

Revision of the gastropod family Cancellariidae from the Danian (Early Paleocene) of Fakse, Denmark

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The very rich mollusc fauna from the Middle Danian deposits of Fakse, Denmark contains eight species of the gastropod family Cancellariidae. Of these six species are previously undescribed, viz: *Unitas anderseni* n. sp., *Unitas alicae* n. sp., *Plesiotriton steni* n. sp., *Admetula rosenkrantzi* n. sp., *Admetula faksensis* n. sp. and *Tatara danica* n. sp. A lectotype for *Semitriton biplicatus* (Ravn, 1902) is designated.

KEY WORDS: Mollusca, Gastropoda, Cancellariidae, Danian, Early Paleocene, Fakse, Denmark, new species.

Introduction

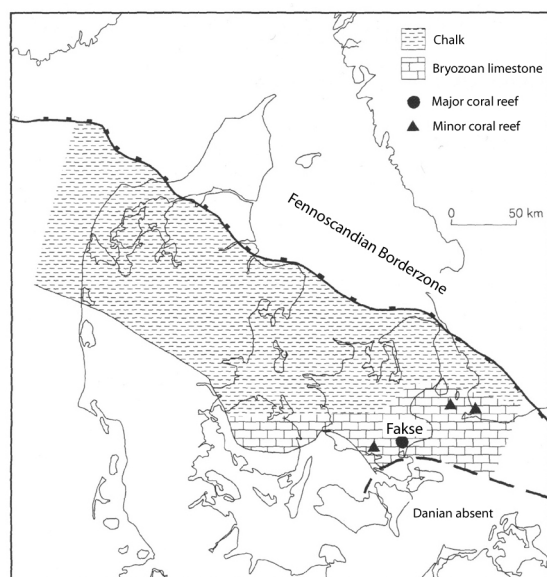


Figure 1. Main structures and facies of the Danish area in Middle Danian. Compiled by Erik Thomsen, Geologisk Institut, Aarhus Universitet. (Reproduced from Schnetler *et al.*, 2001). The boundary to the north to the Fennoscandian Shield is indicated.

The Danian deposits of Fakse, Denmark contain a very rich mollusc fauna (Ravn 1902a; 1902b; 1933; Nielsen 1919;

Schilder 1928, Rosenkrantz 1960; Schnetler *et al.* 2001). A rare part of this fauna is the gastropod family Cancellariidae, to which Ravn (1933) referred three species only in his monograph on the Fakse fauna. Since additional material has been collected (Søren Bo Andersen and Sten Lennart Jakobsen in 1972, Alice Rasmussen in the 1990s), a revision of the family is possible. In the Rosenkrantz collection additional specimens were located. These specimens were collected by him in 1933 and thus not treated in the revision by Ravn (1933). Eight species of Cancellariidae are recognized, of which six are newly described herein, viz: *Unitas anderseni* n. sp., *Unitas alicae* n. sp., *Plesiotriton jakobseni* n. sp., *Admetula rosenkrantzi* n. sp., *Admetula faksensis* n. sp. and *Tatara danica* n. sp.

Geological setting and stratigraphy

The limestone in the quarry east of the small town of Fakse in Eastern Zealand has been excavated for several hundred years. Fakse is situated in the Danish-Polish Trough, which is bounded to the north by the Fennoscandian Shield and to the south by the Ringkøbing-Fyn High (Figure 1). A section through a bryozoan-coral mound complex is exposed in the quarry. In the complex a vast number of interbedded microfacies may be recognized, as results of early diagenesis: Bryozoan limestone, chalky limestone and coral limestone (Bernecker & Weidlich, 1990; Willumsen, 1995). For a review see Surlyk & Håkansson (1999). Desor (1847)

introduced the Danian Stage with the typical localities Fakse Quarry and Stevns Klint and considered the stage as the youngest part of the Cretaceous System. For many years the stratigraphic position of the Danian has been discussed, e.g. by Nielsen (1919), Ravn (1925) and Rosenkrantz (1938), but is now generally considered as the oldest part of the Paleocene. Various subdivisions of the Danian have been suggested, and the sequence at Fakse has been referred to the local *Tylocidaris bruennichi* echinoid Zone (Ødum 1926, Rosenkrantz 1938) of Middle Danian age and to nannoplankton zone NP3 (Perch-Nielsen 1979). Recently Thomsen (1995) divided the Danish Danian into 9 calcareous nannoplankton zones. According to this subdivision the sequence in Fakse quarry falls into his calcareous nannoplankton zones 4 and 5 (Middle Danian age).

Previous work

Ravn (1902b) recognised no Cancellariidae in the gastropod fauna of Fakse. He described *Tritonium biplicatum*, referring it to the Cymatiidae (= Ranellidae) in accordance with customary placement at that time. In his 1933 paper Ravn revised the fauna and established numerous new species from the so-called “nose-chalk”. This type of limestone is an unconsolidated coral limestone in which originally aragonitic mollusc shells are preserved due to a transformation into calcite (Ravn, 1933; Bernecker & Weidlich, 1990). He considered three species to belong to the Cancellariidae: *Admete ? biplicata* (Ravn, 1902), *Admete (Bonellitia)* sp. and *Uxia* sp. These species will be discussed in the systematic part.

Much of the material from the nose-chalk, published by Ravn (1933) was collected by the late Professor Alfred Rosenkrantz, Copenhagen. However, material collected in 1933 by him was not published by Ravn, because it was collected later the same year. Rosenkrantz obviously intended a publication in his later years as he arranged gastropod species from the Paleocene of Fakse, Copenhagen and Nuussuaq, West Greenland, and had artists make drawings under his supervision (Kollman & Peel, 1983). These many hundreds of prepared illustrations are housed in the Rosenkrantz files in the Geological Museum of Copenhagen. Four of the cancellariids treated in this study were drawn by those artists, and Rosenkrantz made a few drawings with accompanying notes of five species established as new in this paper: *Unitas anderseni*, *Plesiotriton steni*, *Admetula rosenkrantzi* n. sp., *Admetula faksensis* and *Tatara danica*.

