Investigations of the Lower Ordovician of the Siljan District, Sweden

I.

Lower Ordovician Ostracods of the Siljan District, Sweden

By

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Preface.

The present paper is intended to be followed by others describing further groups of organisms occurring in the Lower Ordovician of the Palaeozoic Siljan District of the province of Dalecarlia (Dalarna), Sweden. Special papers will deal with the sedimentology of the stratal sequence. Discussions on stratigraphy, palaeohydrology, and changes of level based on the collected biological and sedimentological data, are aimed to be presented at the end.

These publications will appear in the series "Investigations of the Lower Ordovician of the Siljan District, Sweden". The present paper is No. I, and those following will be numbered successively.

The late Prof. G. SÄVE-SÖDERBERGH directed my attention to an interesting oolitic stratum of the Lower Ordovician in Dalecarlia which gave rise to this series of investigations. A very serious illness prevented him from following the work in his Institute, but from his sick-bed he kept in touch with the progress of the work, and accepted my plan for the performance of the investigations. This paper was practically finished at his death on the 8th of June 1948. I shall carry on the work along the lines to which he agreed. With the deepest gratitude, I remember his very stimulating interest in this investigation, as well as in previous ones, and in those projected.

To GUNNAR SÄVE-SÖDERBERGH I am much indebted for all he did for me personally. I shall never forget his noble character and his thoughtfulness, so often manifested.

I also wish to express my gratitude to Prof. H. G. BACKLUND for his interest in the investigation and for including this series of papers in the Bulletin of the Geological Institution of Upsala.

The preparation of the drawings of this paper has been carried out by Mrs I. THOMASSON, Mr A. NILSSON, and Mr E. STÅHL, to whom I wish to express my thanks. Thanks are due to Mr G. ANDERSSON for the preparation of thin slides. For valuable assistance during the work I am indebted to my wife, and to Miss M. WALLIN.

I thank Mr V. JAANUSSON for information on the Estonian stratigraphy and for discussions on the stratigraphy of the Lower Ordovician of Dalecarlia.

For revision of the English I wish to thank Mr E. J. BURGE, B. Sc., Bristol.

Institute of Paleontology, Uppsala University, July 1948.

Ivar Hessland.

Introduction.

In the Palaeozoic Siljan District of the province of Dalecarlia (Dalarna), Sweden, an Ordovician zone (the so-called *Expansus* Limestone) is partly formed as iron oolite (mainly limonitic ooids). In studying this horizon lithogenetically, I had to examine the organic and inorganic components both of this layer and of the nearest parts of the sub- and superjacent strata. Thus, samples with rather small vertical intervals were taken and analysed chemically, granulometrically, petrologically, and biologically.

Both macro- and semimicrofossils are abundant in parts of this stratal sequence. Ostracods are especially numerous. The ostracodal fauna was practically unknown, however, and I had therefore to describe it. About 5 300 specimens were examined. To be determinable, practically all had to be more or less completely prepared at a magnification of about 50 times. 80 species were observed, but 5 of them are described *sine nomine* and 2 are merely designated sp. Within 16 species, 2—6 groups are discernible constituting subspecies, moult stages, sexual dimorphisms, or individual aberrations.

26 genera are represented; 8 of them are proposed in this paper. 18 of the genera do not seem to have been known earlier from the Lower Ordovician. One genus, hitherto reported only from North Greenland, is rather abundant in one part of the present stratal sequence. Only 3 species were described earlier; they were identified for the first time in Sweden.

About 700 specimens were measured after having been drawn at 43 times magnification.

The importance of the ostracods for the interpretation of the lithogenesis of the strata considered is only touched upon in this paper. This question will be treated in a special paper, together with a discussion of the lithogenetic significance of the other groups of organisms represented, and of the inorganic sedimentary phase. The present paper gives mainly taxonomic and frequency data of the ostracods observed; I consider it to be most appropriate to describe such a comprehensive fauna separately.

Later I hope to get an opportunity to study the ostracods of the corresponding strata in other parts of Scandinavia. I also hope to study the ostracods of the sub- and superjacent strata, especially in the Siljan District. It would be very interesting both to study the forerunners of the fauna described here and to follow its further development up to some relatively well-known Middle Ordovician ostracod faunæ.

The material now examined shows that a taxonomic revision is necessary in several cases. I originally intended to postpone the revision until material from the whole Lower Ordovician sequence of zones had been investigated, but since many species could not be allotted to existing genera, some taxonomic proposals and considerations are made already in this paper.

The stratigraphic value of the ostracods now described cannot be assessed until corresponding deposits in other districts have been closely examined. They are fairly widely dispersed, judging by the fact that the earlier known species occur also in Ingermanland, in North German drifts, and in Norway, respectively. During a very brief examination of an old collection of ostracods from the *Asaphus* Limestone of the Island of Öland, I found rather many of the new species.

However, one may not expect the ostracods in other districts to have the same vertical distribution as in the Siljan District. It appears from the present investigation that the ostracods may have a fairly restricted ecological amplitude. Since there are certain lithological differences among the districts, indicating hydrological and consequently also ecological dissimilarities, there is reason to expect certain differences as regards the vertical distribution of the particular species.

Stratigraphy of the layers investigated.

As anticipated, the area investigated is situated in the Central Swedish province of Dalecarlia (Dalarna) and is usually called the Siljan District. It consists of Ordovician and Gotlandian deposits.

General geological surveys of this area are given by TÖRNQUIST 1883 (geological map, Swedish text), WARBURG 1910 (English), MOBERG 1910 (English), and THORSLUND 1936 (Swedish).

TÖRNQUIST's investigation is fundamental for our knowledge of the geology of the Siljan District. Later, special investigations have increased the knowledge of certain parts of the stratal sequence, mainly of the so-called *Leptaena* Limestone. The Lower Ordovician, to which the layers now investigated belong, have not been more closely reexamined until now that they are being investigated by students of the Institute of Paleontology of Uppsala. These investigations are, however, not yet finished.

TÖRNQUIST's above-mentioned map shows the principal occurrence of the Paleozoic rocks of the Siljan District. They are situated in a roughly circular, sunken area, the deepest parts of which are occupied by lakes (cf. Fig. 1). The largest of them is Lake Siljan. The rocks enclosing the Paleozoic area, as well as those enclosed by it (the "Central Cupola"), are prepaleozoic. Tectonic processes, in connection with the upheaval of the "Central Cupola", have dislocated the Paleozoic strata to a rather large extent, but it is not known when this occurred.

Our strata belong to the so-called *Orthoceras* Limestone. On the basis of its colours, it was divided by TÖRNQUIST into four sections:

Upper Grey *Orthoceras* Limestone
» Red » »
Lower Grey » »
» Red » »

The upper part of the "Lower Grey" is lithologically different from the lower part, and the fauna also is partly dissimilar in these divisions (TÖRNQUIST 1883, p. 16); the information on the fauna is, however, not quite correct in all respects.

The *Orthoceras* Limestone of the Island of Öland was divided by LINNARSSON in the same way (cf. NATHORST 1881). MOBERG, in 1890, proposed another method of differentiation of the Öland *Orthoceras* Limestone, chiefly based upon the trilobites:

Strombolituites Limestone
Centaurus »
Transitional layer
Platyurus Limestone
Gigas »
Transitional layer
Asaphus Limestone { Upper *Asaphus* Limestone; *Sphaeronites* Bed; Lower *Asaphus* Limestone }
Limbata »
Planilimbata »

The *Gigas* Limestone is said to contain *Megalaspis gigas* ANGELIN and "closely related species" (no particular information in this respect).

