THE MIDDLE ORDOVICIAN OF THE OSLO REGION, NORWAY

9. Brachiopods of the family Porambonitidae

BY

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CONTENTS

A b s t r a c t . Three species of Porambonitids are described from the Middle Ordovician of the Oslo Region, Norway. One of them, *Porambonites* (*Porambonites*) *kjerulfi* is new. The nomenclature, taxonomy and evolution of the family are discussed. The new species (*P.* (*P.*) *kjerulfi*) is related to the Lower Ordovician representatives of the family, and similar species are also found in other parts of Western Europe during the Middle Ordovician. The two other species, which both belong to the subgenus *Isorhynchus* KING, are Baltic ones.

Introduction.

The Norwegian Middle Ordovician material of Porambonitids is rather small. Altogether, there are only three well defined species, none of which are very common. Only a few specimens show the sculpture, and the internal structures is found in a number of casts, most of which are artificial. In order to examine the interior of the

older, Lower Ordovician species, a serial section was made of a specimen of *P. reticulata* PANDER.

This paper is a part of a larger project, and the author is deeply indebted to Professor L. Størmer for his inspiring leadership of the team-work. I also wish to thank Mrs. A. C. Brenna, who has revised the manuscript, Miss B. Mauritz who has made the photographs, and Miss I. Lowzow, who has made the drawings.

The Family Porambonitidae.

The family Porambonitidae has been placed in different groups by different authors, and as it is a well defined group, the material from the Middle Ordovician of the Oslo Region is described here in a special paper.

Soon after the genus *Porambonites* had been established by PANDER (1830) the systematics of the group were discussed by a number of authors, a discussion which has continued ever since. For the opinions of the older authors, I can refer to TEICHERT (1930) and SCHUCHERT & COOPER (1932).

At present some authors (KOZLOWSKI 1929, ÖPIK 1930) regard the Porambonitidae as being Pentamerids, which, according to KOZLOWSKI (l. c.), belong in the Telotremata. SCHUCHERT & COOPER (1932) among others believe them to be aberant Orthids, and COOPER (1956) refer them to the Syntrophioidea.

There are at present two genera and one subgenus in the family Porambonitidae. The little known genus *Noetlingia* HALL & CLARKE (1896) has *Spirifer tscheffkini* VERNEUIL (1840) as the type, and only species. In the original description (PANDER 1830), *Porambonites* itself contained a large number of closely related species. They were united into larger specific units by later authors (v. BUCH and VERNEUIL). One of these larger units, *P. aequirostris* (SCHLOTHEIM 1820) was made the type species by DAVIDSON (1851—55). This was not in accordance with the rules of nomenclature as SCHLOTHEIM's species was not included in the original description of the genus. Another reason why this species should not have been chosen was that it was also the type species of *Isorhynchus* KING 1850. Later DALL (1877) selected *P. intermedia* PANDER (1830) as the type species, as did also HALL & CLARKE (1896). This was a most unfortunate choice

as the species *intermedia* is crudely figure, and it is obviously indeterminable.

Realizing this TEICHERT (1930), selected *P. reticulata* PANDER (1830) as the type species. SCHUCHERT & COOPER (1932) also used this species as the type of the genus. This procedure might be convenient, but it is not in accodance with the rules of nomenclature. If *reticulata* is to be accepted as the type species, it is necessary to apply to the ICZN for the surpression of the selection of *intermedia*.

If the rules of zoological nomenclature should be followed rigidly in this case, the generic name *Porambonites* would have to be abandoned as the type species is not recognizible, and the name *Isorhynchus* KING should be used instead.

It is doubtful whether *P. reticulata* is suitable as the type species at all. The species is not well known, the interiors have not been studied before now, and the figures of *Noetlingia tscheffkini* (VERNEUIL 1840, pl. 2, fig. 1a-g) show a wide variation in outline, which might overlap with that of *P. reticulata* (ib. pl. 2, fig. 2a-f and PANDER 1830, pl. 14, fig. 2a-d). The internal structures are also similar, as far as they are known (HALL & CLARKE 1896, figs. 155—169 and this paper fig. 1). From the present studies, it seems possible that a gradual. transition exists between *Noetlingia* and *Porambonites*, and that *P. reticulata* is one of the intermediate species. If *Noetlingia* should be accepted as a valid genus, it therefore seems unadvisable to select *P. reticulata* as the type species of *Porambonites*. Other species, such as *P. intercedens* PANDER (1830) have a much more central place in the genus, as it is defined now.

