A new species of Mytilid bivalve, and vertebrate remains from Lower Eocene marine deposits on Røsnæs, Danmark

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Petersen, Kaj Strand, Hoch, Ella and Bonde, Niels: A new species of mytilid bivalve, and vertebrate remains from Lower Eocene marine deposits on Røsnæs, Denmark. *Danm. geol. Unders., Årbog 1972,* pp. 79–86. København, 5. december 1973.

A new species of bivalve, *Mytilus roesnaesiensis,* is described from the Lower Eocene marine clay with ash-layers on the peninsula of Røsnæs, NW Sjælland, and fragmentary remains of sharks, teleostean fishes, and birds are briefly discussed.

En ny muslingeart *Mytilus roesnaesiensis* nov.sp. beskrives. De 12 hele individer er fundet i en konkretion ved askelag + 36 i det askeførende ler af nedre eocæn alder på Røsnæs, Danmark. Der drages sammenligninger med fund fra det øvrige tertiære »Nordsø«-område. Som samme art betragtes den af H. Illies 1949 anførte *Mytilus sp.*

En linse af ler tæt under akelag +90 indeholdt en del skeletrester af fisk og fugle. Af benfisk især hvirvler, kæber og finnestråler. Flg. kunne identificeres: ordenen Elopiformes, Molerets almindelige fisk (en argentinoid), torskefisk (? en merluciid), makrelfisk *(?Scombrinus).* Af hajtænder fandtes *Lamna inflata* (tvivlsom), *Odontaspis rutoti* og *O. macrota striata.*

Fuglematerialet udgøres af fyrre, morfologisk identificerbare, små knoglefragmenter. Overfladen hos de fleste af disse er tydeligt præget af mekanisk og/eller kemisk slid, hvilket muligvis til dels kan tilskrives fordøjelsesvæskerne i tarmsystemet hos større fisk eller fugle. Tre af fossilerne har en vis lighed med de tilsvarende skeletelementer af uglelignende fugle og kan med forbehold henføres til ordenen Strigiformes. De øvriges uspecialiserethed eller fragmentariske tilstand tillader næppe systematisk klassifikation.

Mollusca

Twelve specimens of bivalves of the family Mytilidae were found in a concretionary block from the Lower Eocene of Røsnæs, Danmark. The concretion measures 31 cm × 27 cm × 16 cm and derives from a partially hardened horizon around ashbed + 36 in Lower Eocene marine Clay

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with Tuff. The bivalves all belong to the same species, and in all of them both valves are preserved.

The shells are situated more or less in one plane of the block but are variously orientated (pl. 1, fig. 1). The presence of fossilized wood close to the shells in the block may signify that the Mytilidae were carried to the place in the gregarious way of Mytilus attached, by the byssus to a piece of driftwood. The equivalve shells all expose their exterior face; because of the film-like state of preservation, an investigation of their inner side has not proved possible. The valves have suffered from a pressure broadly perpendicular to the plane of their margins, the effects of the pressure increasing towards the outer sphere of the concretion. A right valve with an almost intact terminal beak (umbo) from the center of the concretion is demonstrated on text-fig. 1.

The shells are ornamented by a distinct, closely packed, concentric sculpture; there are no radial striae. The best preserved specimen shows the ventral margin of the valve to be straight, with the dorsal margin culminating halfway back from the beak. From the bulging front part, the valve flattens towards the posterior edge; the valve has no ridge. The mean length of the shells is 6 cm (min. 5 cm; max. 7,5 cm).