Wenz (1938–44) referred *Plesiotriton* and *Semitriton* to the family Ranelliidae, but Beu & Maxwell (1987) referred both genera to Cancellariidae. *Tatara*, originally (Fleming, 1950) included in the family Ranelliidae, was also referred to the Cancellariidae by Beu & Maxwell (1987).

The molluscan fauna

The mollusc fauna of the bryozoan and coral limestone at

Fakse was discussed by Ravn (1933) and more recently Schnetler (2001) noted the fauna in comparison with the mollusc fauna of the younger (Selandian) Lelling Green-sand. The very rich fauna of the “nose-chalk” is characterised by e. g. numerous Pleurotomariidae, trochoids, Cerithiopsidae, Triphoridae, Ranellidae and cypraeids. Many small species are undescribed. Among the gastropods, supposed sponge eaters were common (Pleurotomariidae, Cerithiopsidae, Triphoridae), while some trochoids were herbivorous and others carnivorous (Fretter & Graham, 1978). *Emarginula* was also very common (sponge and detritus eater; Fretter & Graham, 1978). The Ranelliidae were carnivorous (Riedel, 1995). Representatives of the fauna from soft bottom (e.g. Turridae) were very rare. A *Eulima* was rather common; this genus lives parasitic on echinoids (Müller & Strauch, 1991). Among the bivalves sessile genera were common, cementing forms like *Pycnodonte* and *Gryphaeostrea* or byssate, like representatives of the Arcidae and Pectinidae (Müller & Strauch, 1991). *Limopsis*, *Nuculana* and other representatives of the infauna were rare.

Cancellariidae in other Paleocene and Eocene faunas

Cancellariidae are diverse and abundant in the Selandian of Copenhagen (von Koenen, 1885; Ravn, 1939; Schnetler, 2001). In the rich mollusc fauna eight cancellariid species have been recorded. From the Danian and Montian of Belgium Glibert (1973) mentioned five species, all established by Briart & Cornet (1877) and all referred to the genus *Unitas* Palmer, 1947. Traub (1979) mentioned two rare species of Cancellariidae from the Paleocene of Haunsberg, Austria. The Paleocene of Nuussuaq, West Greenland has yielded a highly diverse cancellariid fauna, consisting of 13 species (Kollmann & Peel, 1983). Furthermore they referred one specimen to a new genus, cf. *Plesiotriton* (p. 67, figs 139A–B), indicating placement in Ranelliidae. According to Beu & Maxwell (1987, p. 23, pl. 29, figs g, h) this specimen should most likely be referred to *Turehua* Marwick, 1943. No representatives of any Nuussuaq genera are present in the Fakse fauna with the possible exception of the juvenile listed herein as *Unitas* sp. The Eocene of the Paris Basin contains a rich cancellariid fauna (Cossmann & Pissarro, 1910–13; Pacaud & Le Renard, 1995). The genus *Unitas* is represented by 25 species and the genus *Plesiotriton* by three species. They list 11 species in the genus *Bonellitia* Jousseaume, 1887 which they consider a synonym of *Admetula*, a synonymy not accepted herein. The remaining genera from the Fakse fauna are not represented. The Eocene of Cotentin (North France) contains seven cancellariids (Cossmann & Pissarro, 1901), of which six were referred to the genus *Uxia* Jousseaume, 1887 and one to the genus *Sveltella* Cossmann, 1889. *Unitas* (as Palmer, 1947 is a replacement name for *Uxia* Jousseaume, 1887) [non Walker, 1866]. The British Eocene contains seven species referred to the genus *Unitas* (as *Uxia*) and 14 to *Admetula* (as *Bonellitia*) fide Wrigley 1935.

Palaeogeographic conclusions

Of the rare Cancellariidae from the Danian of Fakse some species demonstrate faunal affinities to the New Zealand region. According to Beu & Maxwell (1987) *Tatara* is known only from the Eocene to Lower Miocene of New Zealand and *Semitriton* from the Eocene of Australia and the Eocene of North France (Fresville). Beu & Maxwell (1987, p. 52) questioned the generic reference of *Semitriton inopinatus* Cossmann & Pissarro, 1905 from Fresville but the characters of the Fakse species treated herein agree well with the type of *Semitriton*. *Plesiotriton* is a more widespread genus: Cretaceous, Paleocene and Eocene of USA, Eocene of the Paris Basin, Eocene and Oligocene of Java, Eocene of Algeria, Recent from the western and southwestern Pacific. *Unitas* has a widespread distribution in Cenozoic faunas. Beu & Maxwell (1987, p. 14) discussed the distribution of several genera of Cancellariidae and suggested that the known records reflect a very inadequate knowledge of the fossil record. They found it unlikely that the distribution pattern is caused by convergence of groups, evolving separately in Europe and New Zealand. We agree with their opinion about our inadequate knowledge of the fossil record and also with their statement regarding convergence. The genus *Turehua* is relatively common in the Eocene and Oligocene of Europe (Hungary, Germany, Belgium, Denmark) and the Eocene to Pliocene of New Zealand (Beu & Maxwell 1987). Welle (1997, p. 130) also discussed the relationship between Europe and the Australia – New Zealand Region and suggested that this genus was widespread from the Tethys. He presumed the existence of a large Tethys bioprovince from the European region and over the Asian to the Australian region. Records of cancellariids from the Cretaceous are few, but the knowledge of molluscs from this period is poor because the state of preservation for this class is generally bad due to the dissolution of aragonitic shells.

Systematic palaeontology

Abbreviations –

MGUH	The type collection of the Geological Museum, Copenhagen.
GM	Registered material in the Geological Museum, Copenhagen.
ISL	The collection of K.I. Schnetler, Langå, Denmark.
ARF	The collection of Alice Rasmussen, Fakse, Denmark.