The Lower *Asaphus* Limestone consists in the lower part of reddish

<table>
<tr><th colspan="2">Öland</th><th>Siljan District</th></tr>
<tr><td colspan="2">Platyurus Limestone</td><td rowspan="2">Upper Red Limestone</td></tr>
<tr><td colspan="2">Gigas Limestone</td></tr>
<tr><td colspan="2">Transitional layer</td><td>Possibly belonging to ↑</td></tr>
<tr><td rowspan="3">Asaphus Lime-stone</td><td>Upper Asaphus L-st.</td><td>Insufficient information</td></tr>
<tr><td>Sphaeronites Bed</td><td>Insufficient information</td></tr>
<tr><td>Lower Asaphus L-st.</td><td>Lower Grey Orthoceras L-st.</td></tr>
<tr><td colspan="2">Limbata Limestone</td><td>Lower Red Orthoceras L-st.</td></tr>
</table>

strata petrologically scarcely distinguishable from the *Limbata* Limestone; in the upper part, the Lower *Asaphus* Limestone is grey.

The Upper *Asaphus* Limestone is light-red, somewhat spotted with white, and distinctly crystalline. MOBERG's information on the fauna of these strata is insufficient and seems to be somewhat unreliable.

Regarding the strata which are of interest for the present investigation, MOBERG correlated the Öland and Siljan deposits as appears in the table p. 103.

The transitional layer is, in Öland, petrographically similar to the *Gigas* Limestone; no common species were observed, the transitional layer being extremely poor in fossils (only a "*Primitia*" is said to occur in great masses).

v. SCHMALENSEE, in 1892, gave the following stratigraphical survey of the stratal sequence of the Siljan District which is here considered:

Platyurus Limestone (Upper Red Limestone)
Asaphus » (Lower Grey »)
Limbata » (Lower Red »)

WARBURG, in 1910, gave this survey:

Platyurus Limestone	Upper Red Limestone
Gigas Limestone	
Asaphus Limestone	Lower Grey Limestone
Limbata Limestone	Lower Red Limestone

THORSLUND, in 1936, presented the same scheme but exchanged the name "*Asaphus*" for "*Expansus*." By this name LINNARSSON originally designated an Östergötland limestone which MOBERG in 1890 paralleled to the Upper *Asaphus* Limestone of Öland. (In THORSLUND's scheme, "Platyuruskalk" and "Gigaskalk" happened to be erroneously reversed, which should be noticed.)

According to these later works, the stratigraphy of the Lower Ordovician of the Siljan District should be simpler than imagined by MOBERG. The transitional layer between the *Asaphus* and *Gigas* Limestones was not discerned and the *Asaphus* Limestone was considered uniform. Earlier, WIMAN had refrained from distinguishing different zones of the *Asaphus* Limestone in Swedish areas, exclusive of Öland (cf. 1893, p. 10; 1907, p. 84; 1910, p. 9). MOBERG, in a later work, in discussing the *Asaphus* Limestone of Öland (1910, p. 108), suggests that "nothing to correspond with the Upper *Asaphus* Limestone is found elsewhere."

Whether the stratigraphy of the Lower Ordovician is as simple as this might suggest is questionable, considering the fact that the corresponding stratal sequence in Estonia and Ingermanland is more detailed. There, in the so-called Series of Tallinn, the following divisions were discerned:

Stage		Zone			Remarks	Swedish equivalents
Lasnamäe	Acc. to ORVIKU 1940	C I γ	ÖPIK 1930			*Schroeteri* Limestone (JAANUSSON 1947)
Aseri	Acc. to ORVIKU 1940	C I β	ÖPIK 1930		Oolite ("Obere Linsenschicht")	*Platyurus* Limestone (cf. JAANUSSON 1945)
Vaginatum	Acc. to ORVIKU 1940	B III γ	LAMANSKY 1905	*Eichwaldi* Zone		Probably corresponding strata in Öland and the Siljan District[2]
		B III β	LAMANSKY 1905	*Raniceps* Zone	Oolite ("Untere Linsenschicht")	Represented, inter alia, in the Siljan District (cf. below)
		B III α	LAMANSKY 1905	*Expansus* Zone	Only observed in Ingermanland	»
Megalaspis	Acc. to ORVIKU 1940	B II γ	LAMANSKY 1905	*Lepidurus* Zone		Represented in Öland[2]
		B II β	LAMANSKY 1905	*Bröggeri* Zone		?
		B II α	LAMANSKY 1905	*Limbata* Zone	Observed in the Island of Rågö (ÖPIK 1927)	*Limbata* Limestone
				Planilimbata Zone	Observed in the Island of Rågö (ÖPIK 1927)	*Planilimbata* Limestone

Note. C I α distinguished erroneously by ÖPIK; in fact, according to its fauna, it belongs to B III γ.

[2] According to verbal communication by Mr V. JAANUSSON, Dr B. BOHLIN and Mr H. MUTVEI.

Equivalents of the Estonian *Bröggeri* Zone have not been observed in Sweden, and the Swedish *Gigas* Limestone has not been recognized in the Estonia-Ingermanland Region.

LAMANSKY was of the opinion that the *Bröggeri* and *Lepidurus* Zones are lacking in Sweden but possibly occurring in Norway (1905, tabular survey). Furthermore, the *Eichwaldi* Zone should correspond to the *Gigas* Limestone and the upper part of the Upper *Asaphus* Limestone. With regard to the *Expansus* and *Raniceps* Zones, LAMANSKY considered that, in Sweden, the

Expansus Zone is known with certainty only in Östergötland, and that the *Asaphus* Limestone of the other Swedish areas should correspond to the *Raniceps* Zone and the lower part of the *Eichwaldi* Zone. In Norway the *Expansus* Zone should undoubtedly be represented.

Concerning Öland, it is true that *Asaphus expansus* (L.) WAHLENBERG is not observed in the part of the island which was investigated by MOBERG, i. e. the southern part (MOBERG 1910, p. 108); Dr B. BOHLIN and Mr H. MUTVEI who are at present studying the stratal sequence of Öland, communicated verbally that they found *Asaphus expansus* in the northern part of the island. As regards the Siljan District, TÖRNQUIST says that *Asaphus expansus* is extremely rare (1883, p. 16). This may have influenced LAMANSKY to assume that the "Lower Grey" should correspond to the *Raniceps* Zone and the lowermost part of the *Eichwaldi* Zone; if the "Lower Grey" corresponds to the *Expansus* Zone, *Asaphus expansus* in his opinion might have been expected to be more abundant. In the Estonia-Ingermanland Region, this species occurs in the lower part of the *Raniceps* Zone but mainly in the *Expansus* Zone. Perhaps his assumption may also be due to a notice by LINNARSSON (1871, p. 342) reporting *Asaphus raniceps* DALMAN from the "Lower Grey" of the Siljan District. In Estonia-Ingermanland this species occurs in the upper part of the *Expansus* Zone, but mainly in the *Raniceps* Zone.

In TÖRNQUIST's list of the "Lower Grey" fossils there are also mentioned other species occurring, in Estonia and Ingermanland, in the *Expansus* Zone and the lower part of the *Raniceps* Zone, viz. *Ptychopyge angustifrons* (DALMAN) and *Ampyx nasutus* DALMAN. In fact, and partly contrary to TÖRNQUIST's statement, these species and *Asaphus expansus* are frequent in a part of the "Lower Grey," viz. in the zone where the ooids are most abundant, i. e. somewhat below the midheight of the "Lower Grey." This supports the suggestion that this horizon represents the *Expansus* Zone. Of decisive importance for this question, I think, is the fact that *Orthis callactis* DALMAN is abundant, this species being known by LAMANSKY only from the *Expansus* Zone. *Illaenus centrotus* DALMAN, which is also represented in this part of the oolite, is reported by LAMANSKY from the *Expansus* Zone, but not higher. Thus, this part of the "Lower Grey" certainly is equivalent to at least parts of the *Expansus* Zone of Ingermanland.

