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Middle Eocene Tonnoidea (Caenogastropoda) from the Hungarian Paleogene Basin

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Abstract – Middle Eocene Cassidae, Charoniidae, Cymatiidae and Personidae species are described and illustrated from the Hungarian Paleogene Basin. *Pseudosassia* n. gen. and eight new species are designated: *Cassis kalmani* n. sp., *Pseudosassia gurdoni* n. sp., *Pseudosassia traceyi* n. sp., *Monoplex* s.l. *szakonyii* n. sp., *Cymatiella dulaii* n. sp., *Parasassia vargai* n. sp., *Protoplex* ? *zsoldosi* n. sp., and *Personopsis merlei* n. sp. Genus *Semiranella* De Gregorio, 1880 is assigned to the family Charoniidae. *Sconsia cyrenaica* Stefanini, 1921 is regarded as a junior synonym of *Sconsia ambigua* (Solander, 1766). *Cymatiella tzankovi* nom. nov. is proposed as new name for "*Eutritonium* (*Sassia*) *rutoti*" Tzankov, 1940. With 56 figures.

Key words – Alpine Tethys, Cassidae, Charoniidae, Cymatiidae, Hungarian Paleogene Basin, Lutetian, Middle Eocene, Personidae, Tonnoidea

INTRODUCTION

Late Lutetian (middle Eocene) Cassidae, Charoniidae, Cymatiidae and Personidae material of the Hungarian Paleogene Basin (HPB) (NE Alpine Tethys) are described from three fossiliferous sites (Dudar, Balinka and Gánt, W Hungary). Although several papers dealt with Eocene gastropods in Hungary, only two *Galeodea* and three *Cassis* specimens were illustrated in the earlier literature, and a single "*Triton antiquum*" specimen was recorded by Szőts (1956) from the Kis-Sváb-hegy quarry (Budapest) but this specimen is lost. More recently, previously unknown middle–late Eocene localities have been exposed in the western part of Hungary by fossil collectors. From the newly collected material the Muricidae fauna was presented by Kovács & Vicián (2020), the tonnoideans are documented in this paper. *Cymatiella ischnospira* (Cossmann) and *C. microstoma* (Cossmann et Pissarro) are recorded for the first time outside the NE Atlantic Province, *Cassis thesei* Brongniart, *Sconsia ambigua* (Solander) and *Semiranella gemmellaroi* (De Gregorio) are new records in the HPB. A new ge-

nus, *Pseudosassia* n. gen. is introduced, and eight species: *Cassis kalmani* n. sp., *Pseudosassia gurdoni* n. sp., *Pseudosassia traceyi* n. sp., *Monoplex* s.l. *szakonyii* n. sp., *Cymatiella dulaii* n. sp., *Parasassia vargai* n. sp., *Protoplex* ? *zsoldosi* n. sp. and *Personopsis merlei* n. sp. are described as new for science.

GEOLOGICAL SETTINGS

The Alpine Tethys became a deep sea during the middle Lutetian sea transgression (Fig. 1A). The middle–late Eocene HPB in the northeastern part of the Alpine Tethys was a system of small sub-basins belonging to larger regions. Dudar and Balinka are located in the NE Bakony Mts, Gánt in the Vértes Hills regions (Fig. 1B).

The lithostratigraphy of the Eocene formations in Hungary was summarized by Kercsmár (2015). The uppermost Lutetian lithological formations of the Dudar-Balinka basin consist of diverse shallow marine sublittoral deposits with clayey sand, nummulitic sandstone, and yellow to grey marl or siltstone (Csernye Formation) which have yielded rich invertebrate assemblages. Molluscs from the brown coal mine of Dudar were described earlier, e.g. by Strausz (1966), and from the mines of Balinka by Kecskeméti-Körmendy (1980). The specimens illustrated in this paper from Dudar were collected on mine dumps and in a new opencast brown coal mining excavation, the specimen from Balinka came from a mine dump. Middle Eocene deposits of the Gánt Depression (S Vértes Hills) with grey silty clay or marl and thin coaly clay intercalations of lagoon or shallow marine origin represent the upper Lutetian Forna Formation. Molluscs from the vicinity of Gánt were dealt with, e.g. by Szőts (1953), and Pacaud & Vicián (2019). The brief history of the Eocene molluscan palaeontological research of the HPB was delineated by Kovács & Vicián (2020) with additional references.

MATERIAL AND METHODS

The specimens studied in this paper are stored in the Hungarian Natural History Museum, Budapest (HNHM), the Mining and Geological Survey of Hungary (MGSH), the Senckenberg Forschungsinstitut, Frankfurt am Main (SFI), and private collections of Zoltán Evanics (Mindszent), István Gurdon (Veszprém), Imre Orosz (Budapest), József Szakonyi (Szombathely), Zoltán Vicián (Budapest), and Márton Zsoldos (Bakonynána) (Hungary). The taxonomy and terminology follow Beu (2010), Kovács & Vicián (2018), Sanders *et al.* (2019), and Craig *et al.* (2020) with modifications. For sculpture description method of Merle (2001, 2005), Sanders *et al.* (2017), and Landau *et al.*

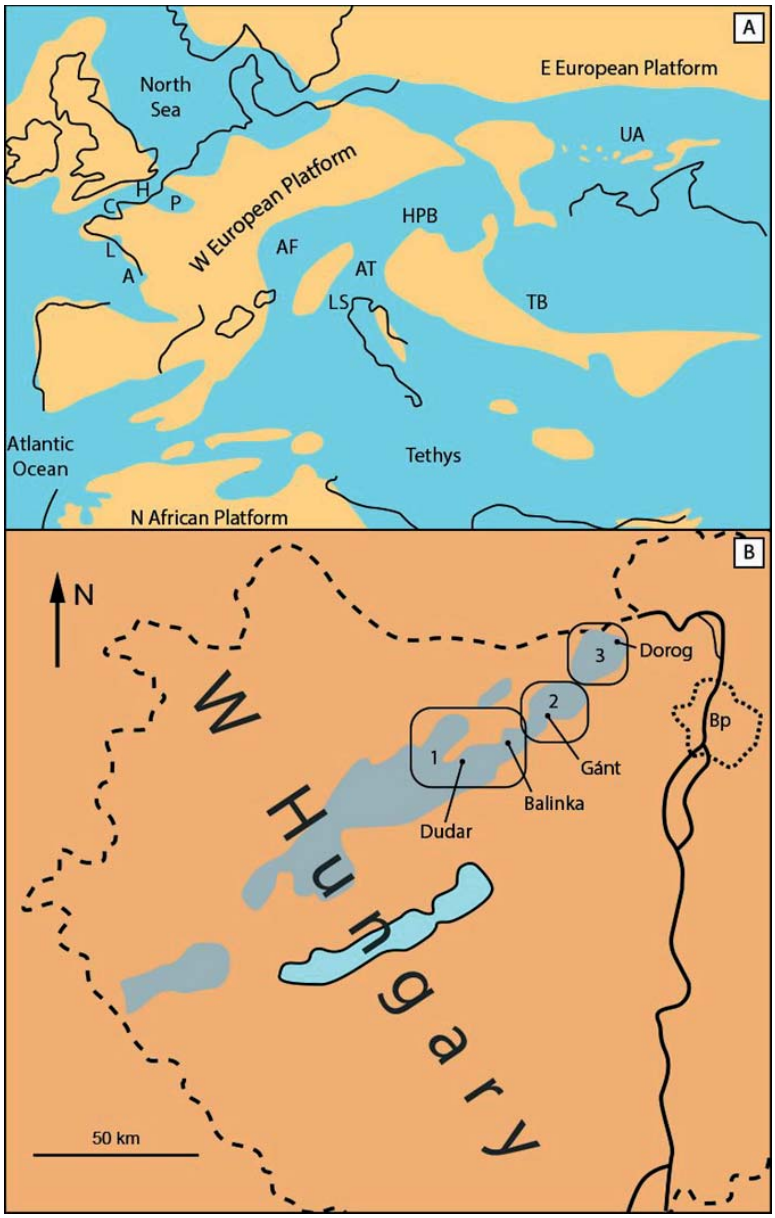


Fig. 1A. Middle Eocene palaeogeography of Europe. A – Aquitaine Basin, L – Loire Basin, C – Cotentin Basin, H – Hampshire Basin, P – Paris Basin, AF – Alpine Foredeep, AT – Alpine Tethys, LS – Lessini Shelf, HPB – Hungarian Paleogene Basin, TB – Thrace Basin, UA – Ukrainian Archipelago. **1B.** Lutetian–lower Bartonian deposits in the HPB, and the locations mentioned in the text. – 1. NE Bakony Mts. – 2. Vértes Hills. – 3. Gerecse Mts. – Bp. Budapest (Modified from Kovács & Vicián 2020)

(2020) are used. Abbreviations: SL – shell length, SW – shell width (given in mm), P – primary spiral cord on the convex part of the whorl, P1 – shoulder cord, IP – infrasutural primary cord, SP – subsutural cord, s – secondary spiral cord, D – apertural denticle, ID – infrasutural denticle.

SYSTEMATIC PALAEONTOLOGY

Class Gastropoda Cuvier, 1797
Superfamily Tonnoidea Suter, 1913
Family Cassidae Latreille, 1825

Remarks – Two subfamilies were recognized by Strong *et al.* (2019) within the Cassidae: Cassinae Latreille, 1825 and Phaliinae Beu, 1981. In the Hungarian Eocene the Cassinae is represented by three genera: *Galeodea*, *Cassis*, and *Sconsia*.

Subfamily Cassinae Latreille, 1825
Genus *Galeodea* Link, 1807
Type species – *Buccinum echinophorum* Linnaeus, 1758

Remarks – Fossil species of the Late Cretaceous – Recent *Galeodea* were recently discussed by Beu (2008, 2010), Gain *et al.* (2017), and Squires (2019). Eocene representatives of the genus are characterized by a small to medium-sized shell with low to moderately high spire and paucispiral protoconch, globose, carinate last whorl, spiral sculpture of spiral rows of tubercles and spiral cords, axial sculpture of varices, wide aperture, slightly flared, denticulate outer lip, concave columella with irregular horizontal folds, expanded parietal callus, short to long, twisted siphonal canal. *Galeodea* displays a world-wide geographical range in the middle–late Eocene appearing in the W African Shelf, the E Atlantic and the Indo-Pacific faunal provinces as well.

Galeodea nodosa (Solander, 1766)
(Figs 2–3)

1766 *Buccinum nodosum* – Solander, p. 43, fig. 131.
1925 *Cassidaria nodosa* (Solander) – Schlosser, p. 111, pl. 4, fig. 13 (*cum syn.*).
1934 *Galeodea nodosa* (Solander) – Wrigley, p. 120, pl. 17, figs 31–32.
1972 *Cassidaria nodosa* (Solander) – Kecskeméti-Körmendy, p. 245, pl. 20, figs 7–8.
1998 *Galeodea nodosa* (Solander) – Schultz, p. 28, pl. 6, fig. 4.
2011 *Mambrinia* cf. *nodosa* (Solander in Brander) – Schnetler & Heilmann-Clausen, p. 68, pl. 5, fig. 4.

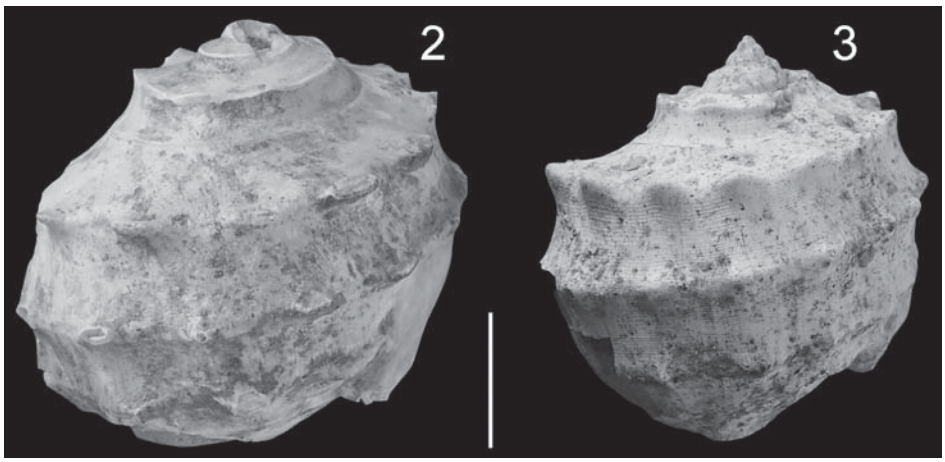
non 1973 *Cassidaria nodosa* (Solander in Brander) – Báldi, p. 281, pl. 35, figs 1–2 [= *Galeodea megacephala* (Philippi, 1843)].