Class Gastropoda Cuvier, 1797

Order Neogastropoda Wenz, 1938

Superfamily Cancellarioidea Forbes & Hanley, 1851

Family Cancellariidae Forbes & Hanley, 1851

Subfamily Plesiotritoninae Beu & Maxwell, 1987

Genus *Plesiotriton* Fischer, 1884

Type species *Cancellaria volutella* Lamarck, 1803 by original designation.

Plesiotriton steni n. sp.

Figures 4, 11

Type locality – Fakse quarry.

Type stratum – Coral Limestone, Middle Danian, Paleocene.

Derivation of name – This species is named after conservator Sten Lennart Jakobsen, Geological Museum of the University of Copenhagen.

Holotype – MGUH 27344 (leg. Sten Lennart Jakobsen, ex ISL Colln: figure 4).

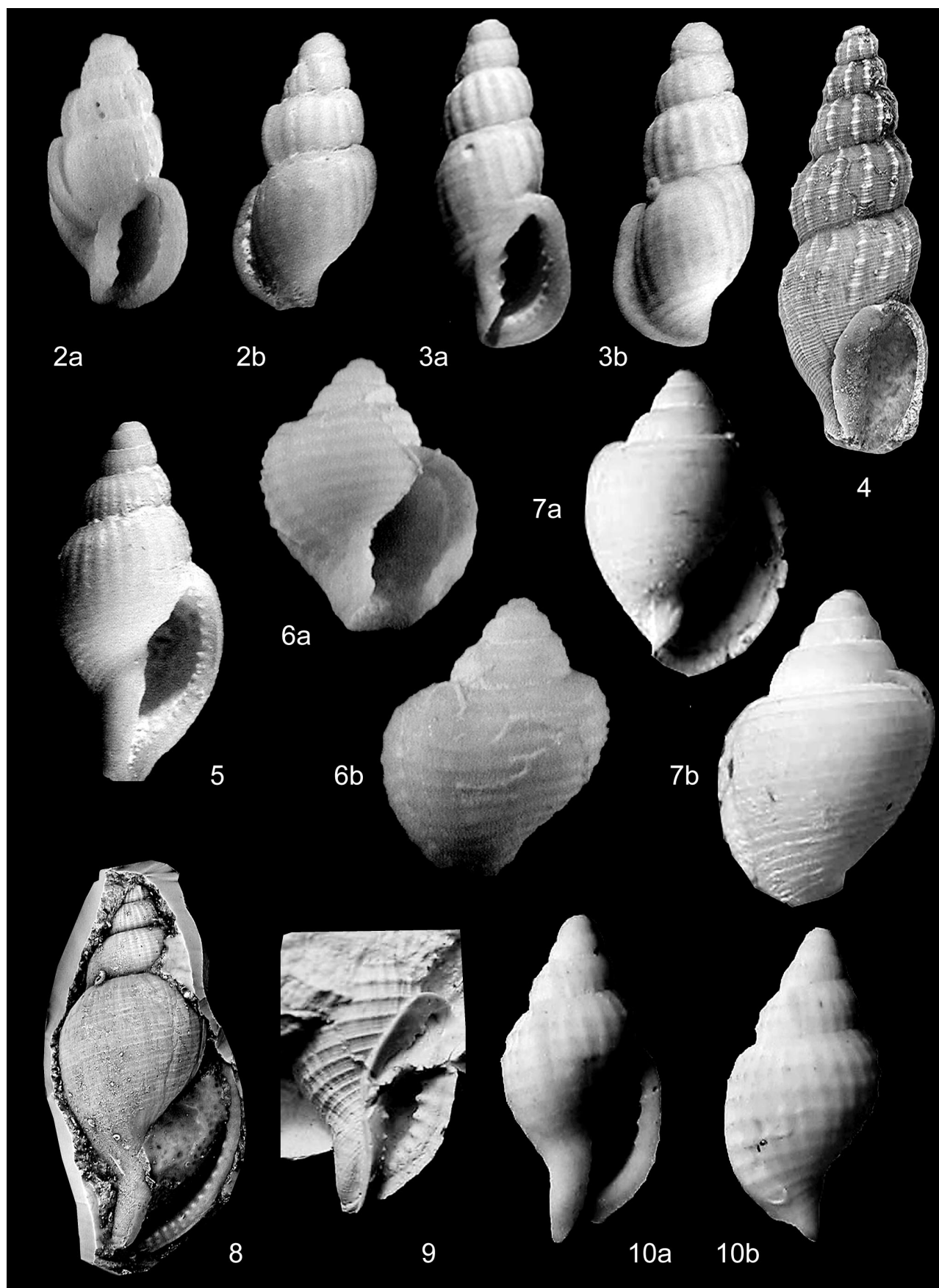
Paratype – MGUH 27345 (leg. Alice Rasmussen, ex ARF Colln: figure 11).