The typical features in the evolution of the Porambonitids, are the reduction of the cardinal process, the traces of which is found even in the youngest species of *Isorhynchus* that have been studied, and the shortening of the straight hinge-line, which is very long in *Noetlingia*, shorter, but still prominent in *Porambonites* s. s., and absent, or nearly so in *Isorhynchus*.

In order to study the internal structure of *P. reticulata*, the author made a rough serial section through a specimen. The dry peel method was used (cf. SPJELDNÆS 1957). The sections show (text-fig. 1 *CH*) that an «orthoid» cardinal process was present. The validity of the genus *Noetlingia* may therefore be doubted, if it is still to be used, it must be as a subgenus. The diagnostic feature of the subgenus is the very long, straight hinge-line. (VERNEUIL's speci-

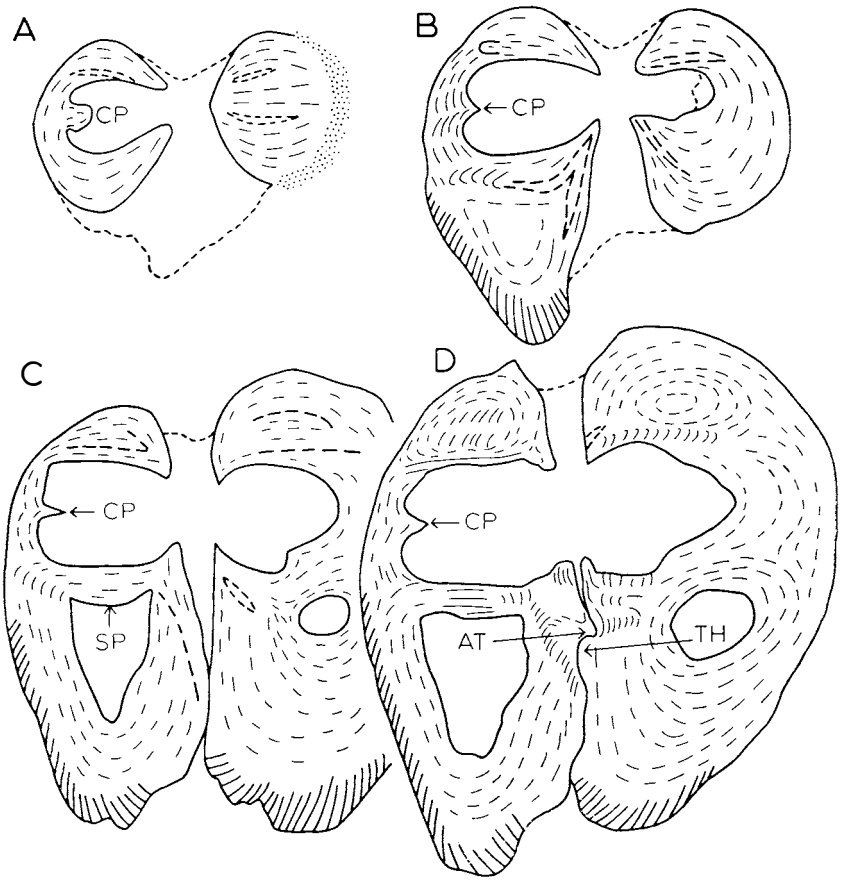

Fig. 1. A serial section (sligthly oblique) through the apical part of the valves of *Porambonites* (*Porambonites*) *reticulata* PANDER, from the Lower Ordovician at Popovka, near Leningrad. Abbreviations: AT = Accessory teeth, CP = Cardinal process, SP = Septum, TH = Teeth. About 5 x.

men on pl. 2, fig. 1a is taken as the type of *Spirifer tscheffkini*, that figured on pl. 2, fig. 2c-g is more like *P. reticulata*).

