

A new genus and species of the Mesozoic superfamily Porcellioidea (Mollusca: Vetigastropoda) from the Danian (early Paleocene) of Faxe, Denmark

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The very rich mollusc fauna of the middle Danian deposits at Faxe, Denmark has yielded a possible representative of the superfamily Porcellioidea, family Porcellioidea, viz: *Faxetrochus problematicus* n. gen. nov. sp. The family Porcellioidea was until now known from the Silurian to the late Cretaceous.

KEY WORDS: Mollusca, Gastropoda, Porcellioidea, Porcellioidea, Danian, early Paleocene, Faxe, Denmark, new genus, new species

Introduction

The Danian deposits of Faxe (Denmark) contain a very rich mollusc fauna (Ravn 1902a, 1902b, 1933; Nielsen, 1919; Schilder, 1928; Rosenkrantz, 1960; Schnetler *et al.*, 2001; Schnetler & Petit, 2006). A unique specimen attributed to the Porcellioidea, the first post-Mesozoic occurrence of this group, was collected by Alice Rasmussen 1994.

Geological setting and stratigraphy

The limestone rocks exposed in the quarry east of the small town of Faxe in eastern Sjælland (Denmark) have been excavated for several hundred years. Faxe 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 (Fig. 1). A section through a bryozoan-coral mound complex is exposed in the quarry. In the complex a vast number of facies may be recognized all displaying a large variation in diagenesis: Bryozoan limestone (Floris, 1980; Bernecker & Weidlich, 1990; Willumsen, 1995). For a review see Surlyk & Håkansson (1999). Desor (1847) introduced the Danian Stage with the type localities Faxe 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 (Gradstein *et al.*, 2004). The mid Danian coral limestone at Faxe 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). Thomsen (1995) subdivided the Danish Danian into 9 calcareous nannoplankton zones. According to this subdivision the sequences in Faxe quarry fall into his calcareous nannoplankton zones 4 and 5 of middle Danian age.

Material

The unique specimen described herein has been collected in the Faxe quarry in an unconsolidated corallian limestone, in which originally aragonitic mollusc shells are preserved, due to early recrystallization of aragonite into calcite (Ravn, 1933; Bernecker & Weidlich, 1990). This type of corallian limestone is informally named 'nose-limestone' after a projecting part in the quarry, which colloquially was called 'the nose' (Ravn, 1933: 'le Nez'),. This occurrence in the quarry was found in the early 1900's and was mentioned in the work by Nielsen (1919), but has disappeared many years ago, due to excavation in the quarry. Material of molluscs was collected by Ravn, Nielsen and Rosenkrantz. Since then 'nose-limestone' has been encountered in the northern part of the quarry. In 1972 S.B. Andersen and S.L. Jakobsen found many molluscs in nose-limestone from a new pit north of the old quarry. In 1994 Alice Rasmussen (Faxe) collected additional material of fossils, including the *Faxetrochus problematicus* n. gen. nov. sp., described below.

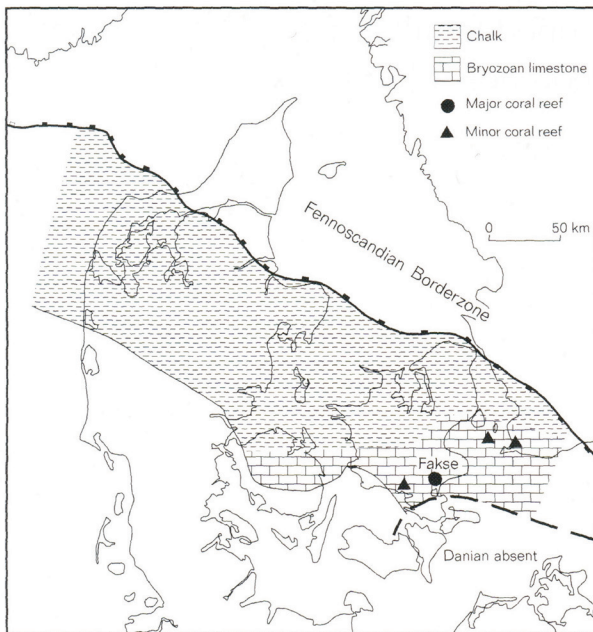


Figure 1. Main structures of the Danish area during the middle Danian. Compiled by Erik Thomsen (1995).

