980. Uppermost Lower Bajocian – Upper Bajocian (*Stephanoceras humphriesianum – Parkinsonia parkinsoni* biozones), Bakony Mountains (Hungary).

Remarks. The genus *Laevitomaria* Conti & Szabó, 1987 has been revised by Gatto *et al.* (2015*a*) to which paper the reader is referred for further details. The species described below extends the stratigraphical range of the genus to the Lower Kimmeridgian in the central region of western Tethys.

Laevitomaria babalusciae sp. nov.
Figure 9A–F

LSID. urn:lsid:zoobank.org:act:XXXXXXXXX

v 1971 *Pleurotomaria* cf. *phileta* d'Orbigny; Wendt, p. 161.

Derivation of name. From *Babaluscio*, Sicilian word for snail.

Holotype. GPIT 1685/32 (Fig. 9A–F).

Type Locality. Piano Pilato, Rocca Busambra (north-western Sicily, southern Italy).

Type level. Upper Oxfordian – Lower Kimmeridgian (*Epipeltoceras bimammatum – Idoceras planula* biozones) neptunian sill limestone.

Additional material. None.

Diagnosis. Shell feebly coeloconoidal. Fully adult whorls moderately convex. Selenizone wide, very slightly concave to flat, delimited by distinct spiral threads, and placed at middle of abapical half of whorl surface. Whorl surface between selenizone and abapical suture narrow and slightly concave. Periphery angular, markedly swollen and carina-like. Base rather flat and with narrow umbilicus. Early teleoconch sharply reticulated. Fully adult part of the shell ornamented by thin spiral threads increasing in number during growth and weakening above selenizone. Collabral riblets vanishing towards selenizone. Base ornamented by spiral threads, sharper on its outermost part, and flat on its axial region. Selenizone of early whorls ornamented by distinct lunulae and, from the third–fourth whorl, crossed by a median lira. Selenizone of last whorl with network ornament of four thin spiral threads and distinct lunulae.

Description. The shell is thin-walled, slightly coeloconoidal and rather elevated. The teleoconch consists of eight–nine whorls with quadrangular cross section. The surface of the whorl is moderately convex. The periphery is angular and marked by a carina-like spiral swelling, which is not covered by the suture on the spire. The selenizone is rather wide, very slightly concave to flat. It is delimited by strong spiral threads and runs in the median region of the abapical half of the whorl surface. Its width changes during growth, from one quarter of the height of the whorl surface on the

early teleoconch to one sixth on the last whorl. The surface between the selenizone and the peripheral bulge is narrow and slightly concave. The base is slightly convex with a rather flat surface and a narrow umbilicus. The peristome is discontinuous or with a very thin parietal callus. The umbilical lip is simple, slightly arched and vertical.

The early teleoconch is ornamented by a network of fine spiral threads and dense collabral riblets. The spiral threads are thinner than the collabral riblets and those edging the selenizone are much stronger than the others. Two–three evenly spaced spiral threads ornament the whorl surface above the selenizone; two spiral threads are present between the selenizone and the peripheral swelling, and two on the peripheral swelling. The spiral threads increase in number during growth. They weaken on the whorl surface above the selenizone whereas strengthen below the selenizone and on the peripheral bulge. On the last whorl, about fifteen very thin spiral threads are visible on the whorl surface above the selenizone. Six to seven, equally spaced and sized spiral threads run between the selenizone and the peripheral cord, and five on the peripheral cord. On the fully adult part of the shell, the collabral riblets gradually weaken and shorten then vanish well before reaching the selenizone. They remain moderately strong below the selenizone where corrugate the peripheral carina, but fade out on the outermost part of the base. The selenizone of the early whorls is ornamented only by distinct lunulae that persist also on the subsequent whorls. From the third–fourth whorl, a median lira appears on the selenizone and other spiral threads also develop during the last growth phase. The selenizone of the last whorl bears four, thin and equally spaced spiral threads. The outermost part of the base is ornamented by spiral threads which are almost as strong and spaced as those of the peripheral bulge. On the median part of the base, the spiral threads tend to cease whereas they are more marked and flat in the periaxial region of the base. The growth lines are prosocline and evenly prosocyrt above the selenizone, opisthocline and slightly prosocyrt below the selenizone, moderately parasigmoidal on the base.

Dimensions. See Table 2.

Remarks. The specimen is well preserved, although the peristome is strongly incomplete on the outer lip. The crowded and weakened lunulae on the selenizone of the last whorl indicate that the specimen is a fully adult shell. *Laevitomaria problematica* (Szabó, 1980) (p. 63, pl. 4, figs 1–3; Conti & Monari 1986, p. 182, pl. 2, figs 1–2, 5; Gatto *et al.* 2015*a*, p. 219, text-figs 2–3), type species of the genus *Laevitomaria* Conti & Szabó, 1987, differs from *Laevitomaria babalusciae* sp. nov. in having an evenly conoidal teleoconch outline. Moreover, the fully adult part of the shell shows a convex selenizone and lacks collabral riblets. *Laevitomaria daytiai* (Das, Bardhan & Kase, 2005) (p. 341, text-fig. 8a–d), from the Early Callovian – Oxfordian of Kutch (western India), is the only species currently known that is sub-coeval with *L. babalusciae* (see Gatto *et al.* 2015*a*). It differs in its wider spiral angle, cyrtoconoidal shell, more convex whorls separated by deeper suture, and dominant spiral sculpture. *Pleurotomaria phileta* Cotteau in d'Orbigny, 1860 (p. 563, pl. 422, figs 1–5), a species ascribed by Fischer & Weber (1997, p. 207) to the genus *Pyrgotrochus* P. Fischer, 1885 differs from *L. babalusciae* in having an evenly conoidal shell, narrower apical angle, and lower and flat whorls.

Distribution of the species. Upper Oxfordian – Lower Kimmeridgian (*Epipeltoceras bimammatum – Idoceras planula* biozones), Rocca Busambra (north-western Sicily, southern Italy).

Genus PYRGOTROCHUS P. Fischer, 1885

Type species. *Pleurotomaria bitorquata* J. C. A. Eudes-Deslongchamps, 1849. Upper Pliensbachian, Calvados (northern France).

Pyrgotrochus vorosi sp. nov.
Figure 9G–L

LSID. urn:lsid:zoobank.org:act:XXXXXXXXX

v 1971 *Pleurotomaria sorlinensis* Loriol; Wendt, p. 160.

Derivation of name. Species dedicated to Attila Vörös, palaeontologist of the Department of Palaeontology and Geology, Hungarian Natural History Museum, and of the Hungarian Academy of Sciences (Budapest, Hungary).

Holotype. GPIT 1685/31 (Fig. 9G–L).

Type Locality. Piano Pilato, Rocca Busambra (north-western Sicily, southern Italy).

Type level. Lower – Upper Oxfordian (*Quenstedtoceras mariae – Gregoryceras transversarium* biozones) neptunian sill limestone.

Additional material. None.

Diagnosis. Shell moderately high conoidal with feebly coeloconoidal apical spire. Outline of whorls slightly convex with very weak concavity below suture. Periphery angular with low spiral swelling more distinct on early shell. Selenizone slightly above periphery, wide, and weakly impressed. Slit about one tenth of last whorl length. Base narrowly phaneromphalous with subangular periumbilical rim. Ornament reticulate of dense spiral threads and slightly stronger collabral riblets. Spiral threads edging selenizone more prominent than others. Selenizone of earliest preserved whorl with median lira and sharp lunulae becoming denser during growth. Selenizone of last whorls with three spiral threads.

Description. The shell is moderately high conoidal, seemingly with a slightly coeloconoidal apical spire. The whorls are high about one quarter of their width. The outline of the whorl is slightly convex with a very weak concavity below the suture. The suture sinks rather deep on the early preserved whorls and becomes almost flush on the last whorls. The selenizone is concave, delimited by spiral threads, and placed much below mid-whorl, slightly above the periphery. It is rather wide, being one quarter of the height of the whorl surface. The slit is wide and short and extends 30–40° back from the peristome. The periphery is angular and bears a low spiral swelling that is more distinct on the early shell. The base is flat, with very slightly convex surface, and narrowly phaneromphalous. The periumbilical rim is subangular. The aperture is quadrangular and the peristome is moderately prosocline. The parietal lip is covered with a thin inductura and the umbilical lip is subvertical, very slightly arched and simple.

The whorl surface bears a reticulate sculpture of dense collabral riblets and slightly weaker spiral threads. The collabral riblets are slightly stronger on the subsutural belt and weaken towards the selenizone. On the earliest preserved whorls, strong riblets irregularly alternate with thinner ones whereas on the last whorls the collabral ornament becomes more uniform, and consists of densely and somewhat irregularly distributed threads. The spiral threads are sharp, almost evenly spaced and sized. During growth, they increase in number by intercalation. On the early preserved spire, the whorl surface above the selenizone bears five to six spiral threads whereas about twelve threads ornament the last whorl. The spiral threads at the edge of the selenizone are more prominent than the others. On the early preserved whorls, the selenizone is ornamented by sharp, moderately spaced lunulae crossed by a median lira. On the last whorls the lunulae become denser and one spiral thread appears at both sides of the median lira. The base is also ornamented by a network of spiral and collabral threads. The spiral threads are more widely spaced towards the umbilicus, and the collabral threads are thinner than those of the spire. The growth lines are prosocline and slightly

prosocyrt above the selenizone, feebly opisthocline and prosocyrt below the selenizone, and distinctly parasigmoidal on the base.

Dimensions. See Table 2.

Remarks. *Pyrgotrochus vorosi* sp. nov. is reminiscent of *Pleurotomaria culminata* Hébert & E. Eudes-Deslongchamps, 1860 (p. 75, pl. 4, fig. 5a–g, pl. 5, fig. 1a–c) in the shape of the shell and almost flat whorl surface. However, in *P. culminata* the spiral angle is much smaller, the base is concave and anomphalous, and the peripheral swelling is nodose and more prominent. *Pleurotomaria subexcavata* Hébert & E. Eudes-Deslongchamps, 1860 (p. 73, pl. 4, fig. 2a–c) differs from *P. vorosi* in having a significantly wider spiral angle, nodose peripheral swelling, and anomphalous base with periaxial depression covered with a thin callus. *Pleurotomaria sorlinensis* Loriol, 1903 (p. 125, pl. 16, fig. 5, 5a–b) has much higher whorls, the periphery lacks a spiral swelling, and the ornament is weaker, being composed only of few, thin and widely spaced spiral threads on the whorl surface. The supraspecific attribution of *P. sorlinensis* is questionable. According to Loriol (1903), the selenizone is placed on the sharp peripheral angulation, a position quite unusual in the conoidal pleurotomarioideans. Moreover, from the original illustrations, the shape of the growth lines suggests that the selenizone is absent.

Distribution of the species. Lower – Upper Oxfordian (*Quenstedtoceras mariae – Gregoryceras transversarium* biozones), Rocca Busambra (north-western Sicily, southern Italy).

Superfamily SCISSURELLOIDEA Gray, 1847
Family AURITOMIDAE fam. nov.

LSID. urn:lsid:zoobank.org:act:XXXXXXXXX

Type genus. *Auritoma* gen. nov. (see below).

Diagnosis. Shell auriform-lenticular. Selenizone convex and forming prominent peripheral carina. Slit making long fissure closed near last peristome.

Remarks. The family Auritomidae fam. nov. is based on the surprising similarity between *Auritoma* gen. nov. (see below) and *Sasakiconcha* Geiger, 2006, a genus represented by a single living species from Western Pacific, *Sasakiconcha elegantissima* Geiger, 2006 (p. 46, text-figs 1–2; 2008, p. 137, text-fig. 1; 2012, p. 1158, text-figs 961–963). *Sasakiconcha* and *Auritoma* share a peculiar combination of characters. Both genera are represented by auriform shells of large size relative to the average of the scissurelloideans, with a distinctly convex selenizone, forming a prominent peripheral carina, and a long foramen due to the convergence of the edges of the slit and its closure at the peristome. *Sasakiconcha* was tentatively placed by Geiger (2006, 2012) in the family Anatomidae McLean, 1989 owing to the peripheral position of the selenizone. However, the author also suggested that *Sasakiconcha* may represent an independent lineage. *Temnotropis* sp. illustrated by Lauridsen & Schnetler (2014) from the Faxe Formation (Danian) of Denmark could be another representative of the family Auritomidae for the general shape and the size of the shell. However, the absence of information on the other characters, particularly the morphology of the exhalant opening, prevents a safe supraspecific attribution. According to Geiger (2006), anatomid species with converging margins of the slit are quite frequent but none has the slit anteriorly closed. The auriform shape of the shell is a characterizing feature of Auritomidae. In Anatomidae, the shape is trochospiral also in lenticular-depressed species, as for example *Anatoma philippinica* (Bandel, 1998) (p. 40, pl. 13 figs 7–8, pl 14, fig. 1; Geiger 2012 p. 1008, text-figs 819–823). Moreover, Auritomidae have a convex selenizone forming a prominent and rounded peripheral cord, whereas

in the Anatomidae the selenizone is most commonly sunken between sharp spiral lamellas and rarely almost flat.

The Depressizonidae Geiger, 2003 (synonymous of Scissurellidae Gray, 1847 according to Bouchet *et al.* 2017) have a similar, subauriform shell and a slit closed at its anterior end, but the selenizone runs on a sharp angulation almost at the middle of the whorl surface and much above the periphery of the shell. The periphery coincides with a sharp and acute angulation that encircles a flat base. A high expansion rate of the whorls distinguishes also the family Larocheidae Finlay, 1927. In this group, however, the shell is mostly naticiform and lacks a selenizone and exhalant opening at the peristome.

The wide chronological gap in the fossil record of Auritomidae, spanning the late Middle Jurassic to Recent, most probably reflects both an original low abundance of this group in the marine communities and the low potential of preservation affecting these very small and fragile shells. In any case, even the fossil record of the Scissurellidae, the best documented and most extensively studied scissurelloidean family, suffers from a considerable lack of information which extends from Middle Jurassic to Late Cretaceous.

Included genera and occurrence. *Auritoma* gen. nov. (here), Lower Callovian, north-western Sicily (southern Italy); *Sasakiconcha* Geiger, 2006, Recent, Western Pacific.

Genus AURITOMA nov.

LSID. urn:lsid:zoobank.org:act:XXXXXXXXX

Derivation of name. Referred to the auricular shape of the shell.

Type species. *Auritoma lenticula* sp. nov., by monotypy. Lower Callovian, Rocca Busambra (north-western Sicily, southern Italy) (see below).

Diagnosis. Shell small, lenticular-auriform, with depressed spire and sunken protoconch. Teleoconch composed of less than three whorls. Whorl surface broadly convex. Periphery prominently carinate and slightly upward curved. Selenizone rather wide, running on adapical side of peripheral carina. Base distinctly convex and phaneromphalous with sharply angular periumbilical rim. Umbilical wall steep and concave. Ornament composed of dense and fine spiral elements.

Remarks. In addition to the family characters mentioned above, *Auritoma* shares with *Sasakiconcha* the final part of the last whorl downward bending, and the ornament made only of fine spiral elements. It differs in having a more prominent and upward curved selenizone-bearing peripheral carina. In *Auritoma* the selenizone is exposed on all spire whorls and the periumbilical rim is sharply angular whereas in *Sasakiconcha*, the selenizone becomes exposed on the spire only in the final part of the last whorl and the periumbilical rim is rounded. As described by Geiger (2006, 2012), in *Sasakiconcha* the umbilical lip directly joins the roof of the parietal region besides the suture without touching at the surface of the base. In this way, a spiral trough forms between the umbilical lip and the surface of the umbilicus. This unique structure corresponds externally to a spiral swelling along the subsutural region of the shell. Although *Auritoma* shows a similar subsutural swelling, in the available material the umbilical lip is partially hidden by the matrix and it is not possible to establish the presence of an umbilical trough.

Included species and occurrence. The genus is represented only by the type species from Lower Callovian sediments of Rocca Busambra (north-western Sicily, southern Italy).

Auritoma lenticula sp. nov.

Figure 10A–H

LSID. urn:lsid:zoobank.org:act:XXXXXXXXX

Derivation of name. Referred to the lenticular shape of the shell.

Holotype. GPIT 1685/36 (Fig. 10A–H).

Type Locality. Piano Pilato, Rocca Busambra (north-western Sicily, southern Italy).

Type level. Lower Callovian (*Macrocephalites macrocephalus* Biozone) neptunian sill limestone.

Additional material. None.

Diagnosis. As for genus.

Description. The shell is small (almost 2 mm), lenticular-auriform with height of the base slightly exceeding half of the shell height. The shell is composed of about two and a half, rapidly expanding whorls. The protoconch is somewhat sunken and seemingly composed of half a convex volution. Its coiling axis seems feebly deviated from that of the teleoconch. The beginning of the teleoconch is marked by the appearance of a peripheral carina carrying the selenizone. The teleoconch whorl surface is slightly convex and its adaxial half forms an almost flat, subhorizontal shelf with a feebly swollen subsutural belt on the last whorl that attenuates near the peristome. The last whorl is abaxially extended and subangular at the periphery, with lanceolate cross section. A strong and slightly adapically bending spiral carina marks the periphery. The selenizone is rather wide and convex between two spiral threads and is placed at the top of the peripheral carina. The suture is strongly impressed and runs in a groove just below the peripheral carina. The base is quite convex and phaneromphalous. The umbilicus is surrounded by a sharply angular periumbilical rim and its wall is slightly concave. The aperture is broadly ovate and sublanceolate and the peristome is strongly prosocline. The outer lip is sharp and prosocyrt between the suture and the periphery. Its basal lip is opisthocyrt and passes almost smoothly to the periumbilical rim at the foot of the umbilical lip. The umbilical lip is simple and concave along its visible abapical part. The margins of the slit converge to each other towards the peristome.

The initial part of the first teleoconch whorl is undulated by some shallow and irregular collabral wrinkles. The remaining part of this whorl bears only growth lines. At the beginning of the last whorl, fine striae appear abruptly and subdivide the whorl surface into flattened, just feebly convex, narrow bands. On the adaxial half of the whorl surface, these spiral bands widen during growth whereas they remain narrow on the abaxial half. The spiral striae are punctuated by the growth lines. Their number increases during growth from about twenty at the beginning of the last whorl to about the double at the peristome. The swollen subsutural region lacks spiral striae. The base is ornamented by the same spiral pattern, with ribbons becoming progressively wider towards the umbilical cavity. The growth lines are fine on the early shell and become marked near the peristome. They are rather prosocline and widely prosocyrt on the whorl surface. The subsutural spiral swelling bears growth lines that are more prosocyrt than in the remaining part of the whorl surface and make this spiral element more distinct). On the surface of the base the growth lines are evenly arched and strongly opisthocyrt.

Dimensions. See Table 2.

Remarks. The last whorl shows traces of repaired fractures and the area around the foramen, corresponding to the weaker and more fragile part of the shell, is not complete. However, the parts of the shell including the termination of the selenizone (Fig. 10G) and the pre-peristomal shell seam

(Fig. 10H) formed by the closure of the slit at the peristome, are preserved. As mentioned above, the only comparable scissurelloidean species is the living species *Sasakiconcha elegantissima* Geiger, 2006. Apart from the differences at genus rank listed above, in *S. elegantissima* the ornament consists of thin, dense and regularly sized spiral threads whereas *Auritoma lenticula* sp. nov. is ornamented by fine spiral striae.

Distribution of the species. Lower Callovian (*Macrocephalites macrocephalus* Biozone), Rocca Busambra (north-western Sicily, southern Italy).

? Superfamily SCISSURELLOIDEA Gray, 1847
? Family ANATOMIDAE McLean, 1989

Genus BUSAMBRELLA nov.

LSID. urn:lsid:zoobank.org:act:XXXXXXXXX

Derivation of name. From Rocca Busambra. Gender feminine.

Type species. *Busambrella fasciata* sp. nov., by monotypy. Aalenian – Lower Bajocian, Rocca Busambra (north-western Sicily, southern Italy) (see below).

Diagnosis. Shell small, globose-sublenticular with very low spire. Base rather convex, much higher than spire and with narrow umbilical fissure. Whorls convex. Selenizone wide, peripheral, edged by sharp spiral threads and bearing only growth lines. Slit presumably short. Suture slightly impressed and running near abapical edge of selenizone. Parietal lip provided with thin callus. Umbilical lip straight and subparallel to spire axis. Surface of whorls without prominent ornament. Base ornamented by spiral and collabral threads.

Remarks. The type species of the genus *Busambrella* gen. nov. is based on specimens with incomplete outer lip. For this reason the lenght of the slit is unknown. The shape of the fracture affecting the outer lip in one of the available specimens (Fig. 10R) seems to indicate that the slit was short.

The genus *Busambrella* is here tentatively ascribed to the superfamily Scissurelloidea Gray, 1847 based on the small size (although near the upper limit of the dimensional range for this group), the general shape of the shell and, especially, for the growth lines of the whorl surface which end abruptly and obliquely at the edge of the selenizone. In contrast to other slit-bearing Jurassic superfamilies, such as the Pleurotomarioidea Swainson, 1840 and Ptychomphaloidea Wenz, 1938, the growth lines typically approach the edges of the selenizone more smoothly and tend to become tangential to them in a prosocyrt way. The exhalant opening and the selenizone in peripheral position would indicate close relationships of *Busambrella* with the members of the family Anatomidae McLean, 1989. Some aspects, however, make this attribution uncertain. Commonly, in the slit-bearing trochospiral scissurelloideans (Anatomidae and Scissurellidae Gray, 1847), the translation rate of the coiling along the spire axis (see Hickman & McLean 1990 for definition) is higher. Consequently, the downward shifting of the suture during growth is more pronounced. Moreover, the selenizone is narrower and sunken between edges that are sharply prominent.

The globose-sublenticular shape of the shell, the selenizone in peripheral position and the absence of a prominent ornament make *Busambrella* similar also to the taxa of the family Ptychomphalidae Wenz, 1938 as defined by Bandel (2009) and subsequently revised in detail by Gründel (2011). In particular, the genus shares with *Proteomphalus* Gründel, 2011 the small size and the spire with a selenizone elevated on the whorl surface, slightly above an incised suture. In *Proteomphalus* the spire is higher and the base has a median callus. On the last whorl, the suture

shifts downward and the selenizone becomes much more prominent on a strongly carinate periphery, whereas in *Busambrella* it becomes almost flush.

Included species and occurrence. The genus is represented only by the type species from Aalenian – Lower Bajocian sediments of Rocca Busambra (north-western Sicily, southern Italy).

Busambrella fasciata sp. nov.
Figure 10I–T

LSID. urn:lsid:zoobank.org:act:XXXXXXXXX

Derivation of name. From Latin adjective *fasciatus*, banded, referred to the wide peripheral selenizone.

Holotype. GPIT 1685/35 (Fig. 10O–T).

Type Locality. Piano Pilato, Rocca Busambra (north-western Sicily, southern Italy).

Type level. Aalenian – Lower Bajocian (*Leioceras opalinum – Sonninia propinquans* biozones) neptunian sill limestone.

Additional material. One specimen: paratype GPIT 1685/34, Aalenian – Lower Bajocian (*Leioceras opalinum – Sonninia propinquans* biozones).

Diagnosis. As for genus.

Description. The shell is small (about 5 mm), thick-walled, inflated sublenticular, and slightly wider than high. The spire is low and the base is more than three times higher than the spire. The shell has a feebly depressed protoconch that is followed by about three and a half, rapidly expanding whorls. The surface of the teleoconch whorls is widely convex, with a narrow shelf along the adapical suture. On the earliest teleoconch whorls, this sutural shelf slopes toward the axis and then it expands and progressively becomes feebly inclined in the opposite (abaxial) direction during growth. The selenizone is peripheral in position, between two spiral threads, and very wide, being about one quarter of the height of the distance between the adapical suture and the periphery measured at the end of the penultimate whorl. It is slightly elevated on the spire and becomes flush on the last whorl. The peripheral region is widely rounded. The suture runs in a narrow furrow, at or slightly above the lower edge of the selenizone of the preceding whorl. The base is globose and much higher than the spire. It shows an umbilical fissure encircled by a sharp periumbilical rim. The aperture is rather large, seemingly subcircular or rounded-ovate. The peristome is prosocline. The parietal lip is provided with a very thin inductura that passes smoothly into the umbilical lip. The umbilical lip is smooth, evenly and gently concave. It joins abapically the periumbilical rim and the basal lip where it is slightly reinforced.

The whorl surface above the selenizone is crossed by growth lines forming subregularly repeating, thin collabral riblets. The outer region of the base, below the selenizone, is ornamented by two, rather closely spaced and sharp spiral threads. The remaining part of the base bears four to five further spiral threads which are, after an initial wide belt, more and more closely spaced towards the spire axis. The surface of the base is ornamented also by shallow, regularly spaced collabral riblets forming a cobweb-like pattern with the spiral threads and small granules at the intersection points. The selenizone bears only very faint, dense, lunuliform growth lines. On the whorl surface above the selenizone, the growth lines are quite prosocline and widely prosocyrt. They end abruptly against the adapical edge of the selenizone, not tangentially. Slightly opisthocyrt

growth lines are in the abaxial, wider part of the base, they become slightly prosocyrt in the periumbilical region.

Dimensions. See Table 2.

Remarks. The material consists of two moderately well preserved specimens. Although the details of the apical spire are not clearly identifiable, a feebly depressed protoconch can be observed. Species comparable to *Busambrella fasciata* sp. nov. have not been found.

Distribution of the species. Aalenian – Lower Bajocian (*Leioceras opalinum – Sonninia propinquans* biozones), Rocca Busambra (north-western Sicily, southern Italy).

Superfamily FISSURELLOIDEA Fleming, 1822
Family FISSURELLIDAE Fleming, 1822
Subfamily EMARGINULINAE Children, 1834

Genus EMARGINULA Lamarck, 1801

Type species. *Emarginula conica* Lamarck, 1801, junior synonym of *Emarginula fissura* (Linnaeus, 1758). Recent, north-eastern Atlantic.

Subgenus EMARGINULA Lamarck, 1801

Type species. As for genus.

Emarginula (*Emarginula*) *burgioi* sp. nov.
Figure 11A–I

LSID. urn:lsid:zoobank.org:act:XXXXXXXXX

v 1971 *Emarginula* sp.; Wendt, p. 154.

Derivation of name. Species dedicated to Enzo Burgio, late curator of the Paleontological and Geological Museum "G. G. Gemmellaro", University of Palermo (Italy).

Holotype. GPIT 1685/37 (Fig. 11A–E).

Type Locality. Piano Pilato, Rocca Busambra (north-western Sicily, southern Italy).

Type level. Upper Toarcian (*Haugia variabilis – Phlyseogrammoceras dispansum* biozones) neptunian sill limestone.

Additional material. One specimen: paratype GPIT 1685/38, Upper Toarcian (*Haugia variabilis – Phlyseogrammoceras dispansum* biozones).

Diagnosis. Shell cap-shaped with mamillated apex and almost circular peristome. Height of shell almost equal to its length. Anterior profile of shell distinctly convex, posterior very slightly convex to almost flat. Apex weakly pointing to rear and slightly posterior in position. Selenizone almost indistinguishable from the ornament pattern. Slit very short. Ornament of two orders of about twenty-five radial ribs crossed by thin, sharp and very dense collabral threads. Secondary ribs slightly weaker than primary ones. Collabral threads opisthocyrt in interspaces between ribs. Radial

ribs edging selenizone stronger than other ribs. Lunulae of selenizone slightly more widely spaced than collabral threads.

Description. The shell is rather high cap-shaped with height almost equal to the lenght and with an almost circular peristome. Apex is mamillated, slightly backward pointing and feebly posterior in position. The protoconch seems to be dextrally coiled, but the adult shell is bilaterally symmetrical. The anterior outline of the shell in lateral view is distinctly convex whereas the posterior outline is very slightly convex to almost flat, with a weak apical concavity. The selenizone is narrow. It runs in the plane of symmetry of the adult shell and is hardly distinguishable from the elements of the outer ornament. On the inner mould, it appears as a radial ridge accompanied by wider furrows at each side indicating that the inner surface of the shell is thickened along the edges of the selenizone. The slit is very short.

The ornament consists of about twenty-five primary radial ribs alternating with secondary radial ribs, both reflected in the inner side of the shell. The secondary ribs appear at a variable distance from the apex along the mid-line of the interspaces between the primary radial ribs and, shortly after their appearance, become nearly as strong as the primary ribs. The intervals between the ribs are crossed by thin, sharp and dense growth threads. In each interval, the growth threads are slightly arched in an opisthocyrt way miming the ornament pattern of the selenizone. The radial ribs edging the selenizone are slightly stronger than the other ribs and the lunulae are slightly sparser than the collabral threads. These are the only elements which differentiate the selenizone from the outer ornament. The selenizone is otherwise hardly distinguishable when the slit, or its trace on inner mould, are not preserved.

Dimensions. See Table 2.

Remarks. The material consists of two inner moulds with large parts of the shell preserved. The morphology of the slit is recognizable from its trace on the inner mould. Among the species coming from comparable stratigraphical levels, *Emarginula triontina* Greco, 1899 (p. 116, pl. 9, fig. 3a–c) is the most similar to *Emarginula* (*Emarginula*) *burgioi* sp. nov. Greco's species is the type species of the subgenus *Emarginula* (*Balinula*) Dacquè, 1933. This subgenus is described as having an elongate and pyriform trema near the anterior margin of the peristome (Cox & Keen 1960). However, Greco (1899) underlined that the shape of the exhalant opening cannot be safely determined in his material due to the poor preservation of that part of the shell. *Emarginula triontina* differs from *E*. (*E*.) *burgioi* in having a higher shell, a clearly concave posterior outline of the shell and an ovate peristome. *Emarginula lindonensis* Hudleston, 1896 (p. 452, pl. 41, fig. 14a–b; Haber 1932, p. 274) differs in having a more posterior apex, an elliptical peristome, stronger and fewer radial ribs, and secondary radial elements that are much thinner or absent.

Distribution of the species. Upper Toarcian (*Haugia variabilis – Phlyseogrammoceras dispansum* biozones), Rocca Busambra (north-western Sicily, southern Italy).

Subgenus TAUSCHIA Haber, 1932

Type species. *Emarginula orthogonia* Tausch, 1890. Lower Jurassic, Dinaric Alps (Croatia).

Emarginula (*Tauschia*) *acutidens* sp. nov.
Figure 11J–M

LSID. urn:lsid:zoobank.org:act:XXXXXXXXX

Derivation of name. From Latin *acutus*, acute, and *dens*, tooth, referred to the shape of the shell.

Holotype. GPIT 1685/40 (Fig. 11J–M).

Type Locality. Piano Pilato, Rocca Busambra (north-western Sicily, southern Italy).

Type level. Upper Toarcian (*Haugia variabilis – Phlyseogrammoceras dispansum* biozones) neptunian sill limestone.

Additional material. None.

Diagnosis. Shell acute with subcircular peristome. Apex strongly posterior but not projected off from line of peristome in apical view. Anterior radial band of shell flat to feebly concave. Selenizone narrow, running on low elevation between two radial threads left from symmetry plane in anterior view. Short slit seemingly present. Ornament of about fifteen primary radial threads regularly alternating with weaker secondary ones. Shell covered with thin and dense growth threads forming a network with radial ribs.

Description. The shell is bilaterally symmetrical, tooth-like, very high and cap-shaped. The apex is backward curved and distinctly posterior but seemingly not projected off the peristomal margin in apical view. The peristome is subcircular and its diameter matches to about three quarters of the height of the shell. The selenizone is narrow and lies left from the plane of symmetry in anterior view. It runs between two strong spiral threads and appears as a low elevation. Right from the selenizone, a rather wide, radial band is formed which is flat near the apex and becomes feebly concave towards the peristome. It is arranged along both sides of the plane of symmetry and between two first order radial ribs. A strong radial elevation divides this area into two, unequally wide radial bands. The narrower one runs besides the selenizone.

About fifteen equally strong and regularly spaced primary radial ribs ornament the outer surface with weaker secondary riblets in the middle of their interspaces. The secondary radial ribs appear slightly adapically from the mid-height of the shell. The growth lines/threads form a pitted pattern.

Dimensions. See Table 2.

Remarks. The only available specimen is an inner mould with small, poorly preserved shelly fragments. The position of the selenizone to the left of the symmetry plane of the shell would indicate *Loxotoma* P. Fischer, 1885 as a likely genus placement for the species. Kollmann (2005) revised the type species of *Loxotoma*, namely *Emarginula neocomiensis* d'Orbigny, 1843 (p. 392, pl. 234, figs 4–8; Kollmann 2005, p. 173, pl. 18, figs 22–23) underlining that the position of the selenizone is highly variable, from slightly left to slightly right or also on the plane of symmetry of the adult shell and cannot be considered distinctive at genus rank. According to him, *Loxotoma* is junior synonymous of *Emarginula* Lamarck, 1801. In *Emarginula* (*Tauschia*) *acutidens* sp. nov. the selenizone is slightly raised on the outer shell surface and this is the diagnostic character of the subgenus *Emarginula* (*Tauschia*) Haber, 1932. The species reminds *Emarginula alfa* De Gregorio, 1886*f* (p. 7, pl. 1, fig. 30a–b) in the acute shape of the shell. It differs from *E. alfa* in having a higher shell, an ornament composed of two orders of radial ribs and in the asymmetrical position of the selenizone.

Distribution of the species. Upper Toarcian (*Haugia variabilis – Phlyseogrammoceras dispansum* biozones), Rocca Busambra (north-western Sicily, southern Italy).

Emarginula (*Tauschia*?) *vigilii* Fucini, 1894
Figure 11N–R

* 1894 *Emarginula*? *Vigilii* Fucini, p. 128, pl. 4, fig. 2, 2a.
v 1971 *Emarginula* (*Tauschia*?) sp.; Wendt, p. 156.

Material. One specimen, GPIT 1685/39, Aalenian – Lower Bajocian (*Leioceras opalinum – Sonninia propinquans* biozones).

Description. The early teleoconch is strongly curved and its outermost part extends well beyond the line of the peristome. It is slightly dextral, whereas the fully adult shell has a bilateral symmetry. The height of the shell is almost equal to the length of the peristome. The apex is placed at about one third of the shell height towards the peristome, hanging just over its posterior edge. The selenizone is narrow and lies in the plane of symmetry. It runs between two ribs and seems to be imperceptibly elevated on the early shell. On the inner mould of the adult part of the shell, the trace of the selenizone appears as a radial ridge. The peristome is circular-ovate with a somewhat wider posterior part. The slit extends almost one eighth of the length of the selenizone.
The shell is ornamented by about twenty-five radial ribs of equal strength. Their number does not increase during growth. Thinner, sharp and dense growth threads cross the interspaces between the ribs. The radial ribs and growth threads are reflected on the inner side of the shell as furrows, i.e. as elevations on the inner mould.

Dimensions. See Table 2.

Remarks. The material consists of an inner mould with some shell remains of the apical part. The presence of a slit is clearly discernible on the inner mould that records also the main elements of the outer ornament. Some considerations suggest leaving open the subgenus attribution. *Emarginula* (*Tauschia*) Haber, 1932 is distinguished from *Emarginula* s.s. mainly in having a selenizone raised on the outer shell surface. In the specimen here described, the early teleoconch, which is the only preserved part of the shell, shows a barely elevated selenizone. This element could be insufficient for a subgenus attribution, unless it is verified on the adult part of the shell. On the inner mould of this part, the trace of the selenizone has the aspect of a rather strong radial rib which could reflect an effectively raised selenizone. Alternatively, this rib may simply reflect a selenizone marked by a radial groove on the inner side of the shell and not elevated on its outer side, as it is the case in numerous species of *Emarginula* s.s.

The specimen described here differs from the single shell, coming from the Aalenian of the western Venetian Alps (northern Italy), on which Fucini (1894) erected *Emarginula* (*Tauschia*?) *vigilii* Fucini, 1894 only in its much bigger size. Most probably, the type specimen represents a not fully adult shell.

Haber (1932, p. 283) regarded *E.* (*T.*?) *vigilii* as belonging to the genus *Rimulopsis* Haber, 1932, and junior synonym of *Emarginula drinna* De Gregorio, 1886*c* (p. 18, pl. 11, fig. 26a–b). However, the presence of a slit indicates that *E.* (*T.*?) *vigilii* safely belongs to the genus *Emarginula* Lamarck, 1801. The species differs from *E. drinna* in its much more curved shell and a significantly smaller diameter of the peristome related to the height of the shell. There is no information about the exhalant opening of *E. drinna*. *Rimula*? *jonica* Greco, 1899 (p. 115, pl. 9, fig. 2a–c) differs in having a higher ratio between the height of the shell and the diameter of the peristome, two orders of radial ribs, sparser and stronger collabral elements and, presumably, a longer slit.

Distribution of the species. Aalenian, Capo San Vigilio (western Venetian Alps, northern Italy); Aalenian – Lower Bajocian (*Leioceras opalinum – Sonninia propinquans* biozones), Rocca Busambra (north-western Sicily, southern Italy).

Superfamily EUCYCLOIDEA Koken, 1897

Remarks. The systematics and phylogeny of the superfamily Eucycloidea Koken, 1897 have been treated by several authors (e.g. Cox 1960*c*; Golikov & Starobogatov 1975; Hickman & McLean 1990; Szabó 1995; Conti & Monari 2001; Kaim 2004; Gründel 2007; Kano 2008; Bandel 2010; Gründel *et al.* 2012; Ferrari *et al.* 2014; Ferrari & Kaim 2018). Two different interpretations have polarized the most recent discussions, one considering this group as a family of the superfamly Seguenzioidea Verrill, 1884 and the other as an independent superfamily. The former interpretation is mainly based on the phylogenetic analyses on molecular data made by Kano (2008) and Kano *et al.* (2009) that indicate the seguenziids as a highly and late derived group developing prominent shell and anatomical differences. The eucyclids possibly represent early derived seguenzioideans. Ferrari *et al.* (2014) explicitly supported the assignment of the family Eucyclidae Koken, 1897 to the Seguenzioidea and this view has been accepted by Bouchet *et al.* (2017).

Bandel (2009, 2010) underlined the discrepancies between the molecular and morphological approaches. According to that author, the palaeontological record indicates an early derivation of seguenzioideans that suggests an independent origin of the Eucyclidae. In Bandel's (2010) systematic arrangement the eucyclids are treated as a rather diversified superfamily represented by several families that share the presence of a nacreous inner layer and rounded first teleoconch whorls ornamented only by collabral riblets. The spiral ornament appears later during the early ontogeny.

Whatever their relationships with seguenzioideans, in the Late Triassic – Jurassic times the eucycloideans performed a high morphological diversification that is difficult to be constrained in a single family. Most of the species here described belong to the Eucyclidae and Eucycloscalidae Gründel, 2007. The diagnostic characters of these families are those defined by Gründel (2007), partly adopted also by Bandel (2010), and are in good agreement with the observations on the studied material. In the Eucyclidae, after the pattern of collabral riblets marking the beginning of the teleoconch, a single spiral keel and angulation appear in the lower part of the whorl which is variably persistent on the adult shell. Instead, in the Eucycloscalidae two or three spiral keels appear that frequently correspond to variably sharp angulations of the whorl.

In the studied material the morphology of the adult part of the shell reflects these differences. In the Eucyclidae the persistence throughout the teleoconch of the single spiral element and associated angulation gives rise to pagodiform adult shells. When the peripheral angulation runs very near to the abapical suture the shape of the adult shell tends to be conoidal. In forms where the keel disappears and the angulation becomes rounded during growth, the adult whorls have a distinctly pendent profile. In the Eucycloscalidae the biangulated early whorls tend to shape subgradate to turbiniform adult shells, with whorls evenly convex or only slightly pendent. Even if suggestive, the correlation in shape between the early teleoconch and the adult shell observed in the studied material is not always significant. Alternative cases are frequent, especially in the Eucycloscalidae. For example, in *Trypanotrochus* Cossmann, 1918 and *Gerasimovcyclus* Gründel, 2005 the early teleoconch is of eucycloscalid type but the adult shell becomes progressively pagodiform or conoidal (e.g. Gründel 2005, 2007; Gründel & Kaim 2006; Guzhov 2007; Gründel & Koppka 2013) seemingly due to a more rapid increase in size and prominence of the lower peripheral keel while the adapical keel becomes thinner and the corresponding angulation tends to vanish.

A substantial difference between the taxonomic arrangement adopted here and that proposed by Bandel (2010) concerns the family Cirridae Cossmann, 1916. This family is here provisionally ascribed to the Eucycloidea following the opinion expressed by Conti & Monari (2001). Instead, according to Bandel (1993; see also Bouchet *et al.* 2017) the group represents a distinct superfamily, the Cirroidea Cossmann, 1916, that includes the slit-bearing Porcelliidae Koken in Zittel, 1895 and slitless Cirridae. Later, Frýda & Blodgett (2004) changed the name of the superfamily into Porcellioidea Koken in Zittel, 1895 (see also Frýda *et al.* 2008 and references therein).

