Investigations of the Lower Ordovician of the Siljan District, Sweden

III.

A Lower Ordovician *Pseudoconularia* from the Siljan District

By

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1. Introduction.

In the present paper is described a fairly large *Conularia* referable to the genus *Pseudoconularia* BOUČEK (= the group Longitudinales HOLM 1893, the group of *Conularia grandissima* BOUČEK 1928). It has been named *Pseudoconularia dalecarliae* n. sp.

Only two species belonging to *Pseudoconularia* seem to have been found earlier in Sweden, viz. *P. curta* (SANDBERGER 1847) and *P. scalaris* (HOLM 1893). HOLM's description of the former species is based on one specimen, and that of the latter on two incomplete faces. A third species, represented by a fragment of a face may belong to *P. scalaris*, or to a very closely related species (HOLM 1893, p. 133). *P. curta* may originate from Östergötland *Tretaspis* Limestone (Upper Ordovician), *P. scalaris* was found n Jämtland drift boulders of *Chasmops* Limestone (Middle Ordovician), and the

third type is reported from an Uppland drift containing *Illaenus schroeteri* (Lower Ordovician).

One Ingermanland *Conularia* has been referred by BOUČEK to *Pseudoconularia*, viz. *Conularia striata* EICHWALD 1860 (Lower Ordovician of Poulkova). SINCLAIR (1941, p. 126) rightly considered this reference unwarranted.

Pseudoconularia, as well as other *Conularia* genera, have been found in rather large numbers in Bohemia. BARRANDE (1867) and BOUČEK (1928) have reported three *Pseudoconularia* species from this country: *P. grandissima* (BARRANDE 1867) ($d\gamma_1$—$d\varepsilon_{1+2}$ = Lower and Middle Ordovician), *P. nobilis* (BARRANDE 1867) ($d\gamma_1$—$e\alpha$ = Lower Ordovician to Lower Gotlandian), and *P. klouček*i (BOUČEK 1928) ($d\gamma_2$ = Lower Ordovician, upper part).

From the British Isles, one *Pseudoconularia* is reported, viz. *P. megista* LAMONT 1946 (Ashgillian).

Also from North America one species is known: *P. magnifica* (SPENCER 1879), redescribed by SINCLAIR 1941 (Niagaran, Gotlandian).

Finally, SINCLAIR (1941), with reservation, referred *Conularia maroccana* TERMIER 1936 to *Pseudoconularia* (Lower Ordovician of Morocco).

Thus, it appears, that this genus is mainly Ordovician; it has not been found in younger formations than Lower Gotlandian, where 2 species occur. The present species is Lower Ordovician (see below).

Investigators of *Conularia* seem to have been struck by the large size of many conulariae which are referable to *Pseudoconularia*, as appears from such specific names as *grandissima*, *magnifica*, and *megista*, as well as from titles of papers dealing with this group (SPENCER 1879 and LAMONT 1946). Regarding the size, the present species is not very inferior to these large types. In fact, *Pseudoconularia,* upon the whole, seems to consist of large-sized species. *P. curta, P. scalaris* and *P.* ? *striata* might appear to be exceptions from this, but it may be noted that the specimens of these species which have been measured, are damaged, so their real size is not established.

P. dalecarliae n. sp. is not perfectly preserved, but it shows such characteristic features that it deserves to be described, all the more as conulariae seem to be stratigraphically important, owing to the fact that even small fragments are determinable.

In the course of the present investigation there were also observed fragments of other conulariae, which, however, are too small to be described. One most likely is a *Pseudoconularia* (Pl. II, Fig. 2). A few words about this fragment are given on p. 435.

2. The stratigraphic position of *Pseudoconularia dalecarliae* n. sp.

Our present knowledge of the Lower Ordovician stratigraphy of Scandinavia is in part so scanty that complete stratigraphic correlations cannot yet be made. The layer containing the species here described is, however, fairly correlatable.

The following macrofossils indicate that it is equivalent to the Ingermanland *Asaphus expansus* Zone (B III α): *Asaphus expansus* (L.) WAHLENBERG, *Illaenus centrotus* DALMAN, and *Orthis callactis* DALMAN. Very frequent are *Ptychopyge angustifrons* (DALMAN) and *Ampyx nasutus* DALMAN, which are also characteristic of this zone. The superjacent stratum contains species distinctive for the Estonian *Asaphus raniceps* Zone: *Megalaspis heros* (DALMAN), *Megalaspis rudis* ANGELIN, and *Clitambonites (?) zonata* (DALMAN).