Palaeoecology

The mollusc fauna of the bryozoan and coral limestone at Fakse was discussed by Ravn (1933) and Rosenkrantz (1960). Schnetler (2001) discussed the fauna briefly in comparison with the mollusc fauna of the younger (Selandian) Lellinge Greensand. The very rich mollusc fauna from the nose-limestone at Fakse yields probably 200 species with more than 180 species of gastropods. The gastropod fauna is characterised by *e.g.* numerous Pleurotomariidae, trochoids, Turbinidae, Cerithiopsidae, Triphoridae, Ranellidae, cypraeids, and many small species, which are still pending description. Among the gastropods sponge eaters are common (Cerithiopsidae, Triphoridae, trochoids and Pleurotomariidae). Especially the families Cerithiopsidae and Triphoriidae are very diverse, with *c.* 30 and eight species respectively. Of the Trochidae and Turbinidae two species of each family are very common. The family Chilodontidae is represented by four species, of which three (previously referred to *Monodonta*) are abundant. *Emarginula* (possibly herbivorous) is also very common. Among the carnivores representatives of the families Buccinidae and Mitridae are very common. Less common but very diverse is the family Cancellariidae, represented by eight species (Schnetler & Petit, 2006). The epifaunal carnivore family Newtoniellidae is represented by more than 10 species. The cypraeids are omnivorous, grazing on algae or eating sponges and anthozoans. Representatives of the infauna (*e.g.* Turridae and Naticidae) are very rare. Several species of *Eulima* (parasites of echinoids) are rather common. The family Architectonicidae feeds on anthozoans and is represented by two species, of which one is common. The nose-limestone is characterized by a dominant coral fauna of octocorals and hydrocorals whereas framebuilding scleractinian corals are less common (B.W.

Lauridsen pers. comm., 2011). Bernecker & Weidlich (1990) presented evidences for the coral mounds being aphotic and azooxanthellate, and they estimated the water depth to have been somewhere between 100 m and 300 m.

Systematic description

Class Gastropoda Cuvier, 1797
 Subclass Archaeogastropoda Thiele, 1925
 Order Vetigastropoda Salvini-Plawen, 1980
 Superfamily Porcellioidea Koken *in* Zittel, 1895
 ? Family Porcelliidae Koken *in* Zittel, 1895

– Note on the Porcelliidae family

The Porcelliidae family is subdivided into the subfamilies Porcelliinae Koken *in* Zittel, 1895 and Agnesiinae Knight, 1956 (Bouchet & Rocroi, 2005). Of these the planispirally coiled Porcelliinae existed from Triassic to late Cretaceous, whereas the sinistrally coiled representatives of Agnesiinae are known from Silurian to late Triassic (Frýda, 1997; Kiel & Bandel, 2001). Cossmann (1915) established the extinct family Cirridae, which by Wenz (1938-44) was assigned to the superfamily Euomphaloidea de Koninck, 1881. Wenz noted that the majority of Cirridae is sinistral (or questionably hyperstrophic dextral) and assigned the Porcelliidae to the superfamily Pleurotomarioidea Swainson, 1840, noting that the Porcelliidae contained slit-bearing planispiral forms. Both families show a heterostrophic coiling, as the protoconch is dextrally coiled, whereas the teleoconch is sinistral. Both Wenz and Knight *et al.* (1960) failed to recognize a selenizone in *Antitrochus* and referred this genus (and the family Porcelliidae) not to the Vetigastropoda but to the Platyceratoidea Hall, 1859 (clade Neritimorpha Golikov & Starobogatov, 1975). The taxonomic position of these families and its history was discussed in detail by Bandel (1993). He was the first to use this change in the coiling as a diagnostic feature and he united slit-bearing members of the Porcelliidae with the family Cirridae, in which no slit is present, into the superfamily Cirroidea Cossmann, 1915. Bandel supposed that the slit-bearing members of the Porcelliidae evolved into the Cirridae. The name Cirroidea was later replaced by Porcellioidea Koken *in* Zittel 1895 (Frýda & Blodgett, 2004). Kiel & Frýda (2004) demonstrated nacre in the late Cretaceous Cirridae species *Sensuitrochus ferreri* Quintero & Revilla, 1966 and concluded that the superfamily Porcellioidea represents an independent, long-lived natural group within the Archaeogastropoda. Absence of selenizone or presence of tremata instead of selenizone was documented in some Palaeozoic Agnesiinae (Frýda & Farrell, 2005; Frýda *et al.*, 2008; Frýda & Ferrová, 2011).