As mentioned above, all Porambonitids seen by the author have a cardinal process. It is strongly developed in the Lower Ordovician species. In the latter ones it is observed as a small median ridge between the socket plates (cf. SCHUCHERT & COOPER 1932, pl. 14 fig. 21). As there is no such structure in the ventral valve and as the gradual reduction to this ridge from an unmistakable cardinal process can

be followed through several stages, it is taken for granted that this ridge represents the cardinal process.

The vascular system is found in several specimens (pl. 1, figs. 9—10), and has been figured by many authors (i. a. SHARPE 1853, VINASSA DE REGNY 1927, SCHUCHERT & COOPER 1932 and several others). Except for minor differences the vascular system is similar in all observed specimens. In both the dorsal and the ventral valve, a large number of branches fork off from a main vessel running parallel to the septal plates. This polypalmate vascular system (see SPJELDNÆS 1957, textfig. 10 M—N) may be an adaption of the ordinary orthoid vascular system, but it has a remarkable resemblance to the vascular system of the Clitambonitids. The arrangement of the vascular branches in relation to the spondylium is similar in both groups.

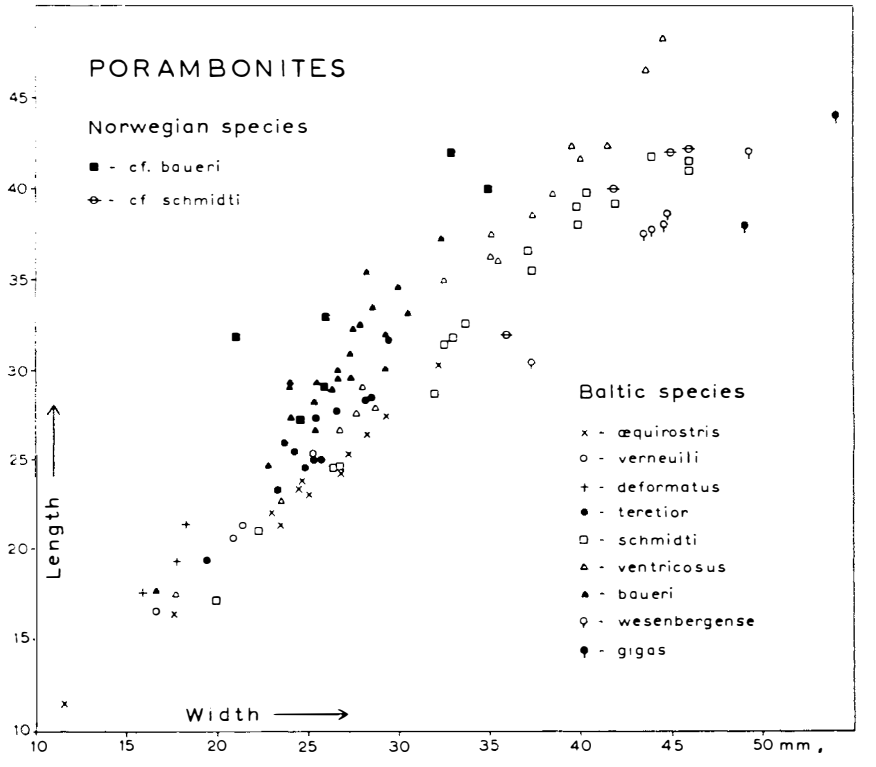

Fig. 2. Diagram showing the Length/Width ratio of some Baltic and Norwegian Porambonites species. Data about the Baltic ones from TEICHERT (1930).