It is not known to which Estonian zone the next subjacent stratum is correlatable, but below this one is the *Megalaspis limbata* Limestone.

P. dalecarliae was found in an oolitic stratum about 1.2 m above the upper limit of the *Limbata* Limestone. The ooids consist of limonite and are included in a very dark grey limestone.

The precipitation of hydrous iron oxide in this form may have occurred in a fairly stagnant water rich both in carbon dioxide and oxygen (from algae). The state of occurrence of iron and phosphorus precipitates, and the development of the ostracodal fauna indicate that the communication between the Siljan District and the ocean was fairly restricted during the *Expansus* and *Raniceps* periods; during the *Limbata* period and the period following on the *Raniceps* period the district was in close connection with the ocean.

The stratum containing *P. dalecarliae* was deposited when the communication with the ocean was most limited. The depth of water must have been least at that time, judging by the fact that the frequency of boring and enveloping algae is greatest there. That the depth of water was least at this time is supported by the fact that great quantities of minerogene particles were deposited during this time so that the transparency of the water must have been small, and consequently the algae could live only in a very shallow water.

For particulars on the changes of level, the hydrology, and the development of the groups of organisms during the periods concerned, cf. special papers of the present series.

3. Description of *Pseudoconularia dalecarliae* n. sp.

Derivation of name. *dalecarliae* alludes to the fact that the holotype was found in the Swedish province of Dalecarlia (Dalarna).

Holotype. The type shown in Pl. I is holotype (Coll. of the Inst. of Palaeontology of Uppsala No. co. 117).

Locality of holotype. Leskusänget limestone quarry, parish of Orsa, Dalecarlia, Sweden.

Stratum of holotype. Lower Ordovician: stratum corresponding to the Ingermanland *Asaphus expansus* Zone (B III α), about 1.2 m above the upper limit of the *Limbata* Limestone.

Species	L	W	$\frac{L}{W}$	∧ apic.	Number of pustules	Number of longitudinal pustular rows		
						Aperture region	Apical region	Region not stated
P. curta (SANDBERGER 1847)	(43)	(17)	2.5	28°	20	—	23	—
P. scalaris (HOLM 1893)	(40)	—	—	25°	20	—	—	30
P. grandissima (BARRANDE 1867)	300	110	2.5	22—23°	6	—	—	15—20
P. nobilis (BARRANDE 1867)	—	—	—	22—23°	20	—	(50—60)	30—40
P. kloučeki (BOUČEK 1928)	70	50	1.4	40°	35	—	—	13—19
P. megista LAMONT 1946	250	92	2.7	25°	7—10	15	30	—
P. magnifica SPENCER 1879	223	95	2.4	27°	11—14	—	—	20—30
P. dalecarliae n. sp.	142	47	3.0	20°	40—50	50	45	—
P.? maroccana (TERMIER 1936)	130?	43	3.0?	16°	17—19	—	—	9—10
P.? striata (EICHWALD 1860)	(20)	(8)	2.5	22°	—	—	—	—

Material. Two faces, partly damaged; apical end disturbed. Both external and internal sides of the test could be studied. A few fragments which are possibly referable to this species were also observed.

Dimensions. Dimensional data appear from the Description and from the tabular survey above (cf. Affinities).

Number of transverse ridges on the pustular rows			Width of face midline	Undulations on internal side of test	Thickness of test	Occurrence
Aperture region	Apical region	Region not stated				
—	—	—	(0.5)	(3—4) (visible externally)	"Test very thin"	*Sweden:* Upper Ordovician, possibly Tretaspis Limestone
—	—	—	0.2	15	"Test thick"	*Sweden:* Middle Ordovician, Chasmops Limestone
—	—	5—8	2	—	1— 1.5—2.5	*Bohemia:* Lower and Middle Ordovician, $d\gamma_{1+2}-d\varepsilon_{1+2}$
—	—	—	2.5	—	—	*Bohemia:* Lower Ordovician— Lower Gotlandian, $d\gamma_1-e\alpha$
—	—	12—18	1	—	—	*Bohemia:* Lower Ordovician, $d\gamma_2$
—	—	5	2	—	—	*British Isles:* Upper Ordovician, Ashgillian
—	—	4—8	2	—	0.2— 0.5—1.5	*North America:* Lower Gotlandian, Niagaran
14	8—10	—	1	14	0.06—0.07	*Sweden:* Lower Ordovician, *Expansus* Zone
—	—	—	1	—	—	*Morocco:* Lower Ordovician
—	—	—	—	—	—	*Ingermanland:* Lower Ordovician