The above-mentioned notice that *Asaphus raniceps* DALMAN occurs in the "Lower Grey" of the Siljan District has not been verified. In fact, this species is very similar to some other *Asaphus* species (for instance *A. vicarius* TÖRNQUIST). I found imperfectly preserved remains of a species reminiscent of *A. raniceps* in one locality (Leskusänget) 1 m above the horizon where *Asaphus expansus*, *Ptychopyge angustifrons*, *Ampyx nasutus*, and *Orthis callactis* occur abundantly. This horizon seems to belong to the *Raniceps* Zone.

In this part of the stratal sequence *Megalaspis heros* (DALMAN) was observed. *Megalaspis rudis* ANGELIN was also found in the upper part of the grey stratum. According to SCHMIDT (1906, p. 54) the former species is most common in the *Eichwaldi* Zone, but sometimes it occurs also in the *Raniceps* Zone; the latter is reported from the *Eichwaldi* Zone but according to a verbal communication by V. JAANUSSON this species has also been found in Estonia in the *Raniceps* Zone. In several localities of Dalecarlia, JAANUSSON made the additional important find of *Clitambonites* (*Iru?*) *zonata* (DALMAN) which does not occur lower than in the *Raniceps* Zone. Thus, these species indicate that the Estonian *Raniceps* Zone is represented in the upper part of the "Lower Grey" of Dalecarlia.

Considering now the lower part of the "Upper Red", it is not known which stratum this horizon corresponds to, either in Estonia or in Öland. By WARBURG (1910) and THORSLUND (1936) it is called *Gigas* Limestone. *Megalaspis gigas* ANGELIN is not, however, observed in the lowermost part of the stratum. This species occurs in a thin stratum (generally crowded with pygidia of *M. gigas*) a few metres above the upper limit of the "Lower Grey"; at Granån it appears about 4.8 m above this limit. At Stenberg it was observed to be immediately superimposed by *Asaphus platyurus* ANGELIN. In the layer between the upper limit of the "Lower Grey" and the *Gigas* horizon no macrofossils were found. Presumably the upper part of this stratum corresponds to MOBERG's transitional layer of Öland. The lower part possibly corresponds to the Upper *Asaphus* Limestone of Öland. In an old collection of Upper *Asaphus* ostracods from Öland, I recognized some species characterizing the lowermost part of the "Upper Red" of the Siljan District. This might mean that the lowermost part of the "Upper Red" corresponds to the Upper *Asaphus* Limestone of Öland. Since it is not yet known how long the Siljan ostracodal fauna considered continued in the "Upper Red," it is not possible to decide, on the basis of the present knowledge of the ostracods, whether the lowermost part of the "Upper Red" of the Siljan District corresponds to the Upper *Asaphus* Limestone of Öland.

The "Lower Red" is *Limbata* Limestone, but it is not clearly decided whether the colour border between the "Lower Red" and the "Lower Grey" coincides perfectly with the upper limit of the Estonian *Limbata* Zone. Two distinct discontinuity surfaces just above this limit are of stratigraphic importance within the Siljan District.

Thus, it is now scarcely possible to make perfect correlations with the Estonia-Ingermanland or the Öland stratigraphy. For the present investigation it is neither necessary nor appropriate. Instead of confining the results here secured to the prevailing but, in several respects, inappropriate or erroneous stratigraphic names, I have used provisional denominations for the strata. A special reason for leaving the stratigraphic questions open until later is the fact that in the solution of this problem the micro- and semimicroorganisms (not least the ostracods, which were practically completely unknown) must be taken into consideration to a very great extent.

This does not mean that the macrofossils should be rejected for this purpose. As anticipated, the whole necrocoenoses as well as the inorganic sedimentary phase must be the collected base upon which stratigraphy has to be founded.

In this paper the uppermost part of the "Lower Red" (the *Limbata* Limestone) is denominated *R I*, the "Lower Grey" (including the *Expansus* and *Raniceps* Zones) *G*, and the lowermost part of the "Upper Red" *R II*. The border between *R I* and *G* is marked *R I/G* and that between *G* and *R II* is given as *G/R II*.

There are reasons in favour of considering each of the two borders *R I/G* and *G/R II* to be mainly synchronous in the whole Siljan District. This question will not be thoroughly discussed in this paper but in a future one dealing with the lithogenesis of the sequence of strata considered. Some important facts concerning the question of the synchronism may be mentioned, however.

Iron occurs mainly as limonite in this stratal sequence. The highest concentration is found in the most oolitic part of stratum *G* (the *Expansus* Zone). The total amount of limonite in *R I* and *R II* is remarkably low, but in the aforesaid zone of stratum *G* it is partly very high (max. about 25 % Fe). In *R I* and *R II* the limonite is rather uniformly dispersed in the sediment, which thus receives a reddish colour. In *G* the limonite is concentrated as ooids or in various fossil fragments; the rest of the sediment is only slightly limonitic and thus mainly greyish.

This difference in the mode of occurrence of the limonite is important for the elucidation of the paleohydrologic conditions. On account of indications which will be discussed more completely in the lithologic paper, the following conclusions may be drawn in this respect.

During the deposition of *R I* and *R II*, the Siljan District was in close connection with the ocean. Easily dissociable Fe-salts which may have been supplied rather continuously and rather abundantly (by rivers and by release from decaying organisms), or occasionally possibly by air (falls of volcanic ash) could not exist in such surroundings but were rapidly oxidized and hydrolysed to form $Fe_2O_3 \cdot n\,H_2O$; hydrous iron oxide may also have been brought to the sea by streams. The hydrous oxide was continuously precipitated, since in this ventilated water the pH was high (possibly about 8 as in the present ocean), and since the solubility product of the hydrous oxide above pH 5 is very rapidly decreased.

During the formation of stratum *G*, the area had no longer such a close communication with the ocean. The water must have been only slightly agitated. The content of electrolytes was low. The pH may have decreased somewhat. Probably the pH was not lower than 6; if so, calcareous substances would have been dissociated, which was generally not the case. It may be reasonable to suggest a pH somewhat > 7, as is stated for many of the present stagnant waters (MÜNSTER STRØM 1936, p. 52). In the bottom layer of the stagnant water the pH was certainly higher, however. Carbonic acid, created at decomposition, reacted with calcium carbonate forming a buffer solution of about 8. $Fe^{\cdot\cdot\cdot}$, $Fe^{\cdot\cdot}$, and $FeOH^{\cdot\cdot}$ ions, as well as $Fe_2O_3 \cdot n\,H_2O$, were supplied as previously, during certain periods, however, obviously richly; the iron likely derived from volcanic ashes.

But in these surroundings $Fe(HCO_3)_2$ was formed owing to the fact that carbon substances were abundant in the sediment and certainly also in the water (as colloids). The solubility of $Fe(HCO_3)_2$ is much higher than $Fe_2O_3 \cdot n\,H_2O$ at the same pH. However, of greater importance was that the CO_2-pressure was high which caused the water to contain large quantities of $Fe(HCO_3)_2$.

Of fundamental importance for the formation of $Fe_2O_3 \cdot n\,H_2O$ in such surroundings as now described is firstly that the CO_2-pressure is lowered: then $Fe(HCO_3)_2$ is changed to FeO which is oxidized (oxygen from algae) and hydrolysed to form $Fe_2O_3 \cdot n\,H_2O$ which, owing to the high pH, is precipitated.

The CO_2-pressure is, above all, diminished by the CO_2-requiring photosynthesis of plants. In the present case there were plenty of plants. At least, penetrating and enveloping algae were very abundant.

The CO_2-pressure was also diminished by other processes. During the decomposition of decaying bodies, FeS is formed, which, in reacting with CO_2, H_2O, and O_2, is transformed to $Fe(HCO_3)_2$ and H_2S. Thus, the CO_2-pressure is diminished at the same time as the amount of $Fe(HCO_3)_2$ is increased, which in the present surroundings with CO_2-requiring and O_2-producing plants and with a high pH, resulted in a final precipitation of $Fe_2O_3 \cdot n\,H_2O$.