Material – HNHM M.62.1213, INV 2021.76., and 6 fragmentary specimens in private collections of Gurdon, Zsoldos and the authors, max. SL 34 mm.

Description – Medium-sized shells, moderately low spire, slightly concave sutural ramp, globose last whorl. Aperture, siphonal canal lost, columella broken. Spiral sculpture of fine threads and four carinae bearing widely spaced, sharp, spinose tubercles.

Remarks – *Galeodea nodosa* was synonymized with the Miocene–Recent *G. echinophora* (Linnaeus) by Beu (2008) without any comments. The Eocene *nodosa* specimens are highly variable in morphology but differ from *echinophora* by having much lower spire and fewer carinae, so the arrangement of Squires (2019) are accepted herein, and *Galeodea nodosa* (Solander) is recognized as an available taxon.

The species is characterized by four well-developed, tuberculate carinae on the last whorl, a weak fifth carina may appear abapically. Several varieties are distinguished in the literature on the basis of the number and strength of spiral threads between the carinae (see Wrigley 1934, Gain *et al*. 2017). The middle Eocene *Galeodea tetratropis* Gain, Belliard et Le Renard differs from *G. nodosa* by non-tuberculate carinae. *Galeodea nodosa* is widely distributed in the middle–late Eocene HPB but generally represented by poorly preserved, fragmentary specimens or internal moulds. The Egerian (late Oligocene – early Miocene) specimen illustrated by Báldi (1973, pl. 35, figs 1–2) as *Cassidaria nodosa* bears a very low spire and four rows of more widely spaced and more projected spines, its morphology agrees with that of *Galeodea megacephala* (Philippi).



Figs 2–3. *Galeodea nodosa* (Solander), Dudar, lateral views. – **Fig. 2.** HNHM M.62.1213., SL 32. – **Fig. 3.** Coll. Gurdon, SL 30. Scale bar: 10 mm

Distribution – Middle Eocene – early Oligocene. Eocene records: Lutetian–Bartonian: NE Atlantic (England: Hampshire Basin, France: Paris Basin, Denmark: North Sea Basin), Alpine Tethys (N Italy, Hungary: HPB, Dudar; Dorog Basin. Bartonian: Romania, Transylvanian Basin), Alpine Foredeep (Lutetian: N Switzerland, S Germany, and Austria). Priabonian: Ukrainian Archipelago.

Genus *Cassis* Scopoli, 1777
Type species – *Buccinum cornutum* Linnaeus, 1758

Remarks – Fossil species of the genus were recently discussed by Beu (2010), Gain *et al.* (2017), Kovács & Vicián (2018), and Landau *et al.* (2020). Paleogene *Cassis* species are characterized by a medium-sized, helmet-shaped shell, multispiral protoconch of smooth whorls, shouldered teleoconch whorls, sculpture of spiral cords and tuberculate axial ribs, elongate aperture, thickened, denticulate outer lip, excavated columella with irregular horizontal folds and denticles, broad, thickened parietal callus and a deep, narrow, strongly twisted siphonal canal.

Cassis is probably one of the descendants of *Galeodea* appearing first in the early Eocene [e.g. *Cassis maussieri* (Cossmann)], and showing a higher degree of diversification during the middle Eocene. In Europe seven species are known from the middle–late Eocene NE Atlantic region in France: *Cassis harpaeformis* Lamarck, *C. verrucosa* Perry (= *C. cancellata* Lamarck), *C. chevallieri* (Cossmann), *C. brasili* (Cossmann et Pissarro), *C. nigellensis* Gain, Belliard et Le Renard, *C. lelongi* Gain, Belliard et Le Renard, *C. parfouruorum* Gain, Belliard et Le Renard – the genus is absent in the Hampshire and the North Sea basins. Five species have been recorded in the Alpine Tethys (N Italy, Croatia) and the Alpine Foredeep (N Switzerland, S Germany, Austria): *Cassis deshayesi* (Bellardi) (= *C. mamillaris* var. *tuberculornata* De Gregorio), *C. thesei* Brongniart, *C. gregorii* Schlosser, *C. postalensis* Oppenheim, and *C. harpaeformis* Lamarck (= *C. mamillaris* var. *ingens* De Gregorio). *Cassis harpaeformis* was also recorded from the Priabonian Thrace Basin (Bulgaria) (Karagiuleva 1964: p. 186, pl. 52, figs 11–13). In the middle–late Eocene Tethyan N–NE African Shelf two species occur: *Cassis nilotica* Bellardi (Egypt, Libya, Somalia) (Piccoli & Savazzi 1983) and *C. anwari* Abbass (Egypt). In the Turan Sea ? *Cassis thesei* was recorded from the Bartonian of S Georgia (Isaeva 1933), and *C.* cf. *deshayesi* from the Priabonian of SW Armenia (Aslanyan 1970: p. 141, pl. 9, fig. 2). One species is known in the ? Ypresian E Tethys: *C. subharpaeformis* d'Archiac et Haime (Indus Basin), and another in the Priabonian Indo-Pacific: *Cassis jogjacartensis* Martin (Nanggulan Formation, Java) (Abbott 1968).

Taxonomic arrangements of earlier Hungarian literature need to be revised. *Phalium* Link, 1807 is a Miocene–Recent genus typical of the Indo-West Pacific,

and is characterized by spine-like marginal serrations on the abapical part of the outer lip. The Eocene–Recent *Semicassis* Mörch, 1852 possesses a globose, non-shouldered last whorl with sculpture of prominent to absent spiral grooves; this sculpture differs in the lack of well-defined to weak axial ribs from that of *Cassis*.

Cassis thesei Brongniart, 1823
(Figs 4–15)

1823 *Cassis thesei* – Brongniart, p. 66, pl. 3, fig. 7.
1823 *Cassis aeneae* – Brongniart, p. 66, pl. 3, fig. 8.
1911 *Cassidea thesei* Brongniart – Boussac, p. 342, pl. 20, figs 22, 34.
? 1933 *Cassidea thesei* Brongniart – Isaeva, p. 36, pl. 3, fig. 22.
1966 *Phalium* (*Semicassis*) sp. – Strausz, p. 52, pl. 15, figs 1, 3.
1968 *Cassis thesei* Brongniart – Abbott, p. 12–479, pl. 33 (*cum syn.*).

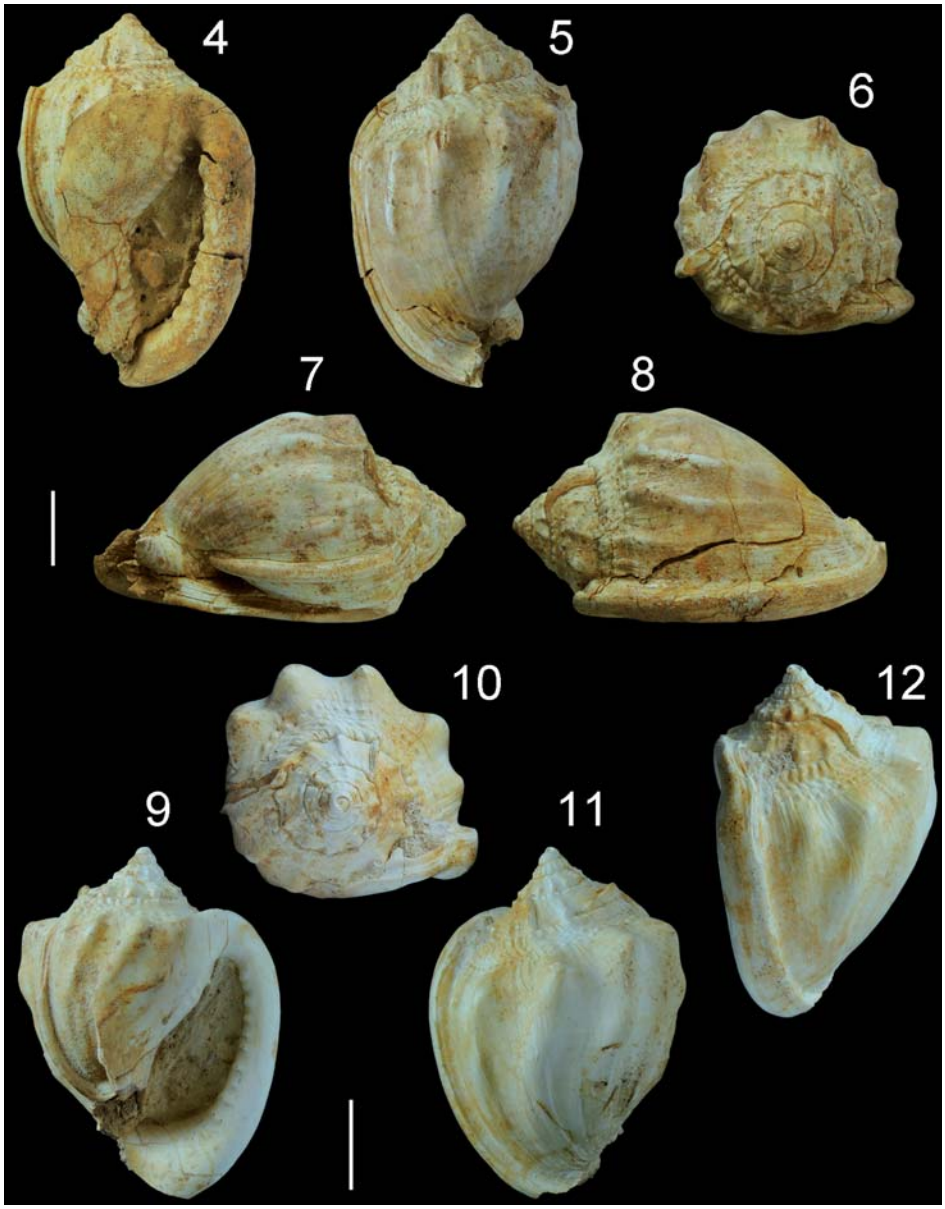
non 1880 *Cassis* (*Phalium* ?) *aeneae* Brongniart – De Gregorio, p. 43, pl. 1, fig. 38, pl. 5, figs 37–39, 44 (= *Cassis gregorii* Schlosser, 1825).
non 1896 *Cassis thesei* Brongniart – De Gregorio, p. 50, pl. 5, fig. 2 [= *Cassis harpaeformis* (Lamarck, 1803)].
non 1974 *Cassis eneae* (sic!) Brongniart – Moisescu & Mészáros, p. 33, pl. 4, figs 10, 31.
non 1988 *Cassidea* (*Semicassis*) *aeneae* (Brongniart) var. – Mellini & Quaggiotto, p. 71, pl. 7, fig. 3 (= *Cassis gregorii* Schlosser, 1825).
non 1988 *Semicassis aeneae* (Brongniart) – Abate *et al*., pl. 2, fig. 2 (= *Cassis gregorii* Schlosser, 1825).
non 1988 *Semicassis thesei* (Brongniart) – Abate *et al*., pl. 2, fig. 5 (= *Cassis gregorii* Schlosser, 1825).

Material – HNHM M.62.1214.1–3, MGSH E.522, E.548, and 9 specimens in private collections of Gurdon, Szakonyi, and Zsoldos, max. SL 55 mm.

Description – Medium-sized, helmet-shaped shell with moderately elevated spire. Protoconch of two smooth, rounded whorls. Rounded, shouldered teleoconch whorls, impressed suture. Beaded subsutural and infrasutural spiral cords with fine spiral threads between. Rounded last whorl, elongate, ovate aperture, outer lip thickened by well-developed labral varix, strong denticles within. Excavated columella bearing numerous irregular horizontal folds, broad, flattened, flared parietal callus. Narrow and deep siphonal canal, strongly recurved posteriorly and adapically. Axial sculpture of widely spaced, rounded, opisthocline ribs weakening abapically. Ribs tuberculate at shoulder and on periphery.