Description. *Pseudoconularia* of moderate size: length of holotype (L) calculated to be 142 mm (apical end damaged); aperture margin of face (W) 47 mm; ratio $\frac{L}{W} = 3.0$. Shell regularly tapering, elongate: apical angle of face calculated to be about 20°. Cross-section unknown.

Test fairly thin (about 0.06—0.07 mm), blackish brown in colour. Faces flattened, except at the apical end, where they are slightly convex; mid-line of face low and narrow (about 1 mm wide; slightly wider and less distinct towards the aperture); accessory, low longitudinal ridges fairly abundant (irregular length and irregular separations).

Pustules small, for the most part longitudinally elongated, and of mutually somewhat different lengths (generally 40—50 per 5 mm; towards the apical region they were partly observed to be fused so that occasionally there are only about 10 per 5 mm); outline somewhat triangular (base directed towards apical end); distance between the longitudinal rows of pustules very small: in the aperture region about 50 per 5 mm, in the apical region about 45 per 5 mm; longitudinal rows connected by minute transverse ridges of mutually somewhat irregular distance: in the apical region about 8—10 per 5 mm, in the aperture region about 14 per 5 mm; transverse ridges extremely slightly and somewhat irregularly curved towards the aperture, thus meeting the mid-line of the face at a large angle.

Inner side of shell smooth, and provided with slight and somewhat irregular transverse undulations, undae about 14 per 5 mm.

Affinities. To facilitate a comparison between the present species and the *Pseudoconularia* species described earlier, dimensional data have been made commensurable and ranged in the tabular survey on p. 432—433. Data are received from EICHWALD 1860, HOLM 1893, BOUČEK 1928, LAMONT 1946, SINCLAIR 1941, and TERMIER 1936; some are obtained from the text, others from the figures; the specimen of *P. curta* described by HOLM, was available and remeasured.

Lengths are in mm, numbers of pustules, rows etc. are invariably referable to a length of 5 mm. L = length of the shell, measured from the midth of the aperture margin to the apex, or, in case of this having been damaged, to the point of intersection of lines along the margins of the face. W is the width of the aperture margin of the face.

Only the Bohemian species are represented by several specimens. The descriptions of the remaining species are each based on one specimen. The representativeness of the dimensional data for these latter species is thus not proved. Furthermore, it may be noted that some of the data given in the tabular survey are possibly not perfectly reliable, viz. those which have been obtained by measurements from drawings or somewhat indistinct photographs. This is especially the case of the number of pustules, but the data may be sufficient to give an idea of the frequency of the pustules.

It appears that *P. dalecarliae* is different from the other species in several characters, and that it is specifically distinctly delimited. The ratio $\frac{L}{W}$ is larger and the apical angle is more acute than in the other species. Furthermore, the pustules are shorter; only *P. kloučeki* is reminiscent of

the present species in this respect but the pustules are of different appearance and, as regards $\frac{L}{W}$ and the apical angle, this species is very dissimilar. The longitudinal rows of pustules are situated more closely together in *P. dalecarliae* than in the other species, possibly with the exception of *P. nobilis*, but this species is distinguishable from the present one as regards other dimensions and also as regards the appearance of at least parts of the pustules.

The pustules are arranged in transverse ridges in some species. Concerning the distance between these ridges, they seem to be situated closer together in the present species than in the others, except *P. kloučeki*.

The width of the mid-line of the face is about the same as in a few other species; it may be added that in the present species the mid-line is much lower and less distinct than in most of the other ones.

The test of the present species seems to be thinner than those of the other species.

Occurrence. Cf. Stratum of holotype, p. 431.

4. Remarks on *Pseudoconularia ?* sp.

Pl. II, Fig. 2.

As mentioned in the introduction, a fragment of a *Conularia* possibly referable to *Pseudoconularia* was observed.

Type. Coll. of the Inst. of Palaeontology of Uppsala No. co. 118.