The boundaries *R I/G* and *G/R II* are rather distinct in the whole Siljan District and the hydrological changes were mainly contemporary which is also shown by the development of the ostracodal fauna.

These changes may not have appeared suddenly, however. The yellowish-brown bands in *R I* and the discontinuity surfaces at the transition to stratum *G*, cf. next chapter, may indicate preceding short stages of restricted agitation of the water. On the other hand, certain lithological structures in the lower part of *G* may indicate occasional agitation of the water, possibly owing to accidental closer communication with the ocean. Towards the end of the *G* stage there existed an occasional slight communication with the ocean, as indicated by the ostracodal development.

Summary. On account of the imperfect state of the present knowledge of Lower Ordovician stratigraphy, the stratal sequence here investigated

cannot yet be perfectly correlated to other Lower Ordovician strata of Sweden or to those of the Estonia-Ingermanland Region. Instead, provisional denominations for the strata examined are used in this paper. The boundary between these strata may be practically synchronous in the whole Siljan District.

Lithological data.

Nine localities were examined as regards ostracods. Lithological observations were made in 8 further localities. A full account of the lithological results will be given in a special paper, but some data will be mentioned here.

The stratum *G* was studied throughout its entire thickness in 5 localities; in the other localities only parts of it were available. Concerning the subjacent stratum, only the uppermost part (*R I*) was examined (8 localities), and of the superjacent stratum, only the lowermost part (*R II*; 7 localities).

R I. This stratum is reddish maroon with scattered grey-greenish spots of generally minute size. Irregularly undulating bands of a yellowish-brown colour mainly conforming to the bedding are distinctive; they are limited downwards by a very thin grey-greenish zone. The bands are thin, only a few millimetres. They are situated at a distance of a few centimetres from each other.

The principal colour of *R I* is due to substances which coat the calcium carbonate crystals, and other particles, with a thin film. These substances consist of mainly hydrous iron oxide.

The yellowish bands are concentrations of hydrous iron oxide and phosphorous compounds. The grey-greenish zone just below the bands contains uncoated glauconite grains. The bands are not discontinuity surfaces in the general meaning. As mentioned on p. 109 they may indicate repeated short periods of stagnation.

R I is crowded with various fossils, more or less detritified: mainly crinoids, ostracods, brachiopods, small orthoids, and trilobites (*Megalaspis limbata* [BOECK]). In the bands they are encrusted, and their cavities and canals are partly filled up with the iron and phosphorous compounds mentioned above. Organisms filled with glauconite are generally coated with hydrous iron oxide. In the remaining part of *R I* the fossils are occasionally filled up or encrusted. Some of the shells are minutely canalized by perforating algae.

R I/G. The transition from *R I* to *G* is clearly discernible. In some localities a few rather distinct discontinuity surfaces are distinguished in the narrow transitional zone; just above *R I/G* there are two distinct discontinuity surfaces.

G. The thickness of stratum *G* in the localities studied is different: min. 1.8 m, max. 4 m. The colour is mainly grey. In the lowermost part the colour varies somewhat, generally light grey or greyish-green; in the middle part, as a rule, it is very dark grey, in the upper part the colour is most often light grey. Small red spots occur occasionally; a reddish zone may occur in the upper part of the stratum.

Stratum *G* is partly developed as oolite. This is the most distinguishing feature of the stratum. Ooids mostly occur in the lower and middle part, but they are also found in the upper part. In all localities the maximum frequency of ooids appears somewhat below the midheight.

The ooids are structurally of two types: concentrically stratified and non-stratified. The main part of the ooids consists chiefly of limonite. A few consist of chamosite and are generally very distinctly stratified; they are distinctive for the upper part of the stratum (the *Raniceps* Zone). The limonite ooids are brown, and the chamositic ooids are greenish of different shades, or black (phosphorite covering). The chamositic ooids themselves contain phosphorite and pyrite.

The majority of the ooids belong to the fraction 0.125—1 mm. The ooids are usually flattened and have a subcircular outline. In the highest frequency zone the limonite ooids are partly gathered in rounded agglomerates of about 2 cm diameter.

Considerable amounts of iron are concentrated in the oolite. In the highest frequency zone the amount of Fe is mostly about 15—25 % of the sedimentary rock. It may be noticed, however, that limonite is enriched not only in the ooids but to a large extent also within and around non-ooidic debris particles of shells and other hard tissues.

Shells and shell fragments in stratum *G* are to a very large extent canalized by boring algae. The canals are filled with limonite. This abundance of algae indicates a moderate depth of water during the deposition of this statum.

A few other typical features of stratum *G* may be mentioned.

In the lowermost part of stratum *G*, there are irregular masses of limonite coated with phosphorite, forming sometimes flattened and mainly horizontal "canals" (about 1 cm diam.). These masses give the unmistakable impression of having been fluid or semifluid. They may have been precipitated as stagnancy colloids, but seem to have been slightly squeezed, and slid when minor changes in the sediment took place, almost certainly caused by slight movements of the water. The sediment around these substances was also slightly stirred up.

Above the zone of the highest frequency of ooids (thus between the *Expansus* oolite and the *Raniceps* oolite) there is, in some localities, a zone characterized by the rock being cleavable along certain surfaces. These surfaces are slightly oblique to the bedding, irregularly undulating, and generally passing over to each other. The surfaces are covered with brown-grey iron and phosphorous colloids. These stagnant water precipitates may have been finally deposited during a sort of a slight criss-cross bedding, i. e. during a period characterized by slight irregular current activity.

The content of minerogene particles in stratum *G* is various in different localities and in different strata of the same locality. In one group of localities situated in the northern part of the district the largest percentages occur mostly around the zone with the highest frequency of ooids (thus in the *Expansus* Zone). In another group situated in the southern part, the highest frequency of ooids is not corresponded by a high percentage of minerogene particles. This part of the district must have been situated at a larger distance from the shore.

Glauconite grains are rather abundant just above *R I/G* in most of the localities; in the remaining part they may appear in very small quantities.

The sediment is generally crowded with carapaces, and fragments of carapaces and other resistant tissues. Most of them belong to small species. Ostracods are abundant, except in the upper half of the stratum. Crinoids are abundant all through the stratum. Small orthoids, inarticulate brachiopods, and gastropods generally occur abundantly just above *R I/G*; the gastropods are often filled with glauconite. In the middle part of the stratum, small orthoids and small gastropods are practically absent but appear again in the uppermost part.

Among the microscopical organic remains are rounded bladders with a wall of chitin. Their nature is unknown, but they may be suggested to be eggs of trilobites. They are most frequent in the middle of the stratum.

The macrofossils consist of brachiopods, cephalopods, conulariae, and trilobites.

The most common brachiopods are *Orthis callactis* DALMAN (*Expansus* part) and *Lycophoria nucella* (DALMAN) (most abundant in the *Expansus* part). Additionally, species occur belonging to the group of *Orthambonites calligramma* (DALMAN), the group of *Porambonites intercedens* (PANDER), "*Strophomena jentzschi*" GAGEL (= *Ahtiella dalecarlica* HESSLAND; *Raniceps* part), *Inversella* sp., and Sowerbyellids. Lingulids, Obolids, and Paterulids occur occasionally all through the stratum. Cephalopods are most common in the middle and upper part. In one locality they are very frequent in the upper part, most likely as a result of a temporary connection with the ocean (a red stratum at Röjeråsvägen).

A large Conularia is represented in the most ooidic part of the *Expansus* Zone (*Pseudoconularia dalecarliae* HESSLAND).

