

NON-MARINE LAMELLIBRANCHS FROM THE UPPER PALÆOZOIC ROCKS OF SEMSVIK IN ASKER

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WITH 2 FIGURES IN THE TEXT

The Essexite lavas of the Oslo district were formerly regarded as Devonian in age until 1931, when Prof. O. HOLTEDAHL assisted by Dr. L. STØRMER, and Mr. P. STØRMER, discovered fossils, including plants and fish remains, in the beds underlying these lavas in the Asker district. Prof. HOLTEDAHL (1931, p. 323) pointed out the importance of these fossils in determining the age of the lavas. The fossil plants were identified by Mr. O. A. HØEG as *Calamites* sp. (probably *C. suckowi* BRONGT.), *Cordaites* sp. and *Walchia* spp. (resembling *W. filiciformis* STERNB. and *W. piniformis* STERNB.), and the fish remains were examined by Dr. A. HEINTZ who identified specimens of *Megalichthys*. On the evidence afforded by these fossils it was suggested that the strata were of Lower Rotliegende age and that the Essexite lavas were probably extruded early in the Permian.

Later Dr. HEINTZ and especially Mr. HØEG made collections of fossil plants, shells and fish remains from beds underlying the igneous rocks at Semsvik in Asker. Unfortunately the results of HØEG's investigations on the flora have not yet appeared, although he has informed one of the writers that the plants found at Semsvik resemble those of the Lower Rotliegende of Germany. The fish remains have been described by Dr. HEINTZ (1934, p. 176) and he records a number of genera including *Pleuracanthus*, *Megalichthys*, *Amblypterus* and *Elonichthys*. Dr. HEINTZ indicated that most of these forms occur in the Carboniferous and Permian of Europe and North America, although *Megalichthys* had not previously been recorded from the Permian of Europe, and he therefore concluded (p. 193) that the Semsvik fossiliferous beds probably represented a transitional zone between the Carboniferous and Permian.

In the pamphlet specially prepared in connection with the visit of the London Geologists' Association in Norway, in August, 1934, Prof. HOLTEDAHL referred to these fossiliferous beds and discussed their bearing on the tectonics of this region (pp. 353—7). He stated "The *Walchia*-bearing fossiliferous beds of "Rotliegendes" type, below the lavas of the Oslo region, indicate that in this region we have the northernmost part of a relatively low-lying, wedge-like crust area with more or less of a Middle-European geology, penetrating far into the Fennoscandian area. Even before the Upper Palæozoic fossils had been found, the "Oslo Graben" had been thought to be structurally connected with Central and even Southern Europe (the "Mjøsen-Mittelmeerzone" of Stille)".

During the Geologists' Association meeting in the Oslo district a small party of its members, directed by Dr. HEINTZ, visited the classical locality at Semsvik in Asker, when *Calamites* sp., shells and fish remains were obtained. The members present on this occasion kindly gave their specimens to the writers, who have also had the opportunity, through the kindness of Prof. HOLTEDAHL and Dr. HEINTZ, of examining the shells from the locality which are preserved in the Paleontologisk Museum of Oslo. They are also greatly indebted to Mr. L. R. COX for giving them access to Permian shells in the British Museum (Natural History) and for helpful suggestions.

The shells occur chiefly in a soft grey-green shale, and are sometimes associated with the plant fragments and fish scales. The largest do not greatly exceed 20 mm. in length, and many are distinctly smaller. All but a few of the smaller specimens are crushed almost flat.

The shells are referred tentatively to *Palæanodonta* cf. *castor* (EICHWALD) and *P. ? stegocephalum* (GEINITZ), but as the specimens are not well preserved it appears desirable to describe such features as are known.

The specimens exhibit the outside of the shell only, and afford no information regarding such features as the muscle scars, and particularly regarding the hinge. The shell appears to have been thin, but there is no trace of any wrinkling of the periostracum such as occurs in *Naiadites* and in certain groups of *Anthracomya*. The shells do not appear to have been much thickened in the hinge area, and it is possible that they were edentulous: no trace of hinge teeth has been discovered in any of the fragments which have been dissected from the shale.

The shells are referred to *Palæanodonta* (AMALITSKY, 1895, p. 346), a genus created for certain *Anodonta*-like shells previously described by AMALITSKY from the Permian of Russia; in some features this genus resembles both *Palæomutela* (AMALITSKY) and *Anthracomya* (SALTER). Some species of *Palæomutela*, especially *P. compressa* AMALITSKY and *P. verneuli* AMALITSKY (1892, pl. XXI & XXII), are similar in shape, but these have simple pseudo-taxodont teeth. No teeth are known in any of the Norwegian specimens.