Locality. Rävanäs, parish of Rättvik, Dalecarlia, Sweden.

Stratum. Lower Ordovician: stratum corresponding to the Ingermanland *Asaphus expansus* Zone (B III α), about 1.4 m above the upper limit of the *Limbata* Limestone.

Description. Test black in colour.

Pustules extremely narrow, elongate, often connected longitudinally by very thin ridges; sometimes the pustules are so narrow that the longitudinal rows appear to be narrow ribs; about 30 pustules per 5 mm.

There are about 40 rows per 5 mm; owing to the fact that the rows of pustules are so very narrow the distance between the rows is proportionally large; these intervening areas are flattened.

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Pl. I.

Fig. 1. *Pseudoconularia dalecarliae* n. sp. Holotype. Nat. size. Whitened with NH_4Cl. Two faces showing mid-lines and accessory longitudinal ridges.

Rectangular field shows the position of the section magnified in Pl. III.

Fig. 2. *a—b—c.* Thin sections through the test showing the inner distinctly laminated layer consisting partly of calcium phosphate, and the outer layer which is less distinctly laminated and of different thickness. N. B. the longitudinal canal in *b*. 180 ×.

Pl. II.

Fig. 1. *Pseudoconularia dalecarliae* n. sp. Nat. size.

Plate opposite to that figured in Pl. I; not whitened with NH_4Cl. Dark spots outer surface, the rest the internal mould.

Rectangular field shows the position of the section magnified in Pl. IV.

Fig. 2. *Pseudoconularia?* sp. 20 ×.

Outer surface, showing pustules and the broad interspace between the longitudinal pustular rows.

Pl. III.

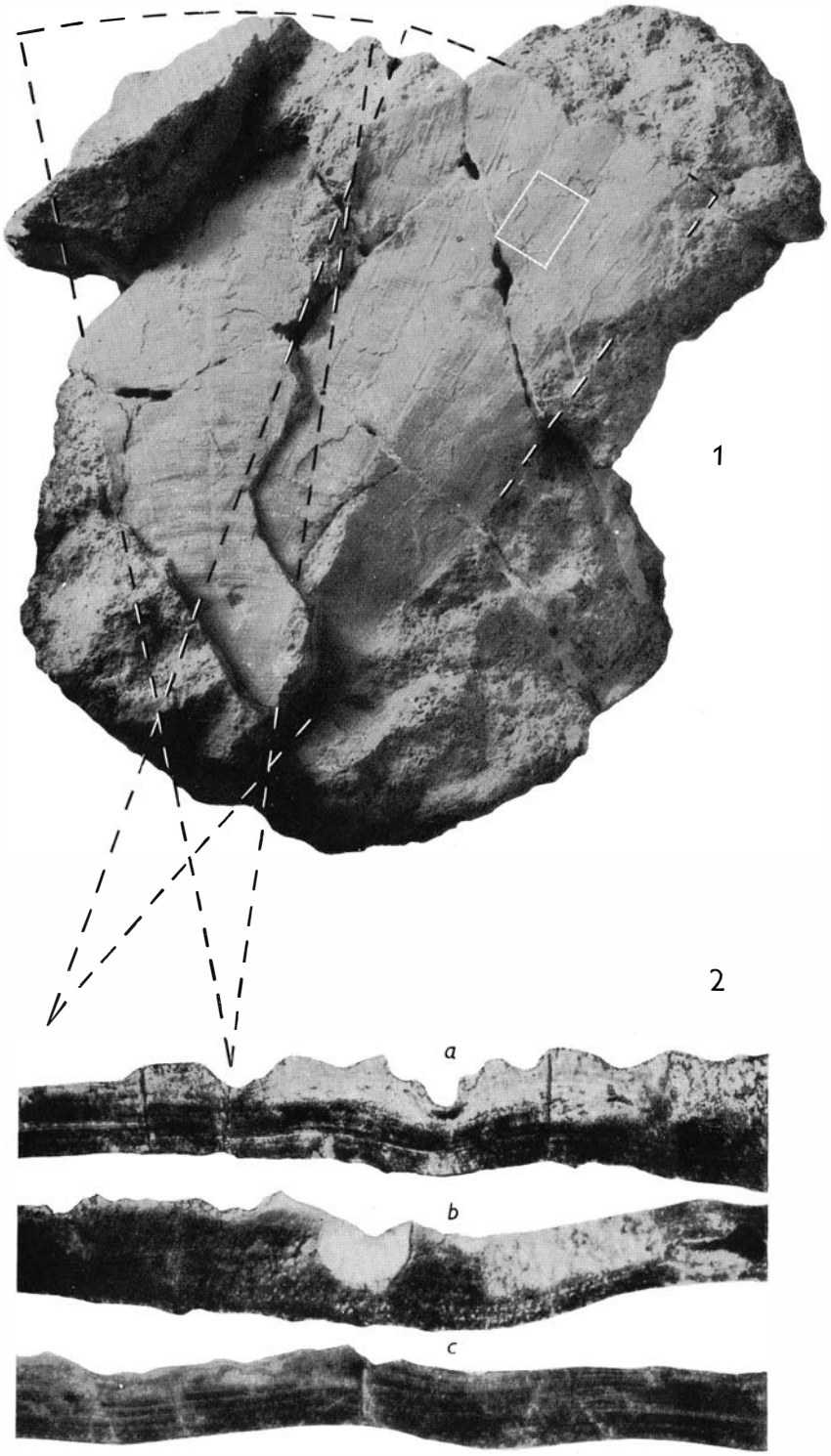
Pseudoconularia dalecarliae n. sp. 20 ×.