Genus *Faxetrochus* n. gen.

Type species – *Faxetrochus problematicus* n. gen. nov. sp.

Derivation of name – The genus is named after the type locality and the trochiform shell.

Diagnosis – A sinistral trochiform vetigastropod with a depressed nucleus, cancellate ornament and the selenizone situated on the base at the transition to the periphery around the umbilicus. The axial ribs are slightly opisthocline.

Discussion – This new genus superficially resembles *Antitrochus* Whidborne, 1891 (type species: *A. arietinus* Knight, 1937, from the middle Devonian). Species in this genus, however, have prosocline axial ribs. As a change of coiling from the heterostroph protoconch to the sinistral teleoconch could not be observed on the new genus, we prefer a tentative assignment to the family Porcellidae. In fact shape convergence exists with other Porcellidae genera as *Anorostoma* Farrell, 1992 or *Garraspira* Frýda & Farrell, 2005 from the early Devonian, but species in these genera have a flat spire and a more convex last whorl; the shell ornament consists also of finer spiral cords (see Frýda & Farrell, 2005).

***Faxetrochus problematicus* nov. gen. nov. sp.**

Plate 1a-f

Type locality – Faxe quarry, Sjælland, Denmark.

Type stratum – Corallian Limestone, middle Danian, Paleocene.

Derivation of name – from Latin, referring to the difficulty of the familial assignment of this species.

Holotype – Plate 1, MGUH 29810, DK 324 (leg. Alice Rasmussen 1994). The holotype is the only specimen known.

Diagnosis – As for the genus.

Measurements – Height 1.84 mm, width 2.76 mm, height of body whorl 1.58 mm, height of aperture 1.2 mm.

Description – The rather thick-walled shell is small, trochiform and sinistral, with a height/width-ratio of 0.67. The unique specimen consists of the protoconch and 2¼ teleoconch whorls. About one eighth of the terminal whorl has been broken off. The protoconch seems to consist of 1¼ convex whorls. The initial whorl is not visible, but depressed, presumably dextral and heterostroph, and descends into the apex. The visible terminal protoconch whorl is sinistral, deviating c. 120° from the axis of the shell. The transition into the teleoconch is indicated by the appearance of two weak adapical spiral ribs and close-set axial ribs, which are increasing in strength adaperturally. The teleoconch consists of 2¼ slightly convex whorls, which increase slowly and regularly in strength. The whorls are separated by a deep suture. The last whorl equals 86%, the aperture 60% of the total shell height. The aperture is rounded quadrangular, having a right angle at the edge of the columella. The labrum is broken and on the columella the callus partly covers the spiral ornament. On the first teleoconch whorl the ornament consists of three

weak adapical spirals and two rather distinct spirals, situated at the periphery. Between these latter two spirals there are two weak spiral ribs. On the base a strong spiral demarcates the selenizone, which is situated at the transition to the periphery around the umbilicus. Between the spiral demarcating the base and the selenizone there are two weak spiral ribs. In the umbilicus two rather weak spirals are visible. The rather narrow and concave selenizone is visible on the terminal ¾ whorl, gradually narrowing towards the slit. It is flanked by two spirals and has crescentic growth lunulae. Three very fine irregular spiral ribs are present on the first visible part of the selenizone, but disappear on its terminal part. The selenizone ends in a short slit, of which the adaxial part is broken off. The axial ornament consists of c. 40 weak, slightly opisthocline and flexuous ribs on the last whorl. On the base they are opisthocyrt and continue into the umbilicus. At the intersections with the spirals fine tubercles occur.

Discussion – Unfortunately, the single available specimen has a rather poorly preserved protoconch, which excludes a determination of the direction of the coiling of the protoconch. Yet the depressed heterostrophic protoconch, descending into the apex, and the general outline match with some genera of Porcellidae (e.g. *Antitrochus* Whidborne, 1891) from the Devonian, but we consider that as a shape convergence as explained above. Thus, this shell is only tentatively assigned to the family Porcellidae. Compared to *Faxetrochus problematicus*, *Antitrochus arietinus* and *A. nodulosus* (Sandberger, 1842) (a very similar species, Bandel, 1993, pl. 1, fig. 2) have a higher spire, more convex whorls, and a restricted umbilicus. Sinistrally coiled Porcellidae are known from the Silurian to the late Triassic. Species of the family Cirridae Cossmann, 1915 have no selenizone and are known from the Triassic to the late Cretaceous.