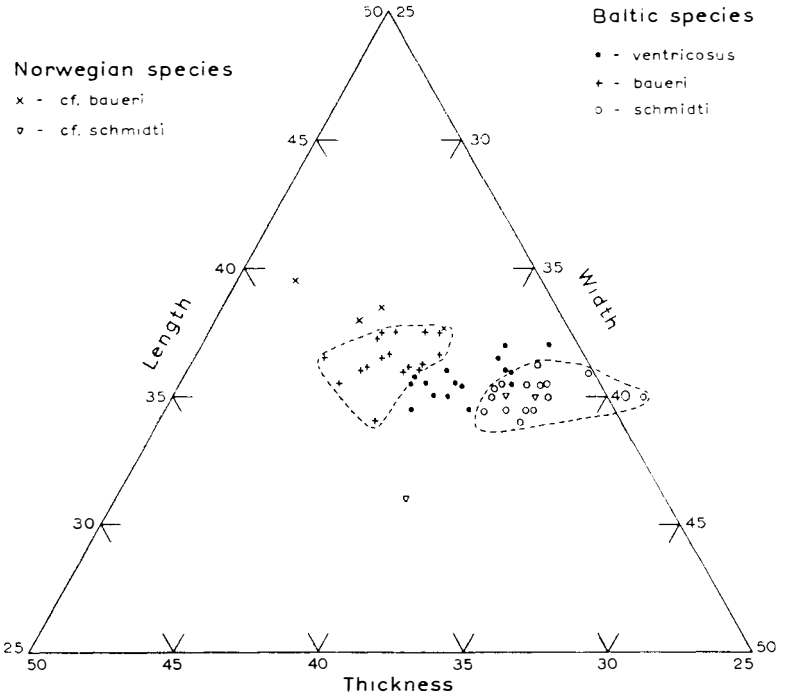

Fig. 3. Diagram showing the variability of some Baltic species of Porambonites (from TEICHERT 1930) supplied with data on Norwegian specimens.

Because of the small and poorly preserved material at the author's disposal, it is impossible to give any new arguments for the relationship of the Porambonitids. It seems to be a very conservative stock, which has features in common with several orthoid groups, including the Clitambonitids. Some species in the latter group show a «Porambonitid» stage in the development of their spondylium (cf. ÖPIK 1934, textfig. 1a).

Most species of the Porambonitidae need a redescription. It is very difficult to discriminate the species. Earlier authors mainly relied upon the length/width ratio, and the outline. These features are highly variable in most other brachiopod groups, and they can therefore only be used with the greatest care in the Porambonitidae. From the descriptions given by TEICHERT (1930) it appear that the species show an amazingly low variability. His biometrical data have been used as a basis for making two diagrams in this paper (textfigs. 2—3).

They show that some species can be distinguished by the measurements only. It must be remembered, however, that it is not known if all the specimens in the sample are measured, or if it is an «ontogenetic series». Neither is there any information on the purity of the samples. The Norwegian material show a much higher variability than that studied by TEICHERT (1930). The lower taxonomic units in the family Porambonitidae therefore need a revision, which must be done on the rich and well preserved Baltic material.

At present, the author recognizes only one genus in the Porambonitidae, *Porambonites*, PANDER 1830 with the illegal type species *P. reticulata* PANDER 1830. *Isorhynchus* KING 1850, type species *Terebratulites aequirostris* SCHLOTHEIM 1820 is accepted as a subgenus for the species with subtrigonal to subpentagonal outline, and very short straight hinge-line. *Noetlingia* HALL & CLARKE 1896 is provisionally accepted as a subgenus, but the relationship of *N. tscheffkini* to *P. reticulata* have to be studied in more detail.

Porambonites (*Porambonites*) *kjerulfi* sp. n.

Pl. 1, figs. 1—4, 9.

D i a g n o s i s : A large species for the subgenus. Sculpture moderately coarse. Length/width ratio about 0,92—1,00. The thickness of the specimens is relatively small. The hingeline is long, and almost straight (at least 55—60% of the total width).

T y p e d a t a : The holotype is PMO 67 040, a complete specimen from zone 4bβ at the southern end of Ildjernet, eastern side of the inner part of the Oslo Fjord.

M a t e r i a l : 1 dorsal interior, and fragments of several others. 4 complete specimens, and determinable fragments of at least 11 others.

D e s c r i p t i o n : Outline almost circular, length/width ratio 0,92—1,00 (holotype 0.93). The specimens are unusually thin for the genus, the holotype, which is the thickest specimen measured has a width/thickness ratio of 1,63, most of the others are about 1,80. In other Middle Ordovician species, especially of the subgenus *Isorhynchus*, this ratio rarely exceeds 1,40 in adult specimens. Hinge-line wide and straight, at least 55—60% of the total width, and in many cases still longer. The sculpture is observed only in a few specimens,

among them the holotype. It is relatively fine for the subgenus, but considerably coarser than in most species of *Isorhynchus*.