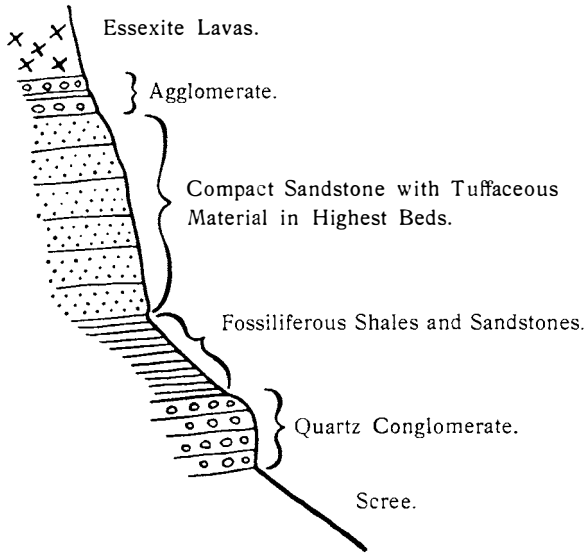


Fig. 1. Profile of Semsvik in Asker.
(After O. Holtedahl, 1931, fig. 3, p. 327).

Palæanodonta resembles *Anthracomya* in many respects, and the distinction of *Palæanodonta* from the less oblique species of *Anthracomya* is a matter of some difficulty; AMALITSKY emphasised the narrowness of the posterior end in *Palæanodonta*, and the generally curved (rarely straight) hinge line. The Norwegian shells all have upper and lower borders nearly parallel; in many specimens the shell tapers slightly towards the posterior end, and in none is there any conspicuous expansion. In many examples moreover there is a distinct curvature of the hinge line. In the absence of any more precise information regarding the hinge features and the muscle scars it appears better to place these shells with *Palæanodonta*.

Palæanodonta cf. *castor* (EICHWALD).*Unio castor* EICHWALD, 1861, Pl. XXXIX, 20.*Unio*? *carbonarius* FRITSCH, 1901, fig. 381.*Palæanodonta castor* SCHMIDT, 1905, Pl. V, 4 b only.*Dimensions:*

	Length	Height (per cent)	Length of anterior end (per cent)
No. 58295 ¹ (fig. 2 a)	22 mm	45	18
No. 51027 (fig. 2 e)	16 mm	44	? 18
No. 51043	20.5 mm	35	18
No. 57108	16 mm	41	19
No. 51030	23 mm	? 48	22
	(estimated)		
No. 57110	16.5 mm	40	21
<i>Unio castor</i> EICHWALD	23.5 mm	36	23
<i>Pal. castor</i> SCHMIDT	25.7 mm	42	24
	26.0 mm	40	27
	27.2 mm	37	24
<i>Anodonta compressa</i> LUDWIG	25.7 mm	39	21

In these shells the upper and lower borders are nearly parallel and the posterior end is scarcely expanded. The umbones are moderately prominent, the anterior umbonal slope being slightly concave; in some crushed specimens the anterior end is indistinct, and the anterior umbonal slope does not appear to be hollowed. The anterior end (measuring from the centre of the umbo) is normally about a fifth of the length of the shell. It is evenly rounded and fairly high. The lower border is gently curved or almost straight, one or two specimens showing a very slight sinuation. The posterior end is rounded, with a tendency to faint angulation in the inferior-posterior region; thence the border sweeps upwards and anteriorly in a smooth curve, the angle between the posterior border and the hinge line being about 135°.

The shells are covered by very fine, regular and closely spaced growth lines. The early growth lines of the umbonal region are tilted at an angle to the lower border. In some specimens a faint ridge

¹ The numbers refer to specimens in the Museum at Oslo. Three specimens from Semsvik have also been placed in the British Museum (Natural History): they are numbered L 63074—6.

extends posteriorly from the umbones (for example No. 57117); these shells closely resemble *Anthracosia* (?) *Fritschi* SCHMIDT (1905, V, 2).

The hinge line is long and in some of the larger specimens is slightly curved (fig. 2 a). A faint groove parallel to the hinge line in some specimens appears to mark the position of the external ligament, but no other hinge structures have been observed. One specimen (No. 51038 in the Oslo Museum) shows the posterior portion of the hinge area, which is devoid of teeth.

It will be noted that these shells do not differ greatly in dimensions from the illustrations of EICHWALD'S species, except that some are proportionally higher. They resemble it fairly closely in other characters, though some examples tend to a greater angulation of the posterior-inferior region and to rather more expansion of the posterior end. This latter feature, however, may be accentuated by the crushing.

Several of the shells closely resemble *P. compressa* (LUDWIG), a species which is not very different from *P. castor*.