Among the trilobites the Asaphids are the most common. The majority of the trilobites occur in the *Expansus* Zone (most ooidic part). In this zone, *Ptychopyge angustifrons* (DALMAN) has the highest frequency, and then follow *Megalaspis acuticauda* ANGELIN and *Asaphus expansus* (L.) WAHLENBERG. Rather common are also: *Cyrtometopus clavifrons* (DALMAN), *Ampyx nasutus* DALMAN, *Illaenus esmarki* (SCHLOTHEIM), and *Illaenus centrotus*

DALMAN. Occasionally occurring are: *Niobe frontalis* (DALMAN), *Nieszkowskia tumida* (ANGELIN), and *Pterygometopus* sp.

In the other parts of stratum *G*, trilobites are less frequent, especially below the *Expansus* oolite. In the upper part of the stratum, however, *Megalaspis heros* (DALMAN) and *Megalaspis rudis* ANGELIN appear abundantly.

G/R II. This border is fairly distinct. Discontinuity surfaces were not observed in this zone. In the upper part of *G* the sediment is partly red, however, as observed at Röjeråsvägen. This may mean that the ventilated stage of *R II* was preceded by occasional, better contacts with the ocean.

R II. The colour is maroon, but the limestone has rather many greenish spots. The abundant cephalopods are generally coated with hematite.

The maroon colour is due to a brownish compound (mainly limonite), which covers the minute calcite crystals with a thin film. In thin slices it appears that the coloured substance is especially concentrated in bands running in different directions. Yellowish concentrations of limonite are rather abundant, especially enclosed in canals and cavities of fragments of fossils.

The rock is crowded with fossils. The macrofossils consist chiefly of cephalopods. Fragments of trilobites and brachiopods are fairly abundant. The most common semimicrofossils are ostracods and crinoids. Occasionally there are plenty of hypostomata of larval trilobites (most likely of Megalaspids) just above *G/R II*. In the lowermost part of *R II*, the fossils are, to a rather large extent, canalized by boring algae, but higher up such structures appear only occasionally.

Summary. A few notes on the characteristic components and structures of the stratal sequence have been made. They improve the idea on the development of the Siljan District as expounded in the next proceeding chapter.

Material and methods.

The nine localities examined for ostracods (cf. p. 110) are situated in the following parts of the mainly circular Siljan District (Fig. 1):

Southern part:	Rävanäs	. . . . . . (*R I*, *G*, *R II*)
	Röjeråsvägen	. . . . . . (» » »)
	Granmor	. . . . . . (» » »)
Eastern » :	Silverberg	. . . . . . (part of *G*)
	Silverberg II	. . . . . . (upper part of *G*, *R II*)
	Born-Dådran	. . . . . . (» » » » »)
	Gulleråsen	. . . . . . (*R I*, *G*, *R II*)
Northern » :	Leskusänget	. . . . . . (» » »)
Western » :	Stenberg	. . . . . . (*R I*, lower part of *G*)

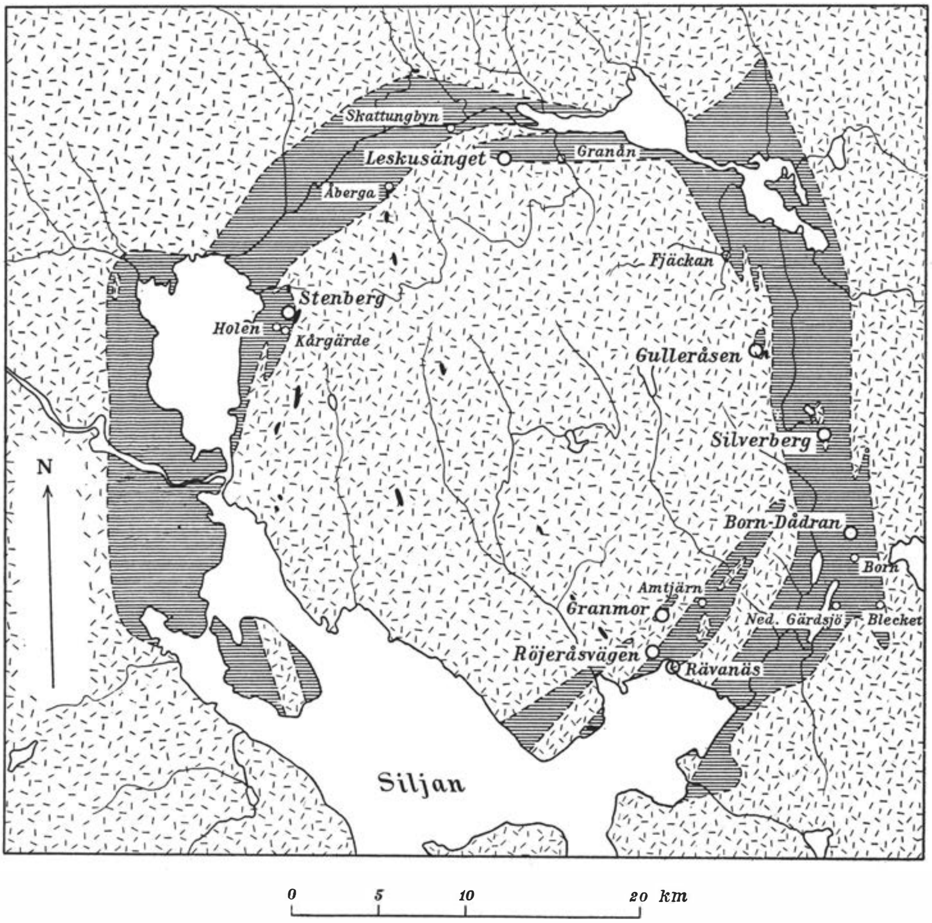

Fig. 1. Map of the Siljan District, showing the circular Ordovician and Gotlandian formation. Black surfaces indicate basaltic dikes. The localities described in this paper are printed in fat-faced types. Compiled from TÖRNQUIST 1883 and THORSLUND 1936; some northern boundaries of the formation corrected.

Series of samples through the stratal sequence were taken. The distance between two consecutive samples is usually as small as possible for practical reasons. However, the distance is not uniform. In sections of obvious interest the samples lie close to each other, in the remaining parts there are, according to the circumstances, various distances between the samples. As a rule, samples were taken from both sides of lithological discontinuities.

As mentioned in the preface of this paper, I intended to study the oolite of stratum *G*. The samples of this stratum were most often taken as sequences with short intervals; the samples were lying close to each other to a rather large extent. In the profiles as drawn in this paper the midheight of the samples is marked. The distance between these levels is on the average 18 cm (min. 5 cm, max. 50 cm) as regards the localities exclusive of Rävanäs and Röjeråsvägen, where the corresponding data are 53 cm (min. 15 cm, max. 1.6 m). Considering *R I* and *R II*, only 1 or 2 samples were taken just below *R I/G* and above *G/R II* resp. Occasionally, isolated samples were taken at greater distances from these borders.

The ostracods of stratum *G* are thus better known than those of *R I* and *R II*. However, the investigation of *R I* and *R II* may be sufficient to give an idea of the ostracod faunæ of these strata, especially of that of *R II*.

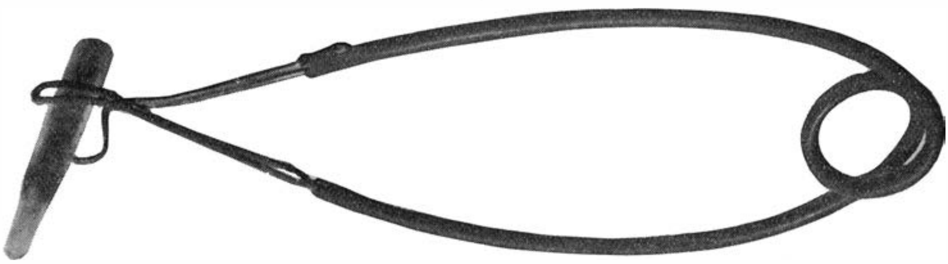

Fig. 2. Pair of forceps with a glass phial filled with ammonium chloride used for whitening of small fossils. About natural size.