The dimensions and proportions of some well preserved specimens are as follows:

Specimen	Zone	District	Length	Width	Thickness	Hinge line	Length/width	Width/thickness
67 040 (holot.)	4bβ	Oslo–A.	37	40	27	24	0,93	1,63
34 427	Cycl.	Toten	28+	48	31	31	—	1,85
7 043	4bα–β	Ringerike	40	41	19+	28	0,97	≈2

The interior shows few differences from the other species of the genus. The teeth are remarkably strong, and accessory teeth are present in the dorsal valve. The dorsal interior shows relatively thin and low branchiophore plates even in adult specimens. They are also placed more closely together than in *Isorhynchus*. The ventral interior is not known in detail.

R e m a r k s : *P.* (*P.*) *kjerulfi* belongs to the *intercedens* group of species with a long, straight hinge-line, relatively thin specimens and fine sculpture for the subgenus. It differ from *P.* (*P.*) *intercedens* as to size, and in being thinner. The hinge-line is also slightly longer in *kjerulfi*. *P. filosa* McCoy (1846) seem sto have a shorter hinge-line, and is thicker. *P.* (*P.*) *ribeiroi* Sharpe (1853) has a shorter hinge-line, but the same proportions of the shell, and may be closely related to *P.* (*P.*) *kjerulfi*. The figured specimens (Sharpe 1853, pl. 8 figs. 7a, c) are smaller than the specimens of *kjerulfi*, but the slight development of the interior indicates that they are young specimens. *P. magnus* (Meneghini) may also be a related species, judging from the figures given by Vinassa de Regny (1927, pl. 4, figs. 12—15). The differences between *kjerulfi* and the species belonging to the subgenus *Isorhynchus* are mentioned above.

D i s t r i b u t i o n : *P.* (*P.*) *kjerulfi* is one of the typical fossils in zone 4bβ in the Oslo—Asker district. Occasionally some small specimens also occur in the uppermost part of zone 4bα. Outside the Oslo—Asker district, it is found in two localities only, Røysetangen, Ringerike (a few specimens from zone 4bα-β) and one specimens from Tangen near Gjøvik, Toten district, in the Cyclocrinus beds.

Porambonites (*Isorhynchus*) *schmidti* NOETLING 1883.

Pl. 1 figs. 7—8, 10

1883 *Porambonites schmidti* sp. n. — NOETLING, pp. 356—362, pl. 15.
1921 *Porambonites schmidti* NOETLING — BEKKER, pl. 4, figs. 3—4.
1930 *Porambonites schmidti* NOETLING — TEICHERT, pp. 197—198, pl. 12, figs. 37—40.
1932 *Porambonites schmidti* NOETLING — SCHUCHERT & COOPER, p. 102,pl. 14, figs. 20—21, 27—28.

M a t e r i a l : One ventral and three dorsal interiors, about 15 complete specimens, most of them compressed, and a number of fragmentary valves.

D e s c r i p t i o n : Outline rounded subpentagonal, with short, curved hinge-line. The dimensions for some perfectly preserved complete specimens are as follows:

Specimen	Zone	District	Length	Width	Thick-ness	Hinge line	Length/ width	Width/ thick-ness
34 428	Cycl.	Hadeland	32	36	35	6	0,89	1,02
34 277	-	-	42	45	33	8	0,93	1,36
33 859	Cycl.	-	40	42	32	5	0,95	1,31

The sculpture is not well preserved in any specimens, but it appears to be fine. The internal structures are quite well preserved, and are similar to those figured and described by NOETLING (1883) and SCHUCHERT & COOPER (1932). The vascular system is well developed in old valves (see above).