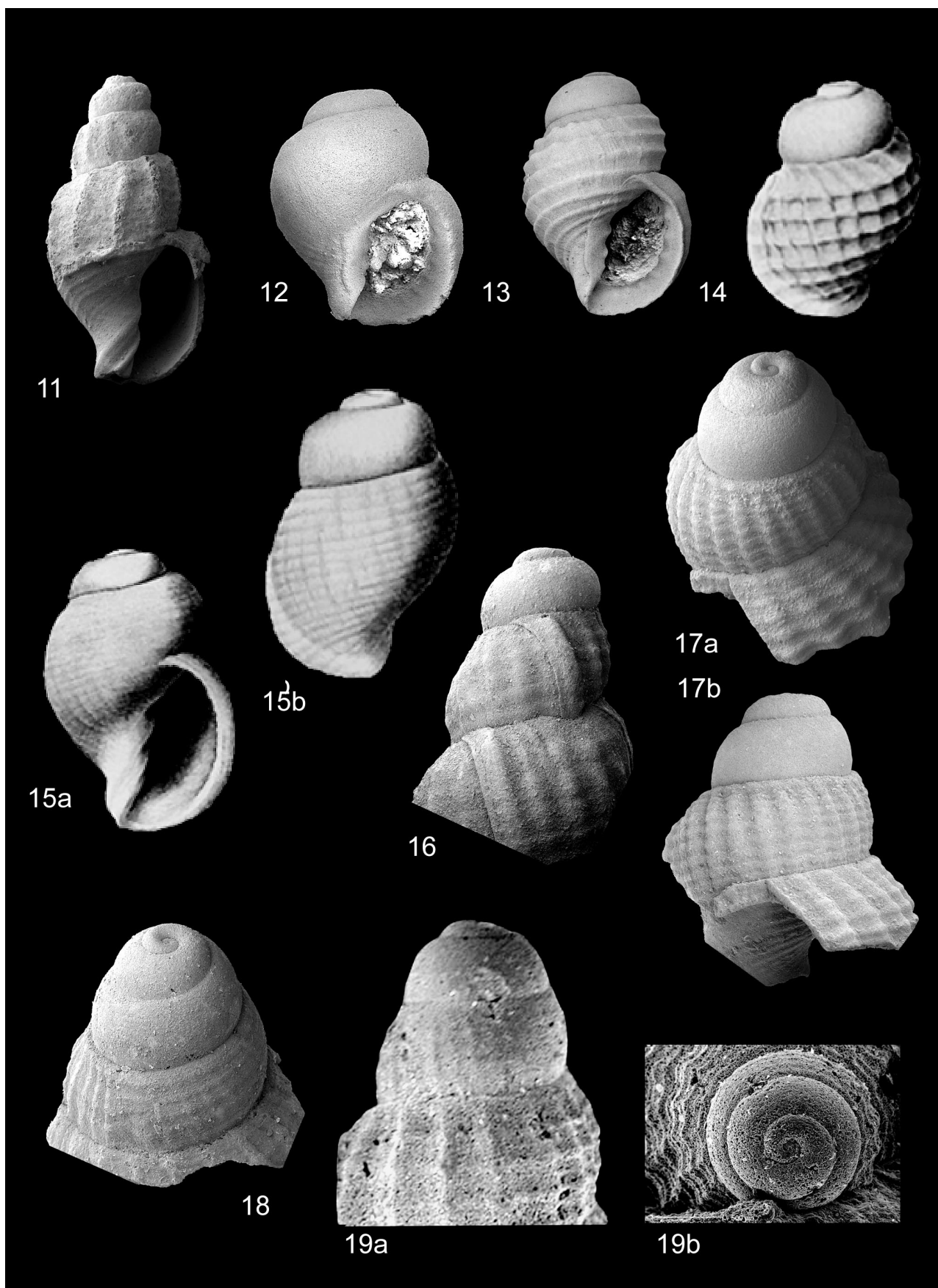
Additional material – ARF Colln, 1 juvenile specimen.

Diagnosis – A slender *Plesiotriton* with opisthocline axial ornament and six primary spirals, of which the medium four are the strongest. Anterior canal relatively long.

Measurements – The holotype has a length of 15 mm (estimated) and a width of 5.0 mm.

Description – The shell is rather small, slender and subfusiform, height/width ratio almost 3.0. The last whorl equals half the total shell height, the aperture and canal about 1/3. The protoconch consists of two smooth, convex whorls, which are separated by a deep suture. The small nucleus is slightly depressed, and the first whorl is planispiral. Immediately before the transition into the teleoconch six spiral cords appear, abapical ones strongest. The transition into the teleoconch is gradual. The teleoconch of the holotype consists of five convex whorls separated by a deep suture. The aperture is defective on the holotype. On the juvenile paratype the aperture is rounded ovate and rather narrow. The labrum is broken, but seems to have been slightly thickened. The columella is slightly sinuate with two weak folds. The callus is rather thick and well defined, covering the spiral sculpture on the parietal wall. The spiral ornamentation consists of six primary spiral cords. Of these the four central cords are strongest. Two or three fine secondary spiral cords soon appear between the primary cords. The convex base has numerous weak spiral cords. The axial sculpture consists of 10–12 slightly opisthocline ribs which are narrower than their interspaces. Where the cords and ribs intersect, spirally elongate tubercles are formed. On the base the axial sculpture gradually weakens. Between the axial ribs weak collabral growth lines meet the axial ribs at an angle of about 20°. There are no varices.





Figures 2a, b. *Unitas anderseni* n. sp. Holotype, MGUH 27346. Height 7.5 mm.

Figures 3a, b. *Unitas alicae* n. sp. Holotype, MGUH 27349. Height 8.8 mm.

Figure 4. *Plesiotriton steni* n. sp. Holotype, MGUH 27344. Estimated height 15.0 mm.

Figure 5. *Semitriton biplicatus* (Ravn, 1902). MGUH 27352. Height 9.8 mm.

Figures 6a, b. *Admetula rosenkrantzi* n. sp. Holotype, MGUH 27351. Height 6.7 mm.

Figures 7a, b. *Admetula faksensis* n. sp. Holotype, MGUH 27356. Height 10.3 mm.

Figure 8. *Semitriton biplicatus* (Ravn, 1902). Lectotype, MGUH 108. Height 45 mm.

Figure 9. *Tatara danica* n. sp. Paratype, MGUH 27355. Estimated height 25 mm. Silicone rubber cast.

Figures 10a, b. *Tatara danica* n. sp. Holotype, MGUH 27354. Height 11.0 mm.

Figure 11. *Plesiotriton steni* n. sp. Paratype, MGUH 27345. Height 4.2 mm.

Figure 12. *Unitas anderseni* n. sp. Paratype, MGUH 27347. Height 2.2 mm.

Figure 13. *Unitas alicae* n. sp. Paratype, MGUH 27350. Height 3.4 mm.

Figure 14. *Unitas alicae* n. sp. Paratype, MGUH 3121 (= Ravn, 1933, pl. 1, figs 12a–b). Reproduced after drawing by Betty Engholm in the Rosenkrantz files in the Geological Museum, Copenhagen. Height 2.4 mm.