The samples are of different weights: most often about 1—3 kg, but sometimes much more. They were partly used up for mechanical and chemical analyses, and for thin slides and polished sections. The remains were completely or partly examined for ostracods.

For this examination they were split up into smaller pieces and inspected at 48 times magnification. Most of the specimens had to be prepared. The dentist's drill is not suitable for preparations of these minute and fragile fossils; it was only used to remove concealing "bigger" parts of the rock. For preparation just around the fossils I used needles of special steel, and common sewing needles. The preparation of the finest details was made by means of fine sewing needles sharpened in oil on soft shales.

The details of the carapace are accentuated and the carapace stands out more distinctly against the rock if the surface is covered with a very thin layer of ammonium chloride, or a very thin film of diluted cellulose lac-varnish. Ammonium chloride gives prominence especially to reticulate patterns and lac-varnish to shallowly pitted surfaces. It is very important that the layer of ammonium chloride is thin and even. For this purpose the following simple arrangement is suitable. A small glass phial is entirely filled with ammonium chloride. The best tool to handle it is a pair of forceps, especially made for this purpose (Fig. 2). Only the tip of the phial should be heated until, after a few seconds, a thin smoke appears. The smoke that appears at first is allowed to disperse in the air and the very thin smoke that is produced for a short while afterwards is made to sublimate on to the fossil. This is performed at a magnification of about 15 times. Higher magnifications give such small fields of vision that most of the smoke disappears during the efforts to direct the opening of the phial on to the fossil.

The fossils must be thoroughly cleaned before being coated with ammonium chloride. Generally, alcohol (95 %) is sufficient. Oils, such as xylol, aniseed oil, monobromonaphthalene (see below) and oils from plastelina (separate ostracods are often mounted in plastelina during examination), should be removed by washing in e. g. petrol or ether. Films of cellulose lac-varnish should be dissolved away by acetone (amyl acetate) before ammonium chloride is sublimated onto the surface. The ammonium chloride itself is removed by alcohol.

The oils just mentioned are used to make the carapaces somewhat translucent so that structures of the internal side of the carapace are visible, for instance muscle scars.

Thin slides for microscopical studies were made from several species. They complete the idea of the construction of the carapace which was received during the preparation. They also made it possible to identify the abundantly occurring carapaces in the thin slides from the rock samples, which would otherwise have been quite impossible, since, as far as I could see, practically all of the sections figured in the literature are from smooth and rounded species.

Most of the sliced specimens consist of separate valves and, hence, the appearance of the carapace had to be reconstructed. Thus, in the majority of the transverse sections reproduced, only one valve is real, the opposite is an image of the former. This is indicated by its ends being left white.

The ostracods were drawn by means of a *Zeiss* drawing apparatus (magnification 43 ×). Non-retouched photographs were intended to be reproduced at the same time, but, if so, the printing expenses would have been too high, and this plan and the project to present retouched photographs were therefore rejected. Photographs of minute ostracods with complicated surface ornaments often require much touching up and even so the result will often not be equal to the drawings. In spite of having at my disposal some very good photographic equipment, a skilful photographer and highly qualified draughtsmen trained in retouching work during many years, I decided to have drawn figures. It would have been better if the drawings had been supplemented by stereoscopic photographs.

The ostracodal necrocoenoses were investigated quantitatively. In non-consolidated sediments this is easily done, but it is more difficult as regards sedimentary rocks. The method of calculating the frequency of the ostracods as used here is not perfect but it may satisfactorily elucidate the changes of frequency of the fauna and the succession of the species.

The specimens on the surface of the rock samples investigated were counted and the weights of the rock samples were determined. By calculations, the frequency of the ostracods was made referable to a unitary number of rock samples having a unitary weight. As reference units were chosen 10 rock samples weighing together 100 g. As a rule, more than 10 rock samples of each level were examined and generally their total weight exceeded 100 g.

As is evident, this method is not quite accurate, since, appropriately, the reference unit should be a surface. But it is practically impossible to calculate the superficial dimensions of the irregular rock samples, and, therefore, the present method was used. There is an inherent incommensurability among the frequency data deduced by this method, since the total surface of many small stones is relatively larger than that of a few big ones. Thus, the method does not allow perfectly correct frequency data, but it gives a rather good idea of the distribution of the ostracods.

The frequency data are reproduced graphically. Too great importance should not be attached to small fluctuations of the curves owing mainly to the above-mentioned inaccuracy of the method of calculating the frequency and the fact that ostracods may be occasionally so covered with limonite that they are not even recognized as ostracods. Of course, the frequency curves do not strictly show biocoenotic changes. In fact, they are referable to necrocoenoses, and these are practically never identical with biocoenoses. Some of the ostracods lived in the place where they were embedded, but others were carried there from other biotopes. The large and more persistant fluctuations of a curve may show the changes both of the autogene fauna in a locality and, to a certain extent, the changes which occurred in the adjacent areas where the allogene constituents lived. The development of the entire ostracod fauna in an area is illustrated when comparing frequency curves from its different parts. In the present case the curves suggest a rather uniform development of the ostracod fauna within the whole area.

The dimensions of the species are given in connection with the description of each species.

It is important that as many dimensions and as many specimens as possible are measured. In this way, information is obtained on the composition of the population. Furthermore, one finds the proportions between the number of adult specimens and larvæ, and also dimensional dissimilarities between different ontogenetic stages and between the sexes. The differences between two consecutive stages of an ontogenetic sequence are often so minute that they are not discernible without measurements. But the differences between the adult specimen and a conspecific young larva are often so considerable that they might not be recognized as belonging to one species if an intervening series of measured specimens did not occur. In fact, such measurements combined with observations on other morphological characters are necessary from a taxonomic point of view. Among the present material, several fairly long ontogenetic sequences were found.

The following dimensions were measured: greatest length (L), greatest height (H), greatest thickness (G), length of dorsal margin, or hinge line (DM), length of free margin (FM), anterodorsal ($\wedge$ ant) and posterodorsal ($\wedge$ post) angle, and breadth of velum (Vel.).

The ratios between the following dimensions were calculated: $\frac{H}{L}$, $\frac{G}{L}$, $\frac{DM}{L}$, $\frac{Vel}{L}$, and $\frac{FM}{DM}$.

The measurements were taken from outline drawings made by means of the above-mentioned drawing camera (43 times magnification).

Summary. In this chapter the localities investigated are mentioned, as well as the technical methods used in the laboratory research. Furthermore, an account is given of the principles for the investigation of the frequency of the ostracods.

Orientation of the carapace.

The question as to which end is the anterior and which the posterior in Paleozoic ostracods — the question of the "orientation" of the carapace — has been much discussed. However, no agreement has been reached, a fact which is of great detriment. Sulci, nodes and other morphological features of the carapace are denominated in accordance with their relation to the anterior or posterior end of the carapace. As long as there are different opinions as regards the orientation of the carapace, the descriptions will obviously be somewhat chaotic. This must not continue, and it is also not necessary.

TRIEBEL, in 1941, presented a thorough investigation of the orientation of the carapace. TRIEBEL's arguments are comprehensive and correct, as far as I am able to judge from my own experience of recent ostracods and from the present material. The present data support and complete these arguments.

TRIEBEL rightly says that those marks of the carapace which are formed by permanent connection with the body are the safest starting points for the orientation. Muscle scars are the most distinct of such marks.