Family EUCYCLIDAE Koken, 1897

Genus PROPEUCYCLUS nov.

LSID. urn:lsid:zoobank.org:act:XXXXXXXXX

Derivation of name. From Latin *prope*, near to, referring to the similarity with *Eucyclus*. Gender masculine.

Type species. *Allocosmia geometrica* Conti & Monari, 1986. Lower Bajocian, Martani Mountains (Umbria, Central Italy).

Diagnosis. High-turbiniform, thin-walled shell with pagodiform, coeloconoidal early spire and cyrtoconoidal succeeding part. Early whorls with angular periphery slightly above suture and ramp slightly concave to slightly convex. Ramp convex on adult part of shell. Peripheral angulation attenuating on last whorls. Base anomphalous. Peristome approximately in one, slightly prosocline plane, with parietal region covered with very thin inductura. Columellar lip stout, twisted and with a rounded fold on its upper part. Ornament of early shell finely and densely reticulated. Fully adult part of shell and base ornamented by numerous, thin to obscure spiral threads. Periphery marked by distinct spiral thread. Collabral ornament disappearing or persisting on last whorls.

Remarks. *Propeucyclus* gen. nov. is here ascribed to the Family Eucyclidae Koken, 1897 based on its pagodiform general shape and the collabrally ribbed early whorls bearing a lower peripheral carina. These characters are well known in the type species (Conti & Monari 1986) and have been also observed in *Propeucyclus sicanus* sp. nov. (see below). The other two species here assigned to *Propeucyclus* are represented by specimens lacking the earliest spire. Also the orientation of the growth lines and the reticulate ornament of the juvenile shell are typical of Eucyclidae. However, the fine ornament of the adult part of the shell and the twisted columellar lip are unusual in this group.

The general shape of the shell, especially the pagodiform early spire, of *Propeucyclus* is very similar to that of *Eucyclus* J. C. A. Eudes-Deslongchamps, 1860 as recently revised by Ferrari *et al.* (2014). These authors maintained that the presence in the type species, namely *Eucyclus obeliscus* J. C. A. Eudes-Deslongchamps, 1860 (p. 145, pl. 11, fig. 9) [= *Eucyclus julia* (d'Orbigny, 1850) (p. 229; d'Orbigny 1853, p. 336, pl. 328, figs 3–4; Fischer & Weber 1997, p. 133, pl. 21, fig. 11; Ferrari *et al.* 2014, p. 1177, text-fig. 1.3)] of a peripheral keeled angulation of the whorl surface slightly above the suture is the main distinctive character of *Eucyclus* and emended the genus diagnosis accordingly. A peripheral angulation beside the abapical suture is present in *Propeucyclus* as well. However, in this genus the columellar lip is twisted, producing an upper fold. The periphery is marked by an almost smooth spiral thread and the spiral ornament of the spire and of the base consists of numerous, thin to obscure spiral threads that are smooth or provided with very small granules. In contrast *Eucyclus* has a straight and smooth columellar lip and is sculptured by more prominent and distinctly nodose spiral elements, including also the peripheral keel. The disappearance of the peripheral angulation on the last whorls is more evident in *Propeucyclus* than in *Eucyclus*.

Included species and occurrence. *Propeucyclus* is known from Aalenian – Lower Bajocian and Lower Bajocian deposits. Its occurrence in the Upper Toarcian sediments is uncertain. The genus is represented by the following species, listed in stratigraphical order:

Propeucyclus? *semireticulatus* sp. nov. (here), Upper Toarcian, Rocca Busambra (north-western Sicily, southern Italy).

Propeucyclus geometricus (Conti & Monari, 1986) (type species, see below for references), condensed Middle Aalenian – Lower Bajocian and Lower Bajocian, Martani Mountains

(Umbria, central Italy); Aalenian – Lower Bajocian, Rocca Busambra (north-western Sicily, southern Italy).

Propeucyclus sicanus sp. nov. (here), undifferentiated Aalenian–Bajocian, and Lower Bajocian, Rocca Busambra (north-western Sicily, southern Italy).

Propeucyclus obesus sp. nov. (here), Aalenian – Lower Bajocian, Rocca Busambra (north-western Sicily, southern Italy).

Propeucyclus geometricus (Conti & Monari, 1986)
Figure 12

v* 1986 *Allocosmia geometrica* Conti & Monari, p. 191, text-figs 12–13, pl. 4, figs 2–5.

Material. Sixteen specimens: GPIT 1685/588–602, Aalenian – Lower Bajocian (*Leioceras opalinum – Sonninia propinquans* biozones); GPIT 1685/603, Aalenian – Lower Bajocian (*Leioceras opalinum – Sonninia propinquans* biozones) neptunian dyke.

Description. The shell is thin-walled, subturriculate and composed of about eight whorls. The early teleoconch is distinctly pagodiform and slightly coeloconoidal. The last part of the shell becomes cyrtoconoidal, following a simply conoidal transition. The last whorl is almost half of the shell height and its final part is slightly inflated. The surface of the earlier whorls is almost twice and half wider than high. A deeply impressed suture separates the whorls and a rather sharp peripheral angulation is present above the suture. This angulation runs at about one third of the distance between the upper and lower sutures on the early preserved whorls, and at about one quarter on the penultimate whorl. On the early whorls, the ramp above the angulation is slightly convex whereas the spiral band between the angulation and the abapical suture is almost flat. During growth, the surface of the ramp becomes progressively more convex and the peripheral angulation more rounded. In the fully adult part of the shell, the angulation disappears from the last whorl and the whorl surface becomes evenly convex. The base is anomphalous and moderately high. It is slightly convex on the subadult shell and gradually becomes more elongated, tending to be subconoidal, and with a more convex surface in the fully adult stage. On the base of the subadult shell a weak angulation is observable along the line of the suture that vanishes on the last part of the shell. The aperture is oval, higher than wide but truncated at the parietal lip. The peristome is moderately prosocline and with an evenly arched, simple and thin outer lip. Usually, a moderately strong varix, making internal and external thickenings, is present before the outer lip of the last peristome. The columellar lip is straight and strengthened by a rather strong fold on its adapical half. The parietal lip is covered with a very thin inductura. The lower margin of the peristome is slightly elongated and this probably reflects the presence of a shallow outlet.

The first preserved teleoconch whorl is ornamented by a very regular pattern of collabral riblets. Subsequently these riblets become thinner and denser, and a spiral keel appears in correspondence to the peripheral angulation. During the adult growth the keel weakens in concomitance to the attenuation of the angulation. Very thin and dense spiral threads ornament the surface of the whorls and the base. They are sharper and slightly more widely spaced on the suprasutural region and on the base and commonly become almost obscure on the ramp of the last whorls. The intersection of the spiral threads with similarly dense and thin collabral lines forms a very fine network. The growth lines are prosocline, almost straight to very slightly prosocyrt on the ramp, very slightly opisthocyrt on the peripheral region and on the adaxial half of the base and prosocyrt on its abaxial region.

Dimensions. See Table 2.

Remarks. The material is represented by shells lacking the apical part and with the peristome incomplete. The description reported above of the ornament of the early teleoconch refers to the re-

analysis of the type material of *Propeucyclus geometricus* (Conti & Monari, 1986) from the condensed Aalenian – Lower Bajocian fissure-fillings of central Italy. The species is slightly variable in shell shape and ornament. The variation of the shell concerns the early teleoconch which is conoidal to slightly coeloconoidal. The spiral ornament can be hardly distinguishable to moderately sharp on the adult shell. Conti & Monari (1986) ascribed their species to the genus *Allocosmia* Cossmann, 1897 mainly for the high-spired shell, the parasigmoidal growth threads and a reticulate early shell. However, the type species of *Allocosmia*, namely *Allocosmia grandis* (Hörnes, 1855) (p. 35, pl. 1, fig. 1) has a much more slender, turritelliform shell, with more convex whorls devoid of angulations. Moreover, the growth lines are almost straight or very slightly sinuous, not parasigmoidal as previously described by Conti & Monari (1986). The holotype of *P. geometricus* (Fig. 12A–D) differs from the material of Rocca Busambra only in having a more marked spiral ornament on the whorl surface. This difference is most probably the effect of recrystallization processes.

Distribution of the species. Lower Bajocian (*Stephanoceras humphriesianum* Biozone) and condensed Middle Aalenian and Lower Bajocian (mixed *Ludwigia murchisonae* and *Stephanoceras humphriesianum* biozones), Martani Mountains (Umbria, central Italy); Aalenian – Lower Bajocian (*Leioceras opalinum – Sonninia propinquans* biozones), Rocca Busambra (north-western Sicily, southern Italy).

Propeucyclus sicanus sp. nov.
Figure 13A–F

LSID. urn:lsid:zoobank.org:act:XXXXXXXXX

Derivation of name. From Latin *Sicani* , Sicanians, ancient pre-roman people who inhabited the central and western Sicily.

Holotype. GPIT 1685/604 (Fig. 13A–D).

Type Locality. Piano Pilato (Rocca Busambra, north-western Sicily, southern Italy).

Type level. Lower Bajocian (*Sonninia sowerbyi – Sonninia propinquans* biozones) neptunian sill limestone.

Additional material. Paratype GPIT 1685/605, Aalenian–Bajocian (exact stratigraphical level unknown), Rocca Busambra (north-western Sicily, southern Italy).

Diagnosis. Shell slender with markedly pagodiform early spire. Ramp concave on early whorls. Base moderately convex. Ornament consisting of thin spiral and stronger collabral threads. Collabral threads densely and regularly spaced, spiral threads variable in size and distribution. Ramp bearing few, widely spaced spiral threads, intercalated by thinner, almost obscure threads or lines. Band between angulation and abapical suture with four–five, sharp spiral threads. Base ornamented by dense spiral lines or very thin threads. Peripheral spiral thread sharp and cord-like, becoming slightly thinner on last whorls.

Description. The shell is highly turriculate with an acute apical region, and composed of about ten whorls. The whorl surface is almost twice and half wider than high, and the last whorl represents about half-height of the shell. The early spire has a slightly coeloconoidal and markedly pagodiform outline. Its periphery is a sharp angulation running near the abapical suture at about one quarter of the height of the whorl surface. Here, the ramp is wide and concave and the narrow subperipheral belt between the angulation and the abapical suture is flat to very slightly convex. During growth,

the angulation becomes more and more rounded and finally disappears on the last whorl. At the same time the ramp gradually changes into convex and also the subperipheral region becomes slightly more convex. The suture is deeply impressed. The base is anomphalous, moderately convex and moderately high. The basal surface is concave around the columella. The peristome is seemingly provided by a solid columellar lip.

The ornament of the whorl surface consists of a network of thin spiral and stronger collabral threads. Very small granules can be present at the intersection points. The collabral threads are uniform, densely and evenly spaced. The spiral threads are variable in strength and distance from each other. On the ramp of the last whorls, five–six primary spiral threads are present and two–three, obscure spiral lirae or lines are visible in their interspaces. Four–five, rather sharp spiral threads ornament the median and lower part of the subperipheral region. The periphery is marked by a sharp cord-like spiral thread becoming slightly thinner on the last whorls. The base is ornamented by a dense pattern of spiral lines or very thin threads and is devoid of collabral ornament. The growth lines are moderately prosocline on the whorl surface. They are straight to opisthocyrt on most of the whorl surface and feebly prosocyrt on the subsutural region. The growth lines of the base are almost straight or very slightly sinuous.

Dimensions. See Table 2.

Remarks. The holotype is represented by a shell lacking the apical spire. The last whorl is incomplete and the cross-section of a rather heavy columella is visible on its broken surface. The paratype consists of an early shell preserving some traces of the ornament. *Propeucyclus sicanus* sp. nov. differs from *P. geometricus* (Conti & Monari, 1986) in having much lower whorls and base, and a higher and more prominently pagodiform early shell. The adult shell is ornamented by distinctly sharper and more widely spaced collabral and spiral threads. Although *P. geometricus* is represented by numerous specimens, none of them show morphological traits transitional to *P. sicanus*.

Distribution of the species. Undifferentiated Aalenian–Bajocian, and Lower Bajocian (*Sonninia sowerbyi – Sonninia propinquans* biozones), Rocca Busambra (north-western Sicily, southern Italy).

Propeucyclus obesus sp. nov.
Figure 13G–J

LSID. urn:lsid:zoobank.org:act:XXXXXXXXX

Derivation of name. From the Latin adjective *obesus*, fat, referred to the globose shape of the shell.

Holotype. GPIT 1685/585 (Fig. 13G–J).

Type Locality. Piano Pilato (Rocca Busambra, north-western Sicily, southern Italy).

Type level. Aalenian – Lower Bajocian (*Leioceras opalinum – Sonninia propinquans* biozones) neptunian sill limestone.

Additional material. None.

Diagnosis. Adult part of shell cyrtoconoidal-ovate in outline. Early whorls concave, becoming distinctly convex on cyrtoconoidal part of shell. Last whorl inflated. Base markedly convex. Columellar lip slightly leftward inclined and forming an obtuse angle with the parietal lip. Peripheral angulation marked by a sharp spiral thread. Surface of whorl above periphery

ornamented by dense and thin spiral threads becoming obscure on last whorls. Similarly dense but distinct threads between periphery and abapical suture, and on base.

Description. The shell is cyrtoconoidal-ovate with seemingly coeloconoidal early teleoconch. The surface of the penultimate whorl is about three times wider than high, and the last whorl is presumably slightly lower than half-height of the shell. The earliest preserved whorl is initially feebly concave but changes into increasingly convex subsequently. Its periphery is marked by a sharp angulation running slightly above the suture. The peripheral angulation gradually smoothens during growth and disappears on the last whorl, while the surface of the whorls becomes quite convex and smoothly passes to the base. The suture is deeply impressed along its full length. The base, as a whole, is convex and anomphalous; its wall is rather convex on the peripheral region and flatten on the periaxial area. The peristome is slightly prosocline. The parietal lip is provided with a thin inductura and meets the columellar lip at an obtuse angle. The columellar lip is slightly leftward inclined, rather thick and seemingly associated with a narrow, rudimentary outlet at its foot. The outer lip is evenly arched.

The main element of the ornament consists of a sharp peripheral spiral thread which becomes slightly less prominent during growth. The wide surface of the whorls above the periphery bears dense and thin spiral threads which seemingly increase in number and become obscure on the last whorls. Similarly dense but sharper spiral threads ornament the narrow belt between the periphery and the abapical suture, and the base. The growth lines are extremely faint. They are feebly prosocline and feebly opisthocyrt on the spire and on the base.

Dimensions. See Table 2.

Remarks. The single specimen preserves the last three and a half whorls. The morphology of the earliest preserved whorl suggests a coeloconoidal, pagodiform outline of the apical shell whereas the latest whorls show a distinctly cyrtoconoidal coiling due to a slightly constricted last whorl. Although the peristome is incomplete, its shape can be reconstructed by its inner mould and by the shape of the growth lines. *Propeucyclus obesus* sp. nov. differs from *Propeucyclus geometricus* (Conti & Monari, 1986) in its ovate latest shell parts, consisting of lower and less convex whorls, and in lacking a network ornament. *Propeucyclus sicanus* sp. nov. has a shell more slender than that of *P. obesus*, and the spiral threads are intersected by collabral threads.

Distribution of the species. Aalenian – Lower Bajocian (*Leioceras opalinum – Sonninia propinquans* biozones), Rocca Busambra (north-western Sicily, southern Italy).

Propeucyclus? semireticulatus sp. nov.
Figure 13K–N

LSID. urn:lsid:zoobank.org:act:XXXXXXXXX

Derivation of name. From the Latin *semi-*, half/partially, and *reticulatus*, net shaped, referred to the network ornament on the abapical half of the whorl surface.

Holotype. GPIT 1685/587 (Fig. 13K–N).

Type Locality. Piano Pilato (Rocca Busambra, north-western Sicily, southern Italy).

Type level. Upper Toarcian (*Haugia variabilis – Phlyseogrammoceras dispansum* biozones) neptunian sill limestone.

Additional material. None.

Diagnosis. Shell with conoidal outline. Whorls subquadrangular in cross-section. Suture deeply impressed and slightly below rounded angulation of whorls. Mid-whorl obscure angulation on early whorls shifting downward to about one third of whorl height. Surface of early whorls above median angulation concave, gradually becoming slightly convex. Surface of whorls between angulations convex and peripheral. Abapical half of whorl surface ornamented by three equally spaced and sized spiral threads intercalated by secondary spiral threads. Secondary spiral threads almost as strong as primary ones on last whorls. Collabral riblets moderately prosocline, uniform, densely and regularly distributed, forming quite regular network with spiral threads. Granules at crossing points.

Description. The shell is thin-walled, conoidal in outline and has a moderately turriculate spire. The last whorl is not preserved and the penultimate whorl is almost twice and half wider than high. The whorls have a subquadrangular cross section. The suture is deeply impressed and runs slightly below a rounded angulation of the whorl surface. The early preserved whorls show another rounded, obscure angulation at half-height of the whorl surface and a feebly concave adapical belt. During growth, this angulation becomes weaker and shifts abapically at almost one-third of the height of the whorl surface. Concomitantly, the concave adapical belt of the whorl becomes gradually narrower making the ramp almost flat. The whorl surface between the angulations is very weakly convex on the earliest preserved whorls and its convexity slightly increases during growth. The position of this band is peripheral. The base is anomphalous and the peristome has a rather heavy columella.

The ornament is composed of spiral threads and collabral riblets. The abapical half of the early preserved whorls bears three strong and equally spaced spiral threads. The uppermost one of these threads is slightly more marked than the others and its position corresponds to the adapical, obscure angulation. During growth, thinner spiral threads appear in the interspaces between the primary ones and on the abapical part of the ramp. They rapidly strengthen and become almost as strong as the primary spiral threads on the last whorls. Above the mid-whorl, the spiral ornament is almost absent or composed of obscure lirae. The collabral ornament consists of moderately prosocline, uniform, densely and regularly repeating suture-to-suture riblets which seem to be slightly more distant to each other and sharper on the earliest preserved whorls. Below the mid-whorl, the intersections of the collabral ornament with the spiral threads form a regular network with granules at the crossing points. On the last preserved whorl the ornament weakens. The growth lines are moderately prosocline, straight to very slightly opisthocyrt on the whorl surface.

Dimensions. See Table 2.

Remarks. The material consists of a single specimen lacking the earliest spire and the last part of the shell. The attenuation of the spiral ornament demonstrates that, most probably, only the last whorl is lacking. The base of the specimen is covered with a smooth shell coating that represents the parietal region of the last whorl. This coating prevents to verify the presence and the pattern of the basal ornament. However, the morphology of the last preserved part of the shell indicates a low conoidal base with a convex wall that turns into the last whorl surface through a rounded angulation. The cross section exposed on a broken surface permits to infer the presence of a slightly leftward tending, rather stout columellar lip in subaxial position. Despite the incompleteness of the shell, the preservation of the specimen is sufficient to characterize the species and to recognize the aspects that distinguish it from the other comparable Jurassic species.

Propeucyclus? semireticulatus sp. nov. differs from the other species belonging to the genus *Propeucyclus* gen. nov. in the presence of an additional indistinct angulation of the whorls and in the position of the periphery that corresponds to the whorl surface between the two angulations. This makes the shape of the shell subgradate whereas in *Propeucyclus*, the outline is pagodiform. These differences suggest leaving the genus attribution provisionally open.

Elymicyclus alternatus sp. nov. (see below) is also similar in the general shape of the shell and ornament pattern. However, the subgradate shape, the absence of ornament above the mid-whorl, and the concave adapical belt in the early whorls make *P.? semireticulatus* different from *E. alternatus*.

Distribution of the species. Upper Toarcian (*Haugia variabilis – Phlyseogrammoceras dispansum* biozones), Rocca Busambra (north-western Sicily, southern Italy).

Genus EUCYCLOMPHALUS von Ammon, 1893

Type species. *Trochus cupido* d'Orbigny, 1850. Upper Pliensbachian, Calvados (northern France).

Remarks. In the genus *Eucyclomphalus* Ammon, 1893 the juvenile spire is coeloconoidal and the fully adult part of the shell is cyrtoconoidal. The whorls are commonly low with a variably angulated and carinate periphery running in the lower third of the whorl. In the type species, namely *Eucyclomphalus cupido* (d'Orbigny, 1850) (p. 227; d'Orbigny 1853, p. 261, pl. 309, figs 5–8; Fischer & Weber 1997, p. 101, pl. 23, fig. 1a–c) the carina bears small but distinct nodes that persist during the adult growth whereas in other species, such as *Eucyclomphalus nesea* (d'Orbigny, 1850) (p. 228; d'Orbigny 1853 p. 328, pl. 326, figs 4–5; Fischer & Weber 1997, p. 129, pl. 23, figs 2–3), from the Upper Pliensbachian of Calvados (northern France), the nodes are much smaller and denser and can become almost indistinct on the last whorl. The presence of a wide and deep umbilicus encircled by a spiral element, varying from a prominent cord to a sharp thread, is one of the most distinctive characters of the genus.

The adult shell of *Sertomphalus* Gründel, 2007 closely resembles that of *Eucyclomphalus* and seemingly these genera cannot be distinguished from each other only on the basis of the adult characters. Gründel (2007) described and illustrated in *Sertomphalus* a very slender apical spire with low and numerous whorls ornamented by strong axial ribs. According to that author, a slender and ribbed apical spire seems to be absent in *Eucyclomphalus*, although this part of the shell is incomplete in the only available specimen of *E. cupido*.

Eucyclomphalus? *marenostrum* sp. nov.
Figure 14

LSID. urn:lsid:zoobank.org:act:XXXXXXXXX

Derivation of name. *Mare Nostrum* is the Roman name of the Mediterranean Sea.

Holotype. GPIT 1685/580 (Fig. 14A–C).

Type Locality. Piano Pilato, Rocca Busambra (north-western Sicily, southern Italy).

Type level. Aalenian – Lower Bajocian (*Leioceras opalinum – Sonninia propinquans* biozones) neptunian sill limestone.

Additional material. Four specimens: paratype GPIT 1685/581, Aalenian – Lower Bajocian (*Leioceras opalinum – Sonninia propinquans* biozones); paratype GPIT 1685/582, Lower Toarcian – lowermost Upper Toarcian (*Hildoceras bifrons – Haugia variabilis* biozones); paratypes GPIT 1685/583 and 584, Upper Toarcian (*Haugia variabilis – Phlyseogrammoceras dispansum* biozones).

Diagnosis. Early teleoconch coeloconoidal and subpagodiform. Adult part of shell cyrtoconoidal to subpupiform. Surface of early whorls flat and steep, with sharp peripheral angulation slightly above

suture. Successive whorls convex, with weakly angular to rounded periphery. Suture shifting downward during growth. Umbilicus with concave inner wall and sharply angular periumbilical margin. Spiral ornament composed of up to four spiral threads between peripheral angulation and abapical suture and single very thin subsutural thread. Early whorls with thin, evenly spaced collabral riblets making peripheral and subsutural spiral threads densely corrugated and vanishing on adult shell. Periumbilical region bearing two–three strong spiral threads.

Description. The shell is thin-walled and composed of about ten whorls. The early teleoconch is distinctly coeloconoidal and subpagodiform. The subsequent part of the shell has a slightly to strongly cyrtoconoidal, almost pupiform outline. The height/width ratio of the whorls decreases during growth and the early preserved whorls are wide twice and half of their height whereas the penultimate whorl is three times wider than high. The height of the last whorl is about half of the shell height. The surface of the early preserved whorls is flat and steep, and bears a sharp peripheral angulation slightly above the suture. During growth, the convexity of whorls increases and the peripheral angulation weakens. The last whorl is the most convex and its periphery is very feebly angular to round. The suture is slightly impressed and runs in a narrow groove that is bordered adapically by the peripheral angulation. The base is distinctly convex and broadly phaneromphalous. The periumbilical rim is sharply angular and the umbilical wall of the whorls is concave. The peristome seems to be discontinuous on the parietal lip or provided with a very thin inductura. The umbilical lip is distinctly arched on the axial plane, with a convex apertural side. It seems to form a shallow outlet-like protrusion at the junction with the basal lip where the periumbilical angulation terminates.

The spiral ornament consists of threads on the spiral band between the periphery and the abapical suture. A spiral thread marks also the peripheral angulation that is commonly stronger than the others. One to three threads run below the peripheral thread but only the uppermost one is exposed on the early spire. The other threads are commonly covered by the following whorl and visible only on the last whorl. In some specimens, the suture gradually shifts downwards during the fully adult growth and can leave all these threads exposed also on the penultimate whorl. Another, very thin spiral thread runs just below the suture. Sparse and very obscure spiral lines can appear on the latest whorls and on the base. The collabral ornament consists of thin, dense and regularly spaced riblets on the earliest preserved whorls that finely and densely corrugate the peripheral and subsutural spiral threads. The riblets fade out early during growth and persist longer as very short riblets that corrugate the spiral threads. They disappear on the last whorls and the spiral threads become smooth. Apart from the spiral threads below the periphery, the base can be smooth or can have a very obscure spiral lineation. The periumbilical angulation bears a sharp spiral thread coupled externally by another, stronger spiral thread. The spiral interval between these threads can be crossed by dense and fine collabral riblets. Few other spiral threads are visible on the umbilical wall of the whorls alongside the periumbilical rim. The growth lines are moderately prosocline and slightly opisthocyrt on the whorl surface, parasigmoidal on the base.

Dimensions. See Table 2.

Remarks. The specimens have the shell wall in a good state of preservation but the apical spire is not preserved and the peristome is strongly incomplete. *Eucyclomphalus*? *marenostrum* sp. nov. is rather highly variable in shell shape and in the details of the ornament. The coeloconoidal outline of the early spire is variably extended to the median part of the adult shell. The latest part of the shell is slightly cyrtoconoidal to subpupiform. The periphery, which is always distinctly angular on the early shell, becomes rounded angular on the last whorl. The spiral threads below the periphery range in number from one to four. They are variably strong and spaced, sometimes alternating in size. They can weaken or disappear on the last whorl. The subsutural spiral thread can be coupled with one or two threads which appear during the growth of the last whorl. The persistence of the corrugation of the peripheral and subsutural threads is also variable.

The lack of information on the apical shell suggests leaving open the genus attribution. *Eucyclomphalus cupido* (d'Orbigny, 1850) differs from *E.*? *marenostrum* in its lower whorls, and a much more pronounced peripheral angulation which is slightly higher on whorl surface. Moreover, the base is ornamented by strong spiral threads with interspaces crossed by collabral riblets and the periumbilical rim is marked by a single prominent spiral cord. In addition, *E. cupido* has a much wider umbilicus. *Eucyclomphalus nesea* (d'Orbigny, 1850) has a fully cyrtoconoidal shell, higher whorls and base sculptured by strong, cord-like spiral threads. *Eucyclomphalus hierlatzensis* von Ammon, 1893 (p. 169; Szabó 2009, p. 85, text-fig. 81A–E and references therein) differs from *E.*? *marenostrum* in having a conoidal shell, prominent and granulated spiral threads on the base, and a roundedly angular periumbilical rim. *Eucyclomphalus profundeumbilicatus* (Parona, 1894) (p. 179, pl. 7, fig. 10a–c; Sacchi Vialli 1964, p. 9, pl. 1, fig. 16a–c) differs in its evenly cyrtoconoidal outline and wider spiral angle. The peripheral angulation is farther from the suture so the sutural channel is wider.

The general shape and ornament of *E.*? *marenostrum* are very similar to those of *Propeucyclus obesus* sp. nov. (see above). Apart from the differences at genus level, *P. obesus* shows lower whorls. The ornament is composed of a single, almost obscure peripheral spiral thread, fine and dense spiral lines on the whorl surface and distinct spiral threads on the base whereas in *E.*? *marenostrum* two to four prominent spiral threads are present on the peripheral region and outer part of the base, the background spiral ornament is quite obscure and most of the base is almost smooth.

Distribution of the species. Uppermost Lower Toarcian – lower Upper Toarcian, and Aalenian – Lower Bajocian, Rocca Busambra (north-western Sicily, southern Italy).

Genus TORONYELLA nov.

LSID. urn:lsid:zoobank.org:act:XXXXXXXXX

Derivation of name. From the Hungarian word *Torony*, tower, and *-ella*, diminutive suffix, referred to the turriculate shape and small size of the shell. Gender feminine.

Type species. *Toronyella lineata* sp. nov., Upper Bajocian, Rocca Busambra (north-western Sicily, southern Italy) (see below).

Diagnosis. Shell slender, high-pagodiform, cyrtoconoidal. Earliest teleoconch whorls markedly convex becoming sharply angulated and carinate at the periphery. Peripheral angulation running on abapical half of whorls. Base anomphalous. Outer part of base of juvenile shell edged adaxially by obtuse and carinate spiral angulation persisting to almost disappearing on adult shell. Aperture rounded to slightly ovate. Parietal lip of last peristome with thin coating or thick inductura. Axial ornament of juvenile shell made of collabral ribs forming nodes on peripheral keel and changing into growth riblets/threads or also vanishing on fully adult shell. Spiral ornament consisting of threads on adult whorls and base.

Remarks. In the type species the protoconch, although poorly preserved, seems to be blunt, globose and of vetigastropod type. The rounded earliest teleoconch whorls ornamented by a regular pattern of collabral ribs and the subsequent appearance of a peripheral spiral keel slightly above the abapical suture indicate that *Toronyella* gen. nov. belongs to the family Eucyclidae Koken, 1897. *Microcheilus* Kittl, 1894, a genus ascribed by Bandel (2010) and Nützel (2013) to the family Sabrinellidae Bandel, 2010, has a slender and high-pagodiform shell reminiscent of *Toronyella*. However, like the other sabrinellids, *Microcheilus* has an outward thickened peristome.

Pseudalaria Hudleston, 1889 resembles *Toronyella* in the high-pagodiform shape of the shell with whorls bearing a sharp, carinate and crenulated peripheral angulation, and an additional

obtuse angulation along the outer part of the base. It differs from *Toronyella* in lacking a distinct collabral ornament. The aperture is also different. According to Hudleston (1889), *Pseudalaria etheridgii* (Tawney, 1873) (pag. 14, pl. 1, fig. 7; Hudleston 1889, pag. 189, pl. 12, figs 6a-c, 7, 8) has a square shaped aperture with an angular, outlet-like recess at the foot of columella. In contrast, *Toronyella* has a rounded-ovate aperture devoid of lower outlet.

Included species and occurrence. The genus ranges from Toarcian to Upper Bajocian and is represented by the following species, in stratigraphical order:
Toronyella lineata sp. nov. (type species, here), undifferentiated Toarcian and lowermost Upper Toarcian, Rocca Busambra (north-western Sicily, southern Italy).
Toronyella margaritata sp. nov. (here), Upper Bajocian, Rocca Busambra (north-western Sicily, southern Italy).

Toronyella lineata sp. nov.
Figure 15A–T

LSID. urn:lsid:zoobank.org:act:XXXXXXXXX

Derivation of name. Referred to the fine spiral ornament.

Holotype. GPIT 1685/479 (Fig. 15A–E).

Type Locality. Piano Pilato (Rocca Busambra, north-western Sicily, southern Italy).

Type level. Upper Toarcian (*Haugia variabilis – Phlyseogrammoceras dispansum* biozones) neptunian sill limestone.

Additional material. Six specimens: Paratypes GPIT 1685/483 and 484, Lower Toarcian – lower Upper Toarcian (*Harpoceras serpentinum – Haugia variabilis* biozones); Paratype GPIT 1685/485, Upper Toarcian (*Haugia variabilis – Phlyseogrammoceras dispansum* biozones); specimens GPIT 1685/480–482 Upper Toarcian (*Haugia variabilis – Phlyseogrammoceras dispansum* biozones).

Diagnosis. Peripheral angulation running at about one quarter of whorl height towards abapical suture. Subsutural region slightly bulged. Basal angulation tending to disappear on the last whorl. Aperture subcircular. Thick inductura on parietal lip. Columellar lip slightly outward reflected and detached from axial region of base. Ornament of early shell composed of evenly spaced and sized collabral ribs overlapped by thin, sharp and very regularly repeating spiral threads. Collabral ribs changing in irregular wrinkles and growth threads on adult part of shell, and nodes of peripheral cord attenuating or vanishing on last whorls. Subsutural swelling with spiral threads stronger than the others and collabrally elongated nodes at intersection with collabral ribs/wrinkles. Base ornamented by dense spiral threads.

Description. The shell is turriculate, high-pagodiform and cyrtoconoidal, composed of slightly less than ten whorls. The protoconch seems to be blunt. The earliest teleoconch whorls are distinctly convex and edged by a strongly impressed suture. The periphery is rounded and placed much below mid-whorl. At the end of the second whorl, the periphery becomes progressively angulated. The whorl surface between the periphery and the adapical suture is wide and steep. It becomes gradually concave while a subsutural spiral swelling appears. The whorl surface between the periphery and the abapical suture is narrow and inclined on the spire axis in abapical direction. The widht of the fully adult whorls is about two times their height and the height of the last whorl is 45% of the shell height. The periphery is distinctly angulated and placed at about one quarter of the height of the whorl towards the abapical suture. The base is conoidal, with a moderately convex surface and

anomphalous. Its outermost band is edged adaxially by a very obtuse spiral angulation on which the suture runs. This angulation attenuates during growth and can also disappear on the last whorl. The aperture is subcircular. The peristome of the not fully adult shell is discontinuous on the parietal lip. During the last growth a thick parietal callus appears and and produces a distinctly continuous peristome. The parietal lip passes smoothly to the columellar lip. The columellar lip is slightly reflected outward and detached from the axial region of the base. The outer lip is thickened at the sutural angle.

The beginning of teleoconch is seemingly smooth. The earliest teleoconch whorls bear prosocline, regularly spaced and sized collabral ribs. On the median part of the teleoconch, the collabral ribs strengthen. They make rounded nodes on the peripheral angulation and collabrally elongated nodes on the subsutural swelling. On the last whorls, the collabral ribs become progressively shallower, wider and more irregular in size. The last whorl can still show some collabral ribs but commonly the collabral ornament is dominated by a dense pattern of irregularly sized growth threads. On the last whorls the nodes of the peripheral swelling tend to vanish. The nodes of the subsutural swelling can become stronger, waving the suture, or reduce to feeble wrinkles. The spiral ornament appears on the earliest teleoconch whorls where two thin spiral threads are present just above the suture. On the second whorl, three–four spiral threads run between the periphery and the abapical suture. On the subsequent whorls, spiral threads appear also between the periphery and the adapical suture. They increase in number during growth and commonly are very regularly spaced. The last whorl bears about fifteen, slightly irregularly sized threads. Concomitantly with the attenuation of the nodes, a spiral cord forms on the peripheral angulation. On the last whorls, the peripheral cord is distinctly prominent, feebly nodose to smooth and ornamented by spiral threads that are thinner and denser than those of the whorl surface. The base is ornamented by spiral threads that are thinner on its outermost band. The basal angulation is marked by a spiral thread that is stronger than the others. The surface between the basal angulation and the axial region of the base bears spiral threads commonly very regularly distributed and sized. The growth lines are prosocline and opisthocyrt on the whorl surface where they become prosocyrt on the subsutural swelling. On the base, they are widely and evenly opisthocyrt, and slightly prosocyrt on the axial region.

Dimensions. See Table 3.

Remarks. The specimens show the shell wall in a very good state of preservation. The early shell is partially preserved. The apertural region is variably complete both in immature and fully adult shells. The variation of *Toronyella lineata* sp. nov. concerns mainly the details of the ornament. On the fully adult shell, the collabral ribs are variably persistent and the subsutural nodes can either attenuate or strengthen during growth. The spiral threads are commonly evenly spaced and sized, but in some specimens this pattern is more irregular with threads roughly alternating in dimensions. Also the strength of the peripheral cord on the last whorl is variable. The basal angulation is somewhat sharp to blunt and can also disappear completely on the last whorl.

Distribution of the species. Lower? – Upper Toarcian, Rocca Busambra (north-western Sicily, southern Italy).

Toronyella margaritata sp. nov.
Figure 15U–Z

LSID. urn:lsid:zoobank.org:act:XXXXXXXXX

v 1971 *Pseudalaria* cf. *etheridgii* (Tawney); Wendt, p. 159.

Derivation of name. From the Latin adjective *margaritatus*, beaded, referring to the ornament of the peripheral keel and of the spiral threads of the sutural region.

Holotype. GPIT 1685/486 (Fig. 15U–Z).

Type Locality. Piano Pilato (Rocca Busambra, north-western Sicily, southern Italy).

Type level. Upper Bajocian (*Strenoceras niortense – Parkinsonia parkinsoni* biozones) neptunian sill limestone.

Additional material. None.

Diagnosis. Peripheral angulation slightly below mid-whorl on adult shell. Aperture slightly ovate. Peristome with thin parietal coating covering axial region of base and passing smoothly to columellar lip. Axial ornament of early shell consisting of thin threads and strong, widely spaced ribs making prominent nodes on peripheral angulation. Ribs disappearing on adult shell and peripheral nodes becoming smaller and denser. Spiral ornament consisting of supra- and subsutural cord-like threads finely beaded by collabral threads and persisting on adult shell. Peripheral angulation with two spiral threads giving rise to duplicate cord on subsequent whorls. Numerous spiral threads progressively appearing on adult shell and forming a sharp and dense network with collabral riblets. Base with about ten spiral threads crossed by collabral riblets.

Description. The shell is slender, high-pagodiform, cyrtoconoidal in outline and presumably composed of about ten whorls. The protoconch and earliest teleoconch are lacking. The first preserved whorls have a concave surface and a prominent peripheral angulation placed slightly above the suture. During growth the periphery moves gradually upwards. It runs slightly below the mid-whorl on the fully adult part of the shell. The adult whorls are wide two and half times their height. The whorl surface between the peripheral angulation and the adapical suture becomes less concave on the adult part of the shell. The whorl surface below the periphery is flat to very slightly convex and inclined on the spire axis in abaxial direction. The suture is incised in a narrow groove edged by a subsutural and suprasutural spiral thread. The base is subconoidal and anomphalous. Its outermost band is slightly concave to flat and limited adaxially by a very obtuse spiral angulation. The suture runs just below this angulation. The remaining surface of the base is moderately convex. The aperture is seemingly slightly ovate in axial direction. The peristome is prosocline. The parietal lip is thickened at the sutural corner. It is provided with a thin inductura that passes smoothly to the columellar lip and covers the axial region of the base. The columellar lip is slightly inclined leftward and backward.

The collabral ornament of the earliest preserved whorls consists of about ten, strong, widely spaced collabral ribs that form prominent, roundly pointed nodes on the peripheral angulation and attenuate towards the adapical suture. These ribs overlay a dense pattern of sharp and thin collabral threads. The spiral ornament of the early shell consists of a suprasutural spiral thread, corresponding to the basal angulation of the adult shell, a pair of spiral threads on the top of peripheral angulation and a subsutural spiral thread. The supra- and subsutural threads persist on the whole shell and are finely beaded by intersection with the collabral threads. On the subsequent whorls, the collabral ribs attenuate and then vanish whereas the nodes on the peripheral angulation progressively become smaller, denser and much more numerous. The collabral threads slightly strengthen and become riblets on the last whorl. The two peripheral spiral threads give rise to a seemingly duplicate keel. Thin spiral threads progressively appear above and below the peripheral keel. On the last two whorls, about six sharp, subregularly distributed spiral threads run on the whorl surface above the periphery and two–three below it. They form a dense and subregular network with the collabral riblets. Granules are present at the intersection points. The base is ornamented by about ten, sharp spiral threads crossed by opisthocyrt collabral riblets. The basal angulation is marked by a spiral

cord-like thread that is more prominent than the others. The growth lines are somewhat prosocline on the whorl surface, where they are almost straight above the periphery and slightly opisthocyrt below it. The base bears widely opisthocyrt growth lines.

Dimensions. See Table 3.

Remarks. The specimen has a well preserved shell but lacks the apical spire and part of the peristome. *Toronyella margaritata* sp. nov. differs from *Toronyella lineata* sp. nov. in the peristome lacking a thick callosity on the parietal lip, and in the peripheral keel being higher on whorl surface and duplicated. Moreover, *T. margaritata* lacks a subsutural spiral swelling and the spiral cord-like thread of the basal angulation is exposed on the spire. Details of the ornament are also different. In *T. margaritata* the early preserved part of the teleoconch bears dense and sharp collabral threads and few collabral ribs making strong nodes on the periphery. In contrast, this part of the shell in *T. lineata* is ornamented by a regular collabral ribbing originating dense and less prominent peripheral nodes. The last whorls of *T. margaritata* bear a sharp and regular network of collabral riblets and spiral threads. This pattern is absent in *T. lineata*.