Remarks – The specimens in the studied assemblage are closely allied in size and morphology to the type (refigured by Abbott 1968), and to the syntype [MNHN.F.B45730: website of the Muséum national d'Histoire naturelle (Paris) https://science.mnhn.fr/institution/mnhn/collection/f/item/b45730] of *Cassis thesei*. The smaller *Cassis aeneae* with identical morphology was regarded as the juvenile form of *C. thesei* by Schlosser (1925) and Abbott (1968). The ma-

terial recorded by De Gregorio (1880) from S. Giovanni Ilarione differ from *Cassis thesei* by their more slender shell with much higher spire; for these speci-



Figs 4–12. *Cassis thesei* Brongniart, Dudar. – **Figs 4–8.** Coll. Gurdon, SL 50, apertural, abapertural, apical and lateral views. – **Figs 9–12.** Coll. Gurdon, SL 39, apertural, apical, abapertural and lateral views. Scale bars: 10 mm

mens a new name, *C. gregorii* was introduced by Schlosser (1925). The poorly preserved Oligocene specimens from the Transylvanian Basin illustrated by Moisescu & Mészáros (1974) as *Cassis eneae* (sic!) are difficult to interpret; this material needs to be revised.

Distribution – Lutetian–Bartonian: Alpine Tethys (N Italy: Lessini Shelf, Hungary: HPB, Dudar), Alpine Foredeep (N Switzerland, S Germany), ? Turan Sea (Georgia).

Cassis kalmani n. sp.
(Figs 16–23)

1966 *Phalium* (*Semicassis*) *harpaeforme* – Strausz, p. 52, pl. 15, figs 4–5 (non Lamarck).

Holotype – HNHM M.62.1210, SL 50 mm, SW 39.4 mm (Figs 16–19).

Paratype 1 – HNHM M.62.1211, SL 54 mm, SW 41 mm (Figs 20–22).

Paratype 2 – MGSH E.549, SL 40 mm, SW 31 (Strausz 1966, pl. 15, figs 4–5).

Paratype 3–6 – HNHM PAL 2021.31.1., PAL 2021.32.1., PAL 2021.33.1., PAL 2021.34.1.

Paratype 7 – Coll. Vicián.

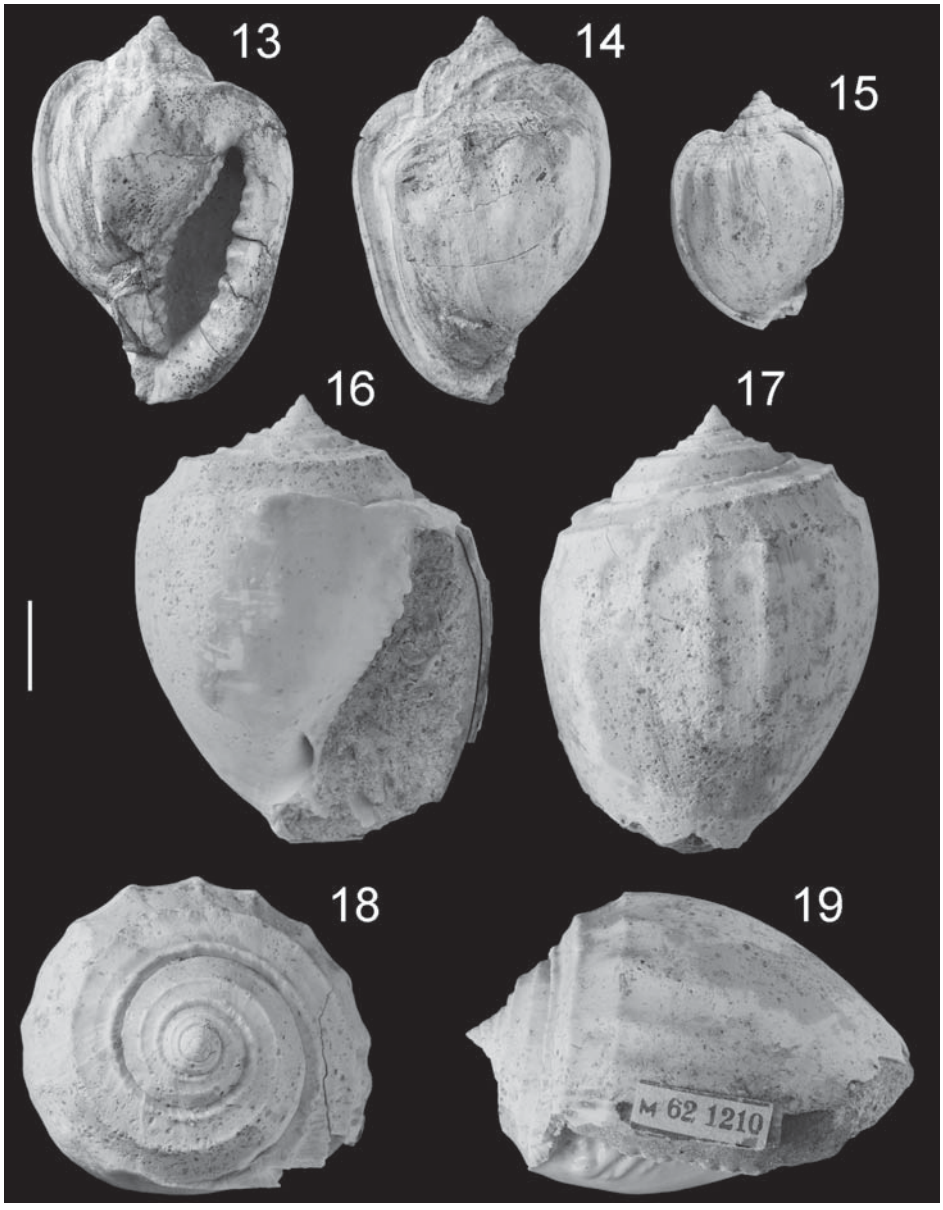
Type strata and locality – Upper Lutetian gray marl (Csernye Formation), Dudar, Hungary.

Derivation of name – In honour of Kálmán Jakab, mechanical manager of the DUSZÉN Kft. (opencast brown coal mine, Dudar, Hungary).

Material – Holotype, Paratypes 1–7, HNHM INV 2021.77., INV 2021.78., and 16 specimens in private collections of Gurdon, Zsoldos and the authors, max. SL 54 mm.

Diagnosis – Medium-sized, helmet-shaped shell, moderately elevated spire, paucispiral protoconch of rounded, smooth whorls, five teleoconch whorls, last whorl rounded, wide, shallow concave groove below the shoulder, aperture ovate, columella folded, parietal callus broad, axial ribs widely spaced, broad, low, rounded with two rows of tubercles on last whorl.

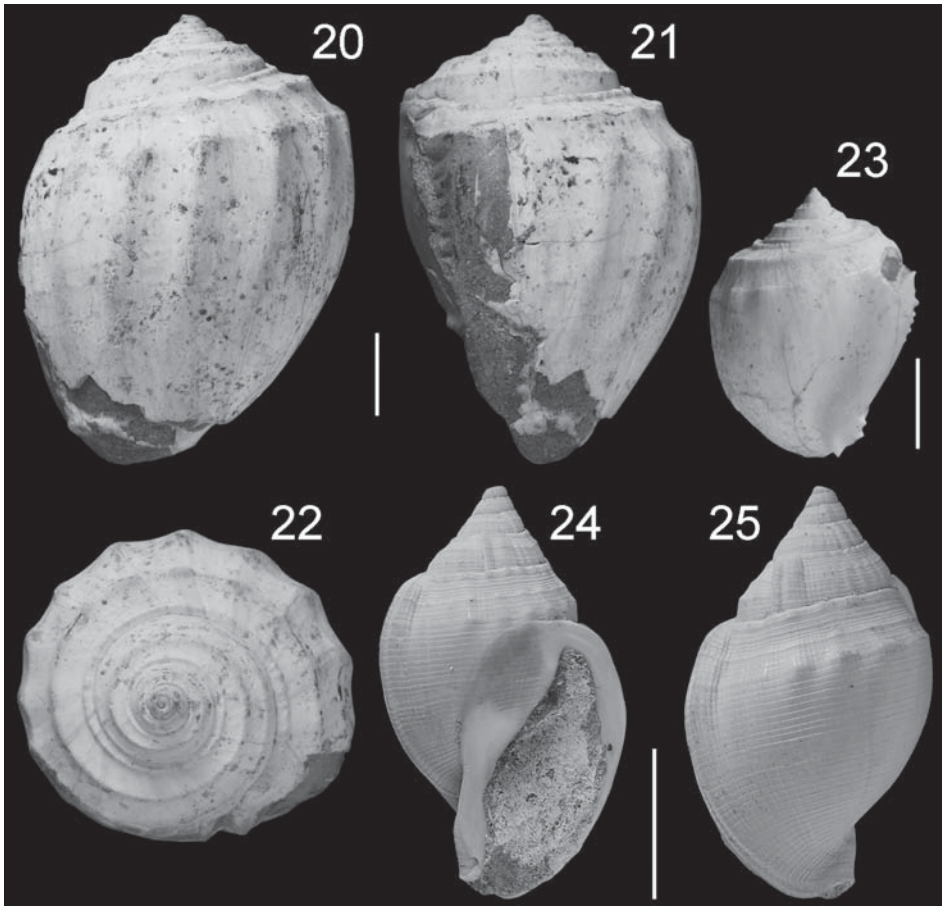
Description – Medium-sized, somewhat globose, helmet-shaped shell, moderately elevated, slightly gradate spire. Eroded protoconch of approx. two rounded, smooth whorls, teleoconch of six whorls. First two teleoconch whorls are covered by fine, dense spiral threads which disappear on late whorls. Suture impressed, canaliculated by a narrow, sharp, beaded subsutural spiral cord. Sutural ramp almost horizontal, shallowly channelled, shoulder angulated. Rounded last whorl approx. 90% of the total height with a wide, shallow, concave groove below the shoulder. Elongate, ovate aperture, outer lip thickened by moderately developed terminal varix, prominent denticles within. Well-developed, rounded anal



Figs 13–15. *Cassis thesei* Brongniart, Dudar. – **Figs 13–14.** Coll. Gurdon, SL 43, apertural and abapertural views. – **Fig. 15.** HNHM M.62.1214.1, SL 26.4, abapertural view. – **Figs 16–19.** *Cassis kalmani* n. sp., holotype, HNHM M.62.1210, Dudar, SL 50, apertural, abapertural, apical and lateral views. Scale bar: 10 mm

canal. Columella bears numerous irregular horizontal folds, parietal callus broad. Siphonal canal not preserved. Axial sculpture of fine growth line on early teleoconch whorls, well-developed ribs from the fourth whorl, episodic varices absent. Ribs widely spaced, low, moderately broad and rounded, weakening abapically, 10–12 on last whorl, tuberculate at shoulder and below the groove.

Remarks – *Cassis kalmani* n. sp. is characterized by its globose last whorl, channelled sutural ramp, widely spaced ribs, and two rows of tubercles on the last whorl adapically. The parietal callus is less expanded than that of the typical *Cassis* species (e.g. the Lutetian *harpaeformis* or *chevallieri*). The material was interpreted as *harpaeformis* by Strausz (1966), however, the latter differs by non-



Figs 20–23. *Cassis kalmani* n. sp., Dudar. – **Figs 20–22.** Paratype 1, HNHM M.62.1211, SL 54 mm, abapertural, lateral and apical views. – **Fig. 23.** Paratype 3, HNHM PAL 2021.31.1., SL 30.3, abapertural view. – **Figs 24–25.** *Sconsia ambigua* (Solander), HNHM M.65.148, Dudar, SL 27.4, apertural and abapertural views. Scale bars: 10 mm

channelled sutural ramp, strongly angulate shoulder, generally less rounded last whorl bearing denser and sharper axial ribs, and flared parietal callus (see Gain *et al*. 2017, figs 223–225, 228–230). Two *harpaeformis* specimens appear in the literature with globose last whorl (see Gain *et al*., l.c. figs 226–227) but both bear denser ribs, and different spire from that of *C. kalmani* n. sp. The middle Eocene *C. parfouruorum* (Gain *et al*. 2017, figs 236–238) (Cotentin Basin) with its rounded last whorl, elevated, gradate spire and canaliculated sutural ramp resembles the new species described herein but is distinguishable by much denser, narrower and sharper, regular ribs. *Cassis kalmani* n. sp. is common in the tonnoidean assemblage of Dudar.