Figures 15a, b. *Unitas* sp. MGUH 3192 (= Ravn, 1933, pl. 7, fig. 7). Reproduced after drawing by Betty Engholm in the Rosenkrantz files in the Geological Museum, Copenhagen. Height 3.5 mm.

Figure 16. *Unitas anderseni* n. sp. Paratype, MGUH 27348. Height 3.5 mm.

Figures 17a, b. *Semitriton biplicatus* (Ravn, 1902), MGUH 27353. Height 2.8 mm.

Figure 18. *Tatara danica* n. sp. Paratype, MGUH 27357. Height 2.3 mm.

Figures 19a, b. *Tatara danica* n. sp. Paratype, MGUH 27358. 19a protoconch and first teleoconch whorl, height 3.0 mm. 19b apical view of protoconch, bar 0.5 mm. Silicone rubber cast.

Discussion – Rosenkrantz (unpublished drawing with notes) considered the species to be a *Plesiotriton*, differing only little from typical representatives of the genus. Definitive generic placement of this species is impossible but *Plesiotriton* seems most suitable. The columellar plications of *P. steni* are not as pronounced as they are in other species but the ornamentation and overall shape make this a suitable, although probably temporary, placement. The sculpture is very close to that of *P. deshayesianus* Beu & Maxwell, 1987 from the middle Eocene of the Paris Basin. That species also has rather weak columellar folds and also has the same type suture. *Plesiotriton steni* differs from other described species of the genus in being elongated as are most species of *Tritonoharpa* but the lack of varices precludes placement therein.

Subfamily Cancellariinae Forbes & Hanley, 1851

Genus *Unitas* Palmer, 1947 (= *Uxia* Jousseaume, 1887, *non* Walker, 1866)

Type species – *Cancellaria costulata* Lamarck, 1803, by original designation of *Uxia* Jousseaume, 1887 [*non* Walker, 1866].

Unitas anderseni n. sp.

Figures 2a, b, 12, 16

Type locality – Fakse quarry.

Type stratum – Coral Limestone, Middle Danian, Paleocene.

Derivation of name – This species is named after conserva-

tor Søren Bo Andersen, Geologisk Institut, Aarhus University.

Holotype – MGUH 27346 (leg. Søren Bo Andersen, ex. ISL Colln: figure 2).

Paratype – MGUH 27347 (leg. Alice Rasmussen: figure 12); MGUH 27348 (leg. Søren Bo Andersen, ex. ISL Colln: figure 16).

Additional material – ISL Colln, 2 juvenile specimens (leg. Søren Bo Andersen); ARF Colln, 6 juvenile specimens.

Diagnosis – A rather stout *Unitas* with strong varices at intervals of about one half whorl.

Measurements – The holotype has a length of 7.5 mm and a width of 3.9 mm.

Description – The shell is small, subfusiform and relatively solid. The length/width ratio is almost 2.0. The body whorl equals almost 2/3 of the total shell height, the aperture about 0.4. The four adapical teeth are stronger and more widely spaced than the other. The columella is almost straight and has three folds, of which the two adapical are stronger and wider spaced than the abapical one, which is placed at the transition to the very short, spout-like canal. The aperture is ovate and relatively narrow with a distinct posterior canal. The thickened labrum has nine teeth internally and runs gradually into the canal without any demarcation in a regular curvature, which projects under the canal. The columellar callus is relatively thick and well defined. There is no pseudumbilicus. On the parietal wall there is a rather distinct protuberance midway between the posterior canal and the adapical columellar fold. The protoconch consists of 2 ¼ convex whorls, which are separated

by a deeply impressed suture. The small nucleus is slightly depressed and the first 1 ½ protoconch whorls are planispiral and placed slightly obliquely to the axis, the last whorl is quickly increasing in strength. The transition into the teleoconch is gradual and is indicated by the appearance of the teleoconch sculpture. The holotype has three teleoconch whorls, which are medium convex and separated by a deep suture. The spiral ornament consists of four spiral cords, of which the abapical one is weakest. The ribs are separated by wider interspaces. The axial ribs are slightly prosocline and of almost the same width as their interspaces. On the body whorl they gradually weaken. At intervals of about half a whorl there are strong varices. The almost invisible growth-lines have the same direction as the axial ribs.

Discussion – Although Rosenkrantz (unpublished drawing with notes) considered this species to be a *Plesiotriton*, it is properly placed in the genus *Unitas*. The genus *Unitas* is represented by numerous species from the Eocene of the Paris Basin, the Eocene of the southeastern United States, the Dano – Montian of Belgium, etc. This new species has some resemblance to *Unitas pearlensis* (Meyer & Aldrich in Meyer, 1887) from the Jackson Eocene of the Mississippi Embayment, Alabama. That species has stronger axial ribs and more prominent oblong tubercles on the labrum. Cossmann & Pissarro (1910–1913) illustrated the Eocene cancellariids from the Paris Basin. According to Pacaud & Le Renard (1995) 25 species of *Unitas* are present in that rich fauna. Of those, the only one resembling the Fakse species is *Unitas rhabdota* (Bayan, 1873) which has small nodes formed by the intersection of the spiral cords and axial ribs and small coronations at the shoulder. Glibert (1973) revised the gastropods of the Dano – Montian of Belgium. None of the Belgian representatives of *Unitas* resembles the Danish species from Fakse.

Unitas alicae n. sp.
Figures 3a, b, 13, 14

1933 *Admete* ? *biplicata* (RAVN) – Ravn, p. 68, pl. 1, figs 12a–b [*partim, non Tritonium biplicatum* Ravn, 1902b].

Type locality – Fakse quarry.

Type stratum – Coral Limestone, Middle Danian, Paleocene.

Derivation of name – This species is named after Mrs. Alice Rasmussen, Fakse.

Holotype – MGUH 27349 (leg. Sten Lennart Jakobsen, ex ISL Colln: figures 3a, b).