Distribution of the species. Upper Bajocian, Rocca Busambra (north-western Sicily, southern Italy).

? Family EUCYCLIDAE Koken, 1897

Genus ZARNGLAFFIA Gründel & Koppka, 2013

Type species. *Zarnglaffia spinigera* Gründel & Koppka, 2013. Upper Oxfordian, Czarnogłowy (previously named Zarnglaff), Pomerania, north-western Poland.

Remarks. Gründel & Koppka (2013) tentatively placed *Zarnglaffia* Gründel & Koppka, 2013 into the turbinid subfamily Angariinae Gray, 1857, presumably based on the presence of a peripheral spiny ornament. However, in the Angariinae the spire is much lower, the aperture is almost radial and the last peristome is flared (Hickman & McLean 1990). The genus is here tentatively moved to the family Eucyclidae Koken, 1897 for the pagodiform shape of the shell with high and distinctly convex base. Although the early spire is incomplete in the type species and is bad preserved in the species described here, the few observable characters would corroborate this attribution. In the type species the earliest preserved part of the teleoconch is slender, padogiform and with a prominent peripheral angulation. In *Zarnglaffia polygonalis* sp. nov. (see below) the first teleoconch whorl seems to be evenly convex. The subsequent whorls are distinctly angulated slightly above the suture and this makes the shape of the early teleoconch quite similar to that of *Eucyclus* J. C. A. Eudes-Deslongchamps, 1860. Since the ornament of the apical shell and their changes during the early growth are unknown, the attribution of *Zarnglaffia* to the Eucyclidae remains uncertain. The presence of nodes/spines formed due to parabolic growth (*sensu* Wendt 1968; Szabó 1979) adds further uncertainties because this character is unusual in the eucycloideans.

The sinus-shaped basal lip reminiscent of a lower outlet is a prominent feature of the fully adult shell of *Zarnglaffia*. This structure usually reflects the presence of an inhalant siphon in the higher prosobranchs. Instead, most probably in *Zarnglaffia* it represents a false siphonal outlet as it is the case for other eucycloideans described here, such as *Ambercyclus* Ferrari, Kaim & Damborenea, 2014, *Lokuticyclus* Szabó, 1995 and presumably *Eucyclomphalus* von Ammon, 1893. A distinct lower channel is also a prominent character of the genus *Gerasimovcyclus* Gründel, 2005 (Gründel 2005; Gründel & Kaim 2006; Guzhov 2007).

Zarnglaffia was represented until now only by the type species, *Zarnglaffia spinigera* Gründel & Koppka, 2013 from Upper Oxfordian of Poland. Two new species are described below that extend its distribution to the Aalenian? – Lower Bajocian. *Zarnglaffia acanthica* (Uhlig, 1881)

(p. 393, pl. 9, fig. 3a–b), from Callovian deposits of Pieniny Klippen Belt (southern Poland) is a further species of this genus.

Zarnglaffia polygonalis sp. nov.
Figure 16

LSID. urn:lsid:zoobank.org:act:XXXXXXXXX

v 1971 *Dicroloma* (*Dicroloma*) cf. *spinigera* (Lycett); Wendt, p. 156, 157, 158.
v 1971 *Dicroloma* sp.; Wendt, p. 159.
v 1971 *Amberleya* (*Eucyclus*) cf. *baugeri* (d'Orbigny); Wendt, p. 159.
v 1981 *Eucycloscala acanthicum* (Uhlig); Szabó, p. 60, pl. 2, figs 3–4.

Derivation of name. Referred to the polygonal shape of the shell in basal and apical views.

Holotype. GPIT 1685/489 (Fig. 16A–F).

Type Locality. Piano Pilato, Rocca Busambra (north-western Sicily, southern Italy).

Type level. Aalenian – Lower Bajocian (*Leioceras opalinum – Sonninia propinquans* biozones) neptunian sill limestone.

Additional material. Twenty specimens: paratype GPIT 1685/490, Lower Bajocian (*Sonninia sowerbyi – Sonninia propinquans* biozones); paratypes GPIT 1685/491 and 492, Lower Bajocian (*Stephanoceras humphriesianum* Biozone); paratype GPIT 1685/493 Lower Bajocian (*Sonninia propinquans – Stephanoceras humphriesianum* biozones); paratype GPIT 1685/498, Upper Bajocian (*Strenoceras niortense – Parkinsonia parkinsoni* biozones); paratype GPIT 1685/500, Lower Bajocian (*Sonninia propinquans – Stephanoceras humphriesianum* biozones); paratype GPIT 1685/501, Aalenian – Lower Bajocian (*Leioceras opalinum – Sonninia propinquans* biozones); specimens GPIT 1685/494 and 495, Lower Bajocian (*Sonninia propinquans – Stephanoceras humphriesianum* biozones); specimens GPIT 1685/496 and 497, Lower Bajocian (*Stephanoceras humphriesianum* Biozone); specimens GPIT 1685/499 and 505, Upper Bajocian (*Strenoceras niortense – Parkinsonia parkinsoni* biozones); specimens GPIT 1685/502–504 and 506, Aalenian – Lower Bajocian (*Leioceras opalinum – Sonninia propinquans* biozones); three specimens GPIT 1685/507, ? Lower Bajocian (*Sonninia sowerbyi – Sonninia propinquans* biozones).

Diagnosis. Shell pagodiform and sligthly coeloconoidal. Peripheral angulation slightly above suture on early whorls, slightly to distinctly below mid-whorl on last whorls. Abapical angulation at suture, attenuating or vanishing on last whorl. Ramp weakly convex and outer face concave to flat on full-grown shell. Base anomphalous or with pseudumbilicus. Basal lip of fully adult shell sinus-shaped at junction with columellar lip. Last whorls ornamented by six to eight swollen, varix-like collabral ribs forming strong, spiny nodes on peripheral angulation. Weak, smoothened nodes on abapical angulation. Collabral ribs at axial angulations giving to spire polygonal outline in basal and apical views. Periaxial region of base smooth or with four to five wide, obscure spiral threads.

Description. The shell is robust, pagodiform, with slightly coeloconoidal outline and composed of seven–eight whorls. The widht of the spire whorls is about two times their height and the height of the last whorl is about 60% of shell height. The earliest teleoconch whorl is seemingly distinctly convex. The subsequent whorls have a sharp peripheral angulation slightly above the suture that feebly and slowly shifts upward during growth. On the last whorl it runs very slightly to distinctly below mid-whorl, at about one third of the height of the whorl surface from the abapical suture. The

ramp is quite wide and steep, slightly convex towards the peripheral angulation and just slightly concave on the subsutural region. The outer face is slightly concave to flat and feebly inclined to the spire axis in abapical direction. Its abapical edge corresponds to a lower angulation which becomes rounded on the last whorl or disappears. The suture runs on the lower angulation of the preceding whorl. The base is subconoidal and anomphalous although a false umbilicus can be present as a narrow furrow along the columellar lip. The surface of the base is flat or slightly concave on the early shell and becomes quite convex, slightly swollen, on the latest whorls. The aperture is subelliptical and the last peristome is feebly prosocline. On the early shell the peristome is discontinuous at the parietal wall and becomes distinctly continuous during the last growth stage. The last peristome has a thick parietal lip that passes smoothly to the columellar lip. The stout columellar lip is slightly outward reflected and very slightly thickened in its lower part. It covers the axial region of the base or can leave visible a deep axial cavity representing a false umbilicus. The basal lip is distinctly sinus-shaped at the junction with the columellar lip, forming a wide and low outlet. The trace of this outlet is visible as a low periaxial elevation of the surface of the base besides the inner lip.

The spiral ornament is represented by two narrow spiral cords marking the peripheral and lower angulations, respectively. The whorls bear thin spiral threads, equally sized and densely distributed on the outer face, more irregularly distributed and less dense on the ramp. The axial region of the base is smooth or with four–five wide, obscure spiral threads. On the early whorls, the peripheral cord has 12–15 small, slightly pointed nodes. During growth they become stronger, fewer and very widely spaced. The last whorls bear six to eight strong, spiny nodes at the intersection of the peripheral cord with strong and swollen, varix-like collabral ribs. These ribs correspond to axial angulations that give to the spire a polygonal outline in basal and apical views. The collabral ribs form low nodes on the abapical angulation and extend to the basal surface as light undulations that disappear towards the adaxial region. The growth lines are strong and make the surface of the shell rough. They are prosocline and gently opisthocyrt on the whorl surface, and sharply prosocyrt on the peripheral keel. They become more and more acutely prosocyrt when forming nodes and opisthocyrt after the nodes, and rapidly change again into increasingly prosocyrt towards the subsequent node. The base bears slightly undulated growth lines that are opisthocyrt on the abaxial region and slightly prosocyrt on the median part of the base. On the periaxial region they are gently opisthocyrt and this reflects the sinus-shaped lower outlet of the basal lip.

Dimensions. See Table 3.

Remarks. The material consists of numerous, variably incomplete specimens with the shell wall in good state of preservation. Some of them are strongly fragmentary. The protoconch is not preserved. The first teleoconch whorl is visible only in the holotype but it is strongly eroded. The variability of *Zarnglaffia polygonalis* sp. nov. concerns mainly some aspects of the ornament. The most important is the lower angulation. In most of the specimens it attenuates on the last whorl and in some it disappears completely and the whorl becomes evenly convex and passes smoothly to the base. The number of nodes on the peripheral angulation of the last whorl is also slightly variable, ranging from six to eight.

Zarnglaffia spinigera Gründel & Koppka, 2013 differs from *Z. polygonalis* in having long spines that are not associated with prominent collabral ribs. The spiral cord marking the basal angulation is stronger and persists on the last whorls, whereas in *Z. polygonalis* it tends to disappear during the adult growth. Moreover, in *Z. spinigera* the spiral bulge surrounding the periaxial region of the base is more prominent and the abapical outlet is more distinct and channel-shaped.

Zarnglaffia acanthica (Uhlig, 1881) (p. 393, pl. 9, fig. 3a–b) differs from *Z. polygonalis* in having a cyrtoconoidal outline of the shell, narrower spiral angle, slightly lower whorls with a concave ramp. Moreover, in *Z. acanthica* the lower angulation and its keel, and the spiral threads on the axial region of the base are more marked.

Distribution of the species. Uppermost Lower Bajocian – Upper Bajocian (*Stephanoceras humphriesianum – Parkinsonia parkinsoni* biozones), Bakony Mountains (Hungary); condensed Aalenian – Lower Bajocian, Lower and Upper Bajocian, Rocca Busambra, north-western Sicily (southern Italy).

Zarnglaffia palermitana sp. nov.
Figure 17

LSID. urn:lsid:zoobank.org:act:XXXXXXXXX

Derivation of name. From the town of Palermo and the Latin suffix *-itanus*, coming from.

Holotype. GPIT 1685/487 (Fig. 17A–E).

Type Locality. Piano Pilato, Rocca Busambra (north-western Sicily, southern Italy).

Type level. Aalenian – Lower Bajocian (*Leioceras opalinum – Sonninia propinquans* biozones) neptunian sill limestone.

Additional material. Two specimens: paratype GPIT 1685/488, Aalenian – Lower Bajocian (*Leioceras opalinum – Sonninia propinquans* biozones); paratype GPIT 1685/508, Upper Bajocian (*Strenoceras niortense – Parkinsonia parkinsoni* biozones).

Diagnosis. Shell pagodiform and coeloconoidal. Ramp and outer face concave on early spire, convex on last whorls. Base anomphalous or pseudumbilicate. Aperture with sinus-shaped outlet at junction of basal lip with columellar lip. Early shell ornamented by shallow collabral elevations. Spiny nodes at intersection with peripheral cord. Last whorls almost devoid of collabral ornament and with ten nodes on peripheral cord. Lower spiral cord gently waved. Periaxial region of the base ornamented by four, obscure spiral threads.

Description. The shell is pagodiform and coeloconoidal. The whorls have a sharp peripheral angulation almost at mid-whorl or slightly below it. The ramp is slightly concave on the first preserved whorls and changes in slightly convex on the last two whorls. The outer face is gently concave to flat and becomes slightly convex during growth. It is weakly inclined toward the spire axis in abapical direction. A lower, rounded angulation, presumably sharper on the early whorls, marks the abapical edge of the outer face. The suture runs along this angulation. The base is anomphalous and subconoidal. The aperture is subelliptical and feebly elongated axially. The last peristome is continuous on the parietal region. The parietal lip is rather thickened and passes smoothly to the columellar lip. The columellar lip can be slightly detached from the basal surface leaving visible a narrow pseudumbilicus. The basal lip at the junction with the columellar lip is sinus-shaped and forms a low outlet that generates a weakly swollen periaxial belt on the basal surface along the inner lip. The outer lip is seemingly almost evenly arched.

The main spiral ornament consists of a narrow cord on both the angulations. The spiral cord at the lower angulation is smooth and narrower than the peripheral cord. Five to six, weak to obscure spiral threads can ornament both the ramp and the outer side of the whorls. The axial ornament of the early spire consists of rib-like undulations of the whorl surface forming prominent, closely repeating spiny nodes by parabolic growth at the peripheral cord. On the subsequent whorls, the axial ornament almost vanish and the nodes gradually become stronger, sparser and fewer. Fourteen nodes are present on the periphery of the antepenultimate whorl whereas eight to ten are on the last whorl. The base is ornamented by spiral lines that can become obscure or disappear on the last whorls. The growth lines are rather strong and prosocline. They are slightly opisthocyrt on the ramp and on the outer face, and converge towards the nodes. On the base, the growth lines are

very slightly opisthocyrt in its outermost region and very slightly prosocyrt on the median part of the base. They are opisthocyrt on the periaxial region corresponding to the lower outlet of the basal lip.

Dimensions. See Table 3.

Remarks. The material consists of three specimens preserving only the last whorls. *Zarnglaffia palermitana* sp. nov. differs from *Zarnglaffia polygonalis* sp. nov. in its much smaller size, more rounded whorls due to the convex outer face of the adult shell, and more numerous and spirally elongated nodes on the peripheral cord. Moreover, in *Z. palermitana* there are no distinct axial ribs on the adult shell and the spire does not have a polygonal outline. Although *Z. polygonalis* is represented by numerous specimens, none of them show characters transitional to *Z. palermitana*.

Distribution of the species. Condensed Aalenian – Lower Bajocian and Upper Bajocian, Rocca Busambra (north-western Sicily, southern Italy).

Family EUCYCLOSCALIDAE Gründel, 2007

Genus AMBERCYCLUS Ferrari, Kaim & Damborenea, 2014

Type species. *Amberleya orbignyana* Hudleston, 1892. Upper Bajocian, Dorset (south-western England).

Remarks. According to Ferrari *et al.* (2014), the presence of a small umbilicus is a diagnostic character of the genus *Ambercyclus* Ferrari, Kaim & Damborenea, 2014. However, the type species *Ambercyclus orbignyanus* (Hudleston, 1892) (p. 285, pl. 22, figs 7, 8; Monari *et al*. 2018, p. 472, fig. 11A–D and references therein) is anomphalous. Also other *Ambercyclus* species rather common in the Lower and Middle Jurassic deposits of Europe, as for example *Ambercyclus ornatus* (Sowerby, 1819) (p. 69, pl. 240, figs 1, 2; Monari *et al.* 2018, p. 474, fig. 11E–U and references therein), *Ambercyclus murchisoni* (Münster in Goldfuss, 1844) (p. 99, pl. 194, fig. 10a–b; Gründel *et al*. 2012, p. 16, pl. 4, figs 12–17, pl. 5, figs 1–3 and references therein) and *Ambercyclus capitaneus* (Münster in Goldfuss, 1844) (p. 97, pl. 194, fig. 10a–b; Schulbert & Nützel 2013, p. 730, text-fig. 7A–C and references therein), lack an umbilicus.

Ambercyclus cratisculptus sp. nov.
Figure 18

LSID. urn:lsid:zoobank.org:act:XXXXXXXXX

v 1971 *Amberleya* (*Eucyclus*) *ornata abbas* (Hudleston); Wendt, p. 156.
v 1971 *Amberleya* (*Eucyclus*) *ornata ornata* (Sowerby); Wendt, p. 156.

Derivation of name. From Latin *cratis*, grid, and *sculptus*, sculptured, referred to the prominent reticulate ornament of the early shell.

Holotype. GPIT 1685/563 (Fig. 18H–L).

Type Locality. Piano Pilato, Rocca Busambra (north-western Sicily, southern Italy).

Type level. Aalenian – Lower Bajocian (*Leioceras opalinum – Sonninia propinquans* biozones) neptunian sill limestone.

Additional material. Eleven specimens: paratypes GPIT 1685/560, 562, 564 and 567, Aalenian – Lower Bajocian (*Leioceras opalinum – Sonninia propinquans* biozones); paratype GPIT 1685/565, undifferentiated Aalenian–Bajocian; specimens GPIT 1685/561, 568–570 and 586, Aalenian – Lower Bajocian (*Leioceras opalinum – Sonninia propinquans* biozones); specimen GPIT 1685/566, Aalenian–Bajocian (exact stratigraphical level unknown).

Diagnosis. Shell turbiniform and gradate with almost conoidal outline. Early whorls with two angulations marked by single spiral cords and edging almost vertical outer face. Abapical angulation peripheral on subsequent whorls. Early ornament composed of strong, wide rectangular network by intersection of equally sized and spaced collabral ribs with spiral cords. Nodes at intersection points. Spiral cords becoming carinae on last whorls and nodes changing in crenulations of variable density. Third nodose spiral cord partially exposed at abapical edge of whorl surface. Fourth spiral keel on obtuse angulation frequently appearing on ramp of last whorls. Collabral ornament consisting of dense, sharp and thin threads. Base with strong, widely spaced spiral cords crossed by same collabral pattern as that of spire.

Description. The shell is moderately high-turbiniform, gradate and consists of half a dozen whorls separated by a deeply impressed suture. The last whorl distinctly exceeds the half-height of the shell. The teleoconch whorls bear two distinct angulations marked by strong, single spiral cords edging a feebly concave outer face. The upper angulation runs slightly above mid-whorl and corresponds to the outer margin of a slightly and evenly convex ramp. The ramp is as wide as the outer face to twice wider. On the early whorls the outer face is almost vertical and peripheral. During growth, the lower angulation progressively becomes the periphery. The band of the whorl between the lower angulation and the suture slopes in abapical and adaxial direction. Its surface is concave and, consequently, the suture runs in a wide channel. The base is anomphalous, subconoidal and moderately convex excepting the area around the columella that is slightly concave. The aperture is subcircular. The peristome is obtusely angular at the junction of the columellar lip with the parietal lip and semicircular on outer lip. The parietal lip is coated with a thin and smooth callosity placed quite deeply in the aperture. The outer lip is slightly prosocline and thin. The columellar lip is rather strong, feebly concave on the apertural side and meets the basal lip through a rounded angulation. In this region the peristomal margin is slightly elongated in abapical direction, feebly reflected outward and forms a shallow outlet-like protrusion.

The most prominent elements of the ornament consist of the two strong spiral cords marking the respective angulations of the whorls. On the first preserved whorls, they are intersected by about twelve collabral riblets which are as strong as the spiral cords, and form a regular and strong grid composed of wide rectangles with nodes at the intersection points. This pattern persists for two and a half to three whorls. At this stage, a third cord becomes partially exposed at the suture on the abapical edge of the whorl surface. This cord is finely and densely corrugated and much weaker than the others. During the adult growth, the two spiral cords of the whorl angulations keep their prominence and become densely nodose and the nodes become collabrally elongated and appear as short and squat ribs confined to the spiral cords. The nodes of the lower spiral cord are usually smaller and denser than those of the upper spiral cord. The collabral ribs gradually and rapidly become thinner whereas fine and sharp collabral riblets appear in their interspaces. On the fully adult part of the shell, most of the riblets are simple, sharp and very dense. In shells having a ramp wider than the outer face, another nodose spiral cord appears gradually almost at the mid-line of the ramp and marks also an obtuse angulation. This cord gradually strengthens during growth but it becomes almost as prominent as the primary spiral keels only on the last whorl of some specimens. The base is sculptured by five to seven, strong, widely spaced spiral cords. Shallow collabral threads cross the spiral cords making them obscurely nodose. The spiral cords are slightly weaker towards the axial region. The growth lines and the collabral riblets are prosocline, almost straight on the adapical half of the whorl surface and slightly opisthocyrt on its abapical half, widely opisthocyrt on the base.

Dimensions. See Table 3.

Remarks. The numerous specimens available have the shell wall in quite good state of preservation but variably incomplete at the apical and apertural parts. One of these specimens (GPIT 1685/564) shows the inner mould of the lower peristomal margin which is slightly elongated in axial direction and feebly reflected outward to make a shallow outlet-like protrusion.

Two main morphs are represented in the material. One consists of specimens with two keels above the sutural cord which make the whorls distinctly biangulated, and with the ramp almost as wide as the outer face. In the other morph, the ramp is about twice as wide as the outer face and it carries a carina at about its mid-line which corresponds to an obtuse angulation. Moreover, the ramp is steeper and the whorls are more rounded. The presence of shells transitional between these morphs demonstrates that the material represents a single, rather variable species. For example, the paratype GPIT 1685/565 (Fig. 18A–E) shows an obscure spiral line at the place of the ramp keel. In the holotype (GPIT 1685/563, Fig. 18H–L) the ramp keel is distinct, though weaker than the other keels, but the ramp is only slightly wider than the outer face and the shape of the whorls is distinctly biangulated. The paratype GPIT 1685/567 (Fig. 18M–O) shows the same characters, but the biangulated shape of the whorls is less pronounced. Other aspects of the variability concern the prominence of the keels and the strength and density of the nodes. The keel at the outer edge of the ramp can be as strong as the lower keel or slightly weaker. The strength and density of the nodes is greatly variable comparing different specimens. The nodes of the peripheral keel are commonly smaller and denser than those of the keel at the outer edge of the ramp, but in some specimens they are equally spaced and sized.

According to Ferrari *et al.* (2014) the presence of pointed nodes is a diagnostic character of the genus *Ambercyclus* Ferrari, Kaim & Damborenea, 2014. In the species described here the nodes are rounded but this difference alone is insufficient to assign the species to a different genus. *Ambercyclus ornatus* (Sowerby, 1819) is very similar to *Ambercyclus cratiscultpus* sp. nov. in the variation of the spiral ornament. It differs in having a wider apical angle, lower early whorls, sharper spiral keels and the upper angulation slightly below mid-whorl. The collabral riblets are diffusely bifurcated or joined in bunches at the nodes. *Ambercyclus capitaneus* (Münster in Goldfuss, 1944) resembles the bicarinate specimens of *A. cratisculptus* but shows wider whorls, sharper spiral keels and collabral riblets bifurcated at the nodes.

Distribution of the species. Aalenian – Lower Bajocian, Rocca Busambra (north-western Sicily, southern Italy).

Genus ELYMICYCLUS nov.

LSID. urn:lsid:zoobank.org:act:XXXXXXXXX

Derivation of name. From Latin *Elymi*, Elymians, ancient pre-roman people inhabiting the westernmost region of Sicily. Gender masculine.

Type species. *Elymicyclus alternatus* sp. nov. Lower Toarcian (*Harpoceras serpentinum – Hildoceras bifrons* biozones), Rocca Busambra, north-western Sicily (southern Italy) (see below).

Diagnosis. Shell thin-walled, high-turbiniform to subturriculate. Periphery rounded, slightly to distinctly below mid-whorl. Surface of whorls rather convex, with evenly convex to slightly pendent outline. Base anomphalous. Collabral riblets crossed by two or three main spiral threads on the early whorls. Adult part of shell and base ornamented by numerous spiral threads or cords and thin collabral threads weakly granulating spiral elements.

Remarks. *Elymicyclus* gen. nov. is closely reminiscent of *Lokuticyclus* Szabó, 1995 in the shape and ornament of the adult shell. *Lokuticyclus* was originally introduced as subgenus of *Eucyclus* J. C. A. Eudes-Deslongchamps, 1860 that differs from *Eucyclus* s.s. only in the presence of an umbilicus (Szabó 1995, 2009). According to Ferrari *et al.* (2014), *Eucyclus* is characterized by the presence of a strong peripheral keel and angulation near the abapical suture. In *Lokuticyclus* the periphery is evenly convex and this difference is sufficient to distinghish *Lokuticyclus* from *Eucyclus* at genus rank.

Elymicyclus differs from *Lokuticyclus* in the absence of an umbilicus and the shape of the shell that tends to be more slender and with lower whorls. *Elymicyclus* has an early teleoconch of eucycloscalid type (see below). In the species of *Lokuticyclus* (see Szabó 1995, 2009; Conti *et al.* 2007; Gatto & Monari 2010), including the type species *Lokuticyclus urkutensis* (Szabó, 1995) (p. 70, pl. 7, figs 7–9; Szabó 2009, p. 78, text-fig. 75A–D), from the Lower? Sinemurian of the Bakony Mountains (Hungary), the early teleoconch is unknown. If further studies demonstrate the presence in *Lokuticyclus* of an eucycloscalid apical shell, *Elymicyclus* should be considered as a subgenus of *Lokuticyclus*.

Marloffsteinia Nützel & Gründel, 2015 resembles *Elymicyclus* in the turbiniform shell and in some aspects of the ornament. In *Marloffsteinia* the shell is much lower and the early spire is not subturriculate. In the type species *Marloffsteinia cyclostoma* (Benz in Zieten, 1832) (p. 45, pl. 33, figs 4a–b; Nützel & Gründel 2015, pl. 4, figs F–J; Gründel & Nützel 2015, p. 58, pl. 3, figs 11–13 and references therein), the ornament of the subadult part of the teleoconch is similar to that of *Elymicyclus*. However, in the fully adult part of the shell the collabral riblets disappear and the last whorls bear only numerous, densely nodose cord-like spiral threads whereas in *Elymicyclus* the collabral ornament persists and forms a dense pattern of sharp and thin threads.

Included species and occurrence. The genus ranges from Upper Sinemurian to Lower Aalenian and is represented by the following species listed in stratigraphical order:

Elymicyclus margaritaceus (Stoliczka, 1861) (p. 167, pl. 1, fig. 10a; Szabó 2009, p. 76, text-fig. 74A–D), Upper Sinemurian, Hierlatz (Northern Calcareous Alps, Austria);

Elymicyclus sandrae (Szabó, 2009) (p. 77, text-fig. 74E–F), Upper Sinemurian, Hierlatz (Northern Calcareous Alps, Austria);

Elymicyclus sp. [Szabó 2009, p. 78, text-fig. 74G–J, described as *Eucyclus* (*Eucyclus*) sp.], Upper Sinemurian, Hierlatz (Northern Calcareous Alps, Austria);

Elymicyclus tataensis (Szabó, 1995) (p. 68, pl. 7, figs 5–6), Lower Toarcian, Transdanubian Central Range (Hungary);

Elymicyclus ietumensis sp. nov. (here), Lower – lower Upper Toarcian, Rocca Busambra (north-western Sicily, southern Italy);

Elymicyclus garibaldii sp. nov. (here), lower part of Upper Toarcian, Rocca Busambra (north-western Sicily, southern Italy).

Elymicyclus martae sp. nov. (here), lower part of Upper Toarcian, Rocca Busambra (north-western Sicily, southern Italy);

Elymicyclus alternatus sp. nov. (type species, here), Lower and Upper Toarcian, Rocca Busambra (north-western Sicily, southern Italy);

Elymicyclus julianensis (De Gregorio, 1886*e*) (p. 668, pl. 1, fig. 1a–b; Kuhn 1934, p. 28, text-figs 8–9), Lower Aalenian, Monte Erice (north-western Sicily, southern Italy).

Elymicyclus carpathicus (Uhlig, 1878) (p. 652, pl. 17, fig. 1a–b), Callovian, Pieniny Klippen Belt (southern Poland).

The species listed below possibly belong to *Elymicyclus* but suffer from a poor information that currently prevents their safe attribution:

Eucyclus papyraceus J. C. A. Eudes-Deslongchamps, 1860 (p. 144, pl. 9, fig. 8), Lower Toarcian, Calvados (northern France);

Amberleya elongata Hudleston, 1892 (p. 292, pl. 23, figs 8–9; Riche & Roman 1921, p. 102, pl. 4, fig. 5; Kuhn 1935, p. 138, pl. 8, fig. 16), Lower Aalenian, Franconia (southern Germany) and Middle Aalenian, Dorset (south-western England);
Eucyclus sp. in Conti & Monari (2001, p. 197, text-figs 6.18–20, 7), Lower Bajocian, Central High Atlas (Morocco);
Amberleya (Eucyclus) princeps (Roemer, 1836) (p. 153, pl. 11, fig. 1; Goldfuss 1844, p. 100, pl. 195, fig. 2; d'Orbigny 1853, p. 357, pl. 335, figs 9–10; Hudleston 1880, p. 537, pl. 17, fig. 11; Fischer & Weber 1997, p. 145, pl. 21, fig. 19), Middle Oxfordian of Ardennes (north-eastern France), and Upper Oxfordian of Lower Saxony (northern Germany) and Yorkshire (north-eastern England).

Elymicyclus alternatus sp. nov.
Figures 19, 20A–M

LSID. urn:lsid:zoobank.org:act:XXXXXXXXX

v 1971 *Bourguetia deshayesea* (Terquem); Wendt, p. 153, 154.
v 1971 *Amberleya* (*Eucyclus*) *elongata* (Hudleston); Wendt, p. 154.

Derivation of name. From Latin *alternatus*, alternated, referred to the spiral ornament composed of two alternate orders of spirals.

Holotype. GPIT 1685/523 (Fig. 19H–L).

Type Locality. Piano Pilato, Rocca Busambra (north-western Sicily, southern Italy).

Type level. Lower Toarcian (*Harpoceras serpentinum – Hildoceras bifrons* biozones) neptunian sill limestone.

Additional material. Thirty-four specimens: paratypes GPIT 1685/521, 522 and 524, Lower Toarcian (*Harpoceras serpentinum – Hildoceras bifrons* biozones); paratypes GPIT 1685/528, 529, 536 and 537, Upper Toarcian (*Haugia variabilis – Phlyseogrammoceras dispansum* biozones); paratype GPIT 1685/546, Lower Toarcian – lower Upper Toarcian (*Harpoceras serpentinum – Haugia variabilis* biozones); specimen GPIT 1685/525, Lower Toarcian (*Harpoceras serpentinum – Hildoceras bifrons* biozones); specimens GPIT 1685/526 and 527, Lower Toarcian – lowermost Upper Toarcian (*Hildoceras bifrons – Haugia variabilis* biozones); specimens GPIT 1685/530–535 and 538–545, Upper Toarcian (*Haugia variabilis – Phlyseogrammoceras dispansum* biozones); specimens GPIT 1685/547–555, Lower Toarcian – lower Upper Toarcian (*Harpoceras serpentinum – Haugia variabilis* biozones).

Diagnosis. Shell subturriculate with coeloconoidal early spire. Adult part of shell basically cyrtoconoidal. Subadult whorls with weak, rounded angulation below periphery, in correspondence to suture. Spiral ornament composed of two orders of threads. Collabral threads sharp, evenly sized, subregularly distributed and thinner than spiral threads. Base ornamented by same pattern as spire.

Description. The shell is thin-walled, high-turbiniform with subturritelliform early shell, and is composed of about ten whorls. The early shell and, sometimes, the central part of the teleoconch are slightly coeloconoidal whereas the fully adult part of the shell is mostly weakly cyrtoconoidal. The width of the whorl surface is almost twice and half of its height. The last whorl is fairly less than half-height of the shell. The whorl surface is distinctly convex. The periphery lies below the mid-whorl and gives to the whorl surface a feebly pendent profile. The suture is distinctly impressed. On the not fully adult shell, a weak angulation runs below the periphery, in correspondence to the

suture. It persists on the fully adult shell of some specimens but commonly disappears on the last whorls and the whorl surface passes smoothly to the base. The base is subconoidal as a whole and anomphalous. Its surface is less convex than that of the whorls, sometimes almost flat. The aperture is semicircular but truncated at the parietal region. The peristome is slightly prosocline. The parietal lip is covered with a thin callosity. The columellar lip is robust, slightly swollen, almost straight and slightly oblique on the spire axis. The outer lip is thin. Its basal lip joins the columellar lip though a rounded angulation which corresponds to a very shallow outlet-like rim.

The first teleoconch whorl seems to be ornamented by very thin collabral threads or riblets. On the second whorl they become more marked and numerous, and form a beaded network with about five spiral threads. The two uppermost spiral threads are weaker than the others. The spiral elements strengthen during growth and increase in number by intercalation. The last whorl is ornamented by half a dozen to about ten and cord-like primary spiral threads intercalated to secondary threads. In some specimens the secondary threads become almost as prominent as the primary ones making the two orders of the spiral ornament barely recognizable. The adapical part of the fully adult whorls, which has a weaker spiral ornament in the earliest teleoconch whorls, frequently retains spiral threads that are thinner than the others. Rarely, this part lacks any spiral ornament. The collabral ornament of the fully adult part of the shell consists of dense, sharp, uniform and subregularly repeated collabral threads that are thinner than the spiral ones. The spiral and collabral ornaments give rise to a fine network with granules at the intersection points. The base has the same ornament pattern as that of the spire, but only with two orders of spiral threads. The secondary threads are just slightly thinner than the primary ones. The growth lines are moderately prosocline on the whorl surface, almost straight on its adapical half and slightly opisthocyrt on its abapical half. The base bears slightly prosocline and opisthocyrt growth lines.

Dimensions. See Table 3.

Remarks. The material consists of numerous, variably incomplete specimens with the shell wall mostly in good state of preservation. *Elymicyclus alternatus* sp. nov. is rather variable both in shell shape and ornament. All the specimens have a coeloconoidal early spire, mostly becoming cyrtoconoidal during growth. However, in different specimens this transition occurs at different growth stages and with different rates. The height of the whorls is also slightly variable. The variation of the ornament concerns mainly the number and strength of the primary spiral elements on the fully adult part of the shell. The most frequent morph is represented by specimens having these elements very slightly stronger than the secondary threads. The spiral ornament is almost as prominent as the collabral ornament and gives rise to a dense, fine and subregular network on the last whorls. The opposite extreme of a clear morphological continuity is represented by specimens with primary spiral elements distinctly stronger than secondary ones. The primary spiral ornament consists of cords already well marked from the early whorls. The granules on these cords are stronger and the spiral elements are fewer than those of the previous morph. In some cases, the secondary threads are lacking from some interspaces. Another aspect of the species variability is the strength of the spiral threads on the subsutural region. They can be as prominent as the other threads or weaker or, more rarely, absent. Furthermore, up to four randomly arranged, low varix-like collabral bands, made by packing of dense growth lines, appear occasionally mainly on the last whorl.

Amberleya elongata Hudleston, 1892 is closely reminiscent of *E. alternatus*. In *A. elongata* the early spire is uknown. In any case, the profile of the whorls is less pendent, the periphery being more adapical on whorl surface, at about mid-whorl. Moreover, the spiral ornament is less dense. Secondary threads are lacking and the collabral threads are much weaker than the spiral ones. *Elymicyclus ietumensis* sp. nov. and *Elymicyclus martae* sp. nov. are also similar to *E. alternatus* in some respects. Comparisons are reported below in the remarks of those species.

Distribution of the species. Lower and Upper Toarcian, Rocca Busambra (north-western Sicily, southern Italy).

Elymicyclus ietumensis sp. nov.
Figure 20N–Y

LSID. urn:lsid:zoobank.org:act:XXXXXXXXX

v 1971 *Amberleya* (*Eucyclus*) *elongata* Hudleston; Wendt, p. 153.

Derivation of name. After Ietum, ancient Roman town near to the type locality.

Holotype. GPIT 1685/571 (Fig. 20N–S).

Type Locality. Piano Pilato, Rocca Busambra (north-western Sicily, southern Italy).

Type level. Lower Toarcian (*Harpoceras serpentinum – Hildoceras bifrons* biozones) neptunian sill limestone.

Additional material. Two specimens: paratype GPIT 1685/572, Lower Toarcian (*Harpoceras serpentinum – Hildoceras bifrons* biozones); paratype GPIT 1685/573, Lower – lower Upper Toarcian (*Harpoceras serpentinum – Haugia variabilis* biozones).

Diagnosis. Coeloconoidal shell. Spiral ornament consisting of four, sparsely nodulose spiral cords. Uppermost cord weaker than others. Fifth stronger cord, without nodules, covered by next whorl. Collabral riblets slightly misaligned at intersection with spiral cords. Base with spiral cords less strong than those of whorl surface and with thread-like growth lines.

Description. The shell is thin-walled, high-turbiniform, coeloconoidal and presumably composed of about ten whorls. The width of the whorl surface is almost twice and half of its height. The whorls are moderately convex on the early teleoconch and their convexity slightly increases during growth. The suture is deeply impressed and runs along a weak angulation of the preceding whorl. This angulation tends to vanish during the latest growth. The periphery is slightly above the suture and gives to the whorls a pendent outline. The base is anomphalous, low conoidal and its surface is much less convex than that of the whorl. The aperture seems rather broad and semicircular. The parietal region of the peristome is seemingly covered with a thin shell layer. The columellar lip is moderately thick, almost straight, and slightly divergent from the spire axis. The lower part of the columellar lip is not preserved but a weak axial protrusion of the base in that region could reflect the presence of a lower outlet.

The ornament consists of spiral cords and collabral riblets. The whorl surface bears four widely spaced spiral cords with small and subregularly repeating nodules. The uppermost cord is weaker than the others. The two most abapical cords are the strongest and both can correspond to the periphery. A fifth, weaker and smooth cord marks the lower angulation. The collabral riblets are thin, sharp, subregularly and densely distributed, and extend from the adapical suture to the lower angulation. They are interrupted by the spiral cords and slightly misaligned at their intersection. Some of them seem to disappear before reaching the adjacent spiral cord. The ornamentation of the base consists of about fifteen spiral cords, which are weaker and denser than those of the whorl surface. Rarely, secondary spiral threads also appear along the mid-line of the interspaces. The collabral riblets are lacking from the base where the spiral ornament is crossed and finely granulated by rather marked growth lines. The growth lines are faint or obscure on the whorl surface and are slightly prosocline and feebly sigmoidal. They are feebly prosocline and slightly opisthocyrt on the base and become prosocyrt on a narrow belt around the columella.

Dimensions. See Table 3.

Remarks. The holotype lacks the apical spire. Two other specimens preserve only the last whorls. *Elymicyclus ietumensis* sp. nov. differs from *Elymicyclus alternatus* sp. nov in having fewer spiral threads and cords that are not arranged in two alternating orders. The collabral riblets are interrupted by the spiral cords whereas in *E. alternatus* each collabral thread continues from suture to suture. Moreover, the outline of the shell of *E. ietumensis* is more coeloconoidal and the latest shell part is not cyrtoconoidal. *Amberleya elongata* Hudleston, 1892 has much higher whorls with more deeply impressed sutures. *Elymicyclus tataensis* (Szabó, 1995) shares with *E. ietumensis* the presence of four, widely spaced spiral cords on the whorl surface. However, the shell of *E. tataensis* is much bigger and not coeloconoidal in outline. The whorls are more convex with a more impressed suture and the periphery is more adapical on the whorl surface. In addition, the spiral cords are more prominent and bear stronger nodes, and the collabral threads are continuous and more irregular in distribution. *Elymicyclus julianensis* (De Gregorio, 1886*e*) has a spiral ornament pattern similar to that of *E. ietumensis* but the shell is almost three times bigger, the whorls are higher and more globose and the collabral ornament is much weaker or obscure.

Distribution of the species. Lower – lower Upper Toarcian, Rocca Busambra (north-western Sicily, southern Italy).

Elymicyclus garibaldii sp. nov.
Figure 21A–E

LSID. urn:lsid:zoobank.org:act:XXXXXXXXX

v 1971 *Amberleya* (*Eucyclus*) *elongata* Hudleston; Wendt, p. 154.

Derivation of name. After Giuseppe Garibaldi who through his conquest of Sicily in 1860 contributed to the achievement of Italian unification.

Holotype. GPIT 1685/574 (Fig. 21A–E).

Type Locality. Piano Pilato, Rocca Busambra (north-western Sicily, southern Italy).

Type level. Upper Toarcian (*Haugia variabilis – Phlyseogrammoceras dispansum* biozones) neptunian sill limestone.

Additional material. None.

Diagnosis. Shell high-turbiniform, coeloconoidal. Whorls rather convex, with periphery below mid-whorl and with rounded angulation just above quite impressed suture. Earliest teleoconch whorls sculptured by rather strong collabral ribs crossed by two spiral threads. Subsequent whorls ornamented by four nodulose spiral cords on lower part of whorl surface with short, dense collabral riblets in their interspaces. Collabral riblets diffusely bifurcated at nodules. Band between the uppermost spiral cord and adapical suture bearing subregularly distributed and continuous collabral riblets. Base with spiral threads granulated by intersection with collabral threads.