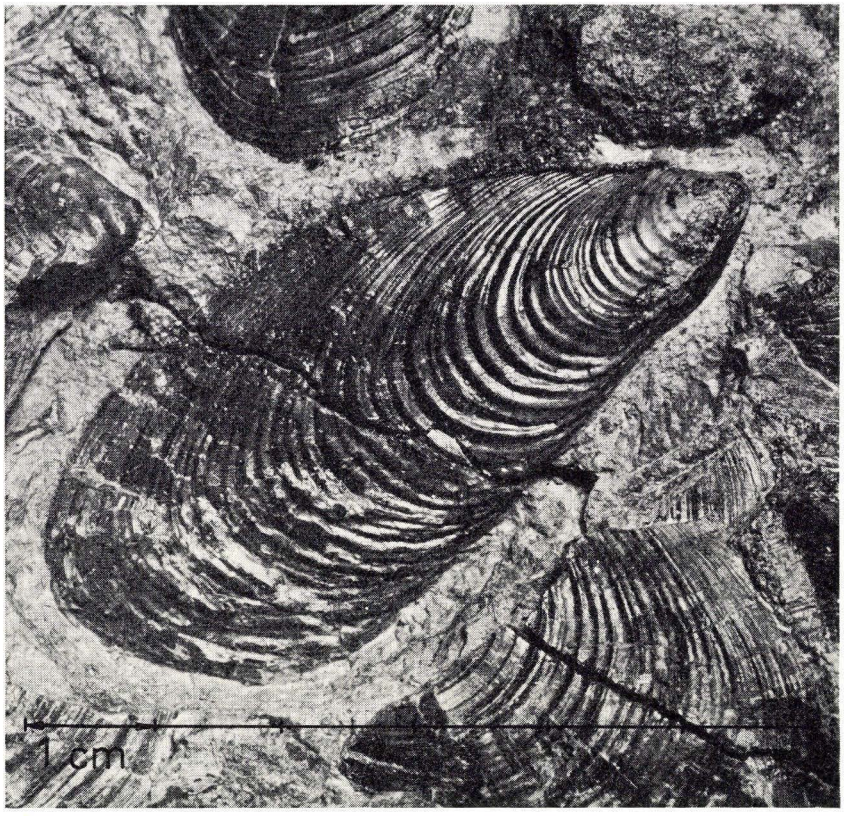
The present specimens are classed within the subfamily Mytilinae and represent the first Mytilinae to be described from the Danish Eocene. Specimens of the genus Perna, mentioned by Gagel (1916, p. 62) from clay at Røjle Klint, have never been found since (Bonde, 1968).

The family Mytilidae is well known from French and English Lower Eocene deposits. None of these specimens shows any close similarity to the present Danish fossils. However, a fragmentary shell which was described as *Modiola undulata* by Wood (1861–71, pl. XIII, fig. 13a) may be a *Mytilus* related to the Danish Mytilidae.

Mytilidae have also been described from the Eocene of northern Germany. A *Mytilus sp.* (Illies, 1949, pl. I, fig. 1) from the so-called "Pflasterhorizonten" is morphologically close to the Røsnæs specimens. The number of distinctive concentreic undulations per cm along the anterior-posterior line of the valves is 7–9 on both the German and the Danish specimens (while it is 5 on the English specimens). Furthermore, the shells from both localitites have fine growth-lines between the heavy ridges of the sculpture.

The Mytilidae specimens from ash-bed horizon + 36 in Clay with Tuff, Lower Eocene, Røsnæs, Danmark are considered a new species, *Mytilus roesnaesiensis* nov.sp.

Diagnosis: The equivalve shell shows a terminal beak. From the bulging front part the shell is ornamented by a distinct pattern of closely packed concentric ridges to the posterior edge where the valve flattens. Ventral



Text-fig. 1: Holotype no. MMH. 12824 *Mytilus roesnaesiensis* nov.sp. Phot. K.S.P.

margin straight and dorsal margin convex, culminating half way back from the beak. Fine growth lines observable between the concentric ridges of the sculpture. Length 6 cm.

Type material: the sideritic concretion containing all of the known Danish specimens was found in 1968 by the author, and now belongs to the Mineralogical Museum of København, kept here in the type collection no. MMH 12824 to no. MMH 12835; no. MMH 12824 (text-fig. 1) is chosen as Holotype. The 11 others are considered paratypes.

The specimens of Mytilidae from Lower Eocene "Pflasterhorizont" in Steinfeld Oldenburg Germany, recorded by Illies (1949), belong to the same species. They are kept in the Geologisches-Paläontologisches Institut, Hamburg.

Locus typicus: A clay pit 800 m WSW of the church in the village Ulstrup on Røsnæs, Danmark.

Stratum typicum: Clay with Tuff, Lower Eocene. KSP

Pisces

A 4 cm thick lens of clayey sediment was discovered below the ash-layer no. + 90. Between the ash-layer and the lens was a 20 cm thick clay deposit with fragments of broken ash-layers (cfr. Petersen 1973).

The fossil content of this lens included many fish remains, viz: shark teeth and fragmentary bones (e. g. vertebrae, ribs, fin rays, and jaw fragments) of teleostean fishes.

Among the groups represented in the contemporaneous Mo-clay Formation (Bonde 1966) at least spiny rayed fished (acanthopterygians) and Elopiformes (tarpons and relatives, pl. 1, fig. 4) and probably Salmoniformes can be identified from the fin spines and vertebrae.