Paratype – MGUH 27350 (leg. Alice Rasmussen, ex ARF Colln: figure 13); MGUH 3121, illustrated by Ravn (1933, pl. 1, figs 12a–b) as *Admete* ? *biplicata* (Ravn): figure 14.

Additional material – Two further juvenile specimens were mentioned by Ravn (1933: 68).

Diagnosis – A *Unitas* with a slightly impressed suture and no varices.

Measurements – The holotype has a length of 8.6 mm and a width of 3.5 mm.

Description – The shell is small, subfusiform and slender, almost 2.5 as high as wide.

The protoconch consists of 3½ convex whorls, quickly increasing in diameter, which are separated by a distinct suture. The small nucleus is slightly depressed and the first 1½ protoconch whorls are planispiral. From the second protoconch whorl a spiral cord is present under the adapical suture, and after further ¼ whorl two spiral cords appear under it. On the terminal ¼ whorl a fourth spiral cord is present immediately above the abapical suture. The spiral cords are regularly spaced, the adapical one a little stronger than the others. The transition into the teleoconch is gradual and visible as the appearance of small tubercles on the two adapical spiral cords caused by the intersection of the axial ribs. The teleoconch of the holotype consists of three whorls, which are medium convex and separated by a slightly impressed suture. Last whorl equals 2/3 of the total shell height, the aperture about 0.4. The aperture is ovate and relatively narrow with a rather distinct posterior canal. The labrum is thickened and has nine lirations on the rather flat and broad internal side. The labrum is almost straight on the adapical part and meets the canal, which is not demarcated from it, in a regular curve. The columella is slightly concave with three folds, of which the two adapical are stronger than the abapical fold, which is placed at the transition into the spout-like canal. The canal is turned to the left. The parietal callus is well demarcated on the columella, but relatively thin on the parietal wall. Five spiral cords, decreasing abapically in strength, can be seen through the parietal wash. The spiral sculpture consists of four primary cords which are soon accompanied by a fifth weaker cord. The spiral ornamentation is relatively weak on the teleoconch whorls. The convex base has an additional five weak spiral cords, with even weaker secondary cords inserted. The axial sculpture consists of about 16 slightly prosocline ribs, slightly wider than their interspaces and gradually weakening abapically. At the intersections with the two adapical spiral cords weak tubercles are formed. Between the axial ribs very weak growth lines, having the same direction as the axial ribs, are visible.

Discussion – This species differs from *P. anderseni* by having a larger protoconch with a different ornamentation, relatively higher whorls without varices, and a deeply impressed suture. The outline of the labrum differs in shape, *P. alicae* having a straighter and more flaring aspect. It also has a thinner callus and stronger sculpture. The body whorl does not slope back regularly to the suture but a small angled shoulder is developed. This new species has only a

few large growth lines, none strong enough to be termed varices. Ravn (1933) described and illustrated a juvenile specimen as *Admete* ? *biplicata* and mentioned two additional juvenile specimens in MGUH. We have reproduced a drawing of this specimen in the Rosenkrantz files, the Geological Museum of Copenhagen.

***Unitas* sp.**

Figures 15a, b

1933 *Admete* (*Bonellitia*) sp. – Ravn, p. 68, pl. 6, figs 12a–b.

Discussion – According to the description and illustration by Ravn the only specimen found is not conspecific with the two species described above. In fact it seems to match the figures of what was identified as “cf. *Coptostoma*” by Kollmann & Peel (1983: 94, figs. 212a–b). As specific identification is not possible, and even generic placement is problematical, it is here left in *Unitas*. Unfortunately, locating the specimen in the Geological Museum, Copenhagen type collection has not been possible. We have reproduced the drawings of the specimen in the Rosenkrantz files, the Geological Museum of Copenhagen.

Genus *Admetula* Cossmann, 1889

Type species – *Cancellaria evulsa* (Solander, 1766) (= *Buccinum evulsum* Solander, 1766), by original designation.

***Admetula rosenkrantzi* n. sp.**

Figures 6a, b

Type locality – Fakse quarry.

Type stratum – Coral Limestone, Middle Danian, Paleocene.

Derivation of name – This species is named after the late Professor Alfred Rosenkrantz.

Holotype – MGUH 27351 (leg. S.B. Andersen, ex ISL Colln: figures 6a, b).

Additional material – GM 1977.1375, one adult specimen.

Diagnosis – An *Admetula* with three spiral cords and no axial sculpture.

Measurements – The holotype has a height of 6.7 mm and a width of 4.8 mm. The specimen GM 1977.1375 has a height of 7.3 mm and a width of 5.2 mm.

Description – The shell is small, ovoid-conical and rather solid. The last whorl equals 0.8 of the total shell height, the

aperture 0.6. Height/width ratio 1.4. The protoconch consists of 2½ smooth and convex whorls, separated by a deep suture. The nucleus is small, and the first protoconch whorl is planispiral and oblique to the axis. The last protoconch whorl is quickly increasing in strength. The terminal ¼ protoconch whorl has three spiral cords, which increase in strength. The transition into the teleoconch is gradual. The holotype has two teleoconch whorls which are convex with a flat adapical part and separated by a deep, almost canaliculate, suture. The aperture is large and ovate. The labrum is regularly curved and thickened. Internally the labrum has nine denticles. The columella is slightly concave with two strong oblique folds adapically. A third weak fold is the margin of the canal. Only a part of the columella is covered by a thin, somewhat indistinctly demarcated callus. Spiral ornamentation consists of three primary spiral cords visible between the sutures, which continue on the teleoconch whorls without secondary cords. A fourth spiral cord immediately above the suture is mostly hidden by the following whorl. The cords are almost as strong as their interspaces. On the convex base there are an additional nine spiral cords, decreasing in strength abapically. Axial sculpture is absent. On the teleoconch three older varices are visible as slight thickenings of the shell, one occurring immediately before the aperture and the two others with a distance of half a whorl. Very weak prosocline growth lines are strongest on the adapical part of the whorl.