Description. The shell is thin-walled, rather high-turbiniform, coeloconoidal and composed of about eight whorls. The last whorl is not preserved. The penultimate whorl is slightly more than twice and half as wide as high. The surface of the whorls is rather convex. The periphery is rounded and lies approximately at the adapical limit of the lower third of the whorl surface. A weak, rounded

angulation runs below the periphery, slightly above the strongly impressed suture. The base of the last whorl preserved is anomphalous. The peristome is not preserved apart from its parietal region that is covered with a very thin shell layer. The orientation of the growth lines indicates that the outer lip is prosocline and feebly opisthocyrt.

The early teleoconch whorls are ornamented by prosocline and rather strong collabral ribs. On the third preserved whorl, two spiral threads appear on the lower half of the whorls with acute nodules at the intersection with the collabral ribs. The adapical thread is peripheral and slightly below the mid-whorl whereas the abapical thread runs slightly above the suture and marks the angulation of the whorls. On about the sixth preserved whorl, a weaker spiral thread appears between the former ones, and another spiral thread develops adapical from the peripheral one. Concomitantly, the collabral ribs slowly become more numerous and change to threads. On the subsequent whorls, the distance between the suture and the most adapical spiral thread rapidly increases and a wide belt develops that is ornamented only by dense collabral threads. The sixth preserved whorl bears about twenty collabral riblets/threads. Other collabral threads between the primary riblets and short riblets in the interspaces of spiral threads appear. The last whorls show a pattern of dense, thin, subequally sized collabral threads, running from suture to suture. Regularly distributed, almost uniform nodules are present at most of the intersections between the spiral and collabral threads but the frequency of smooth intersection points increases on the last whorls. On the last three whorls preserved, some of the collabral threads are bifurcated at the nodes. Bifurcated collabral elements are present only in the interspaces between the spiral threads. They are absent on the wide band between the uppermost spiral thread and the adapical suture, where the collabral threads are simple. The base is ornamented by dense spiral cords crossed by subregularly spaced and inequally thin collabral threads. These are granulated at the intersections and seem to vanish towards the axial region. The growth lines are somewhat prosocline, faintly opisthocyrt on the subsutural region and faintly prosocyrt in the peripheral region, opisthocyrt on the base.

Dimensions. See Table 3.

Remarks. Traces of the suture on the subperipheral part of the shell demonstrate that the specimen lacks the last whorl. For this reason, the base is coated by a thin shell layer representing the parietal region of the last whorl. Due to the thinness of this coating, the main traits of the ornament of the base are still recognizable. The shape of the last preserved whorl suggests that the base of the shell is subconoidal with surface less convex than that of the whorls. The axial region of the base is slightly elongated and this could reflect the presence of a lower outlet. The distinctly stable ornament pattern of the last three whorls indicates that, most probably, the specimen represents an adult shell.

Elymicyclus ietumensis sp. nov. shares with *Elymicyclus garibaldii* sp. nov. the coeloconoidal shell and the teleoconch whorls ornamented by four spiral cords. It differs in the narrower spiral angle and higher whorls. In *E. ietumensis* the spiral cords are subequally distributed on the whorl surface and the collabral riblets are not bifurcated whereas in *E. garibaldii* a wide subsutural area is devoid of spiral ornament and the collabral riblets are diffusely bifurcated at the nodes of the spiral cords. *Elymicyclus sandrae* (Szabó 2009) is similar to *E. ietumensis* in the ornament pattern but has a much more slender shell.

Distribution of the species. Lower part of Upper Toarcian, Rocca Busambra (north-western Sicily, southern Italy).

Elymicyclus martae sp. nov.
Figure 21F–Q

LSID. urn:lsid:zoobank.org:act:XXXXXXXXX

v 1971 *Amberleya* (*Eucyclus*) *elongata* Hudleston; Wendt, p. 154.

Derivation of name. Species dedicated to Márta Bánpataki, J. Szabó's wife.

Holotype. GPIT 1685/557 (Fig. 21F–L).

Type Locality. Piano Pilato, Rocca Busambra (north-western Sicily, southern Italy).

Type level. Upper Toarcian (*Haugia variabilis – Phlyseogrammoceras dispansum* biozones) neptunian sill limestone.

Additional material. Two specimens: paratype GPIT 1685/558 and specimen GPIT 1685/559, Upper Toarcian (*Haugia variabilis – Phlyseogrammoceras dispansum* biozones).

Diagnosis. Shell coeloconoidal with evenly convex whorls. Base subconoidal, slightly less convex than whorl surface. Early whorls sculptured by three spiral cords forming strong grid of almost regular squares by intersection with equally spaced collabral ribs. Adult part of shell ornamented by dense and fine network of three orders of spiral threads crossing thin collabral threads and riblets. Most of riblets short, not extending from suture to suture, and sometimes bifurcated at granules. Base ornamented by two orders of spiral threads crossed by very thin collabral threads. Spiral threads of base denser than those of whorl surface.

Description. The shell is thin-walled, high-turbiniform and presumably composed of about ten whorls. The outline of the shell is slightly coeloconoidal. The spire whorls are slightly less than twice and half wider than high. Their surface is distinctly and evenly convex, and edged by an impressed suture. The periphery is rounded and lies below the mid-whorl, approximately at one third of the height of the whorl surface. The base is anomphalous and low subconoidal in outline. Its surface is slightly less convex than that of the whorl and is concave in the axial region. The aperture is broad and obtusely angular at the junction of the columellar lip with the parietal lip. The peristome is moderately prosocline, with a subcircular, thin and sharp outer lip and a very thin inductura on the parietal lip. The columellar lip is moderately stout, almost straight and slightly divergent from the spire axis. Its foot is slightly elongated in abapical direction, presumably forming a shallow and wide outlet-like extension.

The earliest two preserved whorls (presumably corresponding to the fourth–fifth teleoconch whorls), are ornamented by a strong, regular network of three, equally spaced, cord-like spiral threads and about twenty collabral ribs extended from the adapical suture to the lowermost spiral thread. The collabral ribs are as thick as the spiral threads and form small, slightly acute nodes at the intersection points. A fourth spiral thread is partly visible along the lower suture. The spiral elements of the ornament gradually increase in number by intercalation between the primary threads. All generations of threads strengthen during growth. The last whorls bear three–four orders of spiral threads. The collabral ribs of the earliest preserved whorls become thinner during growth and change into threads and short, sharp riblets. On the second preserved whorl, other subequally sized collabral riblets appear and form a very dense pattern. Some of them are continuous from suture to suture on the whorl surface, but most are shorter and cross only single spiral interspaces or slightly more. Some riblets are also bifurcated at the granules of the intersection points. As a result, the last whorl is sculptured by a dense and fine network of three–four orders of spiral elements, crossed by differently extended collabral riblets. The ornament of the base is denser than that of the whorl surface and consists of about fifteen primary spiral threads, mostly alternated by secondary threads, crossed by dense, very fine collabral threads. The growth lines of the spire whorls are prosocline, feebly opisthocyrt and almost straight on the subsutural part. They are widely opisthocyrt on the base.

Dimensions. See Table 3.

Remarks. The holotype is well preserved whereas the other specimens are strongly incomplete. *Elymicyclus martae* sp. nov. resembles *Elymicyclus alternatus* sp. nov. in the height of the whorls and in the spiral ornament composed of threads alternating in size. It differs in its wider spiral angle and slightly more convex whorls. These differences are already present in the early spire whorls. In *E. alternatus* the fully adult part of the shell has a cyrtoconoidal outline, the last whorls are ornamented by two orders of spiral elements, and the collabral riblets extend from suture to suture. Conversely, in *E. martae* the fully adult shell is coeloconoidal, the spiral ornament is composed of three–four orders of threads and the collabral riblets are short, discontinuous and occasionally bifurcated. Also *Elymicyclus carpathicus* (Uhlig, 1878), from the Callovian beds of Pieniny Klippen Belt (southern Poland) is very similar to *E. martae* in the shape of the shell and ornament pattern. However, *E. carpathicus* is almost twice as big and the whorls are ornamented by stronger and much fewer spiral cords. These bear more prominent tubercles at the intersection with quite regularly bifurcated collabral riblets or threads.

Distribution of the species. Lower part of Upper Toarcian, Rocca Busambra (north-western Sicily, southern Italy).

Elymicyclus? sp.
Figure 21R

Material. One specimen, GPIT 1685/556, Aalenian – Lower Bajocian (*Leioceras opalinum – Sonninia propinquans* biozones).

Remarks. The material is represented by a shell fragment showing a distinctly convex whorl surface ornamented by five, widely spaced, cord-like spiral threads. These are crossed by dense collabral threads roughly interrupted by the spiral ornament and with small nodes at the points of intersection. This ornament pattern is typical, though not esclusive, of *Elymicyclus*.The spiral pattern is different from that of the species ascribed here to this genus but the very poor material prevents further comparisons.

Genus JURASSISCALA nov.

LSID. urn:lsid:zoobank.org:act:XXXXXXXXX

Derivation of name. Referred to the age of the genus and its relationships with *Eucycloscala*.

Type species. *Jurassiscala sturanii* sp. nov., Lower Bajocian (*Stephanoceras humphriesianum* Biozone), Rocca Busambra (north-western Sicily, southern Italy).

Diagnosis. Shell small, thick-walled, turbiniform, anomphalous. Protoconch smooth, slightly protruding and composed of about half a volution. First teleoconch whorl well rounded. Subsequent whorls quite convex, possibly obtusely angulated at spiral ornament. Suture in channel edged adapically by periphery. Peristome with thin inductura on parietal lip. Columellar lip with median, aperturally directed swelling. Columellar region crescent-shaped by weak reflection of inner lip towards axial region of base. Ornament of first teleoconch whorl made of thin collabral riblets. Subsequent whorls with prominent and quite regular network of three–four spiral cords and widely spaced collabral ribs. Cords and ribs subequal in strength and granulated at intersections. Suture runnig on outermost spiral cord of base. Collabral riblets ending at this cord. Base, with widely spaced spiral cords.

Remarks. *Jurassiscala* gen. nov. differs from *Eucycloscala* Cossmann, 1895 in the less acute shell, more rounded whorls and the columellar lip bearing a median swelling directed towards the aperture. *Riselloidea* Cossmann, 1916 and *Trochonodus* Nützel, Hamedani & Senowbari-Daryan, 2003, Mesozoic taxa included by Ferrari *et al.* (2014) and Ferrari & Kaim (2018) into the subgenus *Calliotropis* (*Riselloidea*), are distinguished from *Jurassiscala* by the absence of a columellar tooth-like swelling. Moreover, in *Riselloidea* and *Trochonodus*, as well as in *Biarmatoidella* Grundel, 2003, another genus synonymized by Bandel (2010) with *Riselloidea* and included by Ferrari & Kaim (2018) in *C*. (*Riselloidea*), the earliest spirally keeled teleoconch whorls are flat to slightly concave. Consequently, this part of the shell is conoidal-trochiform and the adult shell retains this shape. In contrast, *Jurassiscala* has convex whorls and the shape of the shell is turbiniform.

The presence of a columellar swelling makes *Jurassiscala* comparable with the members of the family Chilodontidae Wenz, 1938. However, unlike *Jurassiscala*, in *Chilodonta* Étallon, 1859, with the Upper Jurassic type species *Chilodonta clathrata* Étallon, 1859 (p. 106; Loriol 1890, p. 147, pl. 16, fig. 15a–b; Cossmann 1918, p. 198, text-fig. 71) and in most of the living genera usually ascribed to this family (e.g. Herbert 2012 and references therein) the aperture is restricted by a variably complex pattern of strong teeth. In less typical chilodontids, like *Mirachelus* Woodring, 1928, more similar to *Jurassiscala* in the columellar characters, the inner side of outer lip is distinctly lirate (Quinn 1991). The presence of a columellar swelling is not sufficient to establish close relationships between *Jurassiscala* and the Chilodontidae. Most probably this simple structure appeared independently in genera of different families. Moreover, in the Chilodontidae, as well as in Calliotropidae Hickman & McLean, 1990, the early teleoconch whorls are commonly flat and the apical shell is conoidal-trochiform.

Several Late Triassic–Jurassic species have shells very close to that of *Jurassiscala* in shape and ornament pattern. Examples are *Trochonodus iranicus* Nützel, Hamedani & Senowbari-Daryan, 2003 (p. 128, pl. 24, figs 1–4) from Norian beds of Nayband Basin (Iran), *Scalaria limatula* von Ammon, 1893 (p. 176, text-fig. 14; Nützel *et al.* 2003, p. 128, cited as *Trochonodus*) from Lower Sinemurian (Seuss *et al.* 2005) of Northern Calcareous Alps (southern Germany), *Trochus torulosus* Quenstedt, 1882 (p. 430, pl. 202, figs 7–8; Brösamlen 1909, p. 211, pl. 17, fig. 22a–b) from Lower Aalenian of Swabia (southern Germany), *Turbo reticularis* Piette, 1855 (p. 1095; Cossmann 1885, p. 266, pl. 14, figs 47–48, pl. 17, figs 46–47; Fischer 1969, p. 142, described as *Riselloidea*) from the Bathonian of Calvados and Aisne (northern France), *Eucycloscala* sp. 2 in Gründel (2004, p. 25, pl. 3, figs 3–5) from Upper Bathonian of Calvados (northern France) and *Scalaria tenuis* Brösamlen, 1909 (p. 273, pl. 20, fig. 41a–c; Gründel *et al.* 2017, p. 207, pl. 14, figs 9–11) from Upper Kimmeridgian of Swabia (southern Germany). However, none of them show a columellar swelling or tooth.

Included species and occurrence. The genus occurs in Aalenian?–Bajocian deposits and is represented by the following species, in stratigraphical order:

Jurassiscala subreticularis (Conti & Fischer, 1984*b*) (see references below), Lower Bajocian, Martani Mountains (Umbria, central Italy); condensed Aalenian–Bajocian, Lower and Upper Bajocian, Rocca Busambra (north-western Sicily, southern Italy);

Jurassiscala? *martaniensis* (Conti & Fischer, 1984*b*) (see references below), Lower Bajocian, Martani Mountains (Umbria, central Italy);

Jurassiscala sturanii sp. nov. (type species), Lower and Upper Bajocian, Rocca Busambra (north-western Sicily, southern Italy);

Jurassiscala? *tenuiretis* sp. nov. (here), Upper Bajocian, Rocca Busambra (north-western Sicily, southern Italy).

Jurassiscala sturanii sp. nov.
Figure 22A–L

LSID. urn:lsid:zoobank.org:act:XXXXXXXXX

Derivation of name. Species dedicated to Carlo Sturani (1938–1975), geologist and palaeontologist who greatly contributed to the knowledge of the Jurassic pelagic carbonates of Southern Alps and Sicily.

Holotype. GPIT 1685/857 (Fig. 22A–G).

Type Locality. Piano Pilato, Rocca Busambra (north-western Sicily, southern Italy).

Type level. Lower Bajocian (*Stephanoceras humphriesianum* Biozone) neptunian sill limestone.

Additional material. Paratype GPIT 1685/858, Upper Bajocian (*Strenoceras niortense – Parkinsonia parkinsoni* biozones).

Diagnosis. Columellar swelling wide and placed slightly towards junction with parietal lip. Spiral ornament composed of two spiral cords on second teleoconch whorl making whorl profile feebly angulated. Two secondary spiral cords subsequently appearing between primary cords and between upper primary cord and adapical suture, respectively. Secondary cords becoming rapidly as prominent as primary cords.

Description. The shell is turbiniform and cyrtoconoidal. The protoconch is slightly protruding and composed of half a volution. The teleoconch consists of four whorls. The penultimate whorl is about three times wider than high and the height of the last whorl is about 70% of the shell height. The first teleoconch whorl is strongly convex and the periphery is almost at mid-whorl. The subsequent whorls are also markedly convex but the periphery is below mid-whorl and, consequently, the profile of the whorl is slightly pendent. The suture is impressed and becomes grooved on the last whorls. The base is moderately convex and anomphalous. The aperture is subcircular. The peristome is prosocline, developed in a single plane. The parietal lip is covered by a thin inductura. The inner lip is evenly arched and passes smoothly to the basal lip. The columellar region is slightly expanded towards the axial region of the base and forms a sort of crescent-shaped face. An upward and inward developed swelling is present on the median-upper part of the columellar lip. The outer lip is sharp along its outer rim.

The protoconch is seemingly smooth. The ornament is composed of collabral riblets and spiral cords. The first and half teleoconch whorl is ornamented only by a dense pattern of sharp, evenly distributed and equally sized collabral riblets. These progressively become widely spaced ribs. Two sharp, equally and widely spaced spiral cords appear on the second whorl that angulate the whorl profile feebly and obtusely. Subsequently, other two spiral cords appear on the interval between the primary cords and between the upper primary cord and the adapical suture, respectively. These secondary cords rapidly become as prominent as the primary cords. As a consequence, the last two whorls are sculptured by a sharp network of about twenty collabral riblets and four spiral cords with weakly pointed nodules at the intersection points. The base bears five prominent, evenly spaced and equally sized spiral cords. The growth lines are prosocline and very slightly prosocyrt or straight on the spire whorls, widely and evenly opisthocyrt on the base.

Dimensions. See Table 3.

Remarks. The specimens are moderately well preserved. *Jurassiscala sturanii* sp. nov. differs from *Jurassiscala subreticularis* (Conti & Fischer, 1984*b*) in the bigger and more acute shell with higher whorls. The columellar swelling is wider and slightly higher in position. The subadult whorls are only feebly angular and bear four spiral cords whereas in *J. subreticularis* they are distinctly biangulated and with three spiral cords. *Jurassiscala*? *martaniensis* (Conti & Fischer, 1984*b*) shares with *J. sturanii* the same adult ornament pattern but differs in having a distinctly globose shell with

lower and more rounded whorls. In this species the presence of a columellar tooth/swelling is not obvious.

Distribution of the species. Lower and Upper Bajocian, Rocca Busambra (north-western Sicily, southern Italy).

Jurassiscala subreticularis (Conti & Fischer, 1984*b*)
Figure 22M–Y

v* 1984*b* *Riselloidea subreticularis* Conti & Fischer, p. 145, pl. 3, figs 13–14.

Material. Three specimens: GPIT 1685/520, Aalenian – Lower Bajocian (*Leioceras opalinum – Sonninia propinquans* biozones); GPIT 1685/856, Lower Bajocian (*Stephanoceras humphriesianum* Biozone); GPIT 1685/855, Upper Bajocian (*Strenoceras niortense – Parkinsonia parkinsoni* biozones).

Description. The shell is small, turbiniform, slightly cyrtoconoidal in outline and composed of four teleoconch whorls. The protoconch consists of slightly less than one volution. The early teleoconch whorls are evenly and markedly convex, with a strongly impressed and grooved suture. The penultimate whorl is about twice and half wider than high and the last whorl is about two thirds of the shell height. Three angulations marked by acute spiral cords appear on the final part of the second whorl. The adapical angulation is obtuse and runs near the suture. It corresponds to the outer edge of a narrow and almost horizontal sutural shelf. The other two angulations are placed at about two thirds and one quarter of the whorl surface from the abapical suture, respectively. The median angulation runs in the middle of the distance between the adapical and abapical angulations. The abapical angulation is peripheral. The interspaces between the angulations are concave and the suture runs in a wide channel between the peripheral and the subsutural angulations. The base is convex, anomphalous and slightly depressed on its axial region. The aperture is subcircular. The peristome is prosocline and the parietal region is coated with a thin inductura. The columellar lip is relatively strong and is covered with a thin and smooth callus. The weak expansion of this callus towards the axial region of the base forms an arched and concave columellar face. A low, aperturally directed swelling is present on the median part of the columellar lip. The outer lip is sharp.

The protoconch is seemingly smooth. Thin and sharp collabral riblets appear gradually on the first teleoconch whorl. The second whorl bears about twenty prominent, regularly repeating collabral riblets which reach from suture to suture. On the subsequent whorls, the collabral riblets become stronger and fewer, and change into widely spaced ribs. About fifteen collabral ribs ornament the last whorl. These ribs and the spiral cords marking the angulations of the whorls form a regular and conspicuous quadrangular grid. The intersection points bear acute nodes. The collabral ribs of the whorl surface extend to the outermost part of the base where they suddenly vanish. The base is ornamented by four sharp, evenly and widely spaced spiral cords. Strong growth lines intersect the spiral ornament. They make the surface of the base rough and give rise to shallow, dense and quite irregular collabral threads. The growth lines are slightly prosocyrt on the whorl surface and become increasingly prosocline during growth. They are widely and evenly opisthocyrt on the base.

Dimensions. See Table 3.

Remarks. The material is represented by variably incomplete shells. In the specimen GPIT 1685/520 secondary spiral threads appear suddenly in the interspaces between the spiral cords on the last half of the base (Fig 22S). This is probably the effect of a growth anomaly as indicated by the abrupt alteration in strength of the growth lines. The specimen GPIT 1685/856 (Fig. 22U–Y) is

much bigger than the holotype of *Jurassiscala subreticularis* (Conti & Fischer, 1984*b*) and this demonstrates that the latter represents a not fully adult shell. The material described here differs from the holotype only in the less widely spaced ribs on the last whorls. Conti & Fischer (1984*b*) described the earliest teleoconch whorls as smooth. However, evenly repeating and sharp collabral riblets are visible on the holotype although the apical spire is strongly affected by recrystallization.

Distribution of the species. Lower Bajocian (*Stephanoceras humphriesianum* Biozone), Martani Mountains (Umbria, central Italy); condensed Aalenian – Lower Bajocian, Lower and Upper Bajocian, Rocca Busambra (north-western Sicily, southern Italy).

Jurassiscala? *tenuiretis* sp. nov.
Figure 23

LSID. urn:lsid:zoobank.org:act:XXXXXXXXX

Derivation of name. From Latin *tenue*, weak, and *rete*, network, referring to the attenuation of the ornament network on the last whorl.

Holotype. GPIT 1685/519 (Fig. 23A–F).

Type Locality. Piano Pilato, Rocca Busambra (north-western Sicily, southern Italy).

Type level. Upper Bajocian (*Strenoceras niortense – Parkinsonia parkinsoni* biozones) neptunian sill limestone.

Additional material. Paratype GPIT 1685/859, Upper Bajocian (*Strenoceras niortense – Parkinsonia parkinsoni* biozones).

Diagnosis. Shell conoidal-turbiniform. Coiling axis of protoconch slightly tilted. Teleoconch whorls moderately convex and slightly pendent in outline. Abapical half of last three whorls provided with two angulations. Lower angulation peripheral. Suture grooved. Base anomphalous, moderately convex. Collabral pattern of first teleoconch formed by strong riblets. Two cord-like spiral threads appearing on angulations of subsequent whorl. Adult ornament made of a weak network of sharp collabral riblets crossing primary spiral threads and two-three secondary spiral threads appearing on the adapical half of whorl surface.

Description. The shell is conoidal-turbiniform and composed of about five teleoconch whorls. The adult whorls are two and a half times wider than high, and the height of the last whorl is two thirds of the shell height. The protoconch consists of slightly less than one rounded volution. Its coiling axis is weakly inclined with respect to the spire axis of the teleoconch. The earliest teleoconch shows rather convex, subglobose whorls. The subsequent whorls become less convex and with a pendent outline. The periphery lies near the lower suture. On the early teleoconch, two obtuse angulations appear on the abapical half of the whorl surface. The lower angulation is peripheral and sharper than the other. The narrow belt of the whorl surface between the periphery and the suture is concave and forms a groove in which the suture runs. The base is anomphalous, moderately convex and almost as high as the whorl surface. The peristome seems discontinuous at the parietal region. The outer lip is thickened at the sutural corner, and the columellar lip is quite sturdy.

The protoconch is smooth. Prosocline and prosocyrt collabral riblets appear with sudden onset on the first teleoconch whorl. They are strong, regularly spaced, equally sized, and extend from suture to suture. Slightly less than twenty collabral riblets ornament the second whorl. They do not increase in number on the subsequent whorls whereas their interspaces widen. The main spiral ornament consists of three–four threads. Two of them appear during the growth of the second

teleoconch whorl and mark the angulations of the abapical half of the whorl surface. They progressively become as strong as the collabral riblets. Two or three additional widely spaced spiral threads, thinner than the lower ones, appear later on the adapical half of the whorls. Another spiral cord runs on the outermost belt of the base. It is covered by the subsequent whorl in the spire whorls and, thus, is visible only on the last whorl. The spiral threads/cords and collabral riblets are granulated at the intersection points and form a network that slightly weakens on the last whorl. The base seemingly bears a weak ornament of spiral threads. The growth lines are increasingly prosocline during growth and feebly prosocyrt on the spire, slightly opisthocyrt on the base.

Dimensions. See Table 3.

Remarks. In the holotype the peristome is incomplete and the base shows traces of spiral lines seemingly smoothed by dissolution. The paratype lacks the peristome and part of the last whorl. The assignment of the species to *Jurassiscala* gen. nov. is based on the similarities with the other species ascribed here to that genus. However, the more conoidal shape of the shell and the lack of information on the presence/absence of a columellar tooth suggest to leave open this attribution. *Jurassiscala*? *tenuiretis* sp. nov. differs from *Jurassiscala subreticularis* (Conti & Fischer, 1984*b*) and *Jurassiscala sturanii* sp. nov. also in having much stronger collabral riblets on the first teleoconch whorl. In *J. subreticularis* and *J. sturanii* the adult spiral sculpture is more prominent and the spiral cords are subequally sized whereas in *J.*? *tenuiretis* the two primary spiral cords are stronger than the others.

Distribution of the species. Upper Bajocian, Rocca Busambra (north-western Sicily, southern Italy).

Family SABRINELLIDAE Bandel, 2010

Genus FISCHERIELLA Conti & Monari, 1986

Type species. *Fischeriella umbra* Conti & Monari, 1986. Condensed Middle Aalenian and Lower Bajocian (mixed *Ludwigia murchisonae* and *Stephanoceras humphriesianum* biozones), Umbria (central Italy).

Emended diagnosis. Early shell turbiniform with evenly convex whorls. Last whorls angulated making adult shell subgradate to distinctly pagodiform. Angulation peripheral, below or almost at mid-whorl. Base somewhat high and convex. Umbilicus narrow, in a deep transversal furrow encircled by a prominent periumbilical edge. Aperture circular, in single plane. Last peristome continuous. Outer lip thickened externally to form a sharp peristomal crest. Shallow, channel-like concavity of outer surface of peristomal crest on lower part of inner lip, at junction with basal lip. Ornament made of thin spiral threads and collabral ribs. Collabral ribs forming nodes on peripheral angulation and persisting or disappearing on last whorls. Base ornamented by spiral threads.

Remarks. The diagnosis of the genus *Fischeriella* Conti & Monari, 1986 is emended in order to include the characters of a new species, *Fischeriella sicula* sp. nov., described here. This species has a juvenile shell almost identical to that of the type species, *Fischeriella umbra* Conti & Monari, 1986, but shows a different development of the ornament on the last whorls (see below). The genus was tentatively placed by Conti & Monari (1986) in the turbinid subfamily Liotiinae Gray, 1850. It was moved by Nützel (2013) to the family Sabrinellidae Bandel, 2010 essentially for the presence of a wide outer thickening of the peristome and for the general similarities with other members of that family. *Fischeriella* shares with *Microcheilus* Kittl, 1894 most of the aspects of the ornament pattern of the early shell and the gradual appearance and strengthening of a peripheral angulation on the lower half of the whorl surface. *Microcheilus* differs from *Fischeriella* in its subturriculate

shape, discontinuous peristome and in the outer peristomal thickening lacking the shallow transversal concavity at the foot of inner lip.

Included species and occurrence. The genus occurs in Upper Toarcian to Lower Bajocian sediments and is represented by the following species, in stratigraphical order:
Fischeriella umbra Conti & Monari, 1986 (type species, see references below), condensed Middle Aalenian and Lower Bajocian, Umbria (central Italy); uppermost Toarcian, Rocca Busambra (north-western Sicily, southern Italy).
Fischeriella sicula sp. nov. (here), condensed Middle Aalenian and Lower Bajocian, Umbria (central Italy); condensed Aalenian – Lower Bajocian and Lower Bajocian, Rocca Busambra (north-western Sicily, southern Italy).

Fischeriella umbra Conti & Monari, 1986
Figure 24A–F

v* 1986 *Fischeriella umbra* Conti & Monari, p. 185, text-fig. 7, pl. 4, figs 1–6.
v 1971 *Trochoturbella* sp.; Wendt, p. 155.

Material. Specimen GPIT 1685/463, uppermost Toarcian (*Pleydellia aalensis* Biozone).

Description. The shell is small and composed of about five whorls. Its shape is turbiniform with fully adult part gradate-pagodiform. The early teleoconch whorls are quite convex with an impressed and incised suture running slightly below the rounded periphery. The fully adult whorls are slightly less convex and are wide almost twice and half of their height. The last whorl becomes obtusely, but distinctly angulated at the periphery. Its height is about three quarters of the shell height. The peripheral angulation lies slightly below mid-whorl and subdivides the whorl surface in a concave, moderately steep ramp and a feebly convex outer face. The base is high, rather convex and narrowly phaneromphalous. Its surface has a rounded, scarcely distinct angulation on which the suture runs. The umbilical groove is narrow. The aperture is circular. The peristome is almost in a single plane and continuous, although somewhat thin in the median part of the parietal lip. The outer lip is outward thickened along its full length and this thickening produces a rather wide peristomal crest. The outer surface of the peristomal crest is slightly swollen along the apertural rim of the peristome, and has a shallow transversal excavation in the joining area between the basal and inner lips. The outer rim of umbilical lip is cord-like and passes smoothly to the parietal lip.

The main ornament consists of evenly spaced and sized collabral ribs which are present at least from the second teleoconch whorl onward. They are prosocline and almost straight and separated by slightly wider interspaces. During growth, the ribs become more distant, more irregularly distributed and opisthocyrt, and bear smoothly pointed tubercles on the peripheral angulation. Thin to almost obscure spiral lines cross the collabral ornament. The base is ornamented by sharp and quite dense spiral threads that are slightly roughed by the growth lines. Prolongations of the collabral ribs wave the surface of the base and vanish almost at the basal angulation. The growth lines are moderately prosocline on the whorl surface, prosocyrt on the subsutural region and opisthocyrt below it. On the base, the growth lines are widely opisthocyrt and become slightly prosocyrt on the periaxial region.

Dimensions. See Table 3.

Remarks. In general, the single specimen is well preserved, although the lower part of the peristomal crest is incomplete. The preservation of apical spire is also defective and this prevents observation of the ornament of the first teleoconch whorl. Distinct collabral riblets are visible on the second whorl. The specimen shows a thin inductura in the median part of the parietal lip. In contrast, the holotype of *Fischeriella umbra* Conti & Monari, 1986 shows a well thickened parietal

callus. Other specimens of the type series have also a subcontinuous peristome on the parietal lip, especially those with peristomal crest not fully developed. Clearly, a thick parietal callosity forms during the latest growth stage concomitantly with the appearance of the peristomal crest. Up to now, the species has been known from condensed Middle Aalenian – Lower Bajocian sediments. This finding extends its stratigraphical range to the Upper Toarcian.

Distribution of the species. Condensed Middle Aalenian and Lower Bajocian (mixed *Ludwigia murchisonae* and *Stephanoceras humphriesianum* biozones), Umbria (central Italy); uppermost Toarcian (*Pleydellia aalensis* Biozone), Rocca Busambra (north-western Sicily, southern Italy).

Fischeriella sicula sp. nov.
Figure 24G–W

LSID. urn:lsid:zoobank.org:act:XXXXXXXXX

v 1896 *Lepidotrochus* sp.; Conti & Monari, p. 190, pl. 6, fig. 6.

Derivation of name. From Latin *Siculi*, Sicels, inhabitants of eastern Sicily during the Iron Age.

Holotype. GPIT 1685/464 (Fig. 24G–L).

Type Locality. Piano Pilato, Rocca Busambra (north-western Sicily, southern Italy).

Type level. Aalenian – Lower Bajocian (*Leioceras opalinum – Sonninia propinquans* biozones) neptunian sill limestone.

Additional material. Six specimens: paratype GPIT 1685/465 Aalenian – Lower Bajocian (*Leioceras opalinum – Sonninia propinquans* biozones); paratype GPIT 1685/467, Aalenian – Lower Bajocian (*Leioceras opalinum – Sonninia propinquans* biozones) neptunian dyke; paratypes GPIT 1685/468–469 Lower Bajocian (*Sonninia sowerbyi – Sonninia propinquans* biozones); specimen GPIT 1685/466, Aalenian – Lower Bajocian (*Leioceras opalinum – Sonninia propinquans* biozones); specimen GPIT 1685/875, undifferentiated Aalenian–Bajocian.

Diagnosis. Fully adult part of shell distinctly pagodiform with whorls sharply angulated and strongly carinate at periphery. Lower channel-like concavity of outer surface of peristomal crest very shallow and wide. Last whorls without collabral ornament and with very prominent, slightly upward curved and smooth peripheral keel.

Description. The early shell is turbiniform. The fully adult part of the shell is distinctly pagodiform and slightly coeloconoidal in outline. The protoconch is not preserved. The teleoconch is composed of six whorls that are almost three times as wide as high. The first teleoconch whorl is evenly and strongly convex and progressively becomes obtusely angulated at the periphery, close to the abapical suture. On the subsequent whorls the periphery moves upward, slightly below or at mid-whorl, and becomes sharply angulated and keeled. The ramp is concave with a slightly convex subsutural part. The outer face is convex. The last whorl covers about 70% of the height of the shell. The base is markedly convex and narrowly phaneromphalous. The umbilical cavity has the shape of a moderately wide transversal furrow bordered by a sharp and very prominent periumbilical edge. The aperture is circular, slightly trumpet-like and lies almost in a single plane. The peristome is prosocline, continuous on the parietal lip and widely expanded outward. This expansion forms an outer crest that reaches the peripheral keel of the penultimate whorl and extends from the sutural corner to the foot of the inner lip. The umbilical lip is reflected outward partly covering the upper part of umbilical cavity. Its inner rim is slightly thickened, cord-like. The outer

surface of the peristomal crest at the foot of the inner lip forms a wide and shallow channel-like concavity which is almost parallel to the umbilical furrow.

The first preserved whorl, probably representing the second teleoconch whorl, bears a network of collabral riblets and four-five spiral threads. The subsequent two and half whorls are ornamented by strong, evenly spaced and sized, prosocline collabral ribs crossed by very thin and regularly sized spiral threads. The collabral ribs increases in number during growth. About fifteen ribs are present on the third whorl. The spiral threads are more evident on the whorl surface below the periphery. On the first half of the penultimate whorls the collabral ribs suddenly disappear. The spiral threads below the periphery become slightly wider and separated by very thin interspaces. The peripheral keel appears on the final part of the second whorl and strengthens during growth. It bears rounded nodes at the intersection with the collabral ribs. These nodes cease concomitantly with the disappearance of the ribs. On the fully adult part of the shell the peripheral keel is very prominent, upward bending, and ornamented by thin spiral threads. The base is covered by a dense pattern of spiral threads separated by thin interspaces. The growth lines are thin. On the whorl surface they are distinctly prosocline above the periphery and slightly prosocline below the periphery, opisthocyrt on the whole, but slightly prosocyrt on the subsutural region. The base bears widely opisthocyrt growth lines that become prosocyrt on the periaxial region.

Dimensions. See Table 3.

Remarks. Most of the specimens lack the apical spire and parts of the peristome. On the whole, *Fischeriella sicula* sp. nov. shows a low degree of variation that essentially concerns some details of the ornament. The number of collabral ribs and their persistence on the early shell are slightly variable. The spiral threads on the ramp of the last whorl and on the median part of the base can be sharp to almost obscure. The species is very close to *Fischeriella umbra* Conti & Monari, 1986 in shape and ornament of the early shell. In contrast, the fully adult shell of *F. sicula* is much bigger, lacks collabral riblets and has a prominent peripheral keel. Moreover, the outlet-like concavity of the peristomal crest at the foot of inner lip is larger. The specimen classified by Conti & Monari (1986) as *Lepidotrochus* sp. is a poorly preserved shell of *F. sicula*.

Distribution of the species. Condensed Middle Aalenian and Lower Bajocian (mixed *Ludwigia murchisonae* and *Stephanoceras humphriesianum* biozones), Umbria (central Italy); condensed Aalenian – Lower Bajocian (*Leioceras opalinum – Sonninia propinquans* biozones) and Lower Bajocian (*Sonninia sowerbyi – Sonninia propinquans* biozones), Rocca Busambra (north-western Sicily, southern Italy).

? Superfamily EUCYCLOIDEA Koken, 1897
Family CIRRIDAE Cossmann, 1916

Genus RETIMUSINA nov.

LSID. urn:lsid:zoobank.org:act:XXXXXXXXX

Derivation of name. From Latin *retis*, net, referred to the reticulate ornament of the juvenile shell and the similarity with the genus *Hamusina* Gemmellaro, 1879.

Type species. *Retimusina poseidoni* sp. nov., Upper Toarcian (*Haugia variabilis – Phlyseogrammoceras dispansum* biozones) Rocca Busambra, north-western Sicily (southern Italy) (see below).

Diagnosis. Shell sinistral, high-pagodiform and coeloconoidal. Early whorls convex, becoming slightly angulated below mid-whorl. Adult whorls with two keeled angulations. Adapical angulation

peripheral. Abapical angulation suprasutural. Ramp wider than outer face. Outer face concave. Base moderately convex and low, anomphalous or narrowly phaneromphalous. Ornament of early shell reticulate by intersection of three spiral cords with equally spaced and sharp collabral riblets. Intersection points granulate. Median and abapical cords becoming strong peripheral and suprasutural keels on adult shell. Uppermost cord weakening or vanishing on last whorl. Collabral ornament of fully adult shell made by widely spaced and strong ribs forming acute nodes or swellings on peripheral keel. Suprasutural keel smooth. Base ornamented by dense, thin, sharp to obscure spiral threads.

Remarks. The general shape and ornament pattern of the adult shell of *Retimusina* gen. nov. are quite similar to those of *Hamusina* Gemmellaro, 1879, as represented by its type species *Hamusina bertheloti* (d'Orbigny, 1850) (p. 248; d'Orbigny 1853, p. 337, pl. 328, figs 7–8; Cossmann 1916, p. 50, pl. 2, figs 19–20, 26; Fischer & Weber 1997, p. 134, pl. 21, figs 7–8), from Toarcian–Aalenian of Isère (southern France). Gemmellaro (1879), most probably referring to *Hamusina damesi* Gemmellaro, 1879 (p. 166, pl. 4, figs 39–41) and *Hamusina zignoi* Gemmellaro, 1879 (p. 167, pl. 4, figs 42–46), diagnosed his genus as having a flattish or slightly convex whorl surface with an angulation along the outer rim. These characters were subsequently adopted as diagnostic also by Cox (1960*c*) and Bandel (1993). However, the adult shell of *H. bertheloti* shows two angulations. The adapical angulation is below mid-whorl, sub-rounded and provided with a double row of strong and swollen nodes. The lower angulation is suprasutural and bears a sharp and smooth keel.

Significant differences between *Retimusina* and *Hamusina* concern the early teleoconch. In the early teleoconch of *Retimusina* the reticulate ornament is a prominent character that persists on the subadult shell and changes gradually into the adult ornament. The earliest shell of *H. bertheloti* is unknown. However, the first preserved whorl of the lectotype (Fischer & Weber 1997, p. 134, pl. 21, figs 7–8; see also the online catalogue of the Muséum national d'Histoire naturelle, Paris, France at https://science.mnhn.fr), presumably corresponding to the third teleoconch whorl, does not show any trace of a reticulate ornament. Also the early shell of the specimen illustrated by Cossmann (1916, pl. 2, fig 19), seemingly more complete than the lectotype, lacks a reticulate ornament. The early preserved spire is conoidal with slightly concave whorls and a prominent, nodose abapical spiral keel just above the suture. Other differences concern the adult shell. In *Retimusina* the spiral keel on the adapical angulation is peripheral and strengthens during growth. The collabral riblets become strong and widely spaced ribs. However, in *H. bertheloti* the adapical spiral keel attenuates or disappears and collabral ribs are absent on a great part of the adult shell. Moreover, the periphery corresponds to the suprasutural angulation.