The most common fish of the Mo-clay, a small argentinoid (called a "clupavid", Bonde 1966) is almost certainly represented by jaw bones (one maxillary) and some other fragments from the clay lens.

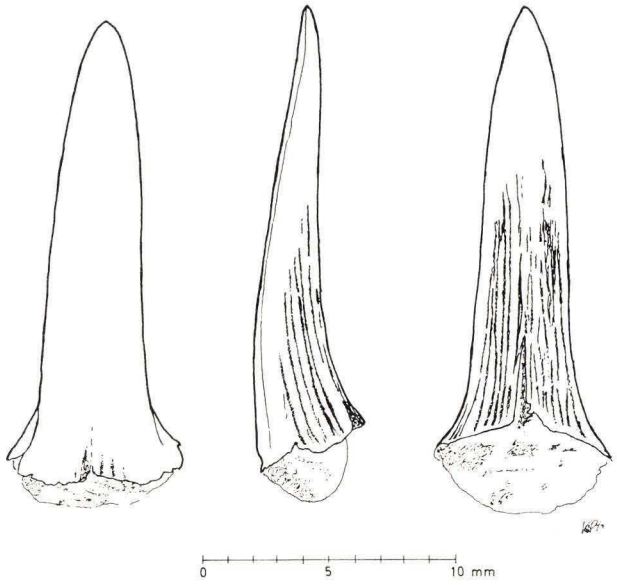
Though there were quite a few fragments of jaws with very small teeth in the lens, only two larger teleostean teeth were found. One is an incomplete, slender, conical, strongly recurved tooth crown, 2,5 mm long, which has a deep pulp-cavity, very delicate striation on the basal half, and two weak cutting-edges indicated distally, where 0,5–1 mm is missing (this was probably a "coiffe"). This tooth may well be from a gadiform fish such as the merluciid (hake) *Rhinocephalus*, which is a genus quite common in both London Clay and Mo-clay (Casier 1966, Bonde 1966 – it is definitely not the hake (?) *Trichiurides*).

The second tooth is 6 mm long, lacking about 1 mm of the apex. It is stout and conical, gently curved, with weak plications at the 3 mm wide, circular base, and is only a little compressed distally. It carries two well marked, but not sharp cutting-edges in its full length. It probably belongs to a scombrid fish and it is not a species from the Mo-clay. Many species of mackerel-like fishes have been described from London Clay, and our specimen resembles teeth of *Scombrinus* (Casier 1966, pl. 42), but proper determination is impossible without direct comparison with these fossils.

Some 50 shark teeth have been found in the clay lens, most of them isolated crowns without roots. *Lamna inflata* may be represented by one tooth, while the rest seem to be odontaspids; we have been unable to identify most of them to species.

However, on the basis of the strong vertical striation on the inner face of some crowns, these have been identified as *Odontaspis macrota striata* (Winkler) (= *Striatolamia striata* (Winkler)). Such a specimen is shown in text-fig. 2 and pl. 1, fig. 2.

One posterior lateral tooth, only 3 mm high, we identify as *O. rutoti*



Text-fig. 2: Tooth crown of *Odontaspis macrota striata*.

(?). It has the puckering of the enamel at the base of the crown, pl. 1, fig. 3, and is very similar to a Landenian tooth described by Casier (1967, pl. 6, fig. 9). Two bigger teeth (crown height 8 and 10 mm resp.) have a very weak puckering at the base and may also represent this species.

Both these species of *Odontaspis* have been identified in the contemporaneous Mo-clay Formation (Bonde 1966), but here also the specimen of *O. rutoti* (crown height 12 mm) has less puckering than typical Upper Paleocene teeth (e. g. in White 1931, Gurr 1962, Casier 1967). The puckering is still weaker in the Røsnæs teeth, which are a little younger than the Mo-clay specimen (found at ash-layer + 90 and + 28 resp.), so they may confirm the hypothesis of the progessive reduction of puckering within this species during the basal Eocene (cfr. Gurr 1962, fig. 1).

Other atypical and younger *O. rutoti* have been identified with doubt from London Clay and the Belgian "Panisélien" (M. Eocene) by Casier (1966, p. 74, pl. 8 and p. 72 resp.); these resemble the Danish specimens.

In a stratigraphic table, Ward (1971) indicated that both *O. macrota striata* (his *S. striata*) and *O. rutoi* are restricted to basal London Clay and older beds, while their presumed descendents (*S. macrota* and *O. trigonalis*) occur generally within the London Clay (undifferentiated). Cfr. discussion of *Odontaspis macrota* by Casier (1966, p. 70), who found it impossible to distinguish between two forms.