Discussion – The genus *Admetula* is well represented in Paleogene and Neogene Tethyan faunas and survives into the Recent fauna. The type species has prominent varices, a feature not present on all species. *Admetula rosenkrantzi* differs from all known congeners in its extreme pyriform shape as most species are either rounded or elongately rounded. Its placement in *Admetula* is questionable due to its overall shape and also the presence of an almost vertical columella. As there is no other suitable genus it is described here due to the number and placement of the columellar folds. *Cancellaria latesulcata* Koenen, 1885 (an *Admetula*) was originally figured illustrating three different shell morphologies, one of which (Koenen, 1885, pl. 1, fig. 2d) is rather low spired and rotund but it is not pyriform. In figuring this species Ravn (1939, pl. 3, figs. 17a–b; as *Admete*) illustrated only the high-spired form.

***Admetula faksensis* n. sp.**

Figures 7a, b

Type locality – Fakse quarry.

Type stratum – Coral Limestone, Middle Danian, Paleocene.

Derivation of name – faksensis (Latin) = from Fakse.

Holotype – MGUH 27356 (GM 1977.1376, leg. A. Rosenkrantz 1933: figures 7a, b).

Additional material – ARF Colln, one adult defective specimen.

Diagnosis – An *Admetula* with a spiral ornament consisting of four low spiral cords, separated by narrow furrows. Varices occur at an interval of about half a whorl.

Measurements – The holotype has a height of 10.6 mm and a width of 7.3 mm. The additional specimen has a height of 11.1 mm and a width of 7.6 mm.

Description – The shell is rather small and ovoid-conical. The height/width ratio is about 1.5. Last whorl equals 0.8 of the total shell height, the aperture 0.6. The protoconch consists of about three convex whorls, separated by a deep suture. The nucleus is small, and the whorls are regularly increasing in diameter. The transition into the teleoconch is gradual. The largest specimen has two and a half teleoconch whorls, which are convex and separated by a deep suture. There is a subsutural ramp. The aperture is wide and ovate, going into the canal without constriction. The labrum has a projecting margin, which is thin on the holotype. On the other specimen known there are three close-set margins, resulting in a more thickened labrum, which has four tubercles internally. The columella is rather short and almost straight and bears three folds, of which the adapical is less oblique than the others. The abapical weak fold is the margin of the canal, which is short and wide, slightly turned to the left. The callus is thin, but well defined, covering only the columella. On the additional specimen there are two tubercles on the parietal wall. The spiral ornament consists of four broad, low cords, which are separated by much narrower interspaces. On the convex base there are 10 further cords, decreasing in strength abapically. There is no axial sculpture, but slightly prosocline growth lines can be observed. Varices occur at an interval of about half a whorl.

Discussion – This species differs from *Admetula rosenkrantzi*, described above, by having flat, narrowly spaced spiral cords and prominent varices. Furthermore, the species is more elongated. This species matches *Admetula* well by its columella, varices and the rounded body whorl.

Genus *Semitriton* Cossmann, 1903

Type species – *Plesiotriton dennanti* Tate, 1898, by original designation.

***Semitriton biplicatus* (Ravn, 1902b)**

Figures 5, 8, 17a, b

1902b *Tritonium biplicatum* (M.U.H.) n. sp. – Ravn, p. 228 (24); pl.2, figs 11–13.

1933 *Admete (?) biplicata* (Ravn) – Ravn, p. 68; pl. 1, figs 12a–b. [*partim, non* pl. 1, figs 12a–b = *Unitas alicaeae* n. sp.].

Lectotype – (designated herein): MGUH.108 (= Ravn 1902, pl. 2, fig. 11); figure 8.

Material – MGUH 27352 (leg. S.B. Andersen, ex ISL Colln: figures 5a, b); MGUH 27353 (leg. S.B. Andersen, ex ISL Colln: figures 16a, b); ISL Colln, 10 juvenile specimens (leg. Søren Bo Andersen); AFR Colln, 24 juvenile specimens.

Measurements – The lectotype, illustrated by Ravn (1902, pl. 2, fig. 11), has a height of 45 mm and a width of 24 mm.

Description – The adult shell is moderately to medium large and subfusiform. The protoconch consists of 2 ½ smooth and convex whorls, separated by a deep suture. The nucleus is small, not depressed, and the first whorl is planispiral. On the terminal ¼ whorl seven or eight spiral cords are present. Transition into the teleoconch is gradual. Largest specimen has four teleoconch whorls, which are convex and separated by a distinct suture. Height/width ratio about 2.0. Last whorl equals about 0.75 of the total shell height, aperture and canal about 0.5. Aperture rather wide and pyriform, labrum thickened, with numerous denticles internally. On the type, illustrated by Ravn there are about 30 denticles. Columella almost straight, with two oblique folds. Canal rather short and turned to the left. The columella callus is thin and not very well demarcated. The convex body whorl is constricted near the base. The spiral ornamentation consists of seven or eight primary cords separated by narrower interspaces. The abapical spiral cord is more or less covered by the following whorl. On the younger whorls secondary ribs occur. The base and the neck of the canal have numerous ribs. The axial ornament consists of about 30 poorly defined and slightly prosocline ribs that gradually weaken on the body whorl. Old apertures appear as varices, usually at intervals of about one half whorl.

Discussion – Rosenkrantz (unpublished notes) considered this species to be a *Semitriton*, but he obviously thought a new genus might be needed. The species matches the descriptions and illustrations of *Semitriton* in Beu & Maxwell (1987) except for the multispiral protoconch. The *Semitriton* protoconchs illustrated by Beu & Maxwell (1987) are paucispiral with a bulbous nucleus. This character thus seems to be only of specific value. Ravn (1902b) designated no holotype, illustrating two internal moulds (1902b, pl. 2, figures 12, 13) and a wax duplicate of an external impression (plate 2, figure 11). As this last specimen illustrates all characteristic features of the species except for the protoconch, it is here designated as lectotype. Ravn (1933, p. 68; pl. 1, figs 12a–b) referred three juvenile specimens from the nose-chalk to this species. Those specimens, however, have only four primary spiral cords and are juvenile specimens of *Unitas alicaeae* n. sp., described herein. This species differs from other known species of *Semitriton* by its multispiral protoconch and its larger size. It is rather common in the collections of the Geological Museum, Copenhagen, but most specimens therein are in-

ternal moulds. Ravn (1933) mentioned 35 specimens.