The juvenile-subadult shell of *Cirrus* J. Sowerby, 1816 resembles the adult shell of *Retimusina* in the subpagodiform shape and in the main elements of the ornament pattern. *Cirrus* differs from *Retimusina* in its typical extraconoidal growth of the last whorls. This aspect varies in the different species. It is very marked in the type species, *Cirrus nodosus* J. Sowerby 1816 (p. 94; Sowerby 1818, p. 35, pl. 219, figs 1, 2, 4; Buckman 1879, p. 137, pl. in text, figs 3, 3a; Hudleston 1892, p. 313, pl. 20, fig. 6; Cossmann 1916, p. 199, pl. 8, figs 4–7), from the Aalenian of south-western England and the Bajocian of Calvados (northern France), where the fully adult part of the shell becomes subdiscoidal with a broad last whorl. In other species, such as *Cirrus leachi* Sowerby, 1818 (p. 36, pl. 219, fig. 3; Buckman 1879, p. 137, pl. in text, figs 1, 2; Hudleston 1892, p. 308, pl. 25, figs 3–5; Cossmann 1916, p. 200, pl. 8, figs 10–12) , from the Toarcian of Calvados (northern France) and the Toarcian-Aalenian of south-western England, the extraconoidal growth is less pronounced even if the fully adult part of the shell is still strongly coeloconodal. Other differences concern the ornament. In *Cirrus* the axial ribs of the spire whorls pass to base where they cross widely spaced spiral keels that are as strong as those of the spire whorls. In *Retimusina* the axial ribs disappear at or before reaching the suprasutural carina and the base is ornamented only by thin spiral threads.

Included species and occurrence. The genus ranges from Upper Toarcian to condensed Aalenian – Lower Bajocian and his represented by the following species, listed in stratigraphical order:
Retimusina poseidoni sp. nov. (type species, here), Upper Toarcian, Rocca Busambra (north-western Sicily, southern Italy).
Retimusina cf. *poseidoni* sp. nov. (here), Aalenian – Lower Bajocian, Rocca Busambra (north-western Sicily, southern Italy).
Retimusina? *tritoni* sp. nov. (here), Aalenian – Lower Bajocian, Rocca Busambra (north-western Sicily, southern Italy).

Retimusina poseidoni sp. nov.
Figure 25A–L

LSID. urn:lsid:zoobank.org:act:XXXXXXXXX

v 1971 *Hamusina* aff. *babylonica* Hudleston; Wendt, p. 154.

Derivation of name. From Poseidon, god of the sea and earthquakes in the Greek mythology.

Holotype. GPIT 1685/577 (Fig. 25A–F).

Type Locality. Piano Pilato, Rocca Busambra (north-western Sicily, southern Italy).

Type level. Upper Toarcian (*Haugia variabilis – Phlyseogrammoceras dispansum* biozones) neptunian sill limestone.

Additional material. Two specimens: paratype GPIT 1685/575 and specimen GPIT 1685/578, Upper Toarcian (*Haugia variabilis – Phlyseogrammoceras dispansum* biozones).

Diagnosis. As for genus.

Description. The shell is sinistral, high-pagodiform and has a slightly coeloconoidal outline. The width of the spire whorls is slightly more twice of the height, and the last whorl is half-height of the shell. The early preserved whorls are convex and edged by an impressed suture. Their convexity increases during growth and the whorl surface becomes angular below mid-whorl, at almost one third of the height of the whorl surface from the abapical suture. The periphery coincides with this angulation and is marked by a spiral cord. It becomes progressively sharper and subdivides the whorl surface in a wide, steep, flat to slightly convex ramp, and a much narrower and concave outer face.The ramp of the adult whorls is rather convex, from evenly convex to obtusely angular. The outer face is edged abapically by a rather sharp carinate angulation which is exposed just above the suture or slightly overlapped by the subsequent whorl. The base is low, moderately convex and anomphalous. The aperture is circular. The peristome is prosocline and the parietal lip is seemingly covered by a thin inductura. The columellar lip is stout and has a moderately wide, swollen outer face bordered by a sharp and thin outer rim.

The ornament of the first preserved whorls consists of three, evenly spaced spiral cords crossed by numerous and sharp collabral riblets forming small nodes at the intersection points. The interspaces between the cords are slightly concave and bear one or two spiral threads. During the growth of the subsequent whorls, the lower and median cords change into strong keels. The lower keel is suprasutural and marks the corresponding angulation of the adult shell. The median keel is on the peripheral angulation and is stronger than the others. The uppermost spiral cord gradually attenuates and changes into a thin and sharp keel or a thread. It can correspond to an obtuse angulation of the ramp. The spiral threads in the interspaces between the cords increase in number

on the abapical part of the ramp and on the outer face. They form a dense pattern of thin, sharp to obscure spiral threads where the primary threads are slightly more prominent than the others. The collabral ornament of the early preserved whorls consists of about 25–30 per whorl, thin, sharp and regularly spaced riblets. On the last three whorls the collabral riblets progressively decrease in number and become very widely spaced and strong ribs forming acute nodes swellings on peripheral keel. The penultimate whorl is sculptured by 10–12 ribs that tend to vanish before reaching the adapical and abapical sutures. The base is ornamented by dense, thin to obscure spiral threads. The growth lines are prosocline on whorl surface, slightly opisthocyrt in the interspaces between the spiral keels and acutely prosocyrt on the keels. The base bears widely opisthocyrt growth lines becoming prosocyrt in a narrow periaxial region.

Dimensions. See Table 3.

Remarks. The holotype and the paratype are well-preserved, although incomplete. The shell lacks part of the apical spire. The peristome preserves only the adapical part of the columellar lip and its adjoining area with the parietal region. The specimen GPIT 1685/578 is strongly fragmentary and in bad state of preservation. The holotype and the paratype show a set of differences indicating that *Retimusina poseidoni* sp. nov. is probably a rather variable species. In the paratype, the early preserved whorls are sharply angulated at the periphery, the ramp is flat and the upper spiral keel is thin. At the same growth stage, in the holotype the peripheral angulation of the early whorls is still almost indistinct, the upper spiral keel is stronger and the ramp is rather convex. Moreover, on the adult whorls of the paratype the upper spiral keel changes into a weak thread and the ramp becomes evenly convex whereas in the holotype the upper keel remains well distinct. It marks an obtuse angulation of the ramp and bears nodes at the intersection with the collabral ribs. In addition, the holotype has a more acute shell and the fully adult whorls have a less sharp peripheral angulation. The surface of the spire whorls is ornamented by a regular and dense pattern of thin spiral threads, whereas in the paratype this pattern is obscure apart from few, distinct and widely spaced threads.

Distribution of the species. Lower part of Upper Toarcian, Rocca Busambra (north-western Sicily, southern Italy).

Retimusina cf. *poseidoni* sp. nov.
Figure 25M–R

v 1971 *Hamusina bertheloti* (d'Orbigny); Wendt, p. 156.

Material. One specimen, GPIT 1685/576, Aalenian – Lower Bajocian (*Leioceras opalinum – Sonninia propinquans* biozones).

Dimensions. See Table 3.

Remarks. The specimen lacks the apical spire. The base is covered with a shell coating that represents the parietal region of the subsequent, not preserved, whorl. The presence of this coating suggests that the peristome is continuous on the parietal lip. The strong collabral ribs disappear abruptly from part of the penultimate whorl and reappear on the last preserved whorl. Since this change follows a trace of reparation most probably it reflects a temporary anomalous growth after the damage of the shell.

The shape of the shell, the size of the whorls and the main ornament seems to indicate that the specimen belongs to *Retimusina poseidoni* sp. nov. However, some differences suggests leaving provisionally open the species attribution. As in *R. poseidoni*, the early preserved whorls are sculptured by a dense pattern of thin spiral threads. However, unlike this species, on the adult shell of the specimen described here these threads gradually change into moderately wide and flat threads

delimited by thin spiral striae. Moreover, the shell has a narrow umbilicus and the outer part of the base below the suprasutural keel has a very obtuse angulation marked by a strong spiral carina. In *R. posedoni* this carina is absent and the shell is anomphalous.

Distribution of the species. Aalenian – Lower Bajocian, Rocca Busambra (north-western Sicily, southern Italy).

Retimusina? *tritoni* sp. nov.
Figure 25S–X

LSID. urn:lsid:zoobank.org:act:XXXXXXXXX

Derivation of name. From Triton, the messenger of the sea and son of Poseidon in the Greek mythology.

Holotype. GPIT 1685/579 (Fig. 25S–X).

Type Locality. Piano Pilato, Rocca Busambra (north-western Sicily, southern Italy).

Type level. Aalenian – Lower Bajocian (*Leioceras opalinum – Sonninia propinquans* biozones) neptunian sill limestone.

Additional material. None.

Description. The shell is sinistral, turbiniform, moderately high, and is composed of four–five, rather convex whorls separated by impressed sutures. The penultimate whorl surface is twice wider than high and the last whorl is slightly more than half-height of the shell. The earliest spire is heterostrophic with a protoconch, possibly submerged. The teleoconch whorls bear three keeled angulations. The lower angulation is peripheral on the first two preserved whorls. It runs slightly above the suture and edges a narrow suprasutural band which is inclined in abapical and adaxial direction. The suture lies in the channel formed by this band and the subsutural shelf of the subsequent whorl. The median angulation runs below mid-whorl, at about one third of the distance between the sutures, and become peripheral on the last two whorls. The upper angulation is more obtuse and lies along the mid-line of the band between the median angulation and the adapical suture. The base is moderately and evenly convex, anomphalous. The aperture is circular. The peristome is rounded and discontinuous or provided only with a thin coating on the parietal lip. The columellar lip is thickened by a comma-shaped, feebly swollen outer side which is delimited by a sharp outer rim. The outer lip is weakly prosocline and very slightly opisthocyrt.

The first two preserved whorls are ornamented by three spiral cords. The uppermost cord is slightly thinner than the others. These cords run on the angulations of the whorls and form a subregular network with sharp, evenly spaced collabral riblets. The spiral cords are initially intercalated with few very thin spiral threads whereas the intervals between the collabral riblets bear marked and dense riblet-like growth lines. A spiral thread, more marked than the others, runs along the mid-line of the band between the uppermost spiral cord and the adapical suture. On the last two whorls the spiral cords become slightly thinner and sharper. Their interspaces are covered with dense and sharp spiral threads. These threads are less marked and regular on the subsutural region and form small granules passing over the collabral riblets. The collabral riblets extend from suture to suture and become denser and more irregularly distributed on the latest shell part. They are crenulated or slightly scaly at the intersection with the spiral cords. The base is ornamented by dense and sharp spiral threads decussated by strong growth lines. A cord-like spiral thread marking

a very obtuse angulation edges the outermost band of the base and is just covered with the suture on the spire. The growth lines are distinct, moderately prosocline and gently opisthocyrt on the whorl surface, where they are slightly and acutely prosocyrt on the spiral cords, and widely opisthocyrt on the base.

Dimensions. See Table 3.

Remarks. The specimen is well preserved. The apical shell is broken on a transversal plane that shows the cross section of a heterostrophic submerged early coiling. The change from the herostrophic to the sinistral coiling is visible on the first preserved whorl. Details of the heterostrophic part of the early spire and its external characters cannot be established. On the final part of the last whorl, the growth lines become distinctly sharper and denser making the outer lip slightly thickened. This indicates that the specimen represents a fully adult shell.

Retimusina? *tritoni* sp. nov. is similar to the early shell of *Retimusina poseidoni* sp. nov. It differs in that the fully adult shell retains the characters of the early shell. Moreover, a comparison with the apical shell of *R. poseidoni* at the same growth stage show that in *R.*? *tritoni* the whorls are more convex and broader. The height of the shell is almost two times of the height of the corresponding part of the shell of *R. poseidoni*. In addition, the apical shell of *R. poseidoni* has stronger spiral keels. The median keel marks the periphery on the whole shell and the collabral threads become less numerous and more spaced during growth. In contrast, in *R.*? *tritoni* the periphery of the early whorls shifts to the lowermost keel in the latest shell parts. The collabral riblets are much weaker and increase in number and density.

Distribution of the species. Aalenian – Lower Bajocian, Rocca Busambra (north-western Sicily, southern Italy).

CONCLUSIONS

Although concerning only five superfamilies and less than 15% of the total number of species, the material described here is sufficient to highlight one of most prominent aspects of the gastropods from neptunian sills of Rocca Busambra, i.e. their extremely high degree of taxonomic novelty. As a matter of fact, almost 80% of the species described here (30 out of 38) are new. Moreover, 18 genera have been recognized of which nine are new. Again, ten families are represented and one of them is new (Tables 4, 5). Among the faunal units defined by Wendt (1971, 2017), the fauna 3 (Upper Toarcian, condensed *Haugia variabilis – Phlyseogrammoceras dispansum* biozones) and the fauna 5 (condensed Aalenian – Lower Bajocian, *Leioceras opalinum – Sonninia propinquans* biozones) are the most diverse at species level (Table 6). The fauna 5 is also the unit with the highest supraspecific diversity (12 genera and 8 families), but this could be the effect of the wider stratigraphical interval condensed in the corresponding level.

Comparisons between the taxonomic composition of the faunas from the different stratigraphical intervals and a reliable reconstruction of the changes of biodiversity over time, as well as a robust analysis of the palaeobiogeographical relationships between the gastropods of Rocca Busambra and the other western Tethyan faunas should be necessarily based on a complete systematic dataset. However, some considerations can be done that concern the part of the fauna described here. Preliminary studies on the whole material (Conti *et al.* 1993, 2004; Szabó *et al.* 1993) demonstrated that the gastropods from neptunian sills of Rocca Busambra are closely related to a faunal stock named by Szabó (1988) as Alpine type. As mentioned above, this stock inhabited topographically elevated areas of the central region of western Tethys characterized by condensed pelagic deposition (Pelagic Carbonate Platforms *sensu* Santantonio 1993, 1994; Santantonio & Carminati 2011) and was very different in taxonomic structure and composition from the faunas of the European epicontinental seas, the intra-Tethyan shallow water carbonate platforms and the North African belt (Szabó 1988, 1992, 1994; Conti & Monari 2001; Gatto & Monari 2010). Its

history started from the Sinemurian and can be traced at least up to the Bajocian (Intratethyan faunal unit in Conti & Szabó 1988; Conti *et al.* 1993, 2004; Conti & Monari 2001).

As far as the Toarcian is concerned, apart from *Fischeriella umbra*, all the species described here are new and known only for Rocca Busambra outcrop. However, the record of Toarcian gastropods from other localities of the central western Tethys is very sketchy, consisting of few species often represented by poorly preserved material (e.g. Mariotti & Schiavinotto 1977; Conti & Monari 1995, 2003; Szabó 1995; Galácz & Szabó 2001), and this could hamper a meaningful comparison with the Rocca Busambra fauna. At genus level *Trochotomaria*, *Propeucyclus* and *Fischeriella* are exclusive of condensed pelagic carbonates of central western Tethys. More in detail, *Trochotomaria polymorpha*, from Toarcian of Rocca Busambra, partially fills a temporal gap of knowledge between *Trochotomaria lobitzeri*, an Upper Sinemurian species from Northern Calcareous Alps (Austria), and the lower Middle Jurassic species, namely *Trochotomaria conoidea* from condensed Aalenian – Lower Bajocian of Rocca Busambra and *Trochotomaria somhegyensis* from Bajocian of Rocca Busambra, Umbria and Bakony mountains. *Propeucyclus* occurs in Aalenian–Bajocian deposits, but a Toarcian species from Rocca Busambra of uncertain attribution, namely *Propeucyclus*? *semireticulatus*, could represent its first occurrence. *Fischeriella umbra* has been found in uppermost Toarcian neptunian sills of Rocca Busambra and is known from condensed sediments with mixed Middle Aalenian and Early Bajocian faunas of Umbria (central Apennines, Italy).

It is noteworthy that none of the Toarcian genera described here are present in coeval deposits of the European epicontinental shelf, although the faunas established in that region after the Early Toarcian anoxic event were relatively diversified and widely distributed in several basins (Schulbert & Nützel 2009, 2013; Gatto *et al.* 2015*b* and references therein). According to Gatto *et al.* (2015*b*), in Toarcian times the faunal exchanges between the European shelf and the central western Tethys were hampered by the very different environmental conditions, reflected by the strong facies differences that characterized each region.

Palaeobiogeographical relationships concerning the Aalenian–Bajocian time span are more clear. Seven species occur also in other localities, namely *Pseudorhytidopilus*? sp., *Trochotomaria somhegyensis*, *Emarginula* (*Tauschia*?) *vigilii*, *Propeucyclus geometricus*, *Zarnglaffia polygonalis*, *Jurassiscala subreticularis* and *Fischeriella sicula*. On the whole, their distribution encompasses the Umbria-Marche zone (central Italy) (Conti & Fischer 1981, 1984*b*; Conti & Monari 1986; Conti & Szabó 1987), Trento Plateau (southern Alps, northern Italy) (Fucini 1894) and Transdanubian Range (Hungary) (Szabó 1980, 1981; Conti & Szabó 1987) (Fig. 26). This confirms close relationships of the gastropods of Rocca Busambra with the other coeval faunas from condensed pelagic carbonates of central western Tethys as also indicated by the distribution at genus level. *Trochotomaria*, *Propeucyclus*, *Fischeriella* and *Jurassiscala* are exclusive of this area. Pre-Oxfordian records of *Zarnglaffia* concern only the pelagic carbonates of central western Tethys, i.e. Aalenian–Bajocian of Rocca Busambra and Transdanubian Range (Szabó 1981), and Callovian of Pieniny Klippen Belt (southern Poland) (Uhlig 1881). *Eucyclomphalus* was widespread in the central region of western Tethys during the Late Sinemurian. Its distribution encompasses the Lombardy Basin (Parona 1894; Sacchi Vialli 1964), Northern Calcareous Alps (Stoliczka 1861; Szabó 2009) and Transdanubian Range (Szabó 1982), extending eastward up to the western Pontides (Turkey) (Conti & Monari 1991). *Eucyclomphalus*? *marenostrum*, from Lower to Upper Toarcian and condensed Aalenian – Lower Bajocian of Rocca Busambra, could represents the younger occurrence of the genus. Conversely, in the European epicontinental region *Eucyclomphalus* is known only in the Pliensbachian of Calvados (d'Orbigny 1853; J. C. A. Eudes-Deslongchamps 1860; Cossmann 1916; Fischer & Weber 1997; Gründel 2007).

Finally, *Trapanimaria gattoi*, *Trapanimaria nicolosiensis*, *Trapanimaria*? *pallinii*, *Laevitomaria babalusciae* and *Pyrgotrochus vorosi* represent the first record supported by a detailed systematic study on Upper Jurassic gastropods from the condensed pelagic carbonates of the central part of western Tethys.

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This published work and the nomenclatural acts it contains, have been registered in ZooBank: http://zoobank.org/References/XXXXXXXXX

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FIGURES CAPTIONS

FIG. 1. Geographical map and stratigraphical column of the study area. A, location of the outcrop area; B, schematic stratigraphical succession of the Jurassic units, data from Basilone (2009, 2011) and Wendt (2017); a, white wackestone and oolitic packstone-grainstone; b, massive red crinoidal limestone; c, wackestone-packstone with thin-shelled bivalves and nodules encrusted by ferro-manganese oxides; d, nodular wackestone–packstone and coarse grainstone with pelagic crinoids and aptychi; e, thin bedded cherty limestone and marly limestone with calpionellids; f, laminated ferromanganese oxyhydroxide crust; g, neptunian dykes and sills. Geographical coordinates are in DMS format.

FIG. 2. Example of the extraordinary richness and diversification of the gastropods from the Jurassic neptunian sills of Rocca Busambra. At least fifteen species occur in about twenty square centimetres. Scale bar represents 10 mm.

FIG. 3. Toarcian–Kimmeridgian gastropod fauna of Rocca Busambra; A, overall taxonomic composition; B, species distribution within the seventeen stratigraphical intervals defined by Wendt (1971, 2017).

FIG. 4. Dimensions of the specimens reported in the systematic descriptions and in Table 2 and 3. A, cap-shaped shells: H, height of the shell; Hap, height of the apex; Lap, distance of the apex from the opposite margin of the peristome; LP, length of the peristome; W, width of the peristome. B, trochospiral shells: H, height of the shell; HL, height of the last whorl; HP, height of the peristome; W, width of the shell; WP, width of the peristome; α_{ap}, apical angle; α_{pl}, pleural angle.

FIG. 5. Patellogastropoda and the Pleurotomarioidea from Jurassic neptunian sills of Rocca Busambra (north-western Sicily, southern Italy). A–E, *Pseudorhytidopilus*? sp.: GPIT 1685/42, apical view, two lateral views (orientation uncertain), anterior (?) view and detail of the shell surface, Aalenian – Lower Bajocian (*Leioceras opalinum – Sonninia propinquans* biozones). F–K, *Ramusatomaria nuda* sp. nov.: holotype GPIT 1685/33, apertural, basal and dorsal views, detail of the base, lateral view, and detail of the last whorls, Upper Toarcian (*Haugia variabilis – Phlyseogrammoceras dispansum* biozones). L–Z, *Trapanimaria gattoi* sp. nov., Lower – Upper Kimmeridgian (*Idoceras planula – Aulacostephanus eudoxus* biozones): L–P, paratype GPIT 1685/26, apertural, basal, dorsal and apical views, and detail of the penultimate whorl; Q–T, paratype GPIT 1685/27, apical, dorsal and basal views, and detail of the spire in apical view; U–Z, holotype GPIT 1685/23, apertural and apical views, detail of the spire in dorsal view, dorsal and basal views, and detail of the last whorls. Scale bars represent 10 mm (L–O, Q– S, U–V and X–Y), 3 mm (A–C, E–H, J, P, T, W and Z) and 1 mm (D, I and K).

FIG. 6. *Trapanimaria nicolosiensis* sp. nov. from Jurassic neptunian sills of Rocca Busambra (north-western Sicily, southern Italy): A–G, holotype GPIT 1685/29, dorsal, basal, apical and apertural views, detail of the last whorl and detail of the spire in lateral and apical views, Upper Oxfordian – Lower Kimmeridgian (*Epipeltoceras bimammatum – Idoceras planula* biozones); H–J, paratype GPIT 1685/30, detail of the last whorls, apertural and apical views, Lower – Upper Kimmeridgian (*Idoceras planula – Aulacostephanus eudoxus* biozones); K–M, BSPG 1932.P.23, detail of the spire, apical and lateral views, Tithonian?. Scale bars represent 10 mm (A–D and I–J), 5 mm (E–H and L–M) and 2 mm (K).

FIG. 7. Pleurotomarioideans from Jurassic neptunian sills of Rocca Busambra (north-western Sicily, southern Italy). A–E, *Trapanimaria*? *pallinii* sp. nov., holotype GPIT 1685/22, apertural, apical, dorsal, and basal views, detail of the last whorls, Lower – Upper Kimmeridgian (*Idoceras*

planula – Aulacostephanus eudoxus biozones). F–H, *Trochotomaria somhegyensis* (Szabó, 1980), specimen GPIT 1685/1, subdorsal and lateral views, and detail of the last whorls, Aalenian – Lower Bajocian (*Leioceras opalinum – Sonninia propinquans* biozones). I–T, *Trochotomaria conoidea* sp. nov., Aalenian – Lower Bajocian (*Leioceras opalinum – Sonninia propinquans* biozones): I–O, paratype GPIT 1685/2, sublateral, apical, dorsal and basal views, detail of penultimate whorl, detail of the early spire in lateral view and detail of the early spire in apical view; P–T, holotype GPIT 1685/3, apertural, dorsal, basal and apical views, detail of the last whorls. Scale bars represent 5 mm, except H, M–O and T (2 mm).

FIG. 8. *Trochotomaria polymorpha* sp. nov. from Jurassic neptunian sills of Rocca Busambra (north-western Sicily, southern Italy): A–D, holotype GPIT 1685/5, apertural, basal and dorsal views, and detail of the last whorls, Upper Toarcian (*Haugia variabilis – Phlyseogrammoceras dispansum* biozones); E–G, paratype GPIT 1685/7, apertural, dorsal and basal views, Upper Toarcian (*Haugia variabilis – Phlyseogrammoceras dispansum* biozones); H–J, paratype GPIT 1685/12, apertural, dorsal and basal views, Lower Toarcian – lower Upper Toarcian (*Harpoceras serpentinum – Haugia variabilis* biozones); K–N, paratype GPIT 1685/15, dorsal, basal and apertural views, and detail of the last whorls, Upper Toarcian (*Haugia variabilis – Phlyseogrammoceras dispansum* biozones); O–P, paratype GPIT 1685/14, apertural and dorsal views, Lower Toarcian – lower Upper Toarcian (*Harpoceras serpentinum – Haugia variabilis* biozones); Q–U, paratype GPIT 1685/16, dorsal and apertural views, detail of the last whorl, early spire in dorsal view, detail of early spire in apical view, Upper Toarcian (*Haugia variabilis – Phlyseogrammoceras dispansum* biozones); V–Z, paratype GPIT 1685/19, apertural, basal and dorsal views, detail of the last whorls and of the base, Lower Toarcian (*Harpoceras serpentinum – Hildoceras bifrons* biozones). Scale bars represent 5 mm, except D, N and Y–Z (2 mm), and S–U (1 mm).

FIG. 9. Species of *Laevitomaria* Conti & Szabó, 1987 and *Pyrgotrochus* P. Fischer, 1885 from Jurassic neptunian sills of Rocca Busambra (north-western Sicily, southern Italy). A–F, *Laevitomaria babalusciae* sp. nov.: holotype GPIT 1685/32, dorsal view, detail of the early spire, apertural, apical and basal views, and detail of the penultimate whorl, Upper Oxfordian – Lower Kimmeridgian (*Epipeltoceras bimammatum – Idoceras planula* biozones). G–L, *Pyrgotrochus vorosi* sp. nov.: holotype GPIT 1685/31, apical, apertural, dorsal and basal views, detail of the last whorl and of the early spire, Lower – Upper Oxfordian (*Quenstedtoceras mariae – Gregoryceras transversarium* biozones). Scale bars represent 10 mm, except B, F and K–L (3 mm).

FIG. 10. Scissurelloideans from Jurassic neptunian sills of Rocca Busambra (north-western Sicily, southern Italy). A–H, *Auritoma lenticula* sp. nov.: holotype GPIT 1685/36, apertural, dorsal, lateral, apical and basal views, detail of the early spire, of the end of selenizone, and of the shell seam back to the peristome, Lower Callovian (*Macrocephalites macrocephalus* biozones). I–T, *Busambrella fasciata* sp. nov., Aalenian – Lower Bajocian (*Leioceras opalinum – Sonninia propinquans* biozones): I–N, paratype GPIT 1685/34, dorsal, apertural and apical views, detail of the apical spire, of the last whorl and of the base,; O–T, holotype GPIT 1685/35, apertural, dorsal, apical, lateral and basal views, and detail of the umbilical region. Scale bars represent 2 mm, except F–H, L–N and T (0.5 mm).

FIG. 11. Fissurelloideans from Jurassic neptunian sills of Rocca Busambra (north-western Sicily, southern Italy). A–E, *Emarginula* (*Emarginula*) *burgioi* sp. nov., Upper Toarcian (*Haugia variabilis – Phlyseogrammoceras dispansum* biozones): A–E, holotype GPIT 1685/37, anterior, apical and right lateral views, detail of the selenizone and of the trace of the slit on the inner mould; F–I, paratype GPIT 1685/38, apical, left lateral, right lateral and anterior views. J–M, *Emarginula* (*Tauschia*) *acutidens* sp. nov., holotype GPIT 1685/40, right lateral, anterior, dorsal and left lateral views, Upper Toarcian (*Haugia variabilis – Phlyseogrammoceras dispansum* biozones). N–R,

Emarginula (*Tauschia*?) *vigilii* Fucini, 1894, GPIT 1685/39, detail of the apical region, posterior, left lateral, dorsal and anterior views, Aalenian – Lower Bajocian (*Leioceras opalinum – Sonninia propinquans* biozones). Arrows indicate the position of the slit/selenizone. Scale bars represent 3 mm, except D, E and N (1 mm).

FIG. 12. *Propeucyclus geometricus* (Conti & Monari, 1986). A–E, type material from Lower Bajocian (*Stephanoceras humphriesianum* Biozone) of Martani Mountains (Umbria, central Italy): A–C, Paratype MPUR MAC123, lateral view and details of the early spire; D–E, holotype MPUR MAC125, dorsal and apertural views. F–V, material from Aalenian – Lower Bajocian (*Leioceras opalinum–Sonninia propinquans* biozones) of Rocca Busambra (north-western Sicily, southern Italy): F–I, GPIT 1685/588, basal, dorsal and apertural views, and detail of the antepenultimate whorl; J–L, GPIT 1685/589, dorsal, basal and apertural views; M–P, GPIT 1685/592, basal, dorsal and apertural views, and detail of the base; Q–R, GPIT 1685/590, apertural and dorsal views; S–V, GPIT 1685/591, apertural view, detail of the apertural region, basal view and detail of the last whorls. Scale bars represent 5 mm, except I, P, T and V (2 mm), and B–C (1 mm).

FIG. 13. Other species of *Propeucyclus* gen. nov. from Jurassic neptunian sills of Rocca Busambra (north-western Sicily, southern Italy). A–F, *Propeucyclus sicanus* sp. nov.: A–D, holotype GPIT 1685/604, dorsal, basal and apertural views, and detail of the penultimate whorl, Lower Bajocian (*Sonninia sowerbyi – Sonninia propinquans* biozones); E–F, paratype GPIT 1685/605, immature shell, dorsal and apertural views, Aalenian–Bajocian (exact stratigraphical level unknown). G–J, *Propeucyclus obesus* sp. nov., holotype GPIT 1685/585, basal, apertural and dorsal views, and detail of the columellar region, Aalenian – Lower Bajocian (*Leioceras opalinum – Sonninia propinquans* biozones). K–N, *Propeucyclus*? *semireticulatus* sp. nov., holotype GPIT 1685/587, detail of the early preserved whorls, apertural and dorsal views, and detail of the penultimate whorl, Upper Toarcian (*Haugia variabilis – Phlyseogrammoceras dispansum* biozones). Scale bars represent 5 mm, except D, E, F, J, K and N (2 mm).

FIG. 14. *Eucyclomphalus*? *marenostrum* sp. nov. from Jurassic neptunian sills of Rocca Busambra (north-western Sicily, southern Italy): A–C, holotype GPIT 1685/580, apertural, basal and dorsal views, Aalenian – Lower Bajocian (*Leioceras opalinum – Sonninia propinquans* biozones); D–E, paratype GPIT 1685/583, basal and apertural views, Upper Toarcian (*Haugia variabilis – Phlyseogrammoceras dispansum* biozones); F–I, paratype GPIT 1685/582, apertural, dorsal and basal views, and detail of the penultimate whorl, Lower Toarcian – lower Upper Toarcian (*Hildoceras bifrons – Haugia variabilis* biozones); J, paratype GPIT 1685/581, dorsal view, Aalenian – Lower Bajocian (*Leioceras opalinum – Sonninia propinquans* biozones); K–O, paratype GPIT 1685/584, basal, apertural and dorsal views, detail of the antepenultimate whorl and of the base, Upper Toarcian (*Haugia variabilis – Phlyseogrammoceras dispansum* biozones). Scale bars represent 3 mm, except I and N (1 mm)

FIG. 15. *Toronyella* gen. nov. from Jurassic neptunian sills of Rocca Busambra (north-western Sicily, southern Italy). A–T, *Toronyella lineata* sp. nov.: A–E, holotype GPIT 1685/479, dorsal, basal and apertural views, detail of the aperture and of the penultimate whorl, Upper Toarcian (*Haugia variabilis – Phlyseogrammoceras dispansum* biozones); F–H, paratype GPIT 1685/485, basal, dorsal and apertural views, Upper Toarcian (*Haugia variabilis – Phlyseogrammoceras dispansum* biozones); I–M, paratype GPIT 1685/483, basal, apertural and dorsal views, and details of the early spire, Lower Toarcian – lower Upper Toarcian (*Harpoceras serpentinum – Haugia variabilis* biozones); N, specimen GPIT 1685/481, juvenile shell in dorsal view, Upper Toarcian (*Haugia variabilis – Phlyseogrammoceras dispansum* biozones); O–R, GPIT 1685/480, dorsal, apertural and basal views, Upper Toarcian (*Haugia variabilis – Phlyseogrammoceras dispansum* biozones); S–T, paratype GPIT 1685/484, apertural and basal views, Lower Toarcian – lower Upper Toarcian (*Harpoceras serpentinum – Haugia variabilis* biozones). U–Z, *Toronyella margaritata* sp.

nov., holotype GPIT 1685/486, dorsal and apertural view, detail of the early preserved whorls, basal view, detail of the ornament of the juvenile shell and of the adult whorls, Upper Bajocian (*Strenoceras niortense – Parkinsonia parkinsoni* biozones). Scale bars represent 2 mm, except D and W (1 mm), and E, M–O and Y–Z (0.5 mm).

FIG. 16. *Zarnglaffia polygonalis* sp. nov. from Jurassic neptunian sills of Rocca Busambra (north-western Sicily, southern Italy): A–F, holotype GPIT 1685/489, apertural, basal and dorsal views, detail of the aperture and of the last whorl, and apical view, Aalenian – Lower Bajocian (*Leioceras opalinum – Sonninia propinquans* biozones); G–I, paratype GPIT 1685/490, dorsal, basal and apertural views, Lower Bajocian (*Sonninia sowerbyi – Sonninia propinquans* biozones); J–L, paratype GPIT 1685/491, subapertural, basal and dorsal views, uppermost Lower Bajocian (*Stephanoceras humphriesianum* Biozone); M–O, paratype GPIT 1685/492, dorsal, apertural and basal views, uppermost Lower Bajocian (*Stephanoceras humphriesianum* Biozone); P–Q, paratype GPIT 1685/500, dorsal and apertural views, Lower Bajocian (*Sonninia propinquans – Stephanoceras humphriesianum* biozones); R–S, paratype GPIT 1685/498, apertural and dorsal views, Upper Bajocian (*Strenoceras niortense – Parkinsonia parkinsoni* biozones); T–U, paratype GPIT 1685/501, dorsal and apertural views, Aalenian – Lower Bajocian (*Leioceras opalinum – Sonninia propinquans* biozones); V–Y, paratype GPIT 1685/493, apertural and dorsal views, detail of the last whorl, and basal view, Lower Bajocian (*Sonninia propinquans – Stephanoceras humphriesianum* biozones). Scale bars represent 5 mm, except D–E, P–S and X (2 mm).

FIG. 17. *Zarnglaffia palermitana* sp. nov. from Jurassic neptunian sills of Rocca Busambra (north-western Sicily, southern Italy): A–E, holotype GPIT 1685/487, apertural, basal and dorsal views, detail of the first preserved whorls and of the last whorl, Aalenian – Lower Bajocian (*Leioceras opalinum – Sonninia propinquans* biozones); F–H, paratype GPIT 1685/488, apertural, basal and dorsal views, Aalenian – Lower Bajocian (*Leioceras opalinum – Sonninia propinquans* biozones); I–L, paratype GPIT 1685/508, dorsal and basal views, detail of the last whorl, and subapertural view, Upper Bajocian (*Strenoceras niortense – Parkinsonia parkinsoni* biozones). Scale bars represent 2 mm, except D–E and K (1 mm).

FIG. 18. *Ambercyclus cratiscultpus* sp. nov. from Jurassic neptunian sills of Rocca Busambra (north-western Sicily, southern Italy): A–E, paratype GPIT 1685/565, apertural, basal and dorsal views, detail of the early preserved whorls and of the last whorl, Aalenian–Bajocian (exact stratigraphical level unknown); F–G, paratype GPIT 1685/564, dorsal and apertural view, Aalenian – Lower Bajocian (*Leioceras opalinum – Sonninia propinquans* biozones); H–L, holotype GPIT 1685/563, dorsal, basal, lateral and apertural views, and detail of the last whorl, Aalenian – Lower Bajocian (*Leioceras opalinum – Sonninia propinquans* biozones); M–O, paratype GPIT 1685/567, dorsal, basal and apertural views, Aalenian – Lower Bajocian (*Leioceras opalinum – Sonninia propinquans* biozones); P–R, paratype GPIT 1685/562, dorsal apertural and basal views, Aalenian – Lower Bajocian (*Leioceras opalinum – Sonninia propinquans* biozones); S–X, paratype GPIT 1685/560, dorsal and basal views, detail of the penultimate whorl, apertural and lateral views, and detail of the base, Aalenian – Lower Bajocian (*Leioceras opalinum – Sonninia propinquans* biozones). Scale bars represent 5 mm, except D–E, L, U and X (2 mm).

FIG. 19. *Elymicyclus alternatus* sp. nov. from Jurassic neptunian sills of Rocca Busambra (north-western Sicily, southern Italy): A–D, paratype GPIT 1685/522, apertural, basal and dorsal views, detail of the penultimate whorl, Lower Toarcian (*Harpoceras serpentinum – Hildoceras bifrons* biozones); E–G, paratype GPIT 1685/524, apertural and dorsal views, and detail of the penultimate whorl, Lower Toarcian (*Harpoceras serpentinum – Hildoceras bifrons* biozones); H–L, holotype GPIT 1685/523, dorsal, basal, apertural and lateral views, and detail of the base, Lower Toarcian (*Harpoceras serpentinum – Hildoceras bifrons* biozones); M–O, paratype GPIT 1685/521, apertural, basal and dorsal views, Lower Toarcian (*Harpoceras serpentinum – Hildoceras bifrons*

biozones); P–R, paratype GPIT 1685/536, detail of the apical spire, dorsal and apertural views, Upper Toarcian (*Haugia variabilis – Phlyseogrammoceras dispansum* biozones). Scale bars represent 5 mm, except D, G and K (2 mm), and Q (1 mm).

FIG. 20. *Elymicyclus* gen. nov. from Jurassic neptunian sills of Rocca Busambra (north-western Sicily, southern Italy); A–M, *Elymicyclus alternatus* sp. nov.: A–E, paratype GPIT 1685/528, apertural, basal and dorsal views, detail of the penultimate whorl and of the apical spire, Upper Toarcian (*Haugia variabilis – Phlyseogrammoceras dispansum* biozones); F–H, paratype GPIT 1685/546, basal, apertural and dorsal views, Lower Toarcian – lower Upper Toarcian (*Harpoceras serpentinum – Haugia variabilis* biozones); I–J, paratype GPIT 1685/529, apertural view and detail of the penultimate whorl, Upper Toarcian (*Haugia variabilis – Phlyseogrammoceras dispansum* biozones); K–M, paratype GPIT 1685/537, apertural view, detail of the antepenultimate whorl and lateral view, Upper Toarcian (*Haugia variabilis – Phlyseogrammoceras dispansum* biozones). N–Y, *Elymicyclus ietumensis* sp. nov.: N–S, holotype GPIT 1685/571, basal, dorsal and apertural views, details of the last whorl, of the apical spire and of the base, Lower Toarcian (*Harpoceras serpentinum – Hildoceras bifrons* biozones); T–V, paratype GPIT 1685/573, apertural, basal and dorsal views, Lower Toarcian – lower Upper Toarcian (*Harpoceras serpentinum – Haugia variabilis* biozones); W–Y, paratype GPIT 1685/572, dorsal and apertural views, and detail of the penultimate whorl, Lower Toarcian (*Harpoceras serpentinum – Hildoceras bifrons* biozones). Scale bars represent 5 mm, except D–E, J, L, Q, S and Y (2 mm).

FIG. 21. Other species of *Elymicyclus* gen. nov. from the Jurassic neptunian sills of Rocca Busambra (north-western Sicily, southern Italy). A–E, *Elymicyclus garibaldii* sp. nov., holotype GPIT 1685/574, dorsal, basal and apertural views, detail of the last whorl and of the apical spire, Upper Toarcian (*Haugia variabilis – Phlyseogrammoceras dispansum* biozones). F–Q, *Elymicyclus martae* sp. nov., Upper Toarcian (*Haugia variabilis – Phlyseogrammoceras dispansum* biozones): F–L, holotype GPIT 1685/557, apertural, dorsal, basal and lateral views, detail of the base, of the apical spire and of the penultimate whorl; M–Q, paratype GPIT 1685/558, dorsal, apertural, basal and lateral views, and detail of the last whorl. R, *Elymicyclus*? sp., GPIT 1685/556, Aalenian – Lower Bajocian (*Leioceras opalinum – Sonninia propinquans* biozones). Scale bars represent 5 mm, except D, J, L, Q–R (2 mm), and E, K (1 mm).