If our specific determinations of these shark teeth are correct, this may indicate that the Danish ash-series and the basal London Clay were deposited at least partly contemporaneously. This is also indicated by the ash-layer recently discovered a little above the bottom of the London Clay (Elliott 1971) and must be evident from the drillings in the North Sea.

KSP and NB

Aves

The fish-yielding deposit also contained bird-remains (pl. 2). Until now about forty morphologically identifiable pieces of avian skeletal elements have been recovered.

The fossils were extracted by first drying the sediment and then immersing it in water. This procedure may have caused a breakage of the majority of the bones. The sharp-edged, apparently fresh fractures of the specimens are contrasted by their surface, which in most cases is marked by wear or dissolution, some of which is probably due to catabolism inside larger animals.

A few of the specimens have pyritic fillings. In the rest of them the fossilizing processes seem to have affected only the bone-tissue, the bones being as hollow and porous as are the inorganic skeletal material of living birds.

The general visual impression of the bone-fragments is that they are of small size, and that they are derived from small birds. The largest specimen is a fragment of a carpometacarpus, text-fig. 3, which in size and morphology resembles the corresponding bone-region of a present-day golden plover *(Pluvialis apricaria)*. The largest avian member of the fossil assemblage, however, seems to be represented by the occipital condyle, pl. 2, 1; the condyle is similar in size and morphology to that of a corncrake (*Crex crex*). – In such statements it should be remembered that the relative proportions of the skeletal elements of birds are variable. The occipital condyle of a bird may be relatively small or relatively large, depending on the functional demands upon it. – The majority of the toe-joints, although some of them are complete, can not be taxonomically evaluated since in most cases it is impossible to indicate the exact position of isolated toe-joints in a bird-foot.

Bird remains, although they are generally small and fragile, are met with fairly often in Eocene deposits. At least four localities yielding several avian remains are recognized within the Lower Eocene North Sea Basin, viz.: Isle of Sheppey, the Danish Mo-clay area, Røsnæs, and Katharinenhof on Insel Fehmarn.

Text-fig. 3: Carpometacarpus, left, proximal end, carpal trochlea.

Bone no. 4, pl. 2, in its relatively strong appearance, its curvature, and its lack of lateral canals, and bone no. 12–13, pl. 2, in its relative stoutness, and in the significant ridge at the upper frontal part of the shaft, the well-marked, distal, trochlear incisure, and the two prominent cristae at the upper part of the back-side, are morphologically close to the corresponding toe-joints of the *Strigiformes* (owl-like birds), and may be derived from bird(s) of this order. Bone no. 5, pl. 2, is similar in its lack of lateral canals to the ungual phalanges of the diurnal and nocturnal birds of prey, while other characters, *e.g.* the rather flat curvature, tend to exclude it from these two groups of birds. No systematic classification of the birds represented by this bone and by the remaining specimens, the great majority of which is in a too fragmentary state for taxonomic investigation, has been ventured upon.

A number of small pebbles, most of them well-rounded fragments of quartz, have been extracted from the fossiliferous clay-sediment. They should be mentioned here as they may have been carried to the place inside birds, as grinding-stones of their gizzard.

E.H.