Genus *Tatara* Fleming, 1950

Type species – *Cymatium pahiense* Marshall & Murdoch, 1921, by original designation.

Tatara danica sp. nov.

Figures 9, 10a, b, 18, 19a, b.

Type locality – Fakse quarry.

Type stratum – Coral Limestone, Middle Danian, Paleocene.

Derivation of name – danicus (Latin) = Danish.

Holotype – MGUH 27354 (leg. Søren Bo Andersen, ex ISL Colln: figures 10a, b).

Paratypes – MGUH 27355 (leg. Søren Bo Andersen, ex ISL Colln: figure 9); MGUH 27357 (figure 18); MGUH 27358 (leg. Søren Bo Andersen, ex ISL Colln: figures 19a, b).

Additional material – 17 specimens, mostly juvenile, from the “nose-chalk” and two adult specimens from the coral limestone (leg. Søren Bo Andersen, ISL Colln); ARF Colln, one adult and two juvenile specimens from the “nose-chalk” and one adult specimen from the coral limestone; MGUH Colln (GM 1977.1373 and 1977.1374), two specimens from the “nose-chalk”.

Diagnosis – A slender *Tatara* with two strong columellar plaits and up to six columellar nodules. The edge of the outer lip is moderately wide and bears nine denticles that are elongate abaxially.

Measurements – The holotype has a height of 11 mm and a width of 5.5 mm. Largest specimen has an estimated height of about 25 mm.

Description – The shell is rather small to moderate large and subfusiform, height/width ratio about 2. Last whorl equals about 0.8 of the total shell height, aperture about 0.6.

Protoconch consisting of $2\frac{3}{4}$ convex and smooth whorls separated by a deep suture. Nucleus is small and slightly depressed. The first protoconch whorl is planispiral and obliquely placed to the axis of the shell. Terminal half protoconch whorl with five spiral cords. Transition into the teleoconch is gradual. The largest specimen has three teleoconch whorls, which are convex and separated by a deep suture. The aperture is elongate-ovate and relatively narrow. The labrum is thickened and has a flat internal side, bearing nine denticles, which are elongate abaxially. Up to six nodules are visible on the parietal wall. These nodules are oblique to the spirals. The columella bears two

strong oblique plaits and up to six (in most cases four) weaker nodules, decreasing anteriorly in size. The heavy but narrow callus covers the columella, and on the adult specimen it has a raised and well defined edge, forming a collar around the aperture. Spiral ornament consists of five spiral cords that are continuations of the spirals on the protoconch. The spirals are considerably weaker than their interspaces. The adapical spiral cord soon disappears, and the abapical one is partly covered by the suture. The three medium strong spirals cords are regularly distributed on the whorl and are much weaker than their slightly concave interspaces. From the first teleoconch whorl and onwards secondary spirals appear, seven fine ones on the largest specimen. The axial ornamentation consists of about 20 prosocline ribs on the first teleoconch whorl, increasing in number to 30 on the adult specimen. The ribs are only slightly wider than their interspaces. At the intersections of the spiral and axial sculpture small pointed tubercles are formed. The concave interspaces between the spiral cords are finely cancellated by the fine secondary cords and the incremental growth lines. Old apertures are visible as varices, with intervals of about half to two thirds of a whorl. The growth lines are parallel to the axial ribs.

Discussion – Juvenile specimens lack the raised columellar shield and are rather similar to *Semitriton biplicatus*, but differ distinctly by their characteristic sculpture. *S. biplicatus* has a higher number of fine, narrowly spaced spirals of almost equal strength. Rosenkrantz (unpublished notes) considered the species to be a *Sassia*. In fact, juvenile specimens are rather difficult to separate from juvenile representatives of *Sassia* as both genera have strong varices and rather similar sculpture. *Sassia* is represented by several species in the Fakse fauna, of which only *Sassia faxensis* (Ravn, 1933) has been established. This new species seems to be related to *T. revoluta* (Finlay, 1924) as figured by Beu & Maxwell (1987, p. 54; fig. 2N, pl. 27 j, k). It differs by having only two columellar plaits and a less wide edge on the thickened labrum. Also, the tubercles on the parietal wall are more distinct. *Tatara flemingi* Beu & Maxwell, 1987 (p. 53, pl. 27, figs a–e) is shorter and wider, lacks varices on most of the spire and has a sinuous aperture and outer lip. Furthermore the spiral ornament is much finer, and the number of ridges on the outer lip is higher. *Tatara pahiensis* (Marshall & Murdoch, 1921), has four columellar plaits and is larger and wider (see Beu & Maxwell, 1987, p. 53, pl. 27, figs f, g). It has coarse cancellate sculpture and a very wide outer lip with 11 coarse transverse ridges. *Tatara transenna* (Suter, 1917) is short and inflated, also with very coarse cancellate sculpture.

Incerta sedis

1933 *Uxia* sp. – Ravn, p. 68, pl. 7, fig. 7a–b.

Discussion – According to the description and illustrations by Ravn the specimen (MGUH 3199) has no spiral ornamentation, but close-set axial ribs on the first teleoconch

whorl. The drawings of the specimen in the Rosenkrantz files show about 10 fine spirals on the neck of the canal and some more weaker spirals suggested on the base. On the terminal part of the body whorl there are no axial ribs. The columella has three strong oblique folds, and the short canal is turned to the left.

The general outline and ornament suggests that the specimen might be a juvenile Mitridae.

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