FIG. 22. *Jurassiscala* gen. nov. from Jurassic neptunian sills of Rocca Busambra (north-western Sicily, southern Italy). A–L, *Jurassiscala sturanii* sp. nov: A–G, holotype GPIT 1685/857, apertural, basal, dorsal and lateral views, details of the base, of the apical spire and of the columellar lip, Lower Bajocian (*Stephanoceras humphriesianum* Biozone); H–L, paratype GPIT 1685/858, apertural and basal views, detail of the apical spire, of the columellar lip and of the last whorl, Upper Bajocian (*Strenoceras niortense – Parkinsonia parkinsoni* biozones). M–Y, *Jurassiscala subreticularis* (Conti & Fischer, 1984*b*): M–O, GPIT 1685/855, basal, dorsal and apertural views, Upper Bajocian (*Strenoceras niortense – Parkinsonia parkinsoni* biozones); P–T, GPIT 1685/520, apertural, and dorsal views, detail of the last whorl, basal view and detail of the apical spire, Aalenian – Lower Bajocian (*Leioceras opalinum – Sonninia propinquans* biozones); U–Y, GPIT 1685/856, apertural, basal, dorsal and lateral views, and detail of the columellar lip, Lower Bajocian (*Stephanoceras humphriesianum* Biozone). Scale bars represent 1 mm, except E–G, J–L, R, T and Y (0.5 mm).

FIG. 23. *Jurassiscala*? *tenuiretis* sp. nov. from Upper Bajocian (*Strenoceras niortense – Parkinsonia parkinsoni* biozones) of Rocca Busambra (north-western Sicily, southern Italy): A–F, holotype GPIT 1685/519, apertural, basal and dorsal views, details of the apical and juvenile spire and detail of the penultimate whorl; G–L, paratype GPIT 1685/ 859, basal, dorsal and apertural views, detail of the eraly spire in apertural and apical views, and detail of the last whorl. Scale bars represent 1 mm, except D–F, I, K and L (0.5 mm).

FIG. 24. *Fischeriella* Conti & Monari, 1986 from Jurassic fissure fillings of Rocca Busambra (north-western Sicily, southern Italy). A–F, *Fischeriella umbra* Conti & Monari, 1986, GPIT 1685/463, apertural, basal, dorsal and lateral views, detail of the penultimate whorl and of the apical spire, uppermost Toarcian (*Pleydellia aalensis* Biozone). G–W, *Fischeriella sicula* sp. nov.: G–L, holotype GPIT 1685/464, apertural, basal, dorsal and lateral views, detail of the apical spire and of the inner lip, Aalenian – Lower Bajocian (*Leioceras opalinum – Sonninia propinquans* biozones); M, paratype GPIT 1685/465, dorsal view, Aalenian – Lower Bajocian (*Leioceras opalinum – Sonninia propinquans* biozones); N–R, paratype GPIT 1685/467, apertural and dorsal views, detail of the juvenile-subadult part of the shell, basal view, and detail of the apical spire, Aalenian – Lower Bajocian (*Leioceras opalinum – Sonninia propinquans* biozones) neptunian dyke; S–V, paratype GPIT 1685/468, apertural, lateral and dorsal views, and oblique view of the base, Lower Bajocian (*Sonninia sowerbyi – Sonninia propinquans* biozones); W, paratype GPIT 1685/469, apertural view, Lower Bajocian (*Sonninia sowerbyi – Sonninia propinquans* biozones). Scale bars represent 2 mm, except L (1 mm) and E–F, K, P and R (0.5 mm).

FIG. 25. Cirridae from Jurassic neptunian sills of Rocca Busambra (north-western Sicily, southern Italy). A–F, *Retimusina poseidoni* sp. nov., holotype GPIT 1685/577, apertural, dorsal, basal and lateral views, detail of the early preserved whorls and of the penultimate whorl, Upper Toarcian (*Haugia variabilis – Phlyseogrammoceras dispansum* biozones). G–L, paratype GPIT 1685/575, apertural, basal, lateral, and dorsal views, detail of the early preserved whorls and of the last whorls, Upper Toarcian (*Haugia variabilis – Phlyseogrammoceras dispansum* biozones). M–R, *Retimusina* cf. *poseidoni* sp. nov., GPIT 1685/576, dorsal , lateral and apertural views, detail of the early preserved whorls, basal view and detail of the last whorl, Aalenian – Lower Bajocian (*Leioceras opalinum – Sonninia propinquans* biozones). S–X, *Retimusina*? *tritoni* sp. nov., holotype GPIT 1685/579, basal, lateral, apertural and dorsal views, detail of the base and of the last two whorls, Aalenian – Lower Bajocian (*Leioceras opalinum – Sonninia propinquans* biozones). Scale bars represent 5 mm, except E–F, K–L, P, R, and W–X (2 mm).

FIG. 26. Palaeogeographical and stratigraphical distribution of the species present in other localities. Abbreviations: To, Toarcian; Aa, Aalenian; Bj, Bajocian; L, Lower; M, Middle; U, Upper. Map redrawn and simplified from Ziegler (1988) and Dercourt *et al.* (2000).

TABLES CAPTIONS

TABLE 1. Stratigraphical succession of the faunal units recognized by Wendt (1971).

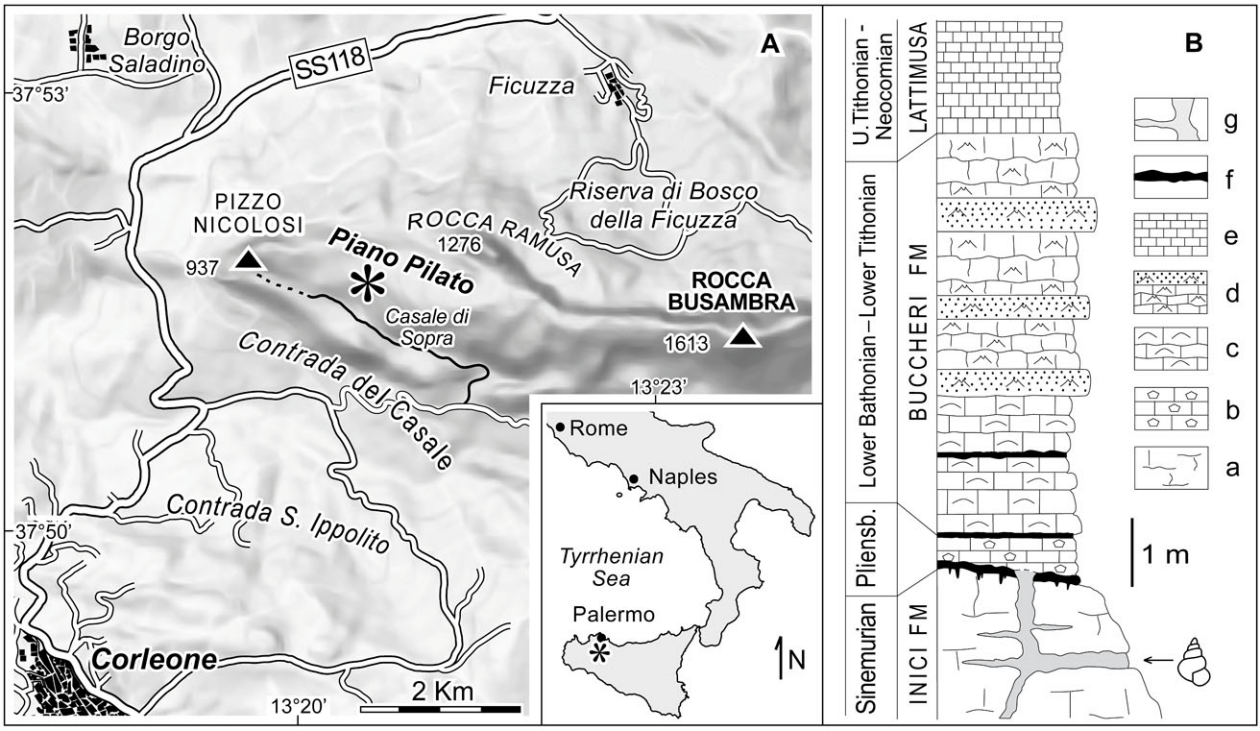
TABLE 2. Measurements of Patellogastropoda, Pleurotomarioidea, Fissurelloidea, Scissurelloidea and part of Eucycloidea.

TABLE 3. Measurements of the other Eucycloidea.

TABLE 4. List of patellogastropod, pleurotomarioidean, scissurelloidean and fissurelloidean species described in this paper and their stratigraphical distribution.

TABLE 5. List of eucycloidean species described in this paper and their stratigraphical distribution.

TABLE 6. Repartition of the species studied here in the faunal units defined by Wendt (1971).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37°50'
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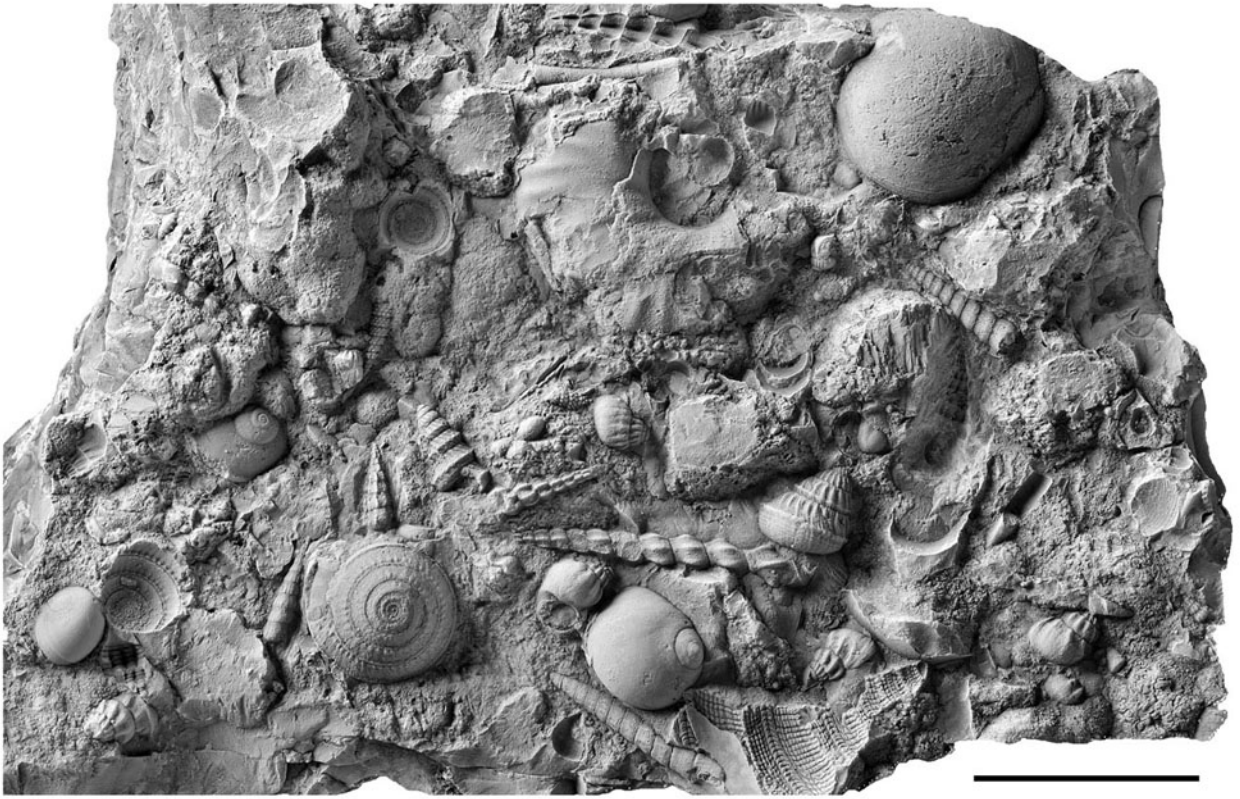