Genus *Sconsia* Gray, 1847
Type species – *Cassidaria striata* Lamarck, 1816

Remarks – Paleogene *Sconsia* species were discussed by Wrigley (1934), Gardner (1939), Alekseyev (1963), and Tracey (1992). As the morphology of the earliest representatives is very closely allied to that of *Galeodea* (Beu 2010), *Sconsia* is probably one of the descendants of *Galeodea* appearing in the early Eocene and is characterized by an elongate, subfusiform shell with rounded whorls, spiral sculpture of fine smooth to tuberculate cords and grooves and axial sculpture of well-defined varices. At least two *Sconsia* species are known from the middle Eocene NE Atlantic: *Sconsia ambigua* (Solander) and *S. calantica* (Deshayes); three species occur in the Bartonian Alpine Tethys: *Sconsia ambigua*, *S. orbignyi* (Bellardi) (Alpine Foredeep), and *S. substriata* (d'Orbigny) [= *Cassis* (*Phalium*) *mitissima* De Gregorio] (N Italy: Lessini Shelf), and one appears in the SW Tethys: *S. ambigua* (= *Sconsia cyrenaica* Stefanini) (Libya).

Sconsia ambigua (Solander, 1766)
(Figs 24–25)

1766 *Buccinum ambiguum* – Solander, p. 28, pl. 4, fig. 56.
1921 *Sconsia cyrenaica* n. sp. – Stefanini, p. 116, pl. 16, fig. 12.
1933 *Cassidea ambigua* Solander – Isaeva, p. 35, pl. 3, fig. 21.
1934 *Sconsia ambigua* (Solander) – Wrigley, p. 114, figs 16–17, 19.
? 1953 *Galeodea ambigua* Br. – Sieber, p. 365.
1963 *Cassidea ambigua* Solander – Alekseyev, p. 84, pl. 17, figs 1–2.
1968 *Phalium ambiguum* (Solander) – Zelinskaya *et al*., p. 53, pl. 14, figs 5–6.
1999 *Sconsia* cf. *ambigua* (Solander in Brander) – Löffler, p. 43, pl. 8, fig. 10 (*cum syn*.).
2014 *Sconsia ambigua* (Solander in Brander) – Müller *et al*., p. 93, pl. 2, fig. 22.

Material – HNHM M.65.148, and 2 specimens in private collection of Gurdon, max. SL 30 mm.

Description – Subfusiform shell, protoconch lost. Preserved teleoconch of five rounded whorls. Conical spire, wide sutural ramp, slightly rounded on spire, concave on last whorl bearing fine spiral threads and a strong spiral cord in the middle. Last whorl rounded, shouldered, aperture ovate, outer lip thickened by labral varix. Siphonal canal narrow, slightly twisted, moderately expanded parietal callus. Last whorl sculptured by dense spiral grooves and weak, irregularly developed tubercles on shoulder. Axial sculpture of weakly developed ribs and narrow, projected varices.

Remarks – The specimen figured herein agrees in morphology with the Bartonian–Priabonian material illustrated in the literature but is somewhat more slender. *Sconsia substriata* has a shorter siphonal canal and much projected spiral row of tubercles on the sutural ramp, while *S. orbignyi* has a more slender shell. Although the spiral sculpture cannot be observed, other morphological features (e.g. tuberculate shoulder) of the poorly preserved type specimen of *Sconsia cyrenaica* Stefanini, 1921 agree well with that of *S. ambigua*; the taxon is recognized as a junior synonym. *Sconsia ambigua* was listed from the early Oligocene HPB by Szőts (1956), this record, however, cannot be confirmed in lack of specimens in the museum collections. The late Lutetian appearance of *Sconsia ambigua* in the HPB is probably the earliest record of the species.

Distribution – Middle Eocene: SW Tethys, N African Shelf (Libya) (*Sconsia cyrenaica*). Lutetian: NE Atlantic (England: Hampshire Basin), Alpine Tethys (Hungary: HPB, Dudar), ? Alpine Foredeep (Austria). Priabonian: Alpine Tethys (N Italy), Alpine Foredeep (French Maritime Alps), Thrace Basin (Bulgaria), Ukrainian Archipelago, Turan Sea (Georgia, SW Armenia). Rupelian: North Sea Basin (Belgium, Germany), Molasse Basin (Bad Häring, Austria), Turan Sea (N Aral region, Kazakhstan).

Family Charoniidae Powell, 1933

Remarks – Subfamily Charoniinae Powell was recognized at family level by Strong *et al.* (2019). The originally monogeneric taxon was completed with a new genus, *Protocharonia* Craig et Tracey by Craig *et al.* (2020); in the present paper another genus, *Semiranella* De Gregorio is also assigned to the Charoniidae.

Genus *Semiranella* De Gregorio, 1880

Type species – *Triton* (*Semiranella*) *gemmellari* De Gregorio, 1880

Diagnosis – Medium-sized shell, multispiral, smooth protoconch, angulate teleoconch whorls, ovate aperture with labral varix and generally split denticles, spiral sculpture of cords and rows of spiny tubercles, axial sculpture of one varix per whorl at approx. every 240°.

Remarks – *Semiranella* was synonymized under *Sassia* or *Charonia* in the previous literature (Beu 1998) but it is regarded herein as an available taxon. Four species are assigned to the genus. The earliest representatives appear in the late Paleocene: *Semiranella vincenti* (Tzankov) (Tzankov 1940, p. 10, fig. 11; Karagiuleva 1964, p. 188, pl. 52, figs 15–16), and *S. multinodosa* (Traub) (Traub 1979, p. 105, pl. 14, figs 2–3); their morphology with elongate teleoconch and dominance of tuberculate spiral sculpture is typical of the genus. In the Eocene the late Ypresian–early Lutetian *Semiranella spinosa* (Rouault) (NW Atlantic, Aquitaine Basin, see Cossmann in O'Gorman 1923), and the Lutetian *S. gemmellaroi* (De Gregorio) (Alpine Tethys) are recognized. The morphology of the genus is close to *Charonia* in the development of the protoconch, and the dominance of spiral sculpture, but *Semiranella* differs by having a smaller and broader shell with fewer teleoconch whorls, spiral rows of strong, "spiny" tubercles, narrower aperture with prominent labral varix [resembling that of *Tritonoranella ranelloides* (Reeve)], and the lack of flaring outer lip. On the other hand the genus differs from *Sassia* by its smooth protoconch and from *Pseudosassia* n. gen. by the seven primary spiral rows of tubercles, and the lack of prominent axial ribs.

Semiranella gemmellaroi (De Gregorio, 1880)
(Figs 26–30)

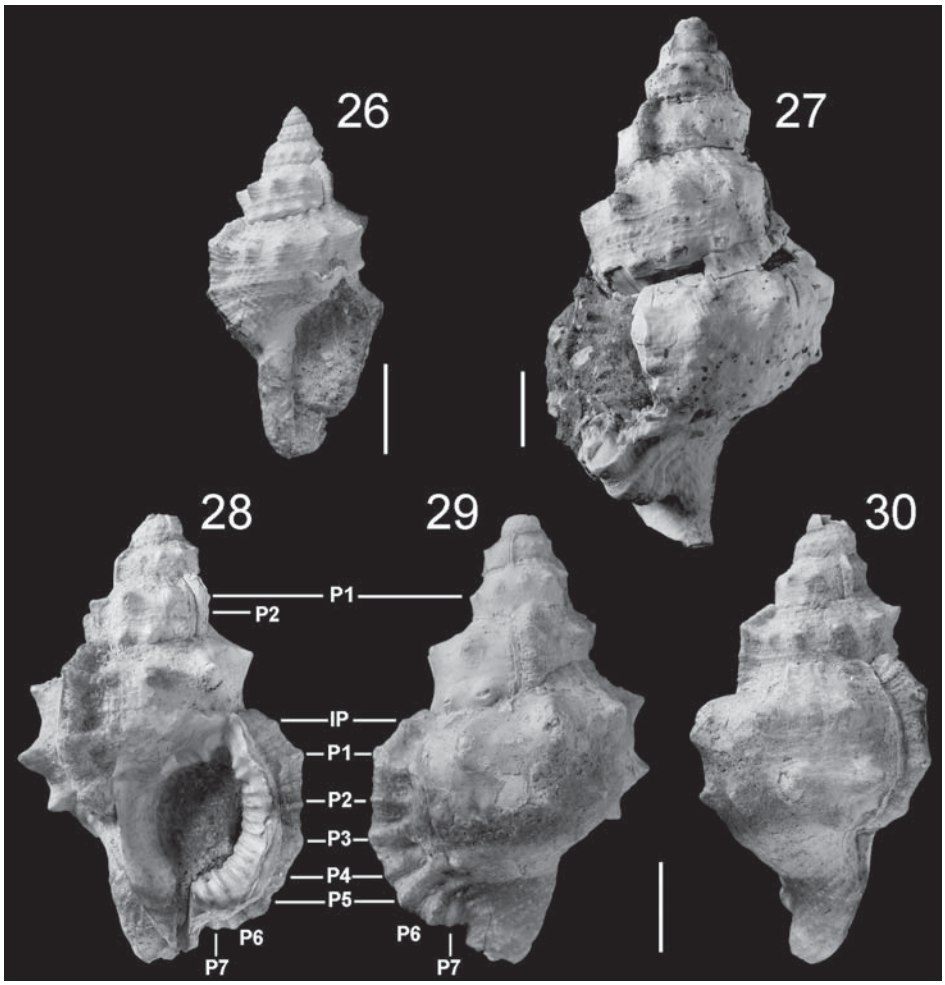
1877 *Triton spinosum* – Mayer, pl. 2, fig. 8 (non Rouault).
1880 *Triton* (*Semiranella*) *gemmellari* De Gregorio – De Gregorio, p. 99, pl. 4, figs 21–22, pl. 7, fig. 62.
1923 *Eutritonium* (*Sassia*) *spinosum* – Cossmann in O'Gorman, p. 88, pl. 6, figs 11–12 (non Rouault).
1925 *Eutritonium Gemmellari* de Gregorio – Schlosser, p. 113, pl. 4, fig. 15.
1988 *Charonia* (*Sassia*) *gemmellarii* (De Gregorio) – Mellini & Quaggiotto, p. 71, pl. 7, fig. 2.
1992 *Sassia gemmellari* (De Gregorio) – Mellini & Quaggiotto, p. 87.

Material – 7 specimens in private collections of Gurdon, Zsoldos and the authors, max. SL 71 mm.

Description – Medium-sized shell with conical protoconch of 4 1/4 convex, smooth whorls (height 2.38 mm), junction with teleoconch sharply delimited, prosocline. Spire of four gradate whorls with steep, somewhat concave sutural ramp, and superficial, undulating suture. Broad, shouldered last whorl (67–71% of the total length). Wide, ovate aperture, outer lip thickened by prominent labral varix, denticulate within (ID, D1–D7; ID, D1–D4 split). Well-developed anal canal, strong parietal denticle, moderately developed parietal callus, columella bearing irregular folds. Short, slightly recurved siphonal canal. Spiral sculpture of fine cords and four rows of beads (infrasutural primary row IP, primary rows P1–P3) on first teleoconch whorl. The shoulder row (P1) is the strongest, its tuber-

cles become stronger and widely spaced on second teleoconch whorl, P2 remains weak throughout the whole shell, P3 tubercles become spiny on third teleoconch whorl. On last whorl IP and fine secondary spiral cords on sutural ramp, P1, P3, P4 consist of spiny tubercles, while P5–P7 are finer rows of beads. Fine rows of beads and spiral cords appear also on siphonal fasciole. Axial sculpture of regularly spaced prominent varices at every 240°, and growth lines.