R e m a r k s : As regards the interior, the Norwegian material seems to be identical with Baltic specimens of *P.* (*I*). *schmidti*. Due to the compression of most Norwegian specimens, it is difficult to discriminate between *schmidti* and *ventricosus*, but all the specimens which are not compressed seem to belong to *schmidti*, judging from their outline and proportions (see table of measurements above, and textfig. 2). The relatively large size of the specimens, and their low length width ratio indicate that they might belong to the younger variety of *schmidti*, intermediate between this species and *wesenbergensis*. This is even more probable as to some large specimens from zone 4bγ in the Oslo—Asker district (pl. 1, fig. 10) the largest

of which is about 60 mm wide and with a length/width ratio of about 0,82. In the Baltic region such dimensions and proportions are found only in the Ashgillian *P.* (*I*). *gigas*. As mentioned above, it is very difficult to draw natural limits between the species in this group.

D i s t r i b u t i o n : According to ÖPIK (1930, p. 236), *P.* (*I.*) *schmidti* is rare in zone C3β, and common in D1 and D2 in Esthonia. It has been recorded from the Mjøsa districts by HOLTEDAHL (1909, pp. 25, 31, 41, 66, 67) and from the Upper Ordovician of Sweden by WIMAN (1908, p. 118). In the Oslo—Asker district it is found in zone 4bγ, generally in the middle part of the zone. Fragmentary and compressed specimens are found in the same zone in Ringerike. In the Northern part of Hadeland, and in Toten, there are a number of specimens from the Cyclocrinus beds, among them the specimens referred to by HOLTEDAHL (1909).

Porambonites (*Isorhynchus*) *cf. baueri* NOETLING 1883.

Pl. 1 figs. 5—6

cf. 1883 *Porambonites baueri* sp. n. — NOETLING, pp. 362—366, pl. 16.
cf. 1890 *Porambonites baueri* NOETLING — GAGEL, p. 51, pl. 5 fig. 3.
cf. 1921 *Porambonites baueri* NOETLING — BEKKER, pp. 80—81, pl. 4, figs. 5—6.
cf. 1930 *Porambonites baueri* NOETLING — TEICHERT, pp. 201—202. pl. 12, figs. 35—36 and fig. on p. 196.
cf. 1932 *Porambonites baueri* NOETLING — SCHUCHERT & COOPER, p. 102, pl. 14, figs. 8, 14.

M a t e r i a l : One specimen showing the interior of both valves, 5 complete specimens and a number of compressed specimens and fragments.

D e s c r i p t i o n : A moderately large species with elongate, thick valves. The dimensions of some well preserved specimens are as follows:

Specimen	Zone	District	Length	Width	Thick-ness	Length/ width	Width/ thick-ness
34 535	Cycl.	Hadel. N.	40	35	31,5	1,14	1,09
34 297	-	-	42	33	34	1,27	0,97
	Coel.	Ringsaker	32	21	28	1,58(!)	0,75(!)
	-	-	33	26	28	1,27	0,93

The third specimen in the table shows no signs of being compressed, but the proportions are so deviating that one cannot be absolutely certain that no compression has taken place.

In accordance with the line of development described by TEICHERT (1930), the older specimens from the Coelosphaeridium zone are considerably smaller than the younger ones from the Cyclocrinus beds. The sides of the specimens are not quite parallel, like the specimens figured by TEICHERT (1930, pl. 12 fig. 35, and table on p. 226). As to outline the Norwegian specimens are intermediate between *baueri* and *deformatus-teretior*. The length/width ratio of the specimens all seem to fall within the range of *baueri* (see textfig. 2). The very low width/thickness ratio also indicates that the Norwegian specimens belong to *baueri*.

The interior is different from that of *P.* (*I.*) *schmidti* in that the septal plates in the dorsal valve are very short and thick, whereas those in the ventral valve are thick in their proximal part, and long, thin and placed closely together distally (pl. 1, figs. 5—6).

R e m a r k s : The Norwegian specimens grouped into this species are somewhat heterogenous. In the specimens from the Coelosphaeridium beds in Ringsaker the dorsal valve is more curved than the ventral, and in this feature it resembles *P.* (*I.*) *teretior*. Both the length/width ratio and the width/thickness ratio are, however, different from typical specimens of that species.

The specimens from the Cyclocrinus beds in the northern part of Hadeland are more like the typical *baueri*, but they are larger than the Baltic specimens.