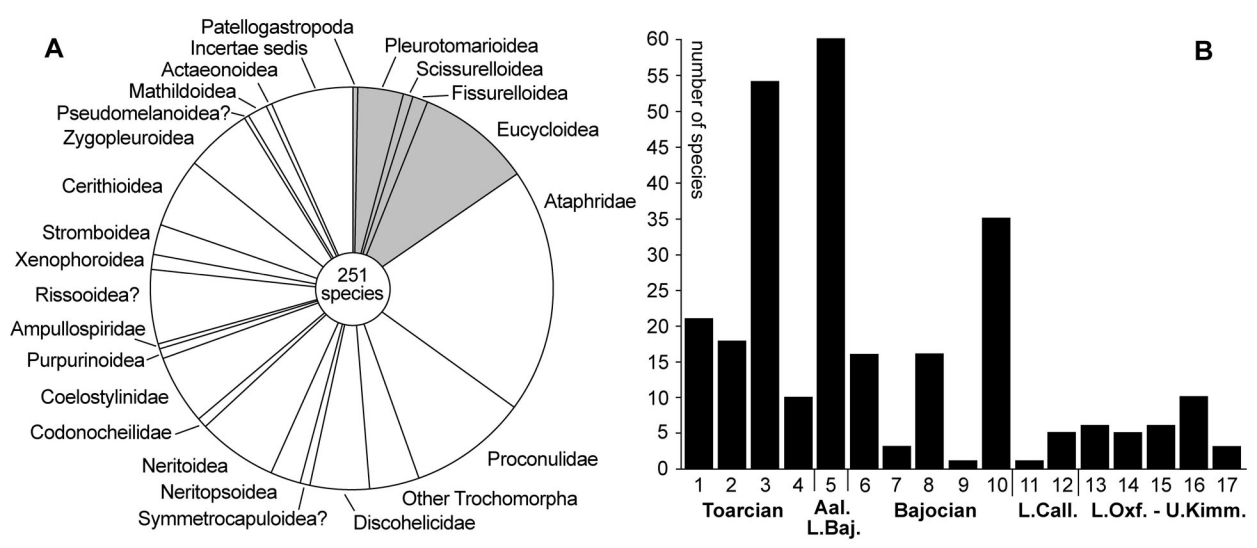
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Xenophoroidea
Rissooidea?
Ampullospiridae
Purpurinoidea
Coelostylinidae
Codonocheilidae
Neritoidea
Neritopsoidea
Symmetrocapuloidea?
Discohelicidae
Other Trochomorpha
Proconulidae
Ataphridae
Eucycloidea
Fissurelloidea
Scissurelloidea
Pleurotomarioidea
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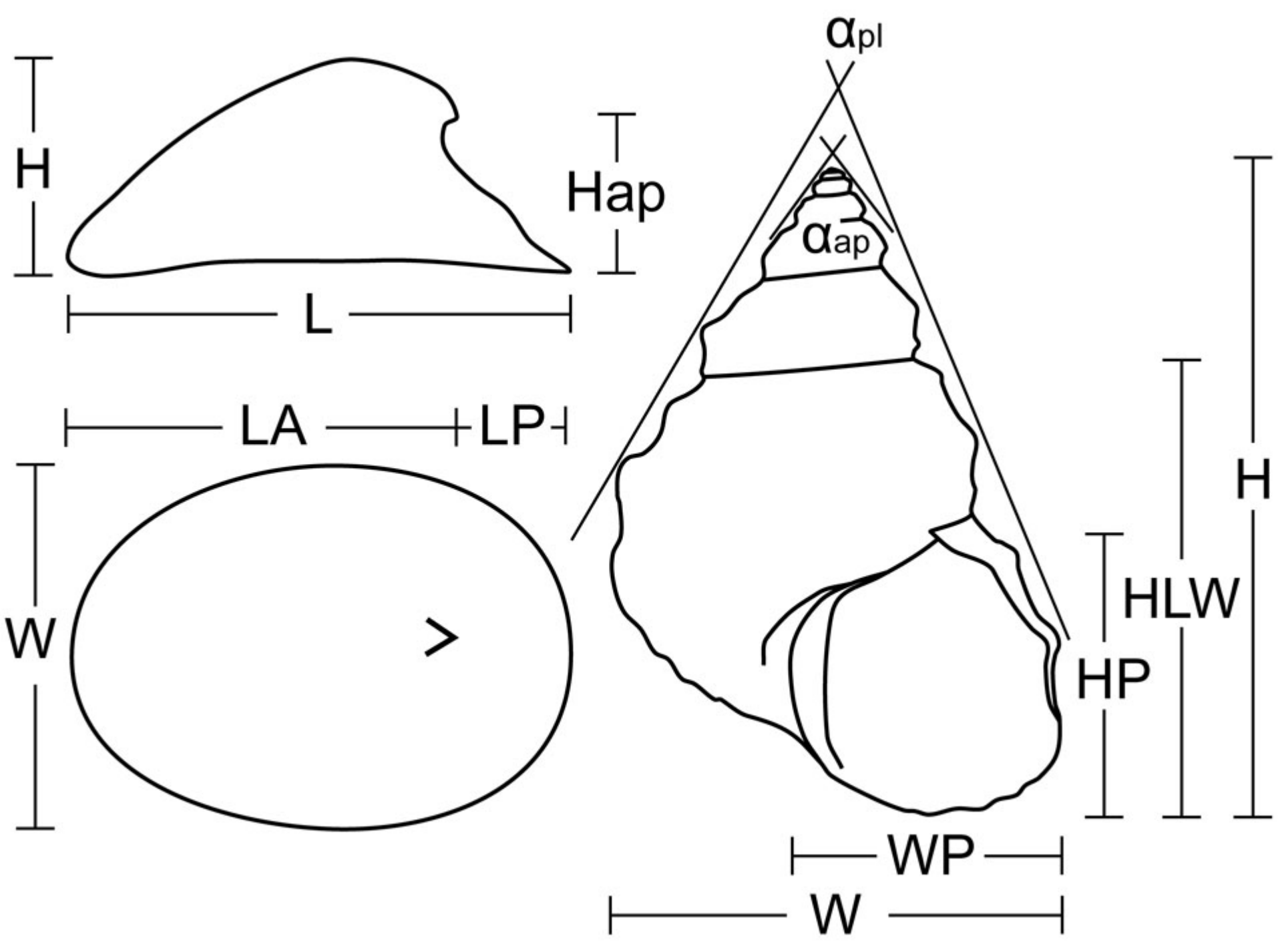
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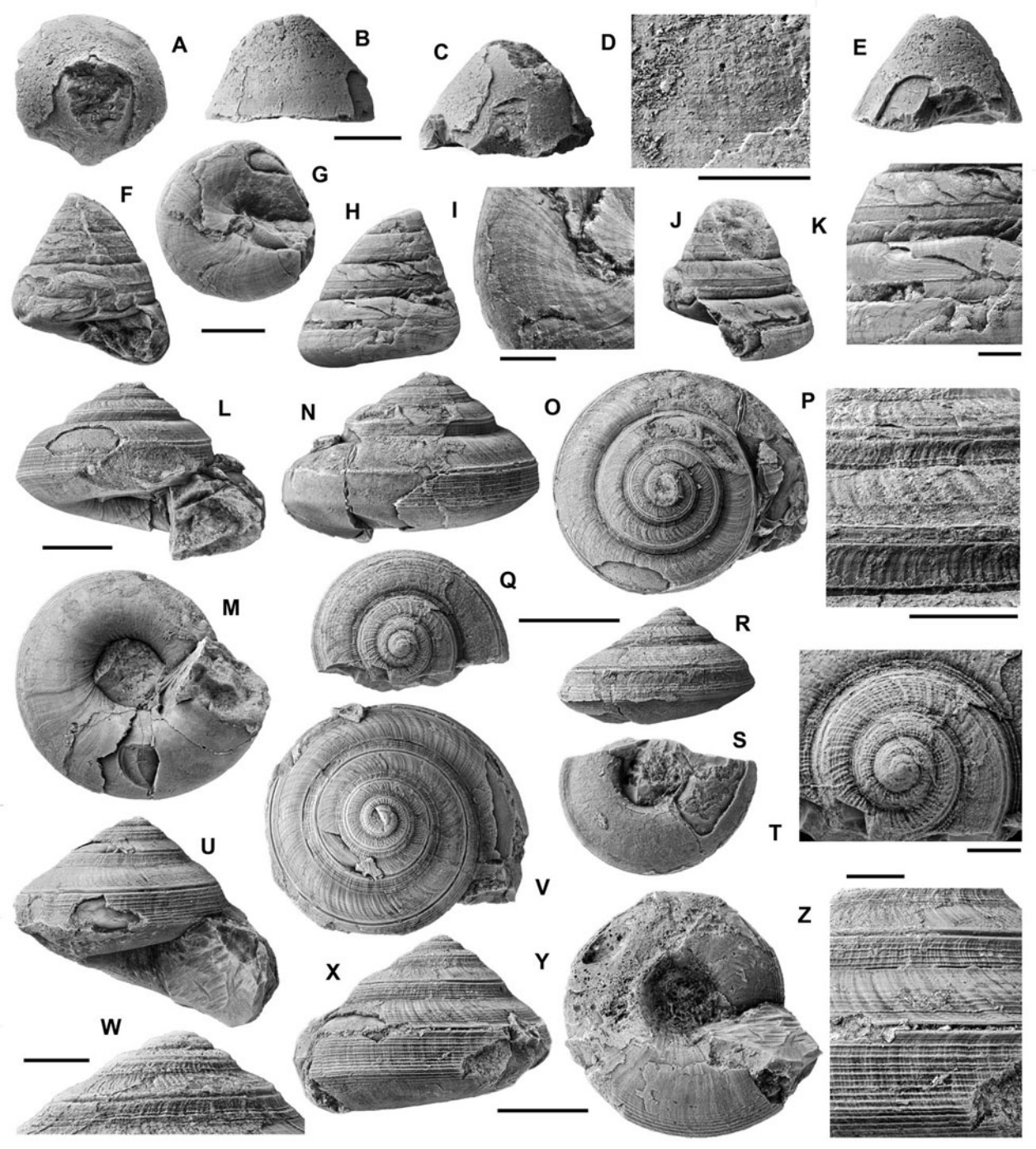
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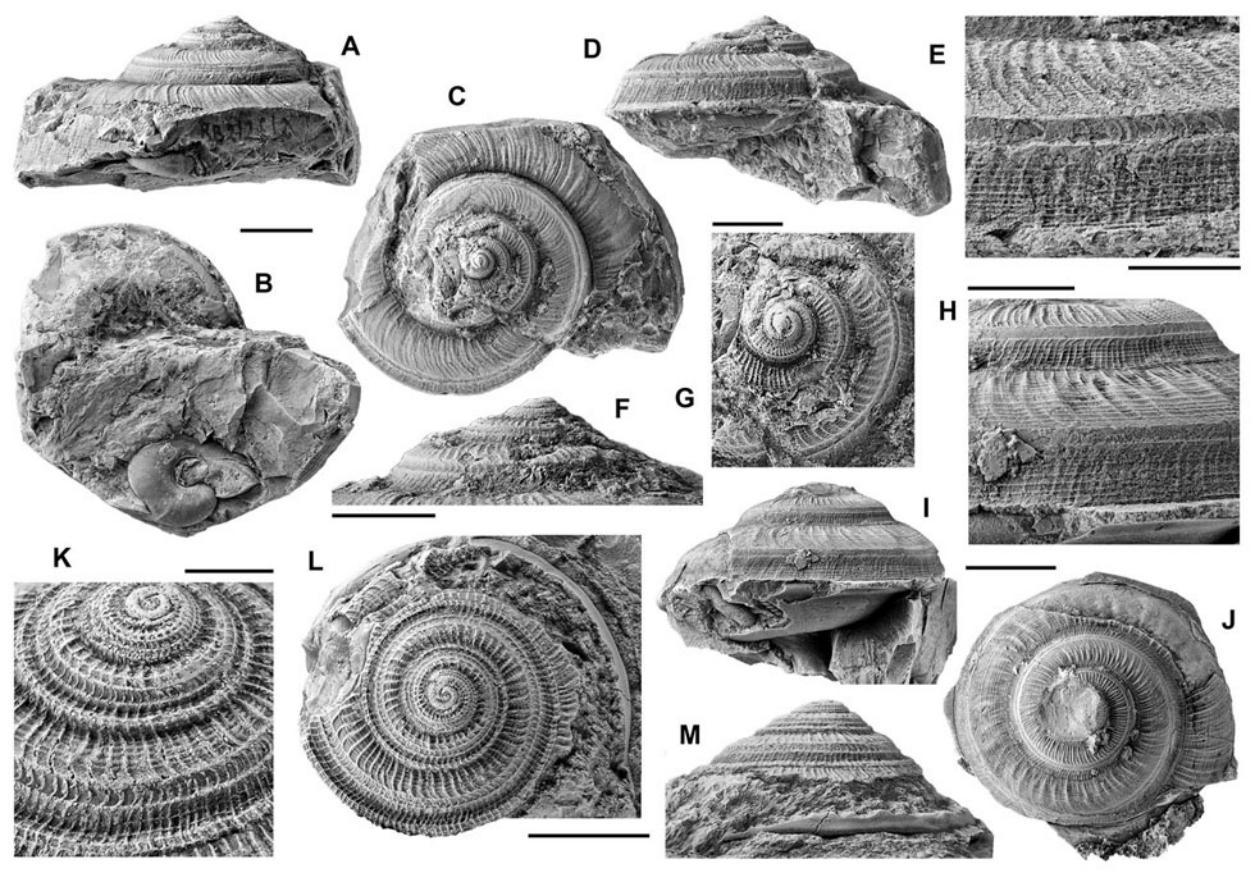
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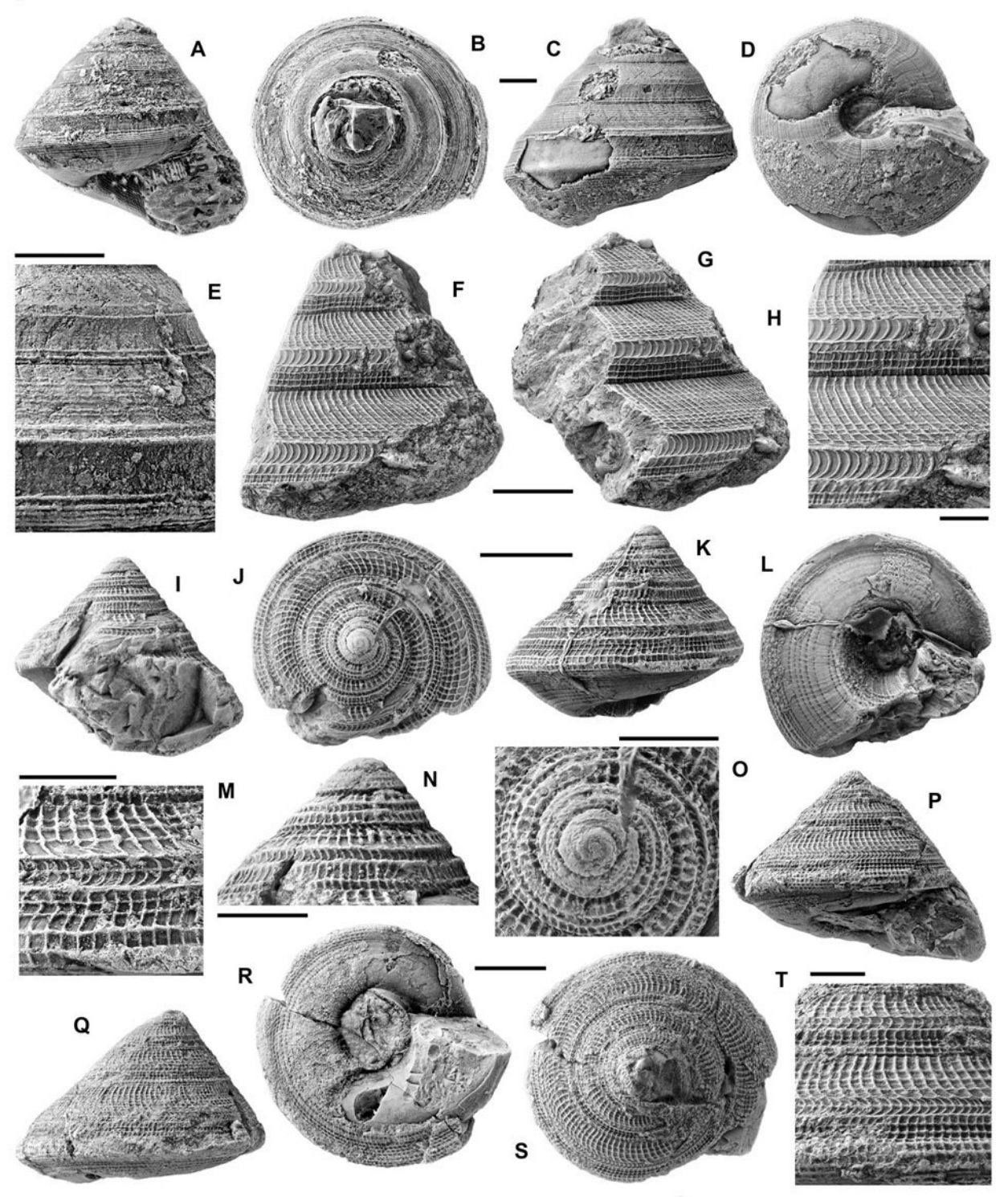
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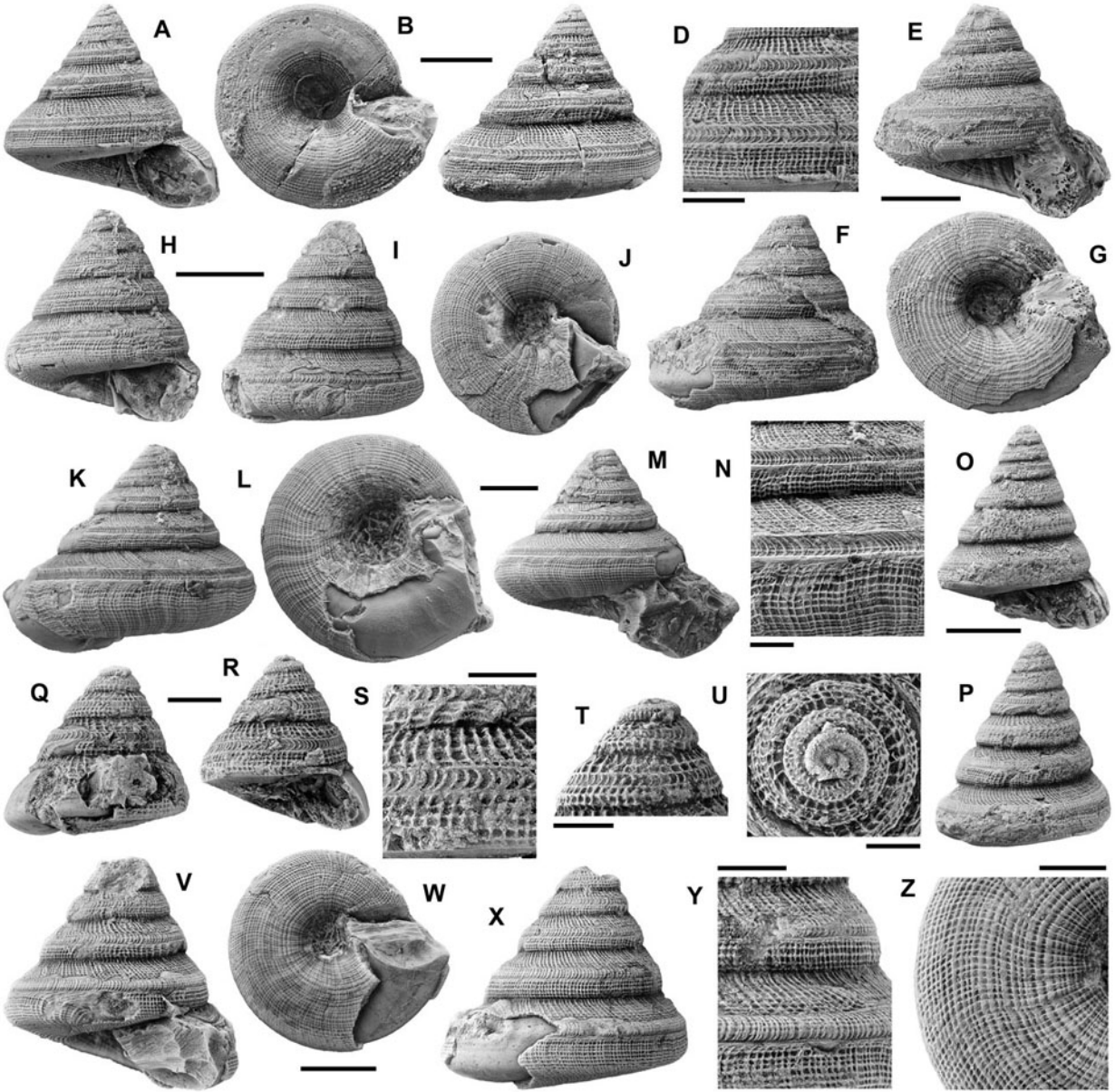
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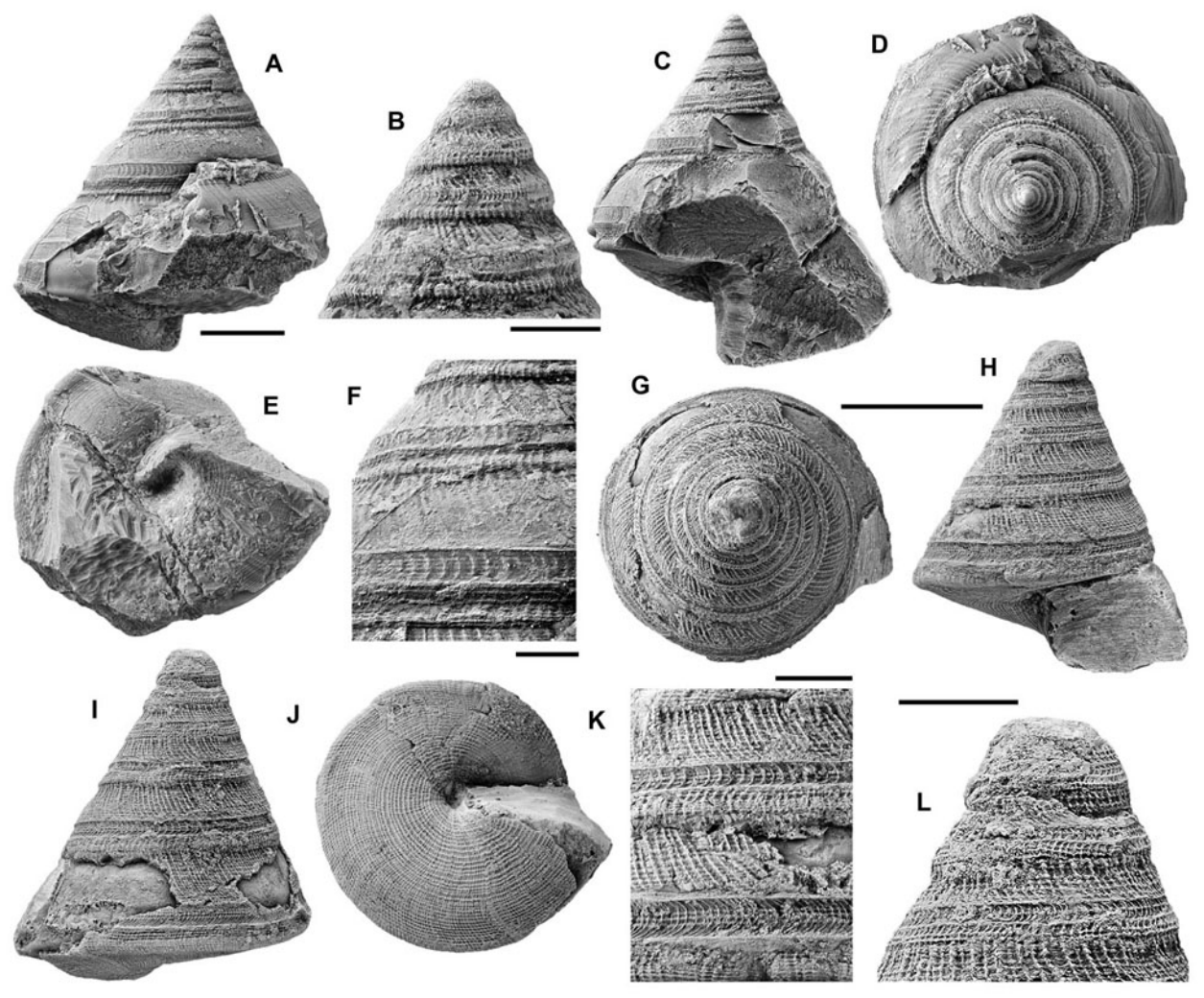
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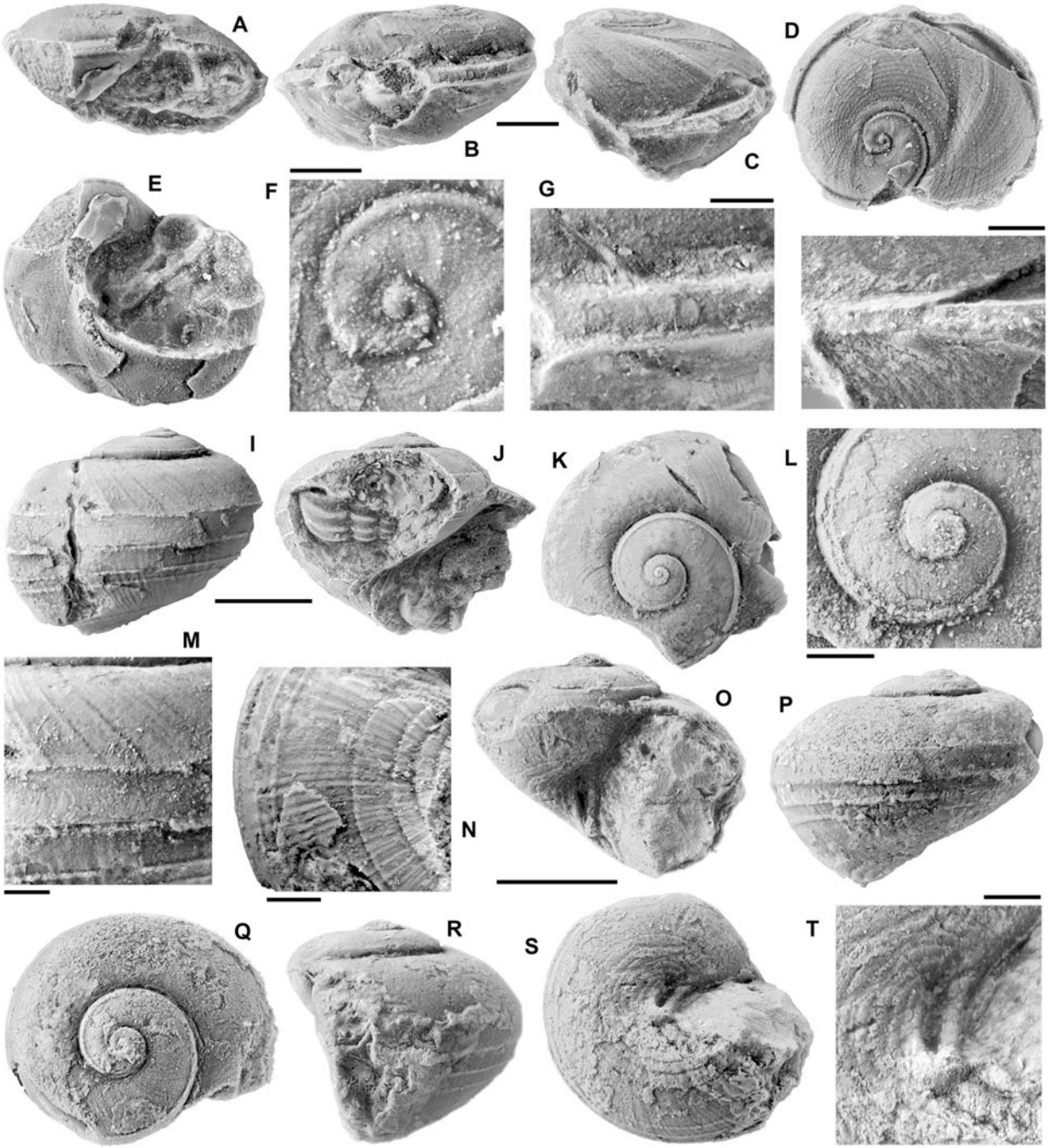
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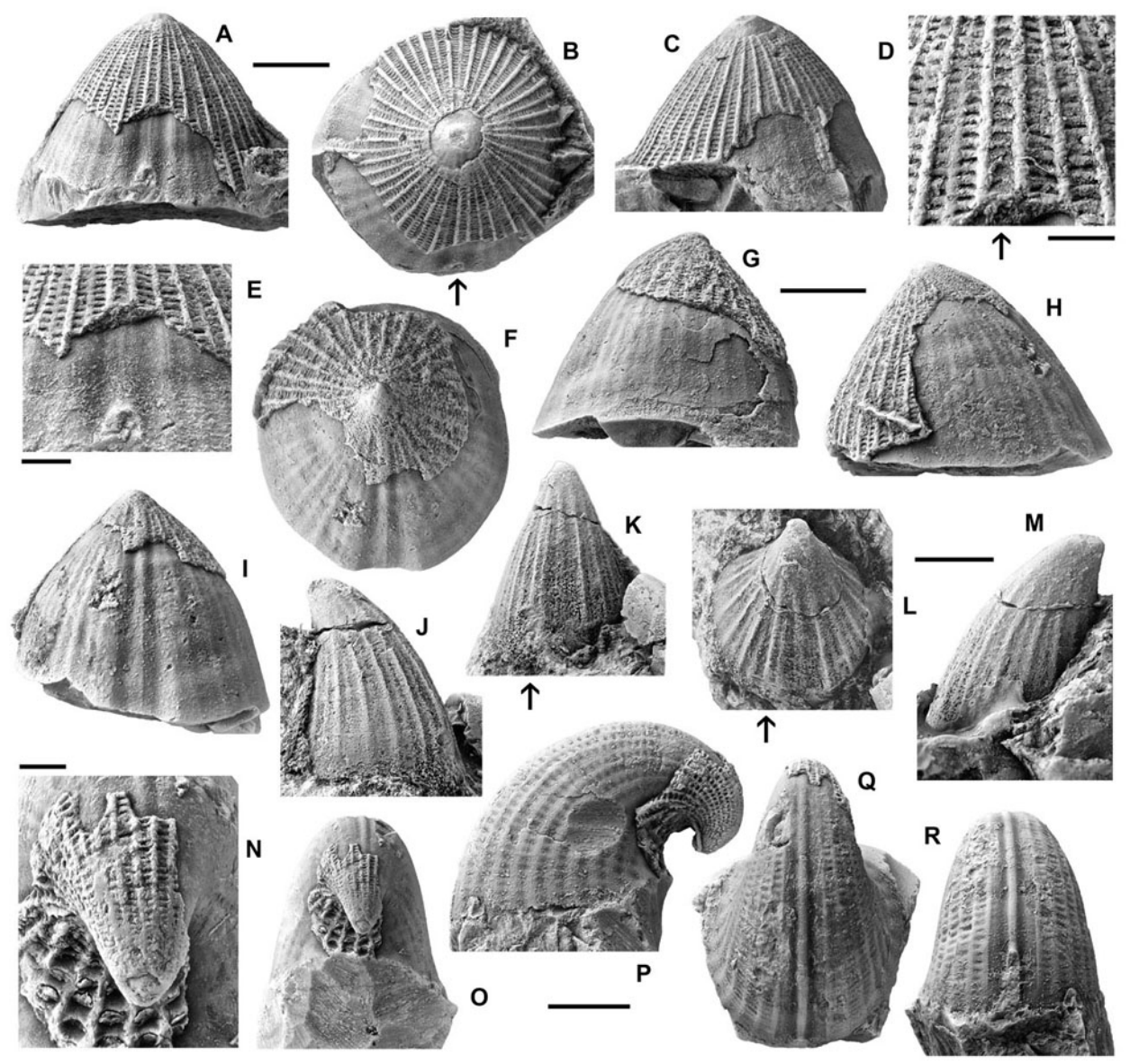
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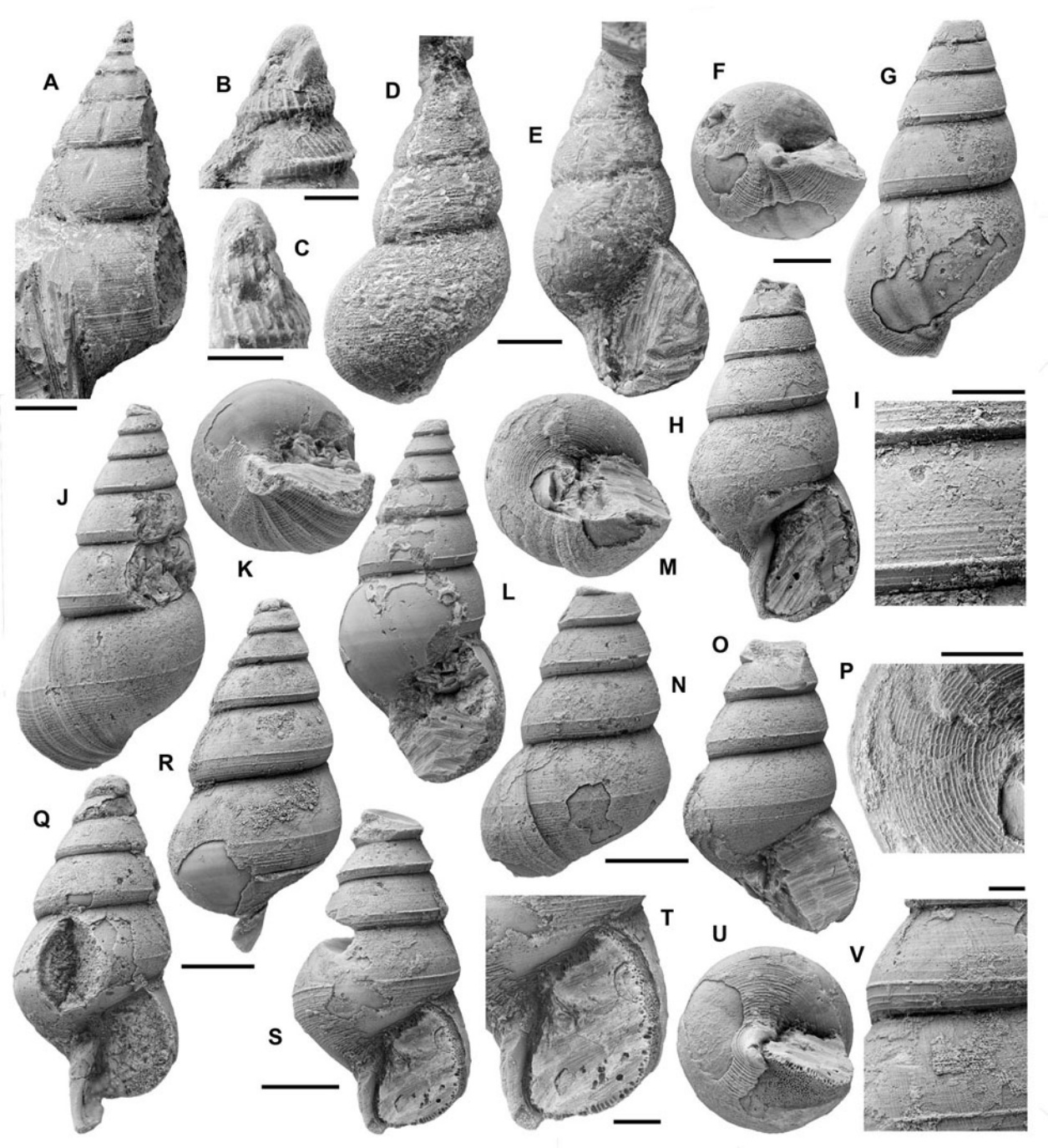
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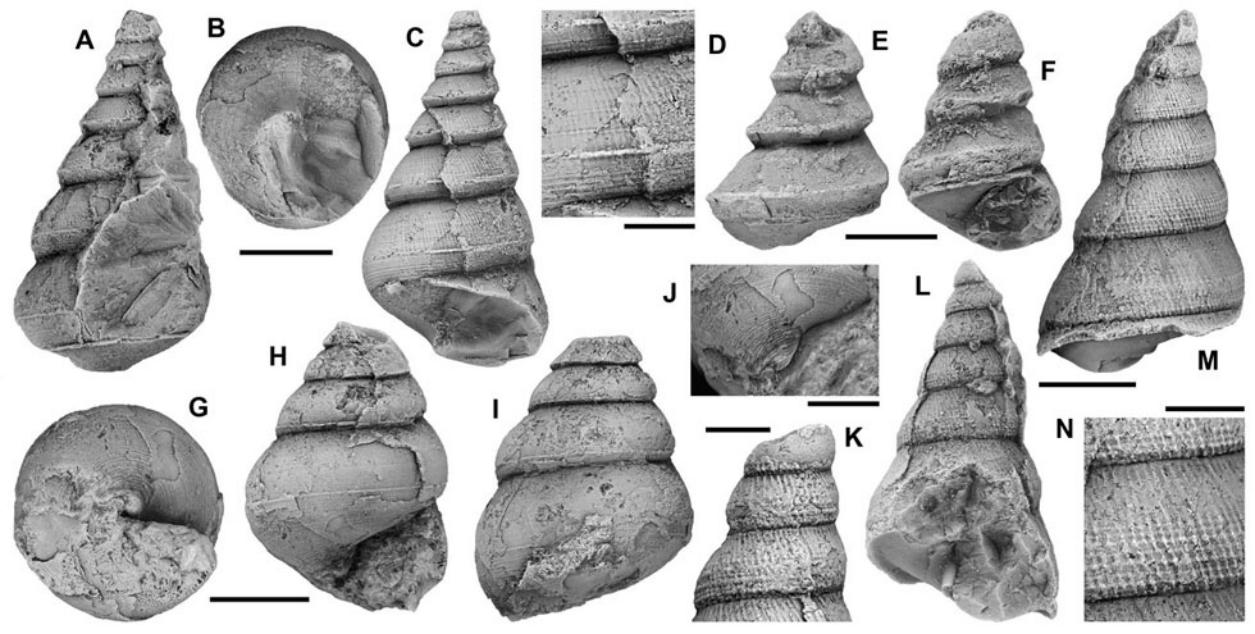
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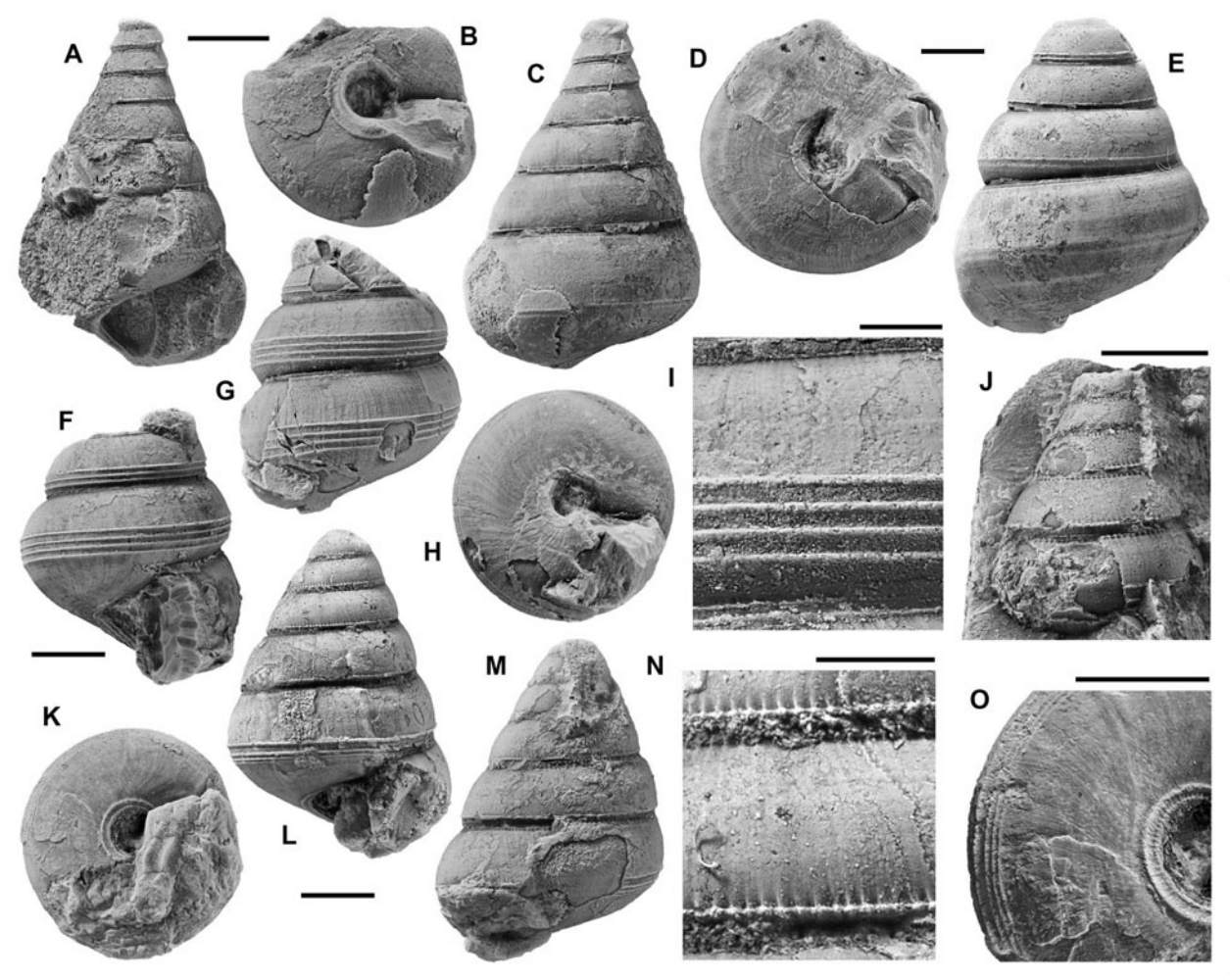
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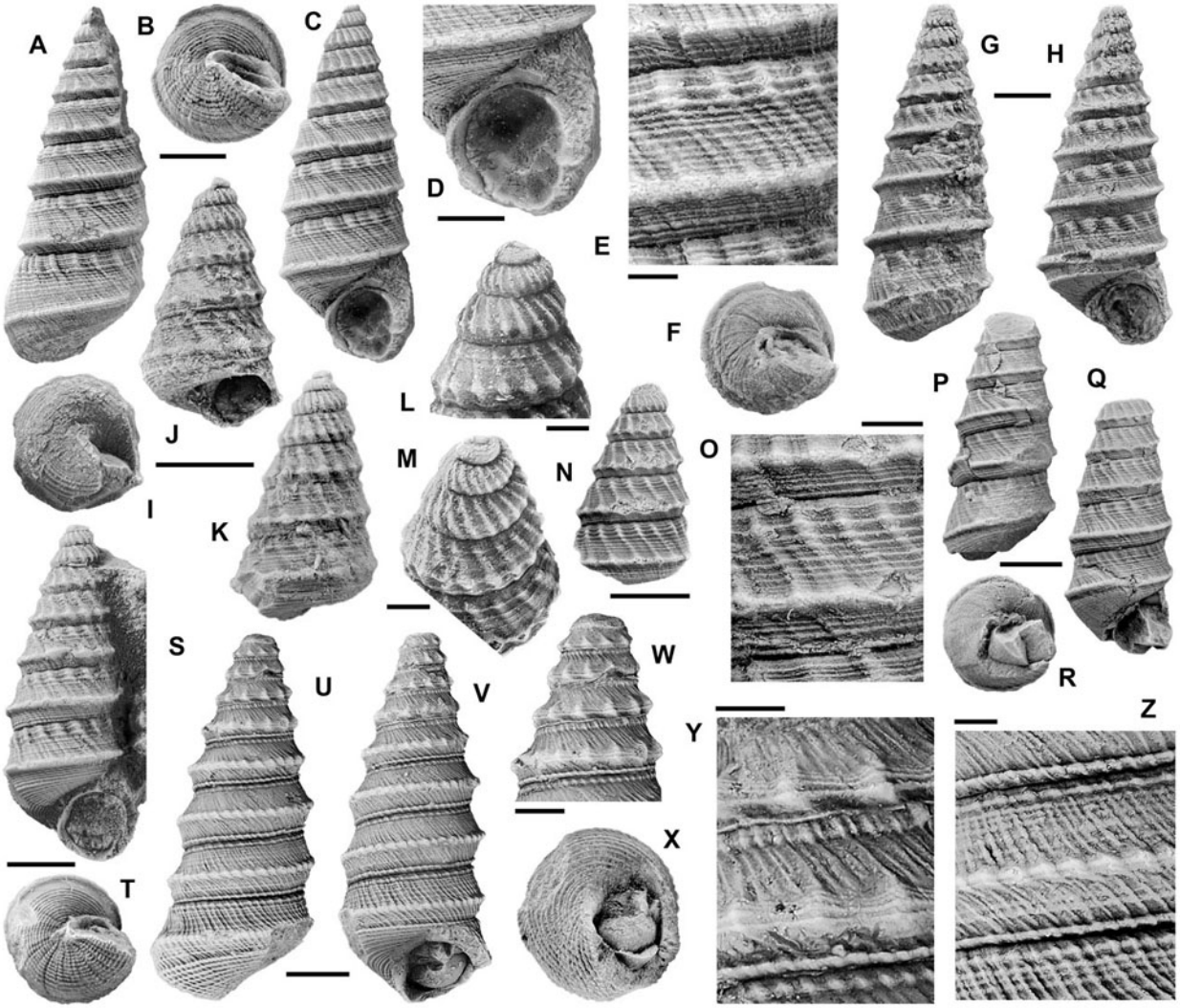
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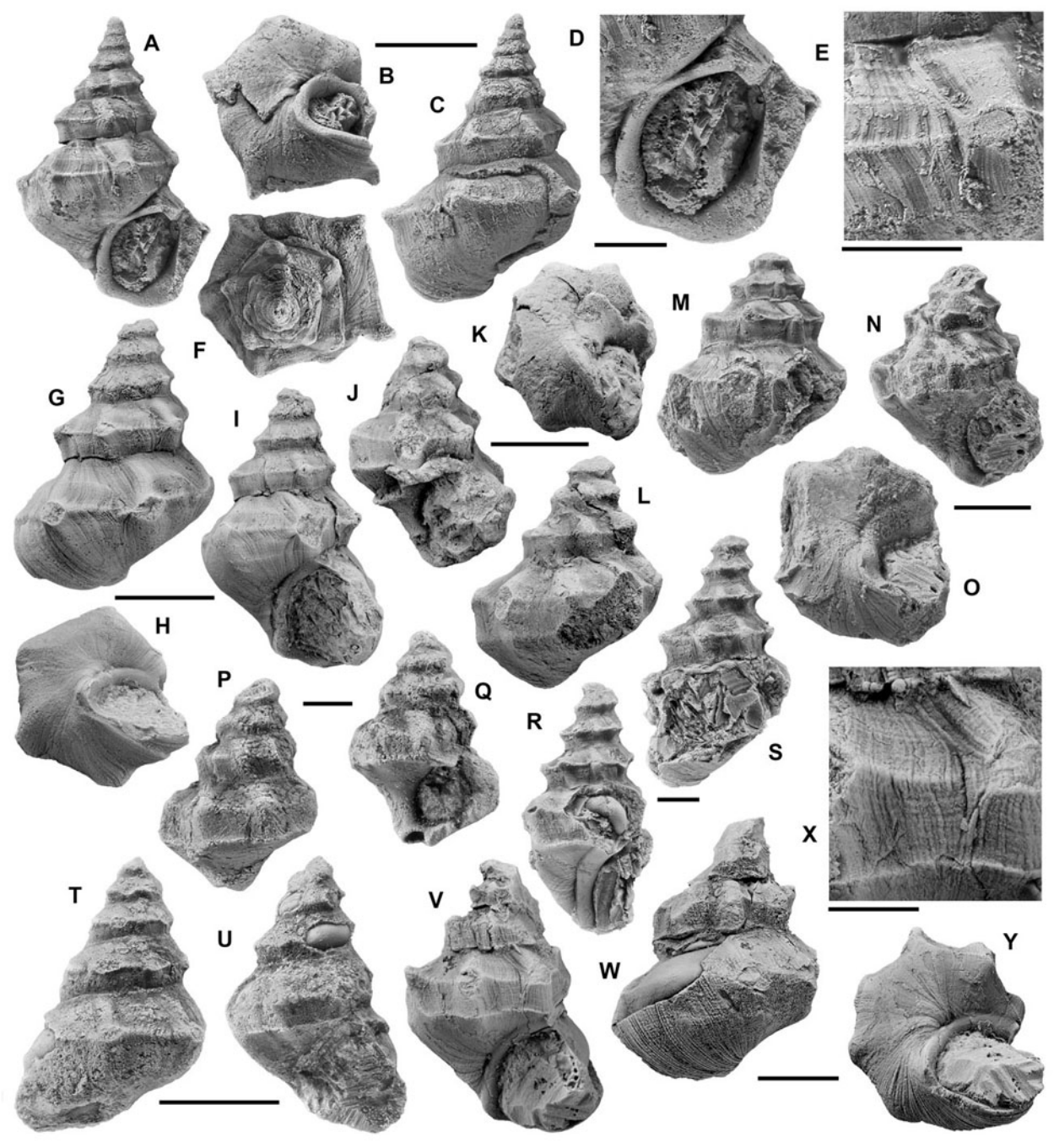
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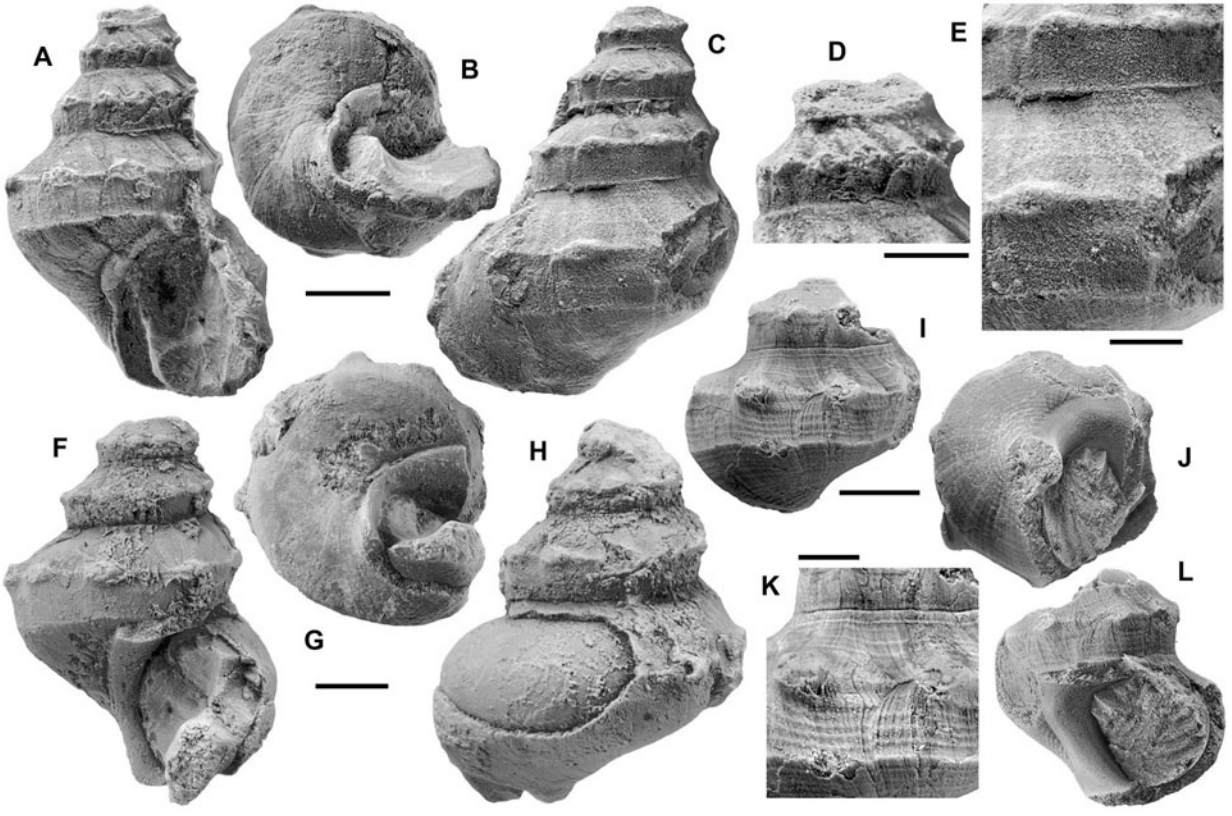
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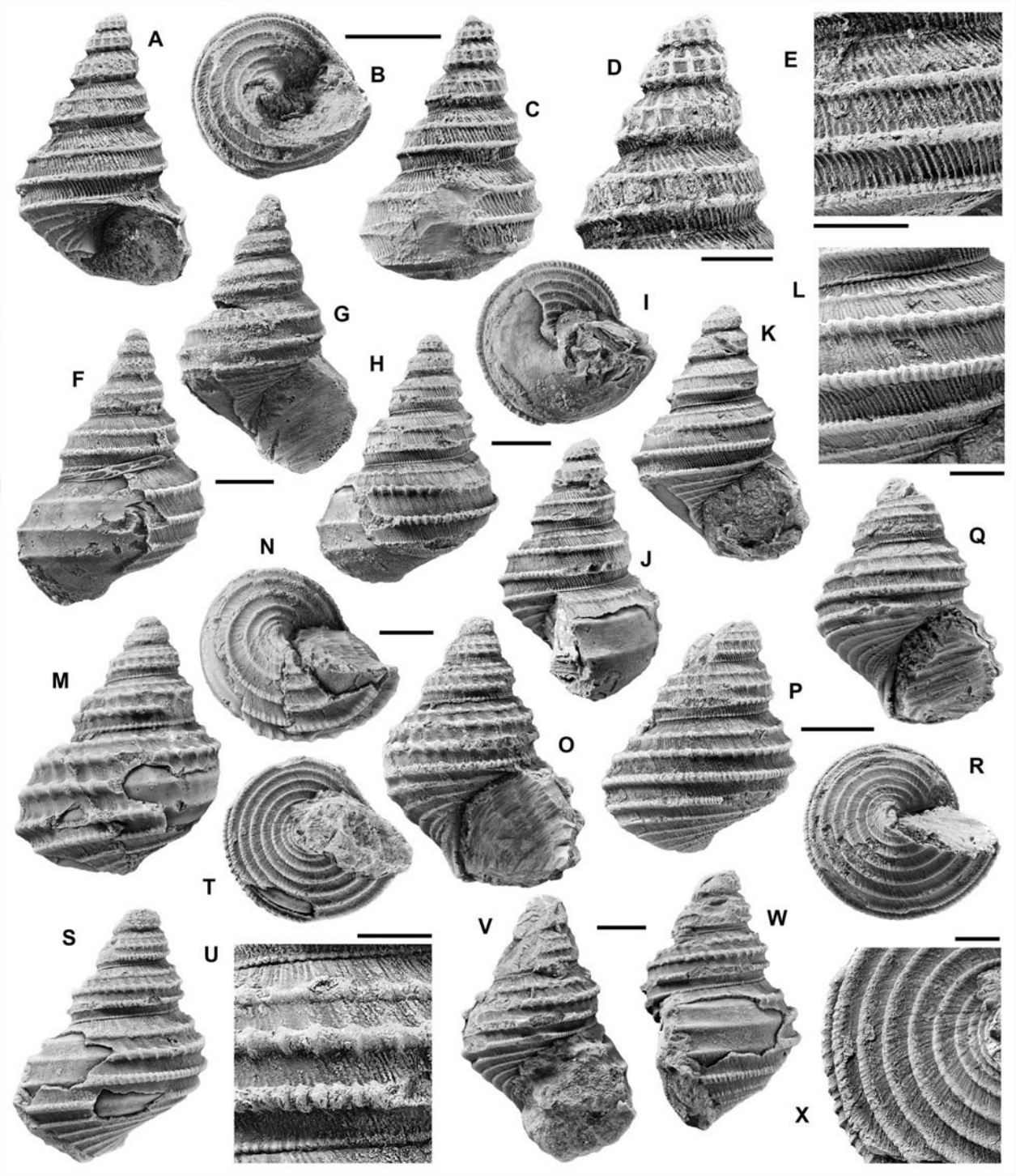
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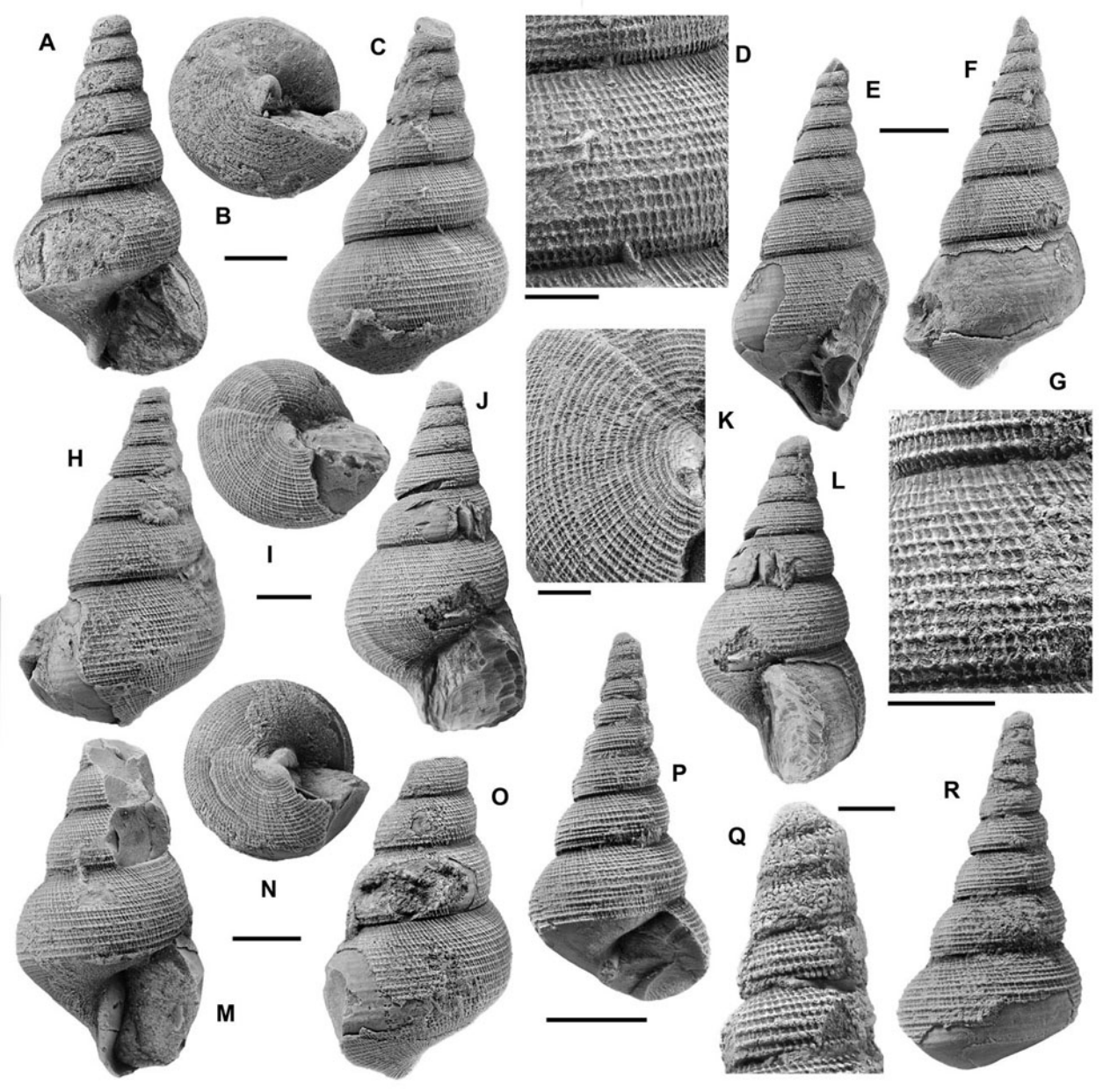
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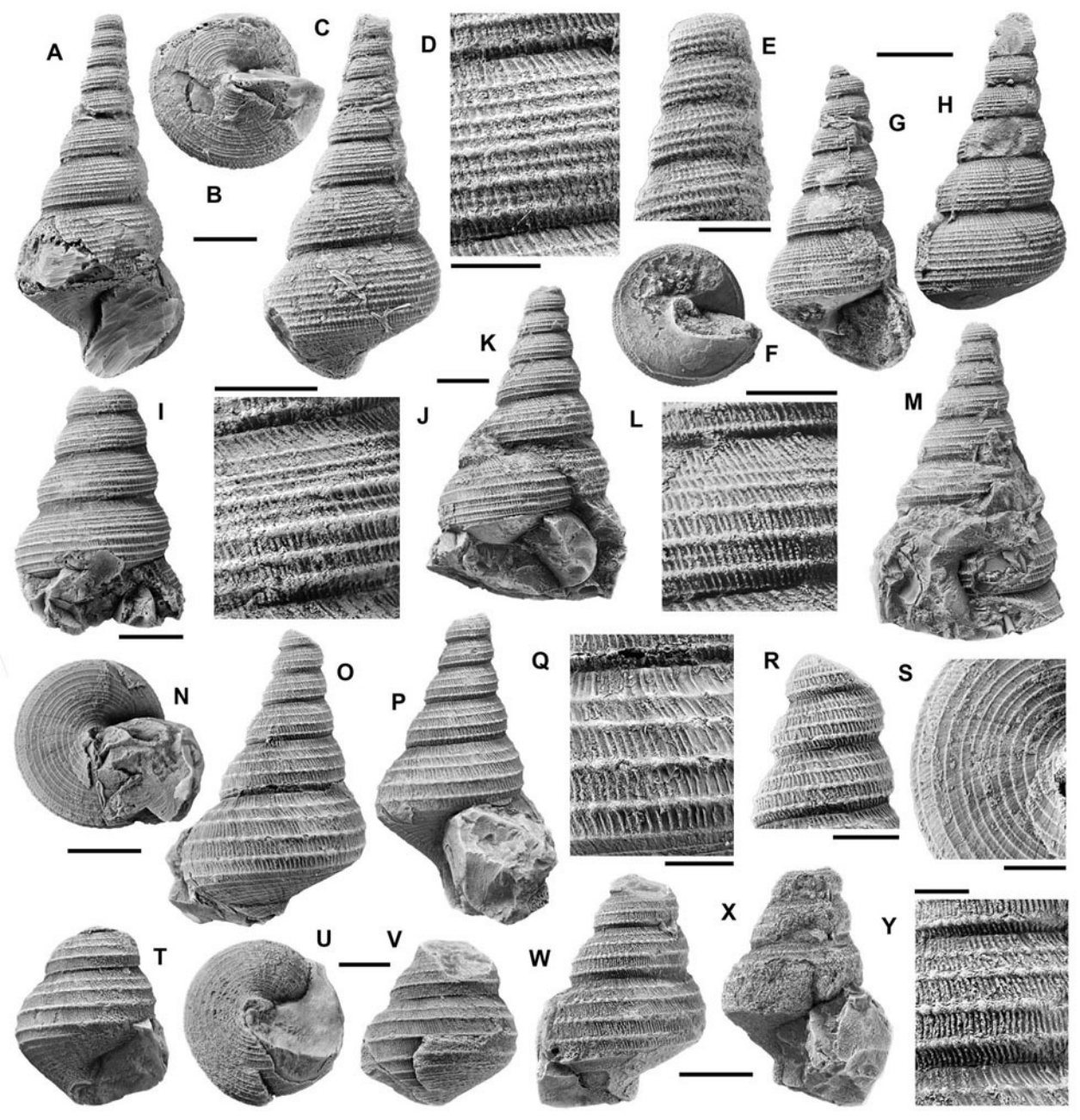
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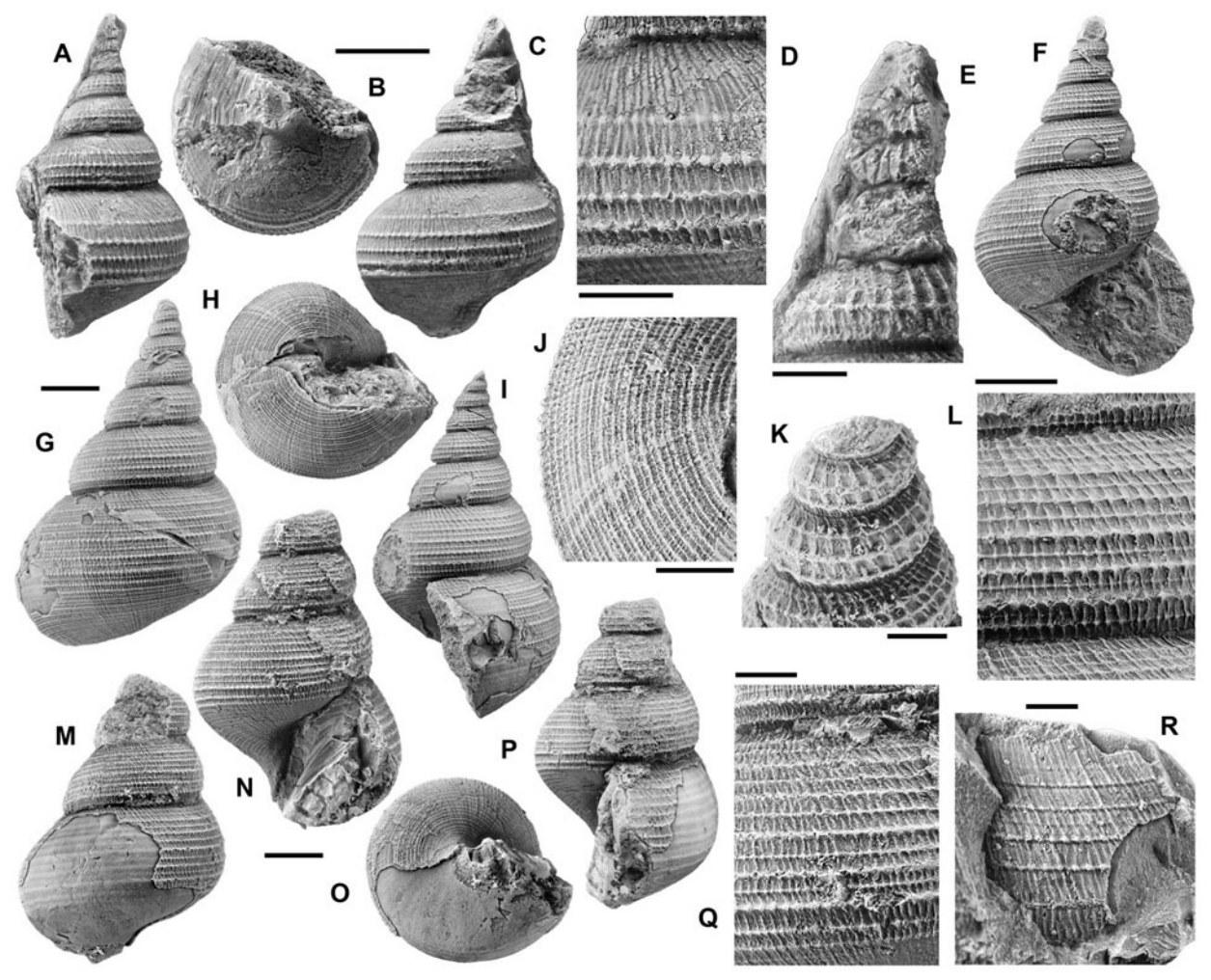
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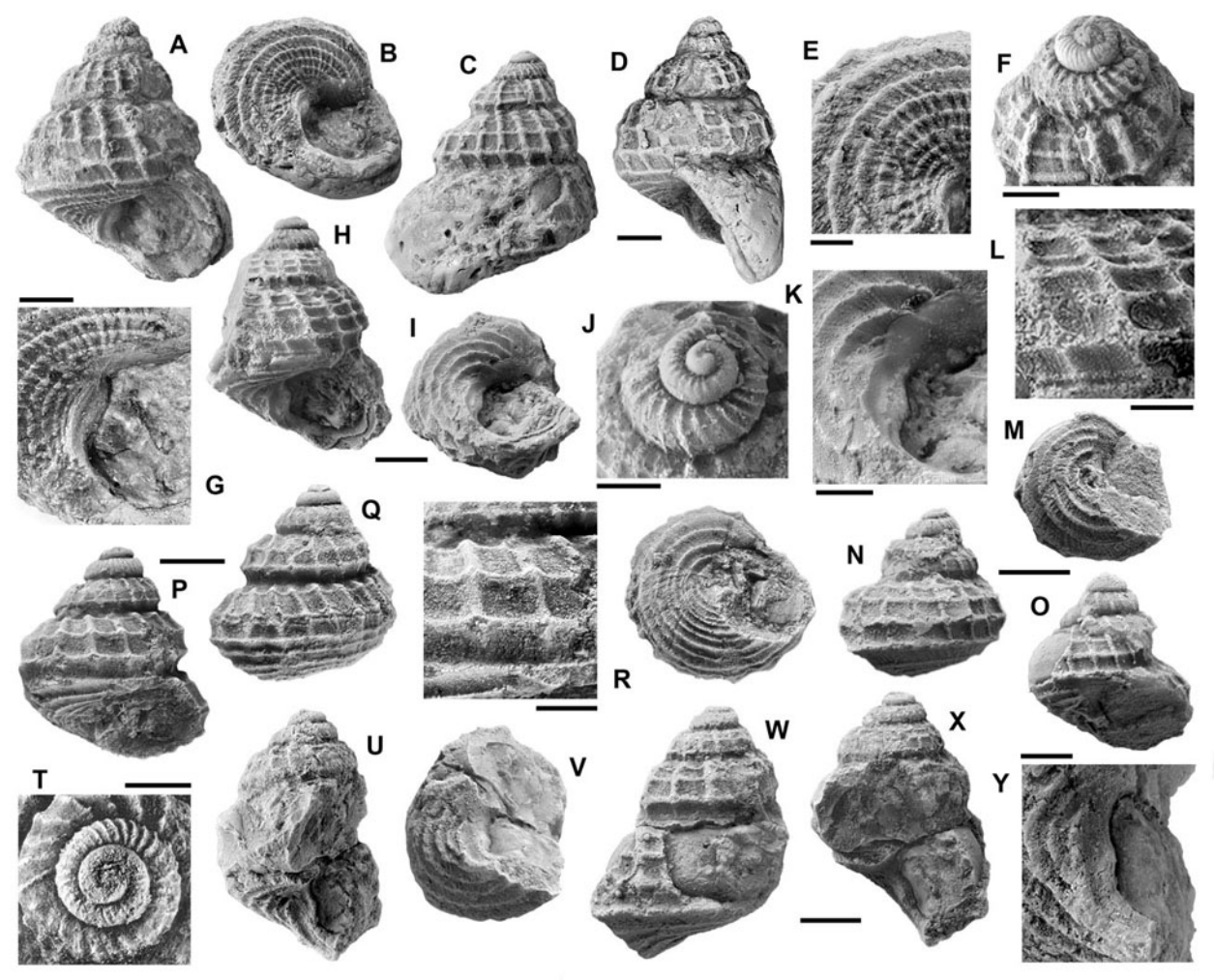
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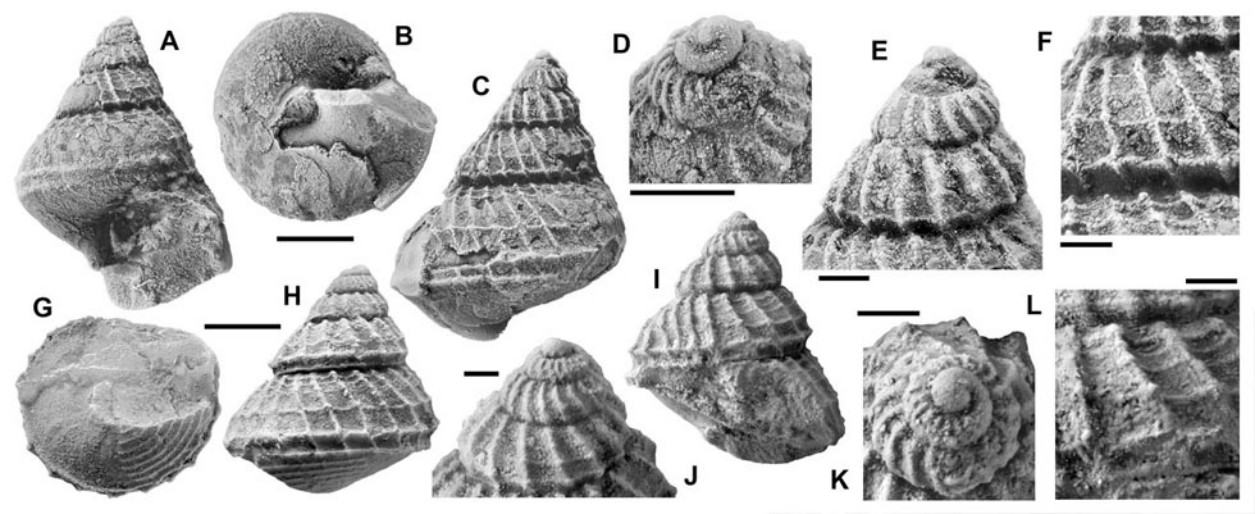
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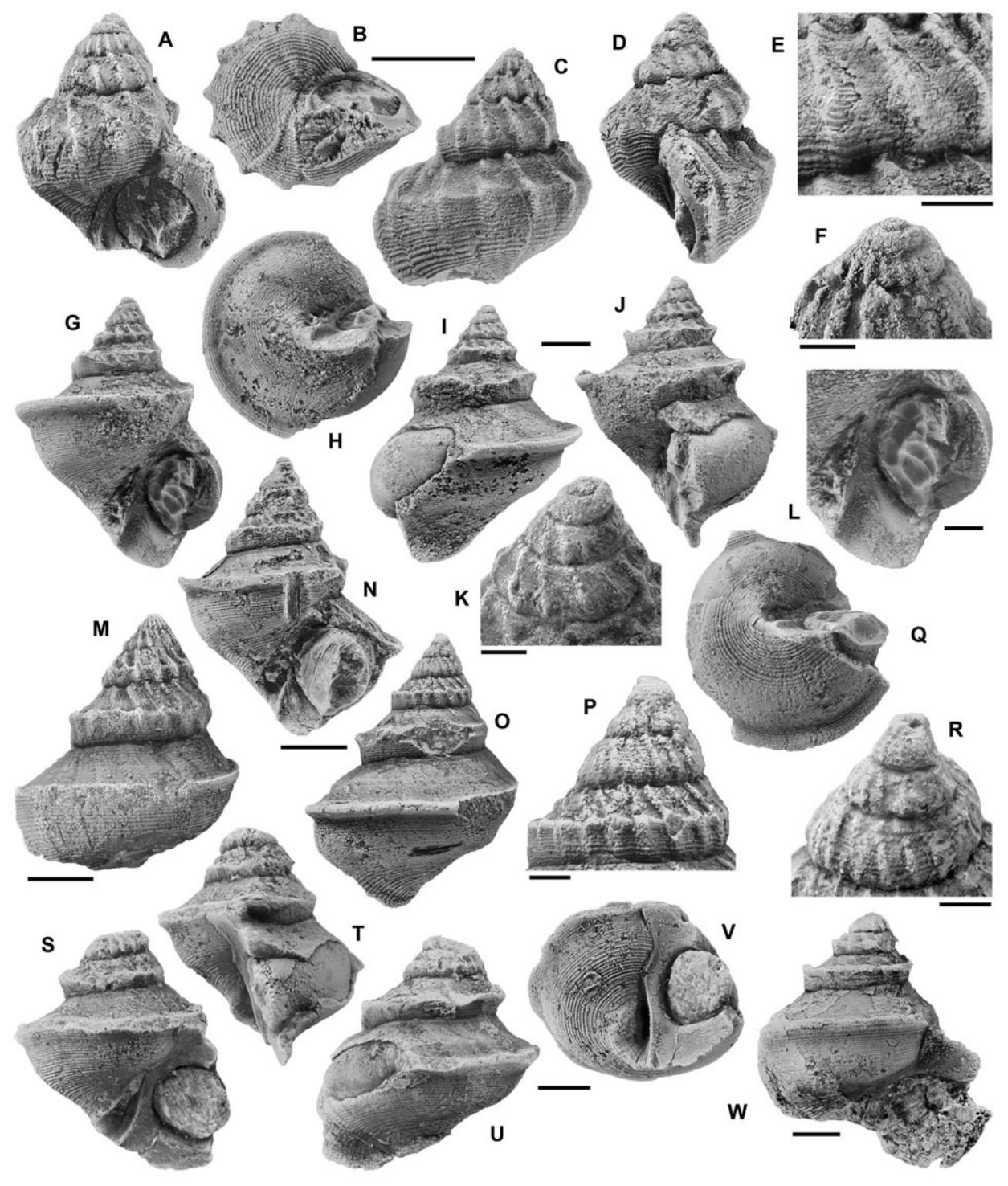
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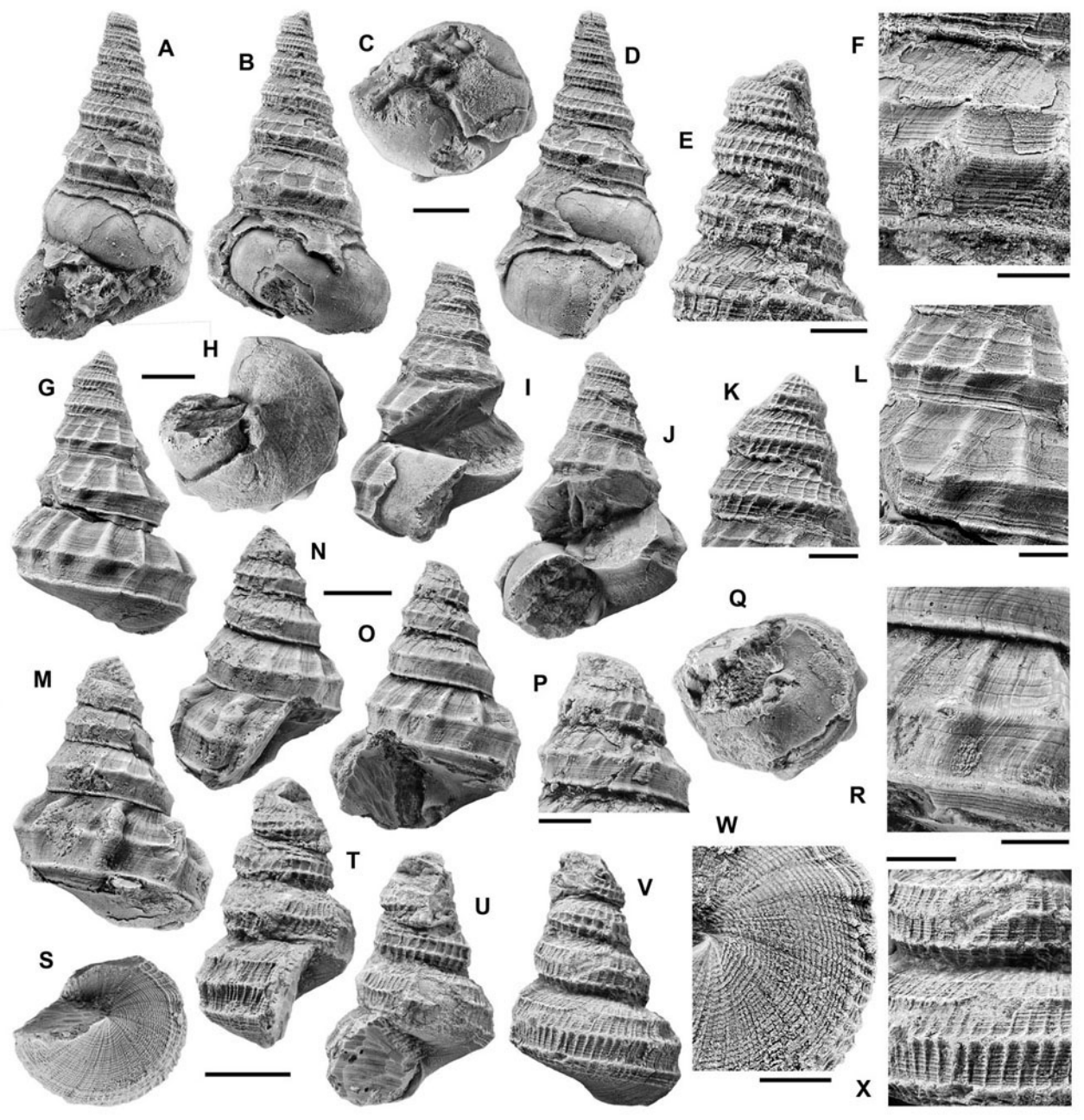
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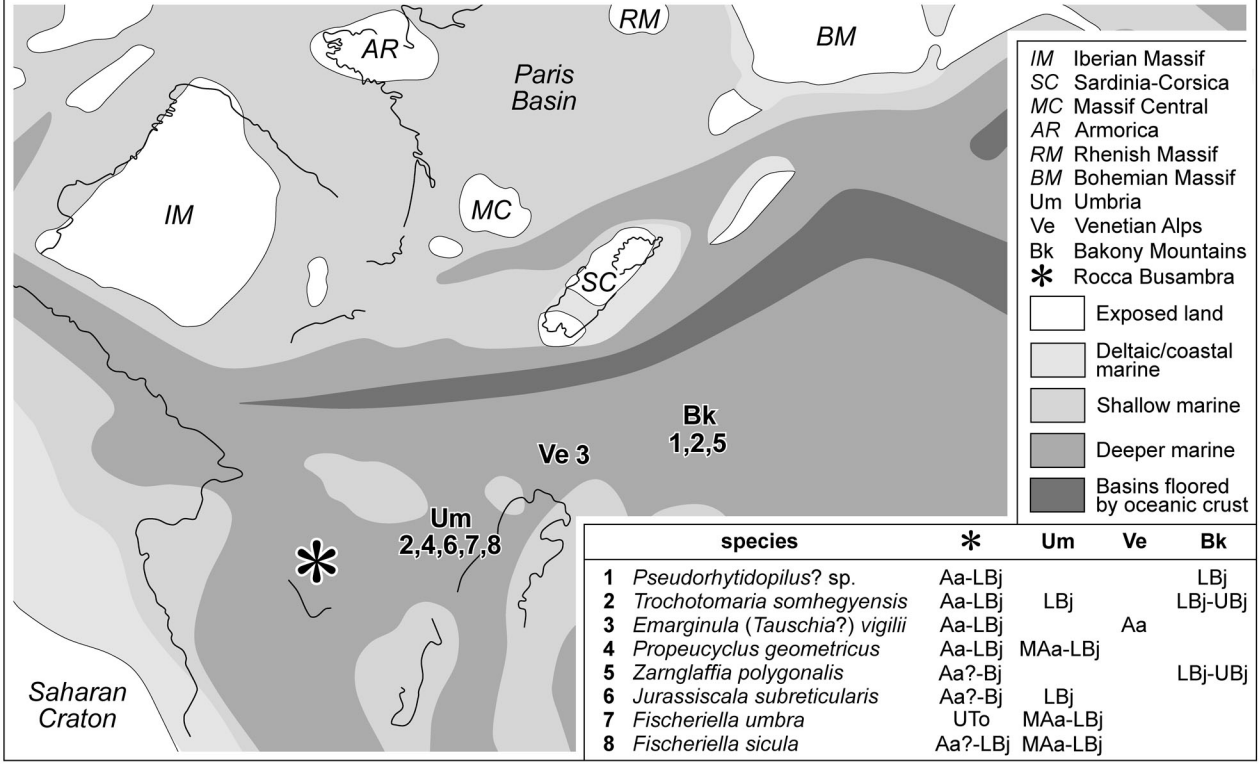