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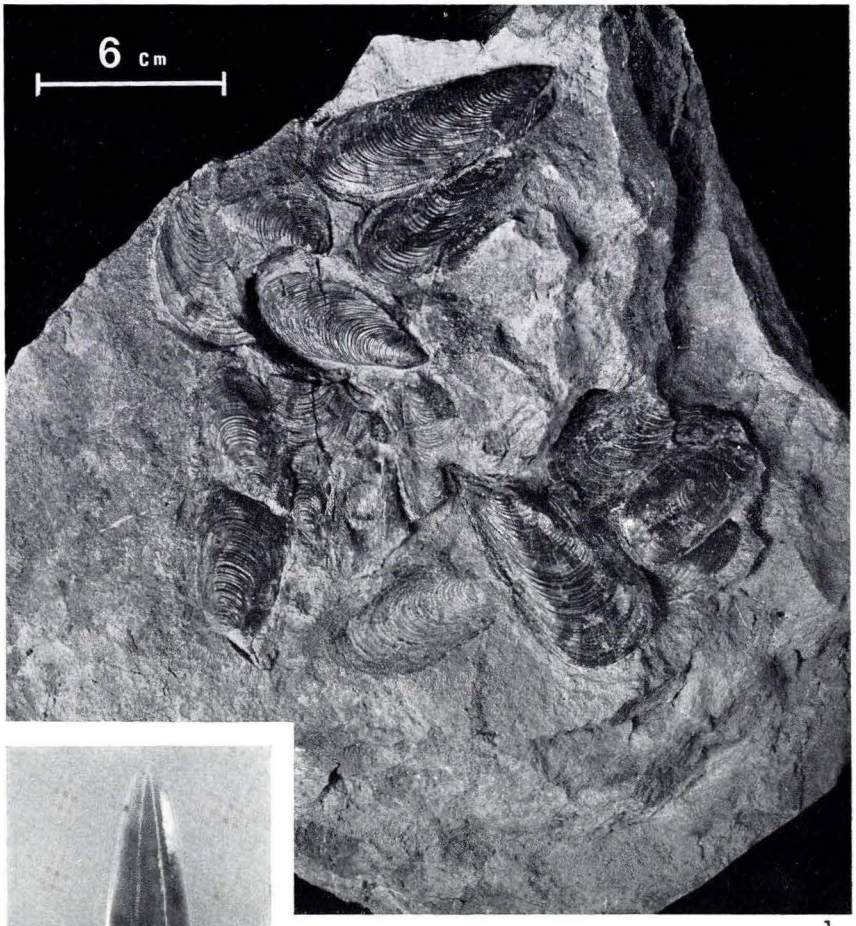
Plate 1

Fig. 1: The sideritic concretion containing all of the known Danish specimens. Holotype and paratypes of *Mytilus roesnaesiensis* nov.sp.

Fig. 2: Tooth crown of *Odontaspis macrota striata.*

Fig. 3: Tooth of *Odontaspis rutoti* (?)

Fig. 4: Half a vertebra of an Elopiform fish.
Phot. O. Neergaard Rasmussen (fig. 2, 3–4).



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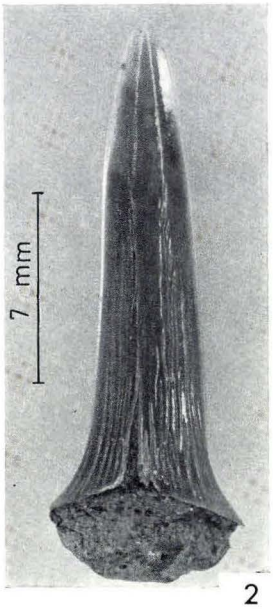

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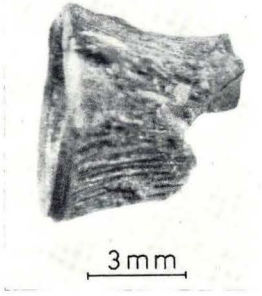

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Plate 2

Aves

Fig. 1. *Occipital condyle,* with part of skull-base, basioccipital and right exoccipital.

Fig. 2. *Humerus,* right, distal end, ectepicondyle and radial condyle.

Fig. 3. *Corpus vertebrae.*

Fig. 4. *Ungual phalanx.*

Fig. 5. *Ungual phalanx.*

Fig. 6. *Ungual phalanx,* with lateral canals for blood and nerves as known from the majority of Recent birds.

Fig. 7. *Synsacrum,* fragment of right side, with lower posterior edge of acetabulum.

Fig. 8. *Tibiotarsus,* right, distal end, outer articular condyle.

Fig. 9. *Phalanx,* distal end missing.

Fig. 10. *Phalanx.*

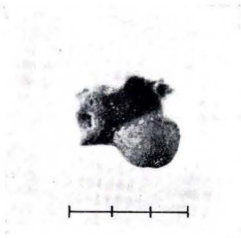
Fig. 11. *Tarsometatarsus,* left, distal end, external digital trochlea.

Fig. 12. *Phalanx,* anterior view; if from owl-like bird: left foot, toe no. II, proximal phalanx.

Fig. 13. *Phalanx,* same as no. 12, posterior view.

The scale indicates 3 mm.

Phot. O. Neergaard Rasmussen.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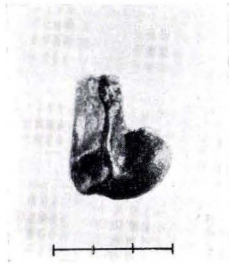
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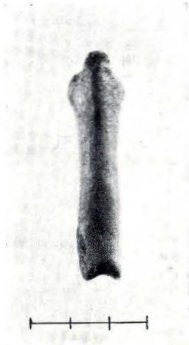
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