Remarks – The development of the P1 and P3 tubercles from small, rounded beads to strong spiny forms is generally gradual, but on some specimens the



Figs 26–30. *Semiranella gemmellaroi* (De Gregorio), Dudar – **Fig. 26.** Coll. Zsoldos, SL 39, apertural view. – **Fig. 27.** Coll. Kovács, SL 70, abapertural view. – **Figs 28–30.** Coll. Vicián, SL 49, apertural, abapertural and lateral views. Scale bars: 10 mm

change occurs suddenly on the third teleoconch whorl after a varix as is demonstrated by the larger specimen of De Gregorio (1880, pl. 7, fig. 62). *Semiranella spinosa* is probably the ancestor of *S. gemmellaroi*, it is similar in size and morphology but is distinguished by wider infrasutural ramp and more developed shoulder spines.

The spelling of *gemmellari* had already been emended as *gemmellaroi* by Vinassa de Regny (1895) (see ICZN, Art. 32.5.1) but this emendation was overlooked in the subsequent literature.

Distribution – Early–middle Eocene: NE Atlantic (Ypresian: Aquitaine Basin, France), Alpine Tethys (Lutetian: N Italy: Lessini Shelf, Hungary: HPB, Dudar), N Alpine Foredeep (Lutetian: N Switzerland, S Germany).

Family Cymatiidae Iredale, 1913

Remarks – The taxon was revised recently by Strong *et al.* (2019). There is no consensus in the literature on the related fossil genera; in this paper *Sassia* Bellardi, *Monoplex* s.l. Perry, *Cymatiella* Iredale, *Parasassia* Craig et Tracey, *Protoplex* Craig et Tracey, and *Pseudosassia* n. gen. are included provisionally.

Genus *Pseudosassia* n. gen.

Type species – *Triton flandricum* Koninck, 1838 (Lectotype in Marquet 2016, p. 21, fig. 2). Rupelian, early Oligocene, Belgium.

Derivation of name – Combination of the Greek prefix 'pseudo-' (meaning false) and the genus name *Sassia* Bellardi, 1873 describing the overall teleoconch similarity between the two genera. Gender feminine.

Diagnosis – Medium-sized, subfusiform shell (max. SL ~52 mm), slightly distorted coiling, multispiral protoconch with whorls smooth to weakly sculptured by spiral threads, elevated spire, rounded to shouldered teleoconch whorls, subcircular to ovate aperture, denticulate (ID, D1–6) outer lip thickened by labral varix, parietal callus and columella with irregular folds, spiral sculpture of moderately developed to strong, regularly spaced primary cords (IP, P1–P6), fine secondaries and tertiaries, axial sculpture of ribs and generally one varix per whorl.

Remarks – As mentioned by Craig *et al.* (2020), in the last 150 years *Sassia* has widely been used as a convenient genus for Paleogene cymatiids, although its peculiarity (high diversity, wide stratigraphical distribution, huge range of size and sculpture) was obvious for researchers (Beu 2010). Based on molecular phylogeny (*Sassia* is polyphyletic, Strong *et al.* 2019), and morphological criteria (Craig *et al.* 2020) the validity of the genus became questionable. In order to clarify the taxonomy, ten new genera were introduced in Craig *et al.* (2020) for Eocene species which had been attributed to *Sassia* sensu lato in the literature. Because medium-

sized "*Sassia*" specimens did not occur in the assemblages of Craig *et al.* (2020), only the morphological differences of certain *Sassia* s.l. species were analysed by the authors without designation a new genus. However, it seems important to introduce a new taxon for several morphologically closely allied *Sassia* s.l. species, so a new genus is proposed here, *Pseudosassia* n. gen. The protoconch of its type, *Triton flandricum* Koninck consists of 3–3.5 smooth, rounded whorls bearing only widely spaced, fine spiral threads (Riedel 1995, fig. 40; Marquet 2016, pl. 3, fig. 4). *Sassia* sensu stricto species – e.g. the Miocene–Pliocene type species, *S. apenninica* (Sassi), the Miocene *S. raulini* (Cossmann et Peyrot), the Oligocene *S. foveolata* (Sandberger), the early Eocene *S. delafossei* (Rouault) and the Paleocene *S. faxense* (Ravn) – are similar in overall morphology to *Pseudosassia* n. gen. but distinguished by smaller size (SL <42 mm) and dome-shaped protoconch with cancellate sculpture at least on the last protoconch whorl.

Other Cenozoic species from Europe and the Turan Sea included: *Triton antiquum* Deshayes, *Tritonium* (*Sassia*) *bjerringi* Ravn, *Charonia* (*Sassia*) *angusta* Traub, *Charonia* (*Sassia*) *danica* Schnetler (Paleocene); *Murex argutus* Solander, *Triton expansus* J. de C. Sowerby, *Murex* (*Muricidea*) *rheanus* De Gregorio, *Sassia planocincta* Wrigley, *Tritonium expansum choresmicum* Alekseyev (Eocene); *Triton expansum postera* Koenen, *Triton multigranus* Koenen, *Charonia* (*Sassia*) *karynjarynica* Amitrov (Oligocene); *Tritonium turritum* Eichwald (Miocene). (The "*Sassia*" species not mentioned herein from Europe or other palaeogeographic regions need further research.)

Distribution – Paleocene–Miocene, Europe (NE Atlantic, North Sea Basin, Alpine Tethys), and the Turan Sea.

Pseudosassia gurdoni n. sp.
(Figs 31–33)

Holotype – HNHM PAL 2021.4.1., SL 45.4 mm, SW 24.2 mm.

Type strata and locality – Upper Lutetian gray marl (Csernye Formation), Dudar, Hungary.

Derivation of name – In honour of István Gurdon, fossil shell collector (Veszprém, Hungary).

Material – Holotype, and one specimen in private collection of Gurdon (max. SL 45.4 mm).

Diagnosis – Medium-sized, subfusiform shell, multispiral protoconch, teleoconch of six angulate whorls, wide last whorl, ovate aperture, denticulate outer lip, thick labral varix, long, recurved siphonal canal. Sculpture of strong, subdivided primary, and fine secondary and tertiary spiral cords, rounded axial ribs, varices, microsurface pattern of fine growth lines.

Description – Medium-sized, subfusiform shell, eroded multispiral protoconch, smooth, rounded, fragmentary last protoconch whorl, junction with teleoconch slightly prosocline, sharply delimited. Elevated spire, teleoconch of six angulate whorls with incised suture and steep sutural ramp. Suddenly widening last whorl (70% of the total length). Ovate aperture, outer lip thickened by labral varix, denticulate within (ID, D1–6), long, narrow, recurved siphonal canal. Spiral sculpture of strong primary cords (IP, P1–P3 on spire whorls, IP, P1–P6 on last whorl), and fine secondary and tertiary cords. P1–P5 subdivided by a narrow median groove. Subsutural spiral cords are more developed on the first four teleoconch whorls. Axial sculpture of prominent, narrow, rounded ribs overridden by the spiral cords, fine growth lines, and one varix per whorl from the fourth teleoconch whorl. Last whorl bears seven ribs which are more prominent than those on spire whorls, and P1 becomes slightly spiny at intersections.

Remarks – The specimen figured here belongs to the *Pseudosassia expansa* group with *P. expansa postera*, *P. rheana*, *P. planocincta* and *P. choresmica*. All these species are characterized by having a medium-sized shell with broad and steep sutural ramp, and expanded last whorl with maximum width at the shoulder. *Pseudosassia gurdoni* n. sp. is distinguishable by somewhat less developed primary spiral cords and the presence of a special microsurface pattern of fine growth lines.

Pseudosassia traceyi n. sp.
(Fig. 34)

Holotype – HNHM M.62.1220., SL 28 mm, SW 15.3 mm.

Type strata and locality – Upper Lutetian gray marl (Csernye Formation), Dudar, Hungary.

Derivation of name – In honour of Steve Tracey, English palaeontologist with the Natural History Museum, London.

Material – Holotype.

Diagnosis – *Pseudosassia* species with medium-sized, subfusiform shell. Multispiral protoconch, teleoconch of five angulate whorls, ovate aperture, folded columella. Sculpture of well-developed, rounded primary, finer secondary and tertiary spiral cords, rounded axial ribs, one varix per whorl, fine growth lines, reticulate interspaces.

Description – Medium-sized, subfusiform shell with non-distorted coiling. Eroded multispiral protoconch with smooth and rounded last protoconch whorl, junction with teleoconch almost orthocline, sharply delimited. Teleoconch of five angulate whorls with moderately steep sutural ramp, maximum width at P2 spiral cord. Last whorl approx. 72% of the total length. Outer lip missing, ovate

aperture, columella bearing irregular folds. Narrow, slightly recurved siphonal canal, fasciole with narrow spiral cords. Spiral sculpture of well-developed, rounded primary spiral cords (IP, P1–P3 on spire whorls and IP, P1–P6 on last whorl), secondaries and tertiaries in interspaces. Axial sculpture of broad, rounded axial ribs (eight on last whorl), one varix per whorl, and marked, dense, fine growth lines. Secondary spiral elements and growth lines form a finely reticulate surface in interspaces.

Remarks – *Pseudosassia traceyi* n. sp. differs from *P. flandrica* by its angulate teleoconch whorls bearing stronger primary spiral cords, and from the similar *P. antiqua* by the broader last whorl.

Genus *Monoplex* sensu lato Perry, 1811
Type species – *Monoplex australasiae* Perry, 1811 (= *Murex parthenopeus* Salis, 1793)

Remarks – The taxon was discussed by Beu (e.g. 1970, 1988, 2010), Beu & Kay (1988), Craig *et al.* (2020), and Landau *et al.* (2020). According to Strong *et al.* (2019), *Monoplex* is polyphyletic, so we provisionally use *Monoplex* sensu lato for the Eocene–Miocene species attributed to the genus. *Monoplex* is characterized by its medium-sized to large, ovately fusiform shell, high, multispiral protoconch, angulate to rounded teleoconch whorls, ovate aperture, denticulate or plicate outer lip thickened by labral varix, columella bearing irregular folds, and short to moderately long siphonal canal. Spiral sculpture of seven broad, strong primary cords (IP, P1–P6), fine secondaries, axial sculpture of weakly developed ribs, and generally one varix per whorl.

Monoplex s.l. is one of the descendants of *Sassia* or *Pseudosassia* n. gen., appearing in the middle Eocene. The earliest species referrable to the genus are *Monoplex* s.l. *janetae* (Squires) (NE Pacific, California), *M.* s.l. *gradatus* Craig, Tracey et Gain in Craig *et al.* (NE Atlantic, France), and *M.* s.l. *cowlitzensis* (Weaver) (late Eocene, NW Atlantic, Washington). The late Lutetian specimens presented in this paper represent the first Alpine Tethyan *Monoplex* record, they markedly extend the middle Eocene geographic distribution of the genus.

Monoplex s.l. *szakonyii* n. sp.
(Figs 35–39)

Holotype – HNHM M.62.1212., SL 22.4 mm, SW 13.7 mm (Fig. 37) (Dudar).
Paratype 1 – SFI 360592, SL 32.7, SW 18.4 (Figs 38–39) (Gánt).
Paratype 2 – Coll. Vicián, SL 26.5 mm, SW 16 mm (Figs 35–36) (Gánt).
Paratype 3 – HNHM PAL 2021.5.1., SL 22 mm, SW 22 mm (Dudar).

Type strata and locality – Upper Lutetian gray marl (Csernye Formation), Dudar, Hungary.