The shells placed in this species, however, exhibit some variation and it is possible that several species may be represented. Some of the larger forms, tapering markedly in the posterior region, resemble *Unio*? *carbonarius* FRITSCH (1901, fig. 381), a form regarded by SCHMIDT (1905, p. 55) as related to *Palæanodonta castor* (AMALITSKY). Other specimens show rather more expansion of the posterior end than is found in *P. castor*. Some of the crushed shells suggest *P. Fischeri* (AMALITSKY, 1892, XXII, 25) and *P. faba* (SCHMIDT, 1905, V, 8 a). In view of the nature of the material available it is

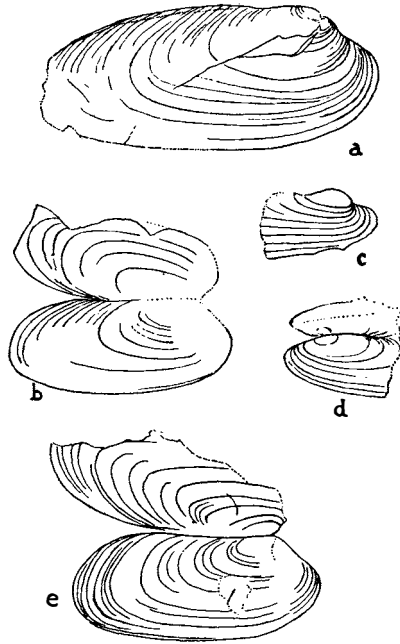


Fig. 2.

Palæanodonta cf. *castor* EICHWALD. a, No. 58295; b, No. 58296; c, No. 58297; d, No. 51032; e, No. 51027. (Specimens in the Oslo Museum). All figures approximately twice natural size.

undesirable to record all these species, however, although they may possibly be represented. On the other hand, it must be borne in mind that many non-marine shells are notably variable, and it is conceivable that the closely associated specimens from Semsvik may be variants of a single species. SCHMIDT's figures of *P. castor* (1905, V, 4 a and 4 b) illustrate the occurrence, in forms which he refers to that species, of variations closely comparable with those included in the present group.

Palæanodonta? *stegocephalum* (GEINITZ).

Anthracosia stegocephalum, GEINITZ, 1882, VIII, 20—21.

Anthracosia stegocephalum, FRITSCH, 1901, p. 81.

Dimensions:

	Length	Height (per cent)	Length of anterior end (per cent)
No. 57279.....	9 mm	39	? 36
<i>A. stegocephalum</i> (GEINITZ) fig. 20	} 19 mm 22 mm	41	30
<i>A. stegocephalum</i> (GEINITZ) fig. 21		41	32
	22 mm	41	30

A few shells amongst those found at Asker have a longer and more pointed anterior end, situated well below the level of the umbones. In dimensions these shells agree with *P. stegocephalum* (GEINITZ). In form they are like *P. verneuli* (SCHMIDT, 1905, V, 5) though they do not resemble AMALITSKY's figures of that species (especially 1892, XIX, 28, 29). Most of the specimens which are very tentatively placed here are incomplete, and the remainder are small and poorly preserved. They may possibly be extreme variants of the forms referred to *P. cf. castor* but in the absence of any specimens with anterior ends of intermediate length it appears better to separate them.

Age of the Shells.

If these shells are correctly identified it may be regarded as certain that the horizon represented falls within the Permian. In view of the uncertainty of the age of the shales in which they occur, the specimens have been compared with shells from the Carboni-

ferous, which on the whole are better known than those from the Permian, but it does not appear that they can be placed with Carboniferous forms. They have some resemblance to *Anthracomya pringlei* DIX and TRUEMAN (1931, Pl. XVII, especially fig. 17) but in that species and its variants the anterior end is longer in proportion than in most of the Semsvik shells, and is situated at a greater distance below the umbones. The more oblique shells also recall the forms described by Prof. P. PRUVOST as *Anthracomya calcifera* HIND from the lower Stephanian of France (Couches de Rive-de-Gier) and the Saar (lower part of the Couches d'Ottweiler) (PRUVOST, 1925, Pl. XII; 1923, pp. 648—9) but differ in having less angulation of the inferior-posterior border, as well as in the absence or feeble development of the carina.

Correlation with the Upper Coal Measures of Britain or with the lowest Stephanian of the Continent appears therefore to be excluded; from the shells of the higher Stephanian, characterized according to Prof. PRUVOST by the occurrence of *Anthraconauta stephaniensis* (PRUVOST), there is no difficulty in making a distinction, and a higher horizon thus appears to be indicated.

PRUVOST has recently pointed out that the lower Permian (Autunian) of many regions is marked by a lamellibranch fauna which has been recorded (inadvisedly in his opinion) under the names of *Anthracomya carbonaria* and *A. goldfussiana* (1923, p. 652, footnote 2). Shells of this type have been recorded from the Permian of many areas.

Some of the Semsvik shells are not unlike these supposed Anthracomyas in general form, but the features characteristic of *Palæanodonta* shown by some of them indicate that the horizon is probably higher.

The species recorded, and most of the forms with which comparison is made, occur in the Rotliegende of Bohemia and other areas.

These shells therefore indicate that the horizon of the Semsvik shales is above the Carboniferous, and suggest that they may be correlated with the Permian, probably some part of the Rotliegende; most of the species referred to have been recorded from the middle Rotliegende, but *Anthracosia*(?) *Fritschi* (SCHMIDT) is from the Lower Rotliegende and correlation with that part of the Permian is not excluded.

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