D i s t r i b u t i o n : As mentioned above, this species occurs in the Cyclocrinus beds in the northern part of Hadeland, and in the lower part of the Coelosphaeridium beds in Ringsaker. It is also found in the Mastopora beds in the Langesund—Gjerpen district.

Porambonites (*Isorhynchus*) sp.

In addition to the material described above, there is one single ventral interior from the Mastopora beds in the Langesund—Gjerpen district. It is about 30 mm long and 30 mm wide, moderately convex, and almost without sinus. The dental plates are rather thick, which indicates that it probably is an adult specimen. It has no stright hinge-line, and therefore belongs to the subgenus *Isorhynchus*. It

resembles small, young specimens of *P.* (*I.*) *schmidti* in outline, but because of the small material, and the bad preservation, it is impossible to determine to which species it belongs.

Stratigraphic distribution.

As mentioned under the description of the species, *P.* (*P.*) *kjerulfi* belongs to the *intercedens* group of species, which died out in the Baltic region in the late Lower Ordovician. Representatives of this group of species are found in Middle Ordovician beds in Eire, Portugal, Southern France, and probably also in Sardinia and the Carnic Alps. *P.* (*I*). *schmidti* ranges from zone D1 to D2 in the Baltic Region, which corresponds roughly to zone 4bγ in the Oslo Region.

P. (*I*). *baueri* is found in D1 and the uppermost part of C3 in the Baltic Region, and in somewhat older deposits in the Oslo Region, in the Coelosphaeridium beds, probably corresponding to zones 4bα and 4bβ.

It is remarkable that the species found in the Oslo—Asker district mostly show Western European affinities, whereas the species found in the Langesund-Gjerpen district and the Ringsaker district are definitely Baltic. In Ringerike and Hadeland a mixture of both types are found. This is in accordance with the faunal assemblage

Stratigraphical and geographical distribution of Middle Ordovician Porambonitids in the Oslo Region.

SPECIES	HORIZONS CHASMOPS SERIES							LOCALITIES						
	4bα	4bβ	4bγ	4bδ	Coel	Cycl	Mast	Oslo—Asker	Langes.—Gjerpen	Ringerike	Hadeland	Toten	Hamar—Nes	Ringsaker
1) *P.* (*P.*) *kjerulfi*	1	1	–	–	–	1	–	1	–	1	–	1	–	–
2) *P.* (*I.*) *schmidti*	–	–	2	?	–	2	–	2	–	2	2	2	–	–
3) *P.* (*I.*) *baueri*	–	–	–	–	3	3	3	–	3	–	3	–	–	3
4) *P.* (*I.*) sp.	–	–	–	–	–	1	4	–	4	–	–	–	–	–

Abbreviations: Coel = Coelosphaeridium Beds, Cycl = Cyclocrinus Beds, Mast = Mastopora Beds.

in the districts, in the Oslo—Asker district the Middle Ordovician fauna is of a British type, whereas that of the Langesund—Gjerpen and Ringsaker districts is of a Baltic type. The two remaining districts show a mixed fauna (cf. STØRMER 1953.)