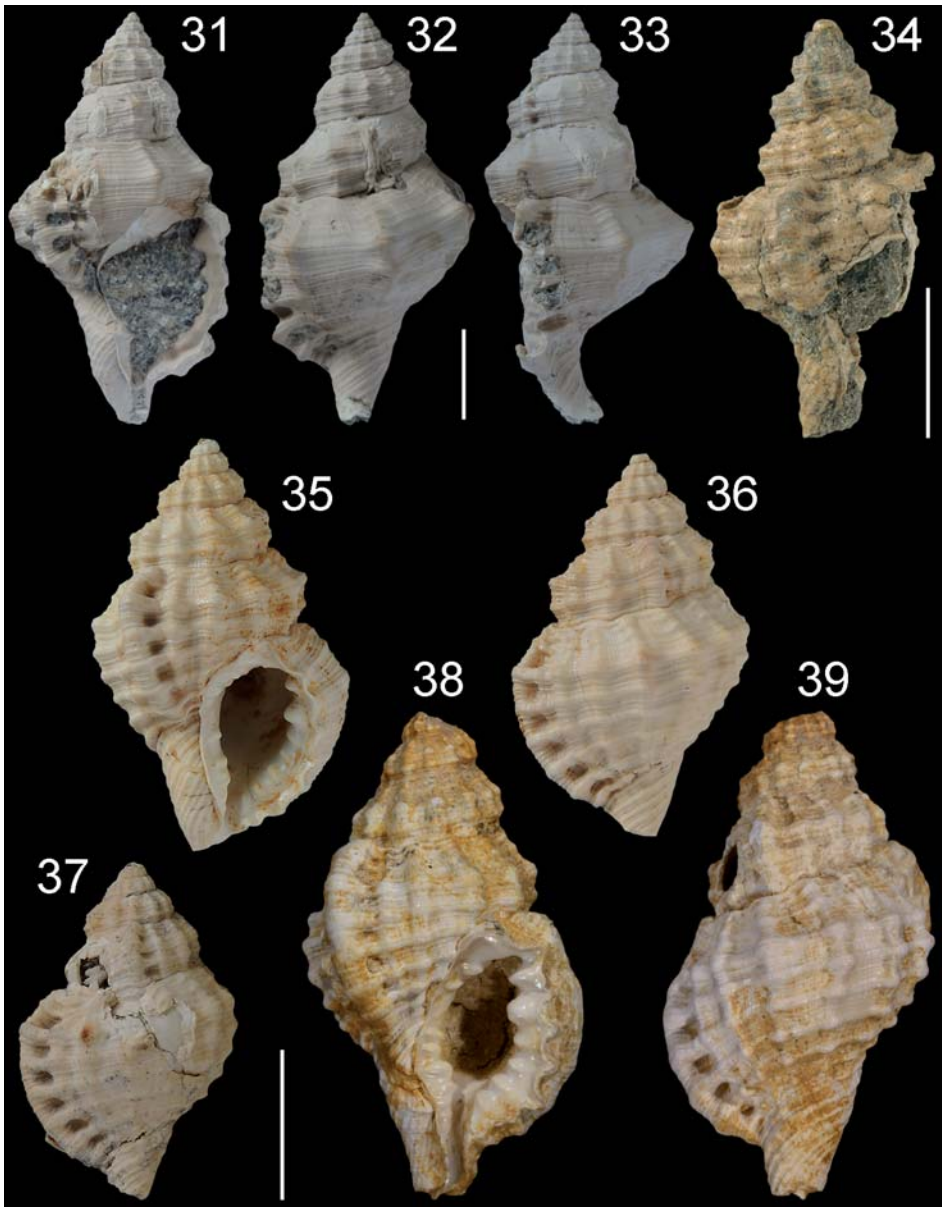
Derivation of name – In honour of József Szakonyi, fossil shell collector (Szombathely, Hungary).

Material – Holotype and paratypes 1–3, max. SL 32.7 mm.

Diagnosis – *Monoplex* s.l. species with subfusiform shell, scalate spire, subangulate teleoconch whorls, ovate aperture, denticulate outer lip thickened by labral varix, folded columella, short siphonal canal, sculpture of well-developed trifid spiral cords and rounded axial ribs, finely reticulate surface.

Description – Subfusiform shell with non-distorted coiling and scalate spire. Protoconch lost. Teleoconch of six subangulate whorls, wide, slightly concave sutural ramp, suture undulating. Last whorl rounded, shouldered, 70–72% of the total height, with periphery at shoulder. Aperture ovate, outer lip thickened by labral varix, denticulate within (ID, D1–D6, D1 strongest). Anal canal wide, rounded, shallow, siphonal canal short, narrow, slightly abaxially recurved. Columella concave, bearing irregular folds, siphonal fasciole sculptured by 7–8 primary spiral cords. Spiral sculpture of strong spiral cords with secondaries and tertiaries in interspaces. First teleoconch whorl bears IP, P1–P2, and secondaries; from the second teleoconch whorl a strong SP appears between IP and suture. Last whorl bears IP, SP, secondaries and tertiaries on sutural ramp, P1–P6 with secondaries and tertiaries in interspaces on convex part. Primaries subdivided by a narrow median groove, and have a trifid appearance by being arranged in groups with central primary cord and secondaries on both sides. Axial sculpture of broad rounded ribs, one moderately developed varix per whorl from the third teleoconch whorl, and fine, dense growth lines. The holotype bears 10 ribs, paratype 1 bears 11 ribs on last whorl. Shell surface finely reticulated with axial elements overridden by spiral cords.

Remarks – Although the protoconch is missing, the specimens figured here correspond to the diagnosis of *Monoplex* s.l., and seem to be one of the earliest representatives of the genus. The new species displays moderate intraspecific variability. The largest specimen is the fragmentary Paratype 1 which bears more widely spaced axial ribs. *Monoplex* s.l. *szakonyii* n. sp. is distinguished from *M.* s.l. *janetae* by its non-distorted coiling, lower spire and lack of prominent varices on early spire whorls. *Monoplex* s.l. *gradatus* is a narrower and more elongate form. *Monoplex* s.l. *szakonyii* n. sp. is closely allied to *M.* s.l. *cowlitzensis* in size and spiral sculpture but differs by its more angulate whorls and less developed varices. Species of genus *Cabestana* are somewhat similar in sculpture, but differ both in other morphological features and stratigraphic range, appearing first in the early Miocene, and bearing well-developed anal canal, smooth columella and slightly



Figs 31–33. *Pseudosassia gurdoni* n. sp., holotype, HNHM PAL 2021.4.1., SL 45.4, apertural, abapertural and lateral views. – **Fig. 34.** *Pseudosassia traceyi* n. sp., holotype, HNHM M.62.1220., SL 28, apertural view. – **Figs 35–39.** *Monoplex* s.l. *szakonyii* n. sp. – **Figs 35–36.** Paratype 2, Coll. Vicián, Gánt, SL 26.5, apertural and abapertural view. – **Fig. 37.** Holotype, HNHM M.62.1212., Dudar, SL 22.4, abapertural view. – **Figs 38–39.** Paratype 1, SFI, 360592, Gánt, SL 32.7, apertural and abapertural views. Scale bars: 10 mm

flared outer lip. *Monoplex* s.l. *szakonyii* n. sp. occurs at Dudar and Gánt in the Hungarian Paleogene Basin.

Genus *Cymatiella* Iredale, 1924

Type species – *Triton quoyi* Reeve, 1844 (= *Triton verrucosus* Reeve, 1844)

Remarks – The genus was recently discussed by Beu (2010), Strong *et al.* (2019), and Craig *et al.* (2020). Paleocene–Recent *Cymatiella* is characterized by its small, slender shell (max. SL ~20 mm), non-distorted growth, smooth, multispiral protoconch, relatively high spire, rounded teleoconch whorls, ovate aperture, denticulate outer lip thickened by labral varix, folded columella, spiral sculpture of fine primary cords (IP, P1–P6) with secondary threads, axial sculpture of riblets, and one or two varices per whorl.

There is no consensus in the literature concerning the European Paleogene species referable to the genus. In this paper e.g. the Paleocene *Cymatiella briarti* (Vincent) (see Glibert 1973), and *C. tzankovi* nom. nov. (see Tzankov 1940, pl. 11, figs 1–4), the Eocene *C. inornata* (Deshayes), *C. triamans* (De Gregorio), *C. boutillieri* (Cossmann), *C. ischnospira* (Cossmann), *C. fresvillensis* (Cossmann et Pissarro), *C. constantinensis* (Cossmann et Pissarro), *C. microstoma* (Cossmann et Pissarro), and *C. putzeysi* (Glibert), and the Miocene *C. tritonea* (Grateloup) are recognized as representatives. *Cymatiella tzankovi* nom. nov. is here proposed as new name for "*Eutritonium* (*Sassia*) *rutoti*" of Tzankov (1940, p. 504, pl. 11, figs 1–4). The specimens described and illustrated by Tzankov from the Paleocene of Bulgaria differ from *Personopsis rutoti* (Vincent) by the elongate shell with weakly distorted coiling and non-cancellate sculpture; they belong to genus *Cymatiella*.

Cymatiella ischnospira (Cossmann, 1897)
(Figs 40–41)

1897 *Lampusia ischnospira* nov. sp. – Cossmann, p. 331, pl. 7, figs 21–22.
1901 *Lampusia* (*Sassia*) *ischnospira* Cossmann – Cossmann & Pissarro, p. 132, pl. 14, fig. 14.
2012 *Sassia ischnospira* (Cossmann) – Lebrun *et al.*, pl. 1, fig. 32.
2020 *Cymatiella ischnospira* (Cossmann) n. comb. – Craig *et al.*, p. 25, text-fig. 9, pl. 9, figs 1–2.

Material – 4 specimens in private collections of Gurdon, and the authors, max. SL 20 mm.

Description – Fusiform shell, protoconch missing, teleoconch of five slightly angulate whorls with broad, steep sutural ramp. Last whorl 63% of the total height, angulate, weakly constricted at base. Aperture ovate, outer lip thickened by labral varix, denticulate within (ID, D1–6). Columella slightly concave, bearing irregular folds, siphonal canal short. Spiral sculpture of well-developed, rounded spiral cords (IP, P1–P6 on last whorl), strong, narrow secondaries, and fine tertiar-

ies. The prominent P1 and P2 create a biangular whorl profile. Axial sculpture of slightly irregularly spaced, narrow, rounded ribs (11 on last whorl), two varices on first–third spire whorls, one prominent varix on last two whorls. Slightly thickened tubercles at intersections of primary cords and ribs on last whorl.

Remarks – The specimen figured here agrees well in overall morphology with that of *Cymatiella ischnospira* but it differs somewhat by being slightly larger with slightly stronger primary spiral cords, and its IP is much closer to the suture.

Distribution – Lutetian: NE Atlantic (France: Loire Basin, Cotentin Basin), E Alpine Tethys (Hungary: HPB, Dudar).

Cymatiella microstoma (Cossmann et Pissarro, 1905)
(Figs 42–43)

1905 *Eutritonium* (*Sassia*) *microstoma* nov. sp. – Cossmann & Pissarro, p. 91, pl. 16, figs 29–30.
2020 *Cymatiella microstoma* (Cossmann et Pissarro) – Craig *et al.*, p. 26, text-fig. 10, pl. 10, figs 1–7.

Material – 1 specimen in private collection of Vicián, SL 16.5 mm.

Description – Fusiform shell, protoconch missing, teleoconch of five slightly angulate whorls with somewhat rounded sutural ramp. Last whorl 68.4% of the total height, slightly angulate, aperture ovate, outer lip thickened by labral varix, denticulate within (ID, D1–6). Columella bearing irregular folds, siphonal canal short. Spiral sculpture of flattened primary spiral cords (IP, P1–P6 on last whorl), narrow secondaries, and fine tertiaries. Axial sculpture of rounded ribs (10 on last whorl), well-developed varices, and fine, dense growth lines.

Remarks – The figured specimen corresponds to the NE Atlantic material in overall morphology, but differs by having a slightly larger shell.

Distribution – Lutetian: NE Atlantic (France: Cotentin Basin), E Alpine Tethys (Hungary: HPB, Balinka).

Cymatiella dulaii n. sp.
(Figs 44–50)

Holotype – HNHM PAL 2021.6.1., SL 12.5 mm, SW 6.7 mm (Figs 44–46).

Paratype 1 – HNHM PAL 2021.7.1., SL 18.6 mm, SW 9.2 mm (Figs 49–50).

Paratype 2 – HNHM PAL 2021.8.1., SL 15.5 mm, SW 7.8 mm (Figs 47–48).