In recent ostracods one may discern 4 groups of muscle scars: the central adductor group, the dorsal group (abdominal muscles, mainly muscles of the furca), the antennal group, and the mandibular group. In some species the muscle scars correspond to depressions on the surface of the carapace. This is magnificently shown in *Iliocypris bradyi* G. O. SARS, a common North European fresh water ostracod. In many cases, the muscle scars are not corresponded by depressions on the surface of the carapace. However, the muscle scars are often visible if the carapace is placed in liquids of high refractive index.

In recent ostracods the central adductor muscle is attached mainly centrally and in front of the midlength; the posterior part of the body is larger than the anterior due to the fact that the voluminous sexual organs are situated there and the sexual products are stored up in the posterior part of the body. (Rare exceptions are known: in the pelagic genus *Conchoecia* the central muscle is attached just posterior to the midlength owing to a pronounced enlargement of the muscles of the antennae, which are swimming organs.) It is a well-known fact among ostracologists that the central adductor muscle is attached to the carapace in front of the midlength. The group of dorsal muscle scars are situated dorsally of the central muscle scars; sometimes this group and the central group are situated on one internal dorsoventral ridge of the carapace which is corresponded by an impression (sulcus) on the exterior of the carapace. The antennal group of muscle scars is in front of the dorsal group and just at the hinge line. The mandibular group consists of two scars situated just in front of the central group. The inner end of the mandibular muscle is joined to a triangular chitinous plate attached to the carapace at two corners.

There are no muscle scars in the posterior part of the valves; as mentioned, the abdominal muscles are attached to the carapace in front of the midlength (the dorsal muscle group). TRIEBEL shows that this is a necessary result of the development of the cutaneous duplicature from which the carapace is originated.

If unmistakable muscle scars are visible in Paleozoic ostracods, there is no uncertainty as regards their orientation. Mostly, the muscle scars are not distinguishable externally, however. But it has been shown that the scars are corresponded by external impressions. BONNEMA gave examples of the fact that the central muscle scar is situated in the ventral part of the median sulcus, in studying the internal side of the carapace (1909). TRIEBEL stated, as example, that in a Paleozoic species there are impressions corresponding to the central, dorsal, and antennal impressions in *Iliocypris bradyi* (1941, p. 309). He presumes that mandibular scars do not occur in Paleozoic ostracods. Furthermore, he says that in disulcate species the anterior sulcus corresponds to the scars of the antennal muscles.

These examples are very helpful for the elucidation of this problem, but it would be most valuable if the observations on muscle scars could be increased. Parts of the present material are suitable in this respect.

My material shows that muscle scars are not for the most part visible on the outer side of the carapace and, as a rule, they are not discernible in highly refractive liquids. They are best studied on the internal side of the carapace or from internal moulds. Most of the present observations are referable to internal moulds. In several cases, the mould substance is favourable for a most perfect preservation of minute structures. These substances are limonite, and grey or greyish green iron silicates, i. e. colloidal precipitates.

The muscle scars are generally shallow and indistinct. As a matter of fact, a distinct muscle scar (the adductor muscle) is constantly discernible only in a few non-sulcate genera.

In *Macronotella* (Pl. IV, Figs. 3 and 4) the adductor or central muscle scar is large and rounded; in *M. fabuliformis* n. sp. it is covered with extremely minute dots. It is situated on one side of the midlength, i. e. in front of the midlength, judging from the situation of the central adductor muscle in recent ostracods. The central muscle scar is also visible on the exterior of the carapace. This spot is smooth but the surroundings are perforated. These perforations have a narrow external opening, but they are bulbous inwards; from the bottom of each bulb a short and narrow canal leads to the interior of the carapace. The shallow pits around the muscle mark on the internal moulds are impressed by the bottom of the bulbs (Pl. XII, Fig. 5). Whether impressions of the other muscle groups occur in *Macronotella* could not be decided; possibly some or other of the pits are muscle scars.

In *Bythocypris* (Pl. X, Fig. 17) the scar of the central adductor muscle is a distinct round spot with a somewhat rough surface. It is situated just below the midheight and in front of the midlength — in the blunt end half of the valve as in the recent genus *Bythocypris.* No other muscle scars were observed. Externally the central muscle spot is generally not discernible.

In *Conchoides* n. gen. a few very shallow depressions on the surface of the carapace can be seen, obviously corresponding to muscle scars. The depressions are more distinct in internal moulds, however (Pl. II, Fig. 10). In favourable cases the following arrangement of the scars appears. All the scars are distinctly situated on one side of the midlength; apparently this half is the anterior one. The scar of the central adductor muscle is rounded; in its ventral part are often a few deeper marks. The scar is situated somewhat dorsally of the midheight, and, in turn, dorsally of this scar is a triangular field with the base mainly parallel to the dorsal margin and one angle directed ventrally. Along the anterior margin of the field one may sometimes discern a row of minute impressions. Judging by the situation of the scar and its triangular outline, the abdominal muscles were attached there (the dorsal muscle group). Just in front of this dorsal scar is a smaller, rounded one. This spot is situated just where the antennal muscles are attached in *Iliocypris bradyi*. Scars of the fourth muscle group, the mandibular group, also seem to occur in *Conchoides*. They form a small area with two distinct pits just in front of the central muscle scar. There is good correspondence with *Iliocypris bradyi* as regards both situation and arrangement of the attaching marks. Thus they may be assumed to be mandibular muscle marks, which TRIEBEL thought to be missing in Paleozoic ostracods.

The area enclosed by the central, dorsal, and mandibular muscle scars forms a slight swelling of the internal mould. The surface of the carapace is generally not swollen. Hence, the carapace is thinner in this spot than elsewere.

The reason for each valve of the carapace being so thin in this spot is not known, but one may assume that light-perceptive organs were situated there, as suggested by BONNEMA.

In this spot is a more or less distinct node on the carapace in the following genera investigated: *Primitiella, Ectoprimitia*, *Euprimitia*, *Euprimites* n. gen., *Eurychilina, Laccochilina* n. gen., *Ctenentoma*, *Aulacopsis* n. gen., *Glossopsis* n. gen., *Ceratopsis*, *Ogmoopsis* n. gen., *Tetradella*, and *Steusloffia.*

In *Primitiella* the scar of the central adductor muscle is large and rounded. Often it can be distinguished on the outer surface of the carapace. It is situated in the ventral part of the sulcus, somewhat in front of the midlength. Other muscle scars are generally not visible; occasionally there are extremely slight mandibular muscle impressions.

In *Euprimitia*, *Euprimites*, *Eurychilina,* and *Laccochilina* the four groups of muscle scars are more or less distinctly impressed. Generally the mandibular muscle scar is the most distinct one.

Ctenentoma (Pl. VII, Fig. 8) was observed to have a two-pitted mandibular muscle scar. In the sulcus is a row of similar pits but a rounded central muscle spot is generally not observable. The antennal scar is small and the dorsal scars are indistinct.

In *Tetradella*, *Glossopsis*, and *Ceratopsis* the muscle scars are shallow and mostly indistinct. The mandibular and antennal muscle scars are most easily discernible but the central muscle scar is remarkably weak; the dorsal scar is indistinct. The sulcus containing the central muscle scar is situated in front of the midlength.

In my material, I found no exception from the rule that all muscle scars are situated laterally of the midlength, i. e. certainly in the anterior half of the carapace as is the rule in recent species.

The carapace having this orientation, the processes and sulci are directed posterodorsally just as in species living now. The greatest number of perforations for sensory bristles are situated anteriorly (e. g. *Pinnatulites procera* [KUMMEROW]).

The importance of the so-called brood pouch for the orientation of the carapace will be discussed separately in the following chapter.

In the literature the conditions are irregular as regards the orientation of the carapace.

TRIEBEL (1941), as mentioned, made the most thorough analysis of this problem. My observations on muscle marks support his ideas. During the years 1913—1938, BONNEMA in several articles made much propaganda for this orientation; his drawing attention to the fact that the scar of the central adductor muscle is situated in front of the midlength, and, moreover, that it is corresponded by the median sulcus are of permanent value.