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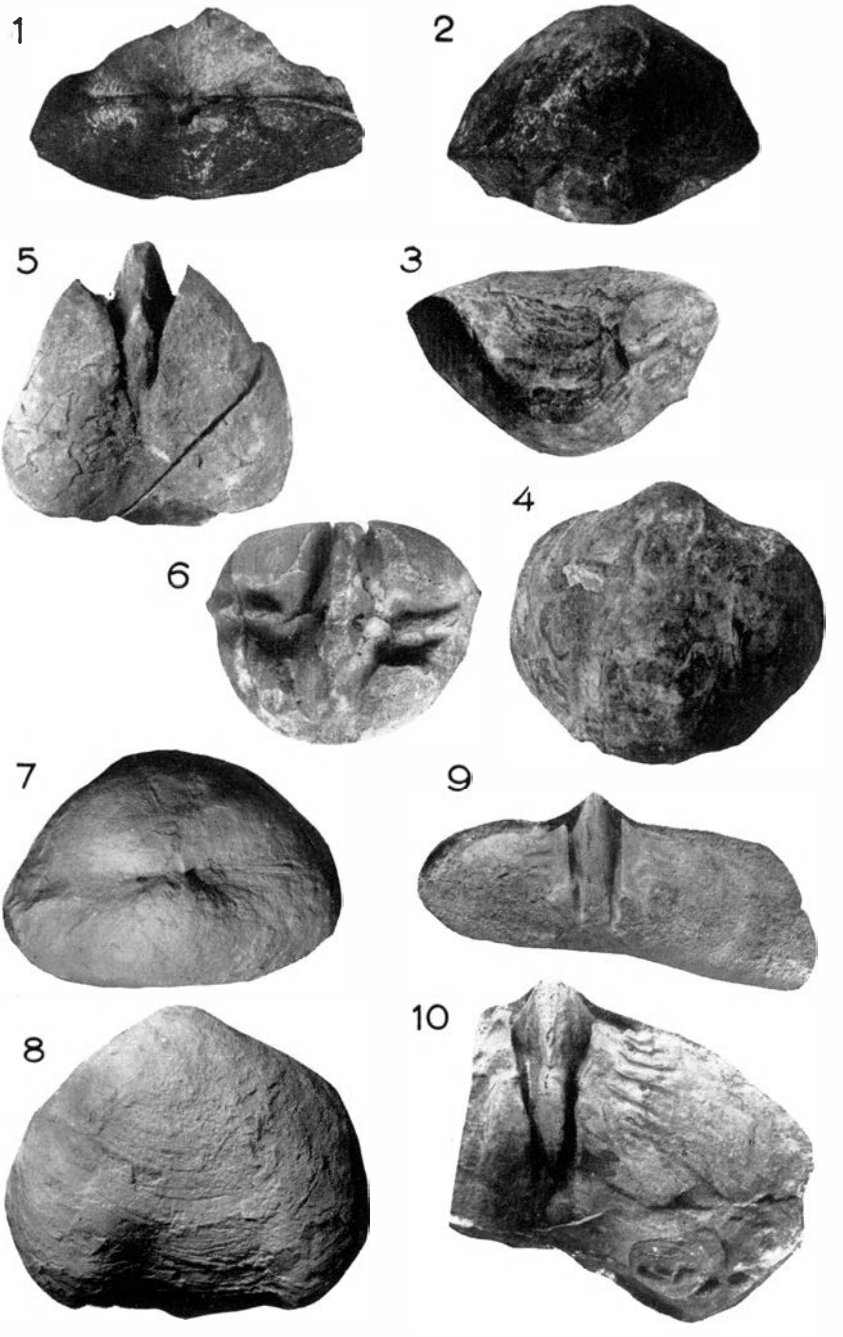
PLATE 1

EXPLANATION TO PLATE 1.

Figs. 1—4, 9 *Porambonites* (*Porambonites*) *kjerulfi* sp. n. *1*. A fragmentary specimen showing both teeth and accessory teeth. From zone 4bβ, Steilene, Oslo district. 1,3 x. *2—4*. Three different views of the holotype, PMO 67 040. From zone 4bβ at southern point of Ildjernet, Oslo district. 1,1 x. *9*. Dorsal interior (artificial cast) PMO 67 042. From zone 4bβ at Steilene, Oslo district. 1,2 x.

Figs. 5—6. *Porambonites* (*Isorhynchus*) *cf. baueri* NOETLING 1883. Two different views of an internal cast of a specimen (PMO 67 041) from the Coelophaeridium zone, between Tørud and Bratberg, Ringsaker district (Coll. S. SKJESETH) 1,2 x.

Figs. 7—8, 10 *Porambonites* (*Isorhynchus*) *schmidti* NOETLING 1883. *7—8*. Two different views of a complete specimen (PMO 34 277) from the Cyclocrinus beds at Gjøvik, Gran, Hadeland. Coll. MÜNSTER. 1,15 x. *10*. Artificial cast of the interior of a very large valve (PMO 67 043) from the middle part of zone 4bγ at Billingstad, Asker district. 1,2 x.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