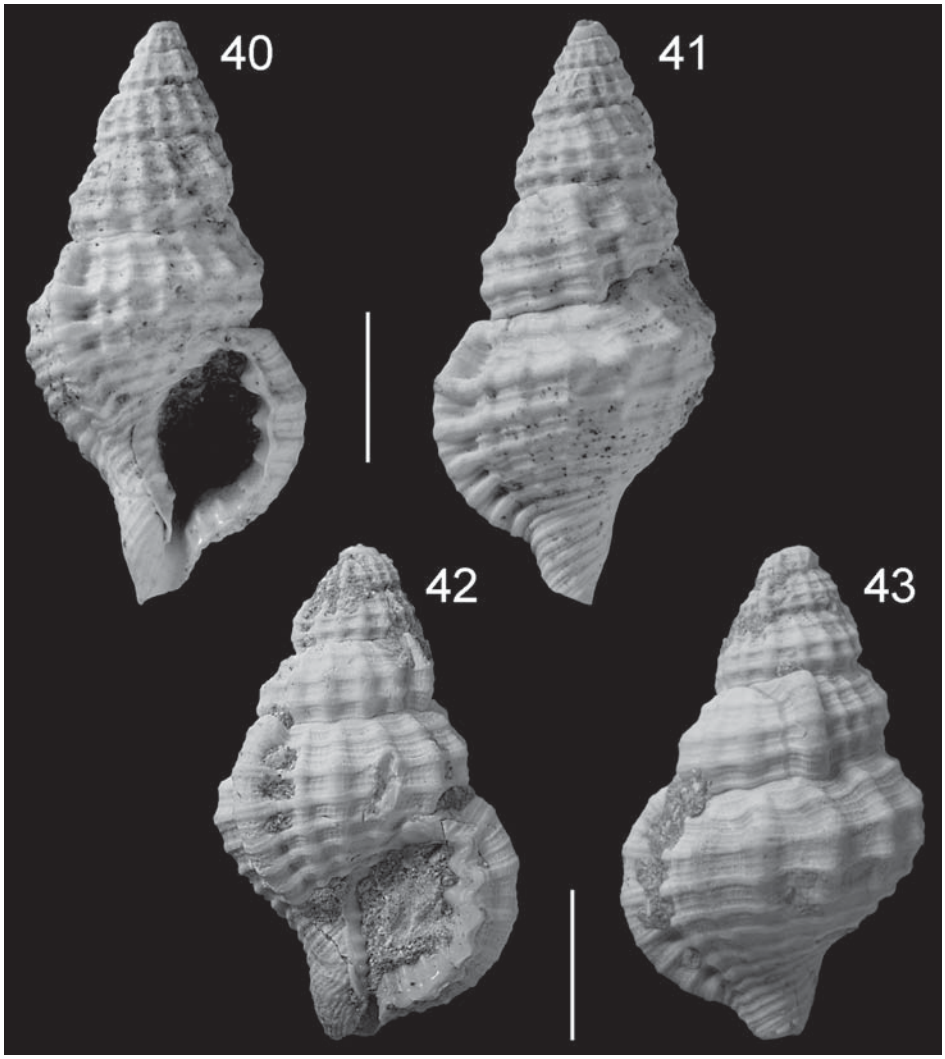
Paratype 3 – Coll. Vicián, SL 11 mm, SW 5.4 mm.

Type strata and locality – Upper Lutetian clayey marl (Csernye Formation), Dudar, Hungary.

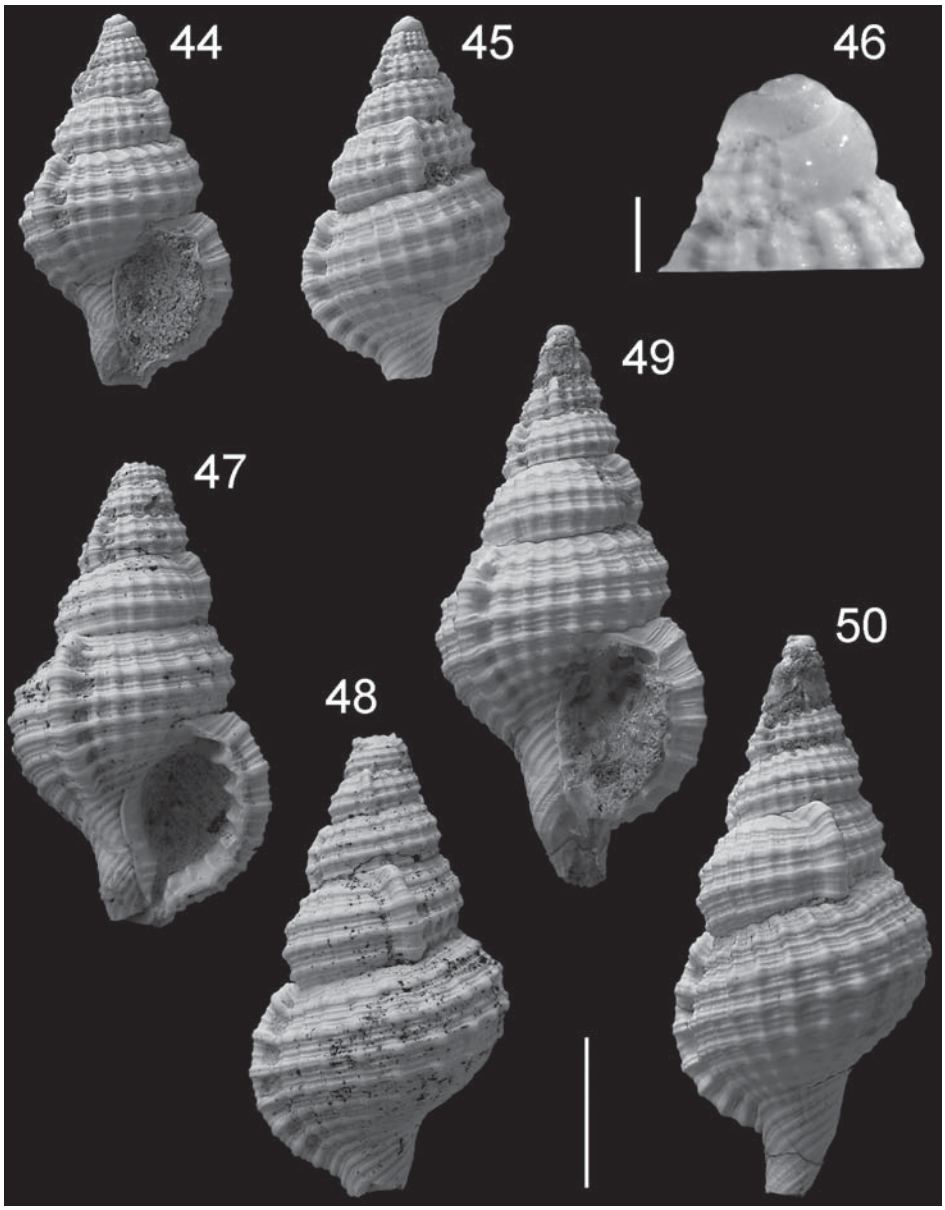
Derivation of name – In honour of Alfréd Dulai, palaeontologist, Hungarian Natural History Museum, Budapest.

Material – Holotype, paratypes 1–3, and 28 specimens in private collections of Gurdon, Zsoldos and the authors, max. SL 19 mm.

Diagnosis – *Cymatiella* species with fusiform shell, multispiral protoconch, five convex teleoconch whorls, ovate aperture, denticulate outer lip, folded columella, short siphonal canal, reticulate sculpture with seven primary spiral cords and 20–24 axial riblets.



Figs 40–41. *Cymatiella ischnospira* (Cossmann), Coll. Gurdon, Dudar, SL 19.5, apertural and abapertural views. – **Figs 42–43.** *Cymatiella microstoma* (Cossmann et Pissarro), Coll. Vicián, Balinka, SL 16.5, apertural and abapertural views. Scale bars: 5 mm



Figs 44–50. *Cymatiella dulaii* n. sp., Dudar. – **Figs 44–46.** Holotype, HNHM PAL 2021.6.1., SL 12.5, apertural and abapertural views, protoconch and first teleoconch whorl. – **Figs 47–48.** Paratype 2, HNHM PAL 2021.8.1., SL 15.5, apertural and abapertural views. – **Figs 49–50.** Paratype 1, HNHM PAL 2021.7.1., SL 18.6. Scale bars: 5 mm for 44–45, 47–50, 500 μm for 46

Description – Fusiform shell, dome-shaped protoconch of 3 smooth, convex whorls, small nucleus. Junction with teleoconch slightly prosocline, weakly delimited. Teleoconch of five convex whorls, broad, steep, convex sutural ramp. Last whorl 57% of the total height, rounded, weakly constricted at base. Aperture ovate, 31–33% of the total height. Outer lip thickened by labral varix, denticulate within (ID, D1–6, ID most developed, D3–D4 weakly developed). Columella slightly concave, two folds in the middle, weaker folds abapically. Siphonal canal short, narrow, slightly abaxially recurved. Siphonal fasciole short, bearing 6–8 spiral cords. Spiral sculpture of narrow spiral cords. IP, P1–P2 on first teleoconch whorl; IP, P1–P6 on last whorl. One secondary spiral cord in interspaces on first three teleoconch whorls, one secondary and two tertiaries between IP–P1, two secondaries between primaries on fourth and fifth whorls, on last whorl one secondary and two tertiaries between IP–P1, P1–P2, P2–P3, two secondaries between P3–P4, P4–P5, and one secondary between P5–P6. Axial sculpture of slightly irregularly spaced riblets, one prominent varix per whorl, and fine growth lines. 18–20 narrow, raised, rounded axial riblets on first teleoconch whorl, 19–22 riblets on last whorl. Riblets overridden by spiral cords, forming slightly thickened tubercles at intersections of primaries.

Remarks – *Cymatiella inornata* is distinguished by its less developed sculpture, *C. constantinensis* differs by the presence of a parietal denticle, stronger D1, finer sculpture with narrower primary cords, more spiral threads in interspaces, and narrower, slightly more widely spaced axial ribs. *Cymatiella ischnospira* is characterized by less rounded teleoconch whorls, and stronger sculpture with a lesser number of secondary spiral cords. *C. triamans* bears less convex teleoconch whorls with only 16 axial ribs on the last whorl. The most similar species is *Cymatium boutillieri* in size and overall morphology but is distinguishable by broader shell with slightly more inflated teleoconch whorls, less developed spiral secondary cords, and stronger tubercles. *Cymatiella dulaii* n. sp. is the most abundant cymatiid species in the molluscan assemblage of Dudar.

Genus *Parasassia* Craig et Tracey in Craig *et al.*, 2020
Type species – *Triton multigraniferum* Deshayes, 1835

Remarks – The genus was introduced in Craig *et al.* (2020) for Eocene species characterized by small to medium-sized shell (max. SL 23), non-distorted coiling, inflated last whorl, short siphonal canal, well-defined anal canal, subequal spiral and axial sculpture, and less prominent varices than that of *Sassia* or *Pseudosassia* n. gen. species. Several European middle–late Eocene cymatiids which were formerly classified as *Sassia* or *Byramia* should rather be assigned to *Parasassia*: e.g. *Murex reticulosus* Lamarck, *Triton dumortieri* Baudon, *Lampusia excavata* Cossmann, *L.* (*Simpulum*) *pustulifera* Cossmann et Pissarro, and ? *Triton fusiforme* Vincent.

Parasassia vargai n. sp.
(Figs 51–52)

Holotype – HNHM PAL 2021.9.1., SL 11.3 mm, SW 6.7 mm.

Type strata and locality – Upper Lutetian clayey marl (Csernye Formation), Dudar, Hungary.

Derivation of name – In honour of Zsolt Varga, fossil shell collector (Gödöllő, Hungary).

Material – Holotype.

Diagnosis – *Parasassia* species with small, subfusiform shell, four slightly convex spire whorls, convex last whorl, ovate aperture, denticulate outer lip thickened by moderately developed labral varix, IP, P1–P6 spiral cords with secondaries and tertiaries, numerous axial ribs, one varix per whorl.