Inner side of test and cast of outer surface. Aperture region, cf. Pl. I; arrow pointing to aperture.

Pl. IV.

Pseudoconularia dalecarliae n. sp. 20 ×.

Outer surface with pustules, and internal mould. About midway between aperture margin and the apical region, cf. Pl. II; arrow pointing to aperture.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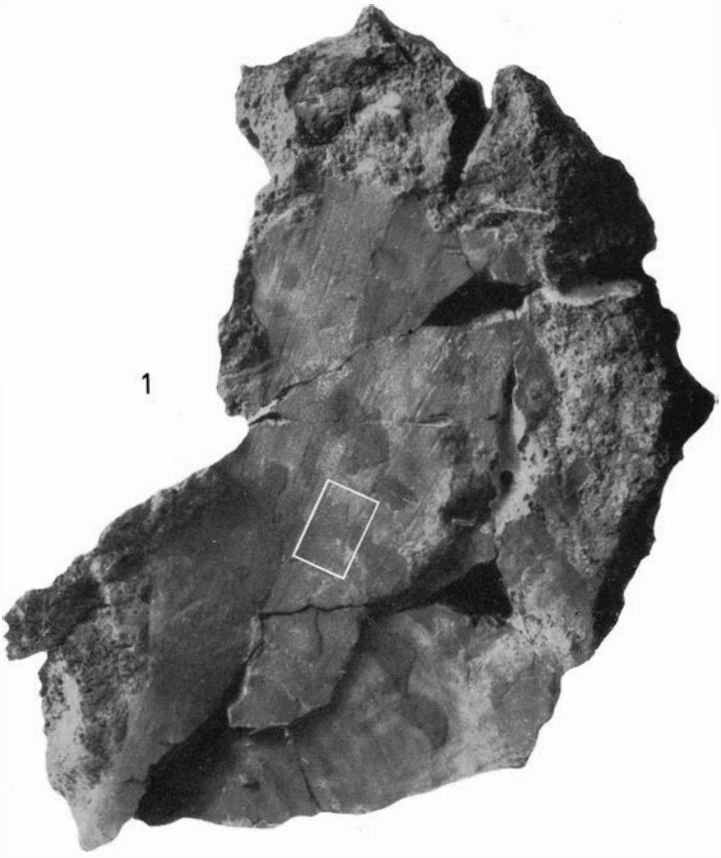
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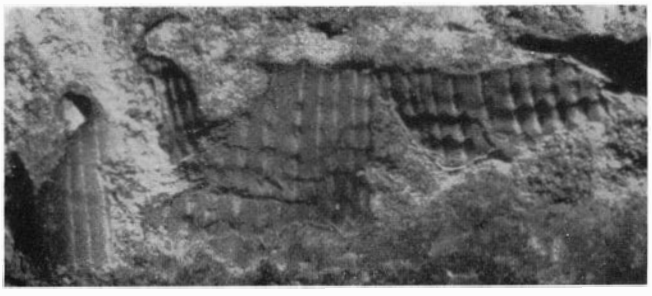
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