	species	*	Um	Ve	Bk
1	*Pseudorhytidopilus*? sp.	Aa-LBj			LBj
2	*Trochotomaria somhegyensis*	Aa-LBj	LBj		LBj-UBj
3	*Emarginula* (*Tauschia*?) *vigilii*	Aa-LBj		Aa	
4	*Propeucyclus geometricus*	Aa-LBj	MAa-LBj		
5	*Zarnglaffia polygonalis*	Aa?-Bj			LBj-UBj
6	*Jurassiscala subreticularis*	Aa?-Bj	LBj		
7	*Fischeriella umbra*	UTo	MAa-LBj		
8	*Fischeriella sicula*	Aa?-LBj	MAa-LBj		

Table 1

F	stages/substages	biozones
1	Lower Toarcian	*Harpoceras serpentinum – Hildoceras bifrons*
2	Lower Toarcian – lower Upper Toarcian	*Hildoceras bifrons – Haugia variabilis*
3	Upper Toarcian	*Haugia variabilis – Phlyseogrammoceras dispansum*
4	uppermost Toarcian	*Pleydellia aalensis*
5	Aalenian – Lower Bajocian	*Leioceras opalinum – Sonninia propinquans*
6	Lower Bajocian	*Sonninia sowerbyi – Sonninia propinquans*
7	Lower Bajocian	*Sonninia propinquans – Stephanoceras humphriesianum*
8	Lower Bajocian	*Stephanoceras humphriesianum*
9	Upper Bajocian	*Stephanoceras humphriesianum – Strenoceras niortense*
10	Upper Bajocian	*Strenoceras niortense – Parkinsonia parkinsoni*
11	Lower Callovian	*Macrocephalites macrocephalus*
12	Lower Callovian	*Macrocephalites macrocephalus*
13	Lower – Upper Oxfordian	*Quenstedtoceras mariae – Gregoryceras transversarium*
14	Upper Oxfordian	*Gregoryceras transversarium*
15	Upper Oxfordian – Lower Kimmeridgian	*Epipeltoceras bimammatum – Idoceras planula*
16	Lower – Upper Kimmeridgian	*Idoceras planula – Aulacostephanus eudoxus*
17	Uppermost Kimmeridgian	*Hybonoticeras beckeri*

F, faunas; stratigraphical data revised by Wendt (2017).

Table 2

CAP-SHAPED SHELLS							
specimens	**H**	**Hap**	**L**	**Lap**	**LP**	**W**	
***Pseudorhytidopilus*? sp.**							
GPIT 1685/42	4.4P	-	-	-	6.7P	6.2P	
Emarginula* (*Emarginula*) *burgioi sp. nov.							
GPIT 1685/37	5.7	-	-	4.6	8.9	8.5	
GPIT 1685/38	8.7P	-	-	4.9P	9.3P	8.8P	
Emarginula* (*Tauschia*) *acutidens sp. nov.							
GPIT 1685/40	8.6	8.3	-	-	7.5	8.0	
Emarginula* (*Tauschia*?) *vigilii Fucini, 1894							
GPIT 1685/39	9.6	3.2	15.2	12.6	11.5P	10.0	
HELICOSPIRAL SHELLS							
Specimen	**H**	**HL**	**HP**	**W**	**WP**	**α_{ap}**	**α_{pl}**
Ramusatomaria nuda sp. nov.							
GPIT 1685/33	8.2P	4.9	2.7	7.6	3.8P	- (3)	49°
Trapanimaria gattoi sp. nov.							
GPIT 1685/23	21.8P	17.6	12.8	29.5	-	132°	96°
GPIT 1685/24	18.0P	-	-	29.5P	-	- (2)	104°
GPIT 1685/26	24.1P	19.8	14.7	36.6	14.8	112°(4)	103°
Trapanimaria nicolosiensis sp. nov.							
GPIT 1685/29	27.0P	22.4P	17.4P	52.7	-	118°	113°
GPIT 1685/30	27.4P	23.4P	-	34.5P	-	- (2)	111°
Trapanimaria*? *pallinii sp. nov.							
GPIT 1685/22	27.4P	20.7	15.3	30.6	13.5	- (3)	70°
Trochotomaria somhegyensis (Szabó, 1980)							
GPIT 1685/1	16.8P	12.6P	-	-	8.3P	-	-
Trochotomaria conoidea sp. nov.							
GPIT 1685/3	13.4P	10.0P	6.2P	18.9P	-	- (3.5)	82°
GPIT 1685/2	11.0P	7.5P	4.2P	12.8P	-	92°	84º
Trochotomaria polymorpha sp. nov.							
GPIT 1685/5	13.5	7.4	4.4	14.2	5.7	101°	76°
GPIT 1685/6	16.2P	11.1P	7.5P	19.1	-	78°(4)	95°
GPIT 1685/7	15.0P	9.8	6.2	16.6	-	65°(4)	80°
GPIT 1685/8	11.7P	7.2	4.7	12.7	-	74°(4.5)	63°
GPIT 1685/10	10.7P	7.0	4.7P	12.2	-	76°(4)	72°
GPIT 1685/11	10.8P	7.8P	-	14.4	-	- (3.5)	75°
GPIT 1685/12	13.7P	6.9	4.0	13.0P	-	81°(5.5)	58°
GPIT 1685/13	13.4	7.7	4.7	12.5	5.8	90°	70°
GPIT 1685/14	15.0	7.1	4.2	12.8	-	106°	54°
GPIT 1685/15	18.6P	12.4	7.3	20.9P	-	71°(5)	83°
GPIT 1685/16	6.4	4.0	2.3	6.3	3.0P	125°	58°
GPIT 1685/17	13.2P	9.8	6.3	22.3	-	- (3)	101°
GPIT 1685/18	14.0P	10.5P	-	17.5P	-	- (3)	72°
GPIT 1685/19	13.5	7.8	-	14.8	-	- (4)	66°
Laevitomaria babalusciae sp. nov.							
GPIT 1685/32	40.6P	26.3	-	35.6P	-	75º	69°
Pyrgotrochus vorosi sp. nov.							
GPIT 1685/31	24.2P	13.9	8.9	20.2	10.5P	48º (6.5)	48°
Auritoma lenticula sp. nov.							
GPIT 1685/36	2.1	2.0	1.8	3.9	2.6	181°	160°
Busambrella fasciata sp. nov.							
GPIT 1685/34	4.0P	3.7P	2.9P	4.8P	-	137°	131°
GPIT 1685/35	3.7	3.4	3.0	4.6	2.6	-	134°
Propeucyclus geometricus (Conti & Monari, 1986)							
GPIT 1685/588	25.1P	15.0	10.3	12.0	6.5	41°(6)	30°
GPIT 1685/589	28.1P	18.1	12.0	14.0	8.0	45°(4)	29°
GPIT 1685/590	26.1P	16.7	10.9	12.5	7.0	45°(5)	25°
GPIT 1685/591	21.0P	13.5P	11.8P	9.5	6.8	42°(4)	31°
GPIT 1685/592	20.0P	12.8P	7.9P	11.7	-	- (3.5)	31°
GPIT 1685/593	15.4P	10.4	7.1	8.1P	4.7P	- (3.5)	31°
GPIT 1685/597	17.5P	9.7P	6.0P	9.6	5.6	35°(5.5)	35°
GPIT 1685/598	14.5P	10.4P	-	10.8	-	- (3)	30°

Propeucyclus sicanus sp. nov.							
GPIT 1685/604	20.0P	9.5P	-	10.7	-	26°(7)	25°
GPIT 1685/605	5.3P	3.1P	-	3.6P	-	39°(3)	-
Propeucyclus obesus sp. nov.							
GPIT 1685/585	14.6P	9.8P	5.8P	10.4P	5.6P	- (3)	35°
Propeucyclus? semireticulatus sp. nov.							
GPIT 1685/587	11.6P	6.2P	-	6.6P	-	- (5)	34°
Eucyclomphalus? marenostrum sp. nov.							
GPIT 1685/580	13.6P	7.4	4.5	9.0	3.4	35°(6)	43°
GPIT 1685/583	14.8P	10.7	7.1	12.0	-	- (3)	35°
GPIT 1685/584	13.3P	7.3	4.1	6.8	4.1	- (4)	37°

Linear measurements are in millimetres, angles in degrees. P, linear measurements made on incomplete specimens. In shells lacking the earliest spire, the apical angle (α_{ap}) refers to the first observable whorls and is accompanied by the total number of preserved whorls. See text for the institutional abbreviations and Figure 4 for the abbreviations of the dimensions.

Table 3

specimen	H	HL	HP	W	WP	αap	αpl
			Toronyella lineata sp. nov.				
GPIT 1685/479	10.9P	4.9	3.4	4.1	2.7	54°(8)	9°
GPIT 1685/480	9.6P	4.3P	2.5P	4.2	-	30°(5)	8°
GPIT 1685/481	5.1P	2.6P	-	3.0P	-	40°(5)	15°
GPIT 1685/483	5.3P	2.6	1.5	3.0	1.7	60°	28°
GPIT 1685/484	9.5P	7.1	4.6	4.0	6.7	55°(7)	10°
GPIT 1685/485	11.6P	8.1	4.8	8.0	4.5	46°(8)	14°
			Toronyella margaritata sp. nov.				
GPIT 1685/486	11.6P	-	-	4.9P	-	37°(8)	12°
			Zarnglaffia polygonalis sp. nov.				
GPIT 1685/489	15.0	9.1	6.0	10.0P	-	42°	51°
GPIT 1685/490	13.8P	9.1	5.8	10.1	5.7	45°(4)	44°
GPIT 1685/491	11.6P	8.1	5.2	9.0	-	- (3)	63°
GPIT 1685/492	14.3P	10.5	17.0	11.4	-	- (3)	58°
GPIT 1685/493	16.9P	11.8	6.7	12.4	7.0	- (3)	58°
GPIT 1685/500	8.2P	5.1	4.0	6.1	-	- (3.5)	57°
GPIT 1685/501	11.2P	6.9	5.0	7.4	-	- (3.5)	46°
			Zarnglaffia palermitana sp. nov.				
GPIT 1685/487	9.5P	6.4	4.3	7.1	4.4	- (3)	55°
GPIT 1685/488	9.9P	7.1P	-	7.6P	-	- (3)	54°
			Ambercyclus cratisculptus sp. nov.				
GPIT 1685/560	21.9P	15.8	10.4	14.9	-	- (3)	55°
GPIT 1685/562	18.4P	14.7	10.1	15.1	-	- (2.5)	50°
GPIT 1685/563	21.4P	14.1	8.8	14.7	7.5	41°(4)	48°
GPIT 1685/564	26.8	18.2	12.6	18.3	-	46°(5)	53°
GPIT 1685/565	14.4	8.3P	4.9P	9.5	4.8	41°(5)	45°
GPIT 1685/567	26.6P	18.4	11.9	20.0	12.0	49°(4)	60°
GPIT 1685/569	21.2P	15.0	10.1	16.1	9.0	- (3)	59°
			Elymicyclus garibaldii sp. nov.				
GPIT 1685/574	18.3	12.1	-	11.5P	-	- (7)	57°
			Elymicyclus alternatus sp. nov.				
GPIT 1685/521	24.2P	16.0	9.9	13.7P	6.4P	- (3)	38°
GPIT 1685/522	28.1P	15.2	9.1	15.1	7.9	30°(6)	37°
GPIT 1685/523	30.8P	18.4P	12.3P	16.2	8.8	28°(6)	43°
GPIT 1685/524	28.3P	15.6	10.9	10.9P	-	25°(7)	37°
GPIT 1685/528	24.9P	12.5	8.4	11.7	6.5	20°(8)	38°
GPIT 1685/529	17.2P	10.1P	-	12.4P	-	- (4)	34°
GPIT 1685/530	27.2P	15.8P	-	15.2P	-	- (4)	28°
GPIT 1685/531	27.4P	17.7	-	15.9	-	- (3)	32°
GPIT 1685/536	18.4P	7.9P	-	9.4P	-	23°	39°
GPIT 1685/537	27.3P	10.3P	-	16.0P	-	27°(6)	32°
GPIT 1685/538	29.4P	15.5P	-	15.5P	-	- (4)	26°
GPIT 1685/542	18.6P	12.2	7.9	11.8	-	- (4)	39°
GPIT 1685/543	16.0P	9.0	5.3	9.8	-	- (4)	29°
GPIT 1685/546	18.7P	8.7	5.6	9.1	-	26°(6)	32°
GPIT 1685/547	35.5P	18.2	11.4	16.7	9.4	28°(6)	34°
GPIT 1685/548	23.2P	11.3	-	12.9	-	26°(7)	37°
			Elymicyclus ietumensis sp. nov.				
GPIT 1685/571	19.5P	11.7	8.2	12.3	-	23°(5)	50°
GPIT 1685/572	16.0P	10.8P	-	11.3	-	32°(3)	52°
GPIT 1685/573	17.9P	-	-	15.4	-	- (2)	52°
			Elymicyclus martae sp. nov.				
GPIT 1685/557	30.9	18.5	12.1	19.1	-	32°(6)	51°
GPIT 1685/558	26.4P	18.3	11.8	17.4	9.9	- (3)	45°
			Jurassiscala subreticularis (Conti & Fischer, 1984)				
GPIT 1685/520	3.3	2.3	1.4	2.9	-	84°	60°
GPIT 1685/855	2.4P	1.4P	-	2.4	-	-	59°
			Jurassiscala sturanii sp. nov.				
GPIT 1685/857	6.1	4.2	2.7	4.5	2.6	86°	48°
GPIT 1685/858	4.5	3.6	2.3	3.8	2.1	83°	49°
			Jurassiscala*? *tenuiretis sp. nov.				

GPIT 1685/519	4.3	3.0	2.1	3.2	1.7	73°	54°
GPIT 1685/859	3.2P	2.3P	-	2.8P	-	74°	57°
Fischeriella umbra Conti & Monari, 1986							
GPIT 1685/463	5.0	3.6	2.3	4.0	2.4	91°	56°
Fischeriella sicula sp. nov.							
GPIT 1685/464	10.5	8.4	5.5	7.9	3.7	68°	70°
GPIT 1685/465	7.9P	5.5P	-	6.9	-	70°	60°
GPIT 1685/467	8.5	5.9	4.3	6.8	3.6	65°	73°
GPIT 1685/469	9.9P	7.0P	-	9.0P	-	- (3.5)	66°
Retimusina poseidoni sp. nov.							
GPIT 1685/575	27.2P	15.6	10.1	17.9	9.9	31°(5)	44°
GPIT 1685/577	29.6P	14.7	9.3	16.9	-	27°(7)	35°
Retimusina* cf. *poseidoni sp. nov.							
GPIT 1685/576	19.5P	11.9	7.6	14.4	8.2	38°(5)	60°
Retimusina? tritoni sp. nov.							
GPIT 1685/579	15.1P	8.8	5.8	9.8	5.8	27°(4)	39°

Units and symbols are the same as in Table 2. See text for the institutional abbreviations and Figure 4 for the abbreviations of the dimensions.

Table 4

species	n	F	stratigraphical distribution	
			stage/substage	Biozone
Order PATELLOGASTROPODA Lindberg, 1986				
? Family ACMAEIDAE Forbes, 1850				
***Pseudorhytidopilus*? sp.**	1	5	Aalenian – Lower Bajocian	*opalinum–propinquans*
Superfamily PLEUROTOMARIOIDEA Swainson, 1840				
Family STUORELLIDAE Bandel, 2009				
Ramusatomaria nuda gen. et sp. nov.	1	3	lower Upper Toarcian	*variabilis–dispansum*
Family PLEUROTOMARIIDAE Swainson, 1840				
Trapanimaria gattoi gen. et sp. nov.	6	16	Lower – Upper Kimmeridgian	*planula–eudoxus*
Trapanimaria nicolosiensis gen. et sp. nov.	1	15	Upper Oxford. – Lower Kimmeridgian	*bimammatum–planula*
	1	16	Lower – Upper Kimmeridgian	*planula–eudoxus*
Trapanimaria*? *pallinii gen. et sp. nov.	1	16	Lower – Upper Kimmeridgian	*planula–eudoxus*
Trochotomaria somhegyensis (Szabó, 1980)	1	5	Aalenian – Lower Bajocian	*opalinum–propinquans*
Trochotomaria conoidea sp. nov.	3	5	Aalenian – Lower Bajocian	*opalinum–propinquans*
Trochotomaria polymorpha sp. nov.	2	1	Lower Toarcian	*serpentinum–bifrons*
	3	1–2	Toarcian	*serpentinum–variabilis*
	12	3	lower Upper Toarcian	*variabilis–dispansum*
Laevitomaria babalusciae sp. nov.	1	15	Upper Oxford. – Lower Kimmeridgian	*bimammatum–planula*
Pyrgotrochus vorosi sp. nov.	1	13	Lower – Upper Oxfordian	*mariae–transversarium*
Superfamily SCISSURELLOIDEA Gray, 1847				
Family AURITOMIDAE fam. nov.				
Auritoma lenticula gen. et sp. nov.	1	12	Lower Callovian	*macrocephalus*
? Superfamily SCISSURELLOIDEA Gray, 1847				
? Family ANATOMIDAE McLean, 1989				
Busambrella fasciata gen. et sp. nov.	2	5	Aalenian – Lower Bajocian	*opalinum–propinquans*
Superfamily FISSURELLOIDEA Fleming, 1822				
Family FISSURELLIDAE Fleming, 1822				
Emarginula* (*Emarginula*) *burgioi sp. nov.	2	3	lower Upper Toarcian	*variabilis–dispansum*
Emarginula* (*Tauschia*) *acutidens sp. nov.	1	3	lower Upper Toarcian	*variabilis–dispansum*
Emarginula* (*Tauschia*?) *vigilii Fucini, 1894	1	5	Aalenian – Lower Bajocian	*opalinum–propinquans*

n, number of specimens; F, faunal units defined by Wendt (1971); stratifgraphical distribution of the faunas as in Wendt (2017) and tab. 1.

Table 5

species	n	F	stratigraphical distribution	
			stage/substage	Biozone
Superfamily EUCYCLOIDEA Koken, 1897				
Family EUCYCLIDAE Koken, 1897				
Propeucyclus geometricus (Conti & Monari, 1986)	16	5	Aalenian – Lower Bajocian	*opalinum–propinquans*
Propeucyclus sicanus gen. et sp. nov.	1	6	Lower Bajocian	*sowerbyi–propinquans*
	1	-	Aalenian–Bajocian	?
Propeucyclus obesus gen. et sp. nov.	1	5	Aalenian – Lower Bajocian	*opalinum–propinquans*
Propeucyclus*? *semireticulatus gen. et sp. nov.	1	3	Upper Toarcian	*variabilis–dispansum*
Eucyclomphalus*? *marenostrum sp. nov.	1	2	Lower – Upper Toarcian	*bifrons–variabilis*
	2	3	Upper Toarcian	*variabilis–dispansum*
	2	5	Aalenian – Lower Bajocian	*opalinum–propinquans*
Toronyella lineata gen. et sp. nov.	2	1–2	Toarcian	*serpentinum–variabilis*
	5	3	Upper Toarcian	*variabilis–dispansum*
Toronyella margaritata gen. et sp. nov.	1	10	Upper Bajocian	*niortense–parkinsoni*
? Family EUCYCLIDAE Koken, 1897				
Zarnglaffia polygonalis sp. nov.	6	5	Aalenian – Lower Bajocian	*opalinum–propinquans*
	1	6	Lower Bajocian	*sowerbyi–propinquans*
	3	6?	Lower Bajocian	*sowerbyi–propinquans*
	4	7	Lower Bajocian	*propinquans–humphriesianum*
	4	8	Lower Bajocian	*humphriesianum*
	3	10	Upper Bajocian	*niortense–parkinsoni*
Zarnglaffia palermitana sp. nov.	2	5	Aalenian – Lower Bajocian	*opalinum–propinquans*
	1	10	Upper Bajocian	*niortense–parkinsoni*
Family EUCYCLOSCALIDAE Gründel, 2007				
Ambercyclus cratisculptus sp. nov.	10	5	Aalenian – Lower Bajocian	*opalinum–propinquans*
	2	-	Aalenian–Bajocian	?
Elymicyclus alternatus gen. et sp. nov.	5	1	Lower Toarcian	*serpentinum–bifrons*
	2	2	Lower – Upper Toarcian	*bifrons–variabilis*
	10	1–2	Toarcian	*serpentinum–variabilis*
	18	3	Upper Toarcian	*variabilis–dispansum*
Elymicyclus ietumensis gen. et sp. nov.	2	1	Lower Toarcian	*serpentinum–bifrons*
	1	1–2	Toarcian	*serpentinum–variabilis*
Elymicyclus garibaldii gen. et sp. nov.	1	3	Upper Toarcian	*variabilis–dispansum*
Elymicyclus martae gen. et sp. nov.	3	3	Upper Toarcian	*variabilis–dispansum*
***Elymicyclus*? sp.**	1	5	Aalenian – Lower Bajocian	*opalinum–propinquans*
Jurassiscala subreticularis (Conti & Fischer, 1984)	1	5	Aalenian – Lower Bajocian	*opalinum–propinquans*
	1	8	Lower Bajocian	*humphriesianum*
	1	10	Upper Bajocian	*niortense–parkinsoni*
Jurassiscala sturanii gen. et p. nov.	1	8	Lower Bajocian	*humphriesianum*
	1	10	Upper Bajocian	*niortense–parkinsoni*
Jurassiscala*? *tenuiretis gen. et sp. nov.	2	10	Upper Bajocian	*niortense–parkinsoni*
Family SABRINELLIDAE Bandel, 2010				
Fischeriella umbra (Conti & Monari, 1986)	1	4	uppermost Toarcian	*Pleydellia aalensis*
Fischeriella sicula sp. nov.	4	5	Aalenian – Lower Bajocian	*opalinum–propinquans*
	1	6	Lower Bajocian	*sowerbyi–propinquans*
	1	-	Aalenian–Bajocian	?
? Superfamily EUCYCLOIDEA Koken, 1897				
Family CIRRIDAE Cossmann, 1916				
Retimusina poseidoni gen. et sp. nov.	3	3	Upper Toarcian	*variabilis–dispansum*
Retimusina* cf. *poseidoni gen. et sp. nov.	1	5	Aalenian – Lower Bajocian	*opalinum–propinquans*
Retimusina*? *tritoni gen. et sp. nov.	1	5	Aalenian – Lower Bajocian	*opalinum–propinquans*

n, number of specimens; F, faunal units defined by Wendt (1971); stratifgraphical distribution of the faunas as in Wendt (2017) and tab. 1.

Table 6

F1 Lower Toarcian (*serpentinum–bifrons*)
Trochotomaria polymorpha sp. nov.
Elymicyclus alternatus sp. nov.
Elymicyclus ietumensis sp. nov.

F2 Lower–Upper Toarcian (*bifrons–variabilis*)
Eucyclomphalus? *marenostrum* sp. nov.
Elymicyclus alternatus sp. nov.

F3 Upper Toarcian (*variabilis–dispansum*)
Ramusatomaria nuda sp. nov.
Trochotomaria polymorpha sp. nov.
Emarginula (*Emarginula*) *burgioi* sp. nov.
Emarginula (*Tauschia*) *acutidens* sp. nov.
Propeucyclus? *semireticulatus* sp. nov.
Eucyclomphalus? *marenostrum* sp. nov.
Toronyella lineata sp. nov.
Elymicyclus alternatus sp. nov.
Elymicyclus garibaldii sp. nov.
Elymicyclus martae sp. nov.
Retimusina poseidoni sp. nov.

F4 Upper Toarcian (*aalensis*)
Fischeriella umbra Conti & Monari, 1986

F5 Aalenian–Lower Bajocian (*opalinum–propinquans*)
Pseudorhytidopilus? sp.
Trochotomaria somhegyensis (Szabó)
Trochotomaria conoidea sp. nov.
Busambrella fasciata sp. nov.
Emarginula (*Tauschia*?) *vigilii* Fucini
Propeucyclus geometricus (Conti & Monari)
Propeucyclus obesus sp. nov.
Eucyclomphalus? *marenostrum* sp. nov.
Zarnglaffia polygonalis sp. nov.
Zarnglaffia palermitana sp. nov.
Ambercyclus cratisculptus sp. nov.
Elymicyclus? sp.
Jurassiscala subreticularis (Conti & Fischer)
Fischeriella sicula sp. nov.
Retimusina cf. *poseidoni* sp. nov.
Retimusina? *tritoni* sp. nov.

F6 Lower Bajocian (*sowerbyi–propinquans*)
Propeucyclus sicanus sp. nov.
Zarnglaffia polygonalis sp. nov.
Fischeriella sicula sp. nov.

F7 Lower Bajocian (*propinquans–humphriesianum*)
Zarnglaffia polygonalis sp. nov.

F8 Lower Bajocian (*humphriesianum*)
Zarnglaffia polygonalis sp. nov.
Jurassiscala subreticularis (Conti & Fischer)
Jurassiscala sturanii sp. nov.

F10 Upper Bajocian (*niortense–parkinsoni*)
Toronyella margaritata sp. nov.
Zarnglaffia polygonalis sp. nov.
Zarnglaffia palermitana sp. nov.
Jurassiscala subreticularis (Conti & Fischer)
Jurassiscala sturanii sp. nov.
Jurassiscala? *tenuiretis* sp. nov.

F12 Lower Callovian (*macrocephalus*)
Auritoma lenticula sp. nov.

F13 Oxfordian (*mariae–transversarium*)
Pyrgotrochus vorosi sp. nov.

F15 Upper Oxfordian–Lower Kimmeridgian (*bimammatum–planula*)
Trapanimaria nicolosiensis sp. nov.
Laevitomaria babalusciae sp. nov.

F16 Lower–Upper Kimmeridgian (*planula–eudoxus*)
Trapanimaria gattoi sp. nov.
Trapanimaria nicolosiensis sp. nov.
Trapanimaria? *pallinii* sp. nov.

UNDIFFERENTIATED STRATIGRAPHICAL POSITION

Toarcian

F1-2 *Trochotomaria polymorpha* sp. nov.
F1-2 *Toronyella lineata* sp. nov.
F1-2 *Elymicyclus ietumensis* sp. nov.

Aalenian-Bajocian

? *Propeucyclus sicanus* sp. nov.
? *Fischeriella sicula* sp. nov.
? *Ambercyclus cratisculptus* sp. nov.

F, faunas; stratifgraphical distribution of the faunas as in Wendt (2017) and tab. 1.