Description – Small, subfusiform shell, non-distorted coiling. Protoconch lost. Teleoconch of five whorls with steep infrasutural ramp. Spire whorls slightly convex, last whorl convex, 71% of the total length. Wide, ovate aperture. Outer lip thickened by moderately developed labral varix, denticulate within (ID, D1–6). Columella concave, bearing irregular folds. Siphonal canal short, narrow, slightly recurved, siphonal fasciole short, bearing fine spiral cords. First teleoconch whorl with spiral sculpture of P1–P2, and numerous fine axial ribs. From the second whorl one varix per whorl. Last whorl: spiral sculpture with IP and P1–P6, secondaries and tertiaries on the ramp, one secondary, and two tertiaries between P1–P2 and P2–P3, axial sculpture with 19 irregularly spaced, narrow, rounded ribs, one weakly developed varix. Spiral sculpture overrides the axial ribs, forming small tubercles at intersections.

Remarks – The size and morphology of the new species agrees well with the diagnosis of genus *Parasassia* (Craig *et al.* 2020). *Parasassia vargai* n. sp. is closely allied to the Lutetian–Bartonian *P. dumortieri* and *P. reticulosa* (NE Atlantic, France) but distinguished by having fewer primary spiral cords.

Genus *Protoplex* Craig et Tracey in Craig *et al.*, 2020
Type species – *Protoplex gervillei* Craig et Tracey in Craig *et al.*, 2020

Remarks – The genus was introduced in Craig *et al.* (2020) for Eocene cymatiid species characterized by medium-sized, inflated shells generally with a single varix 245–260° before the outer lip, a smooth, multispiral protoconch, an ovate, denticulate aperture, folded columella, sculpture of low spiral cords (the peripheral pair the strongest) and low axial ribs with prominent rounded tubercles at the intersections. Beside the type species, also *Murex nodularius* Lamarck, *Sassia websteri* Wrigley and *S. biserialis* Wrigley were assigned to the genus by the

authors. The Priabonian *Triton rossii* Oppenheim seems to agree with the diagnosis of *Protoplex* except for the flat protoconch; this species needs to be revised.

Protoplex ? *zsoldosi* n. sp.
(Figs 53–54)

Holotype – HNHM PAL 2021.10.1., SL 23.5 mm, SW 15 mm.

Type strata and locality – Upper Lutetian clayey marl (Csernye Formation), Dudar, Hungary.

Derivation of name – In honour of the collector: Márton Zsoldos (Bakonynána, Hungary).

Material – Holotype.

Diagnosis – Medium-sized, broad shell, gradate spire, angulate and inflated last whorl, well-developed primary spiral cords and rounded axial ribs, varices limited to the last whorl.

Description – Medium-sized, broad shell, eroded protoconch, gradate spire of three angulate whorls. Inflated and shouldered last whorl, 71% of the total length, steep sutural ramp. Aperture ovate, outer lip thickened by moderately developed labral varix. Denticles and columella cannot be described. Spiral sculpture of broad, rounded primary cords (IP, P1–6) with secondaries and tertiaries in interspaces. The spire whorls bear IP, P1–P2, on the last whorl P1–P3 the most prominent, with a trifid appearance by arranged in groups with central primary cord and secondaries on both sides. Axial sculpture of broad rounded ribs on the spire. The last whorl bears seven ribs, and two very weakly developed, rib-like varices, one next to the labral varix, the other 250° before the terminal outer lip.

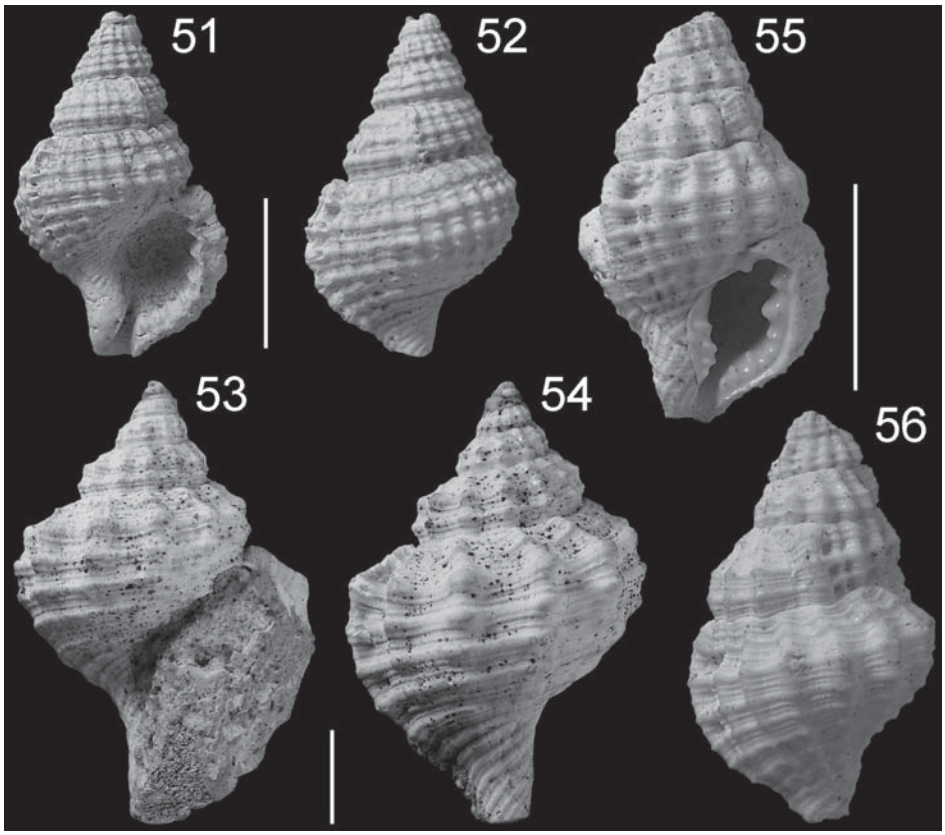
Remarks – Although the outer lips of the new species are not thickened by varices on earlier whorls, based on the overall morphology it is assigned provisionally to genus *Protoplex*. *Protoplex gervillei* and *P. websteri* are distinguishable by their narrower and elongate shells, *P. nodularius* and *P. biserialis* differ by their higher spires and tuberculate sculpture. The Priabonian *Sassia* sp. from Ukraine, Dnipro region (INV. 61352, collector A. Berezovsky) illustrated by the International Fossil Shell Museum (https://www.fossilshells.nl/ukreo032.html) corresponds in size and morphology to the new species and is regarded herein as a late Eocene representative of *Protoplex* ? *zsoldosi* n. sp.

Family Personidae Gray, 1854

Remarks – The taxon was dealt with by Beu (1988), Kronenberg (1994), Landau *et al.* (2004) and Strong *et al.* (2019). Two genera are assigned to the family: *Distorsio* Röding, 1798 (late Cretaceous–Recent) and *Personopsis* Beu, 1988 (late Paleocene–Recent).

Genus *Personopsis* Beu, 1988
Type species – *Triton grasi* Bellardi, 1872

Remarks – The taxon was introduced by Beu (1988) for species that had been referred to genus *Distorsio* in the literature but which are characterized by their small (SL < 25 mm), biconic shell, less distorted coiling and less excavated columella than that of typical *Distorsio*. The earliest representative, *Personopsis rutoti* (Vincent) appeared in the late Paleocene (Vincent 1930; Krach 1963; Gorbach 1972) as the descendant of *Distorsio*, and the genus was a rare element of gastropod faunas in the Eocene. So far only one species has been assigned to the genus with certainty in the Lutetian of Europe, *Personopsis minae* (De Gregorio) from N Italy (Lessini Shelf).



Figs 51–52. *Parasassia vargai* n. sp., holotype, HNHM PAL 2021.9.1., Dudar, SL 11.3, apertural and abapertural views. – **Figs 53–54.** *Protoplex* ? *zsoldosi* n. sp., holotype, HNHM PAL 2021.10.1., Dudar, SL 23.5, apertural and abapertural views. – **Figs 55–56.** *Personopsis merlei* n. sp., holotype, HNHM PAL 2021.11.1., SL 10, apertural and abapertural views. Scale bars: 5 mm

Personopsis merlei n. sp.
(Figs 55–56)

Holotype – HNHM PAL 2021.11.1., SL 10 mm, SW 5 mm.

Type strata and locality – Upper Lutetian clayey marl (Csernye Formation), Dudar, Hungary.

Derivation of name – In honour of Didier Merle, French palaeontologist with the Muséum national d'Histoire naturelle, Paris.

Material – Holotype.

Diagnosis – *Personopsis* species with small, subfusiform, slightly distorted shell, five subangulate teleoconch whorls, oblique, narrow, ovate aperture, denticulate outer lip thickened by labral varix, folded columella, IP, P1–P6 spiral cords with secondaries and tertiaries, 12 axial ribs on last whorl, one varix per whorl.

Description – Small, subfusiform shell, slightly distorted coiling, protoconch absent. Teleoconch of five subangulate whorls with steep sutural ramp. Last whorl 71% of the total length, oblique, narrow, ovate aperture. Outer lip thickened by labral varix, denticulate within (ID, D1–6; D1 most developed). Columella excavated, bearing one parietal ridge, and four folds in the abapical part. Short, narrow, slightly recurved siphonal canal. Siphonal fasciole short, bearing two primary and two secondary cords. First teleoconch whorl with sculpture of three narrow spiral cords (IP, P1–P2), one secondary cord in interspaces and 12 rounded axial ribs. From the second whorl one varix per whorl. Last whorl: IP, P1–P6, secondaries on the ramp, one secondary and two tertiaries between P1–P2, two secondaries in each interspaces below, 12 irregularly spaced, narrow, rounded axial ribs, one varix. Spiral sculpture overrides the axial ribs, forming slightly thickened, horizontally elongate tubercles at intersections.

Remarks – *Personopsis merlei* n. sp. differs from *P. minae* by subangulate teleoconch whorls (see De Gregorio 1880, pl. 7, fig. 64). The new species is closely allied in morphology to *Personopsis septemdentata* (Gabb) from the middle Eocene of the Gulf region (W Atlantic) (see Gabb 1860, pl. 67, fig. 21; Gardner 1945, pl. 17, figs 12–13) but is distinguishable by a more slender shell.

CONCLUSIONS

Based on revisions of museum collections and new fieldwork 14 tonnoidean species are described in this paper from the late Lutetian (middle Eocene) Hungarian Paleogene Basin. The material represents the families Cassidae, Charoniidae, Cymatiidae and Personidae, the last three taxa have hitherto been unknown in the NE Alpine Tethys. Dudar displays the highest tonnoidean diversity among the fossiliferous sites of the HPB: four cassid, one charoniid, seven

cymatiid and one personid species appear in its gastropod assemblage. The most abundant species is *Cymatiella dulaii* n. sp. with 32 specimens at this locality. The occurrences of *Cassis thesei* Brongniart, *Sconsia ambigua* (Solander), *Semiranella gemmellaroi* (De Gregorio), *Cymatiella ischnospira* (Cossmann) and *C. microstoma* (Cossmann et Pissarro) in the HPB, as well as the newly designated *Monoplex*, *Parasassia*, *Protoplex* ? and *Personopsis* species extend the palaeogeographic distributions of these genera. Designation of *Pseudosassia* n. gen. may contribute to the taxonomic revision of the Cymatiidae.

The highest alpha diversity of the middle–late Eocene Tonnoidea in Europe is typical of the NE Atlantic province (Loire, Cotentin and Paris basins), while the Alpine Tethys regions (Alpine Foredeep, Lessini Shelf, HPB) show a lower diversity. The HPB record with 14 species is similar to that of N Italy and the Alpine Foredeep. In N Italy (for references see Kovács & Vicián 2020) about 16 tonnoideans occur from which four appear in the HPB: *Galeodea nodosa* (Solander), *Cassis thesei* Brongniart, *Sconsia ambigua* (Solander), and *Semiranella gemmellaroi* (De Gregorio); moreover, *Pseudosassia rheana* (De Gregorio) and *P. gurdoni* n. sp. are also closely allied forms. The Alpine Foredeep assemblages usually consist of internal molds so their interpretation seems uncertain; however, 14 tonnoidean forms were distinguished by Schlosser (1925). The faunal compositions are slightly different in these regions. In N Italy the *Cassidae* shows the highest alpha diversity with at least 7 species, while in the Alpine Foredeep and the HPB the cymatiids are dominant (6 and 7 species, respectively).

*

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Authorship contribution statement – Zoltán Vicián: project administration, investigation, review. Zoltán Kovács: conceptualization, writing, editing, visualization.

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