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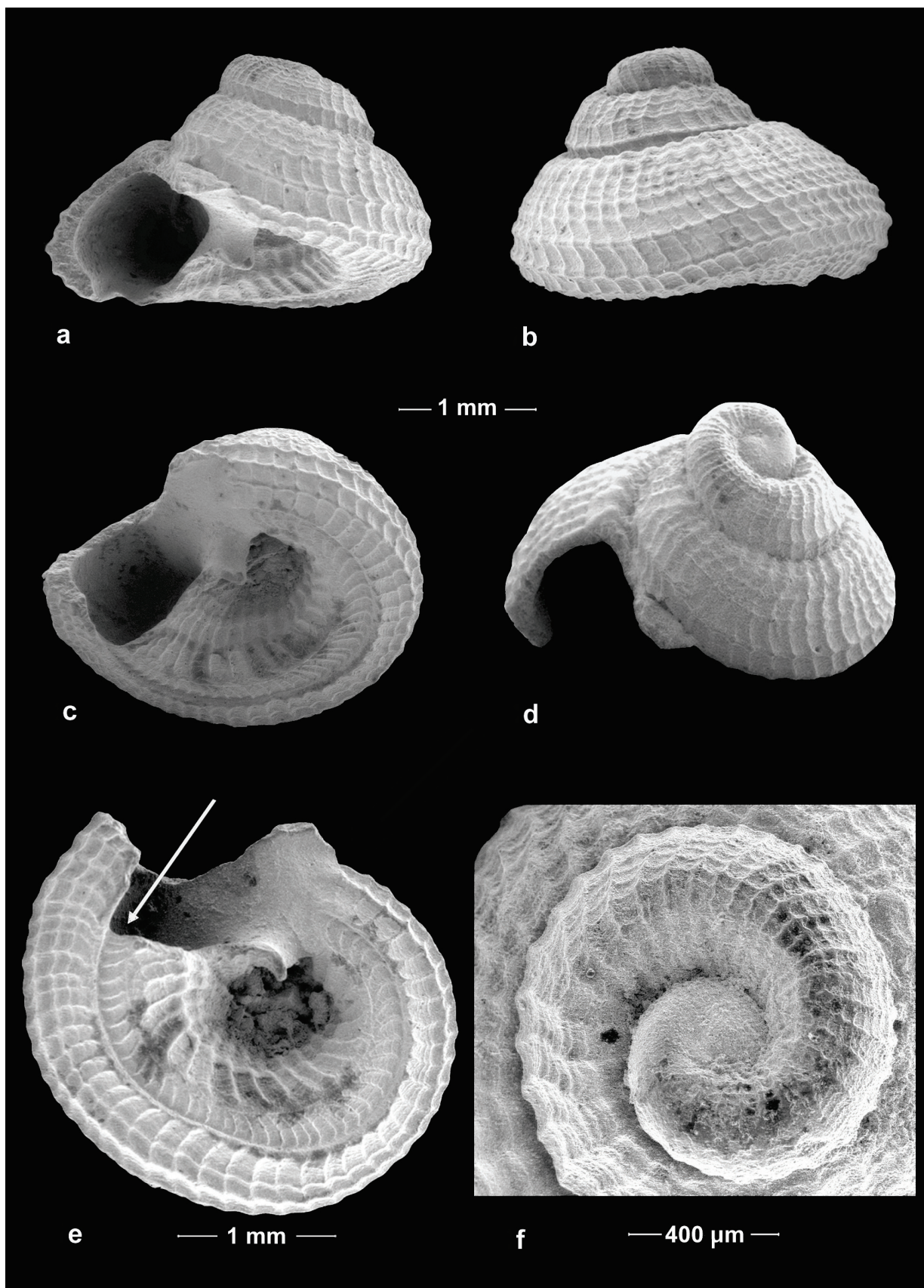


Plate 1.
Faxetrochus problematicus nov. gen. nov. sp. **Holotype**, MGUH 29810. SEM images, made by Sten Lennart Jakobsen and Jan Adolfsen (Geological Museum, University of Copenhagen). a: apertural view; b: dorsal view; c: oblique umbilical view; d: oblique apical view; e: umbilical view (arrow indicates selenizone); f: initial whorls, apical view.