This orientation is used by some modern authors, for instance SPIVEY 1939 (England), SCHMIDT 1941 (Bohemia), and SWARTZ 1933 and 1936 (U. S. A.). Among earlier authors this orientation is rather common, for instance by JONES, LINNARSSON (1869), HALL and WHITFIELD (1875), KIESOW (1888 and 1890), KRAUSE (1889—1892), STEUSLOFF (1894), MOBERG and GRÖNWALL (1909), HADDING (1913), and TROEDSSON (1918).

Another group of ostracologists use the reverse orientation. This was proposed by REUTER (1885). ULRICH and BASSLER developed the points of view in favour of this orientation (1908), and KUMMEROW supported their ideas in two papers (1931 and 1933). These authors did not make comparisons with the morphology of recent ostracods.

The criteria for this orientation are summed up by ULRICH and BASSLER as follows (1923, also quoted in BASSLER and KELLETT 1934):

1. relative width, position, and direction of the median furrow, or sulcus, which was found to be wider than either the anterior or the posterior sulcus, to lie almost always more or less behind the midlength of the valves, and when prolonged ventrally to curve more or less backward;

2. correlation and identification of the median and the posterior lobes, both of which lie behind the median sulcus and usually are distinctly separated by the posterior sulcus, although occasionally completely confluent, as in *Ctenobolbina ciliata;*

3. the outline of the valves, particularly in straight-hinged forms, which commonly are more or less oblique and widest behind, with a backward swing from the hinge, which suggests a parallelogram rather than an oblong;

4. the location of the brood pouch, which obviously should be associated with the posterior half of the carapace and, in fact, always lies, at least for its greater part, behind the anterior lobe.

Apparently, this guide for orientation is not useful. This is also half admitted by BASSLER and KELLETT (1934, p. 11).

The papers of ULRICH and BASSLER are comprehensive and fundamental, and these authors have great authority. They were followed by many students, such as RUEDEMANN (1901), COWPER REED (1910), MATERN (1929; he applies the orientation of ULRICH's and BASSLER's to Upper Devonian species), BOUČEK (1936), TEICHERT (1937), KAY (1934 and 1940), ÖPIK (1935 and 1937), and THORSLUND (1940).

Summary. Muscle scars are the most certain criteria for the orientation of Paleozoic ostracods. In recent ostracods the muscle scars are situated in the anterior half of the carapace. The present material permitted several observations of the muscle attachments, and it could be confirmed that they are situated in one half of the carapace, which thus is proved to be the anterior.

For this orientation, lobes, nodes, and spines are directed backwards as in recent ostracods. The so-called brood pouch for the greater part is mostly situated anteriorly.

The brood pouch problem.

The situation of the so-called brood pouch has been considered especially important for the orientation of the carapace: it should be situated posteriorly.

However, if the orientation of the carapace is made in accordance with the evidence from the muscle scars, the so-called brood pouch, at least for the greatest part of its extension, is usually situated in the anterior half of the carapace.

The question of the nature of the so-called brood pouch as well as its importance for the orientation of the carapace has been much discussed, but it has not been satisfactorily answered.

Certain swellings situated mainly ventrally and, as mentioned, chiefly in front of the midlength are interpreted as brood pouches. They are sausage-shaped, ellipsoidal, or subglobular. Such swellings occur in some Paleozoic species. These species are interpreted as sexually dimorphic; specimens having the swellings considered should be females. Swellings of this kind are unknown in recent ostracods.

Brood care is not very common in recent ostracods: "Die grosse Mehrzahl der marinen Ostracoden besitzen keinen Brutraum und dürfte ihre Eier einzeln an Algen, Sandkörner u. dgl. befestigen" (ELOFSON 1941, p. 363; this author thoroughly studied the biology of the Skagerack ostracods during several years). Fresh water ostracods attach their eggs to hydrophytes and other objects by means of a viscous secretion (ALM 1915, p. 229). In a few marine genera there are, however, real breeding rooms for eggs and brood. Eggs and brood are accommodated in the space between the dorsum of the body and the corresponding parts of the carapace, i. e. in the posterior hinge region and the dorsal part of the posterior margin. But eggs and brood are never carried in the ventral part of the carapace.

Water currents, generated by the respiratory plates, pass continually through the brood space and, hence, the oxygen supply is good. The eggs and brood are apparently not fixed; in one genus they even were observed to be in permanent movement. The animals themselves stir the eggs about by means of the cleaning extremity or by the two hindmost ones (ELOFSON 1941, p. 362).

Whether Paleozoic ostracods without so-called brood pouch had brood care is not yet known. It appears from the transverse sections that the space corresponding to the brood space in recent ostracods is usually rather narrow and, hence, unsuitable for the brood. However, in some specimens, the space may be sufficient for the accommodation of eggs and brood. But even so, I think there was generally no brood care, if so, larval valves or carapaces might occur in one or other of the adult carapaces which were observed in the hundreds of microscopical sections made for lithological studies; but I did not see any. Entire shells of the molluscan genus *Pisidium* in Quaternary deposits not seldom enclose larval shells. I think that Paleozoic ostracods without so-called brood pouches, as a rule, had no brood care.

In discussing the nature of the swollen areas which are interpreted as brood pouches, it is necessary first to investigate whether the different types of "brood pouches" are of the same shape.

My material is insufficient to answer this question completely. However, it is sufficient to decide that two types of "brood pouches" certainly could not be breeding rooms, but that a third type was very likely a real brood pouch though not a very suitable one. The material investigated are the *Eurychilina* and *Laccochilina* species described in this paper, *Chilobolbina dentifera* (BONNEMA) (the same thin section as drawn and discussed by THORSLUND 1940, p. 166), and *Beyrichia kloedeni* McCOY (a Gotlandian species).

First, we shall consider the possibility of transferring eggs from the genital openings to a brood pouch situated mainly anteroventrally.

The oviducts and the receptacula semina open between the furca and the two hindmost extremities. The abdomen is movable to a rather large extent. In most cases its posterior part may certainly be bent forwards as far as the posterior part of the "brood pouch" which is generally extended somewhat behind the midlength of the carapace. In the case of a broad communication between the brood pouches and the interior of the carapace, fertilized eggs may be directly transferred. Additionally, eggs may have been moved forwards by means of the abdominal extremities. It is not known definitely, but I think that, in recent brood-caring ostracods, fertilized eggs are brought to the posterodorsal brood space by means of abdominal extremities. In fact, it may not be more difficult to transfer eggs to an anteroventral brood pouch than to a dorsal.

The brood pouch of *Beyrichia kloedeni* is an imperfectly spherical swelling. The greatest part of it is situated in front of the midlength. The communication with the interior of the carapace is very broad; in fact, the pouch is merely a bladder on the carapace (Pl. XIV, Fig. 9). This pouch may very well be thought of as a brood pouch. In fact, I think it was, judging by the circumstance that larval carapaces were observed within the carapace. They most certainly did not come in from outside. The interior of the carapace is filled up with calcite crystals, but there is no mud, which might have been the case if the valves had been parted ever so little (the fossils occur in a marl, the so-called Mulde märgel of the Island of Gotland).

The larval carapaces were observed in one thin section (only 3 specimens were investigated). They are 2 in number. One is situated in the brood pouch, the second in the dorsal part of the interior of the carapace. Owing to their being freely movable within the carapace after the animal's death, the final positions of the larval carapaces are not identical with the original ones. I think that they were all originally situated in the bladders now discussed which were most likely real brood pouches.

One might question why such brood pouches disappeared and why in recent brood-caring ostracods the breeding space is invariably situated on the back of the animals.

We saw that there may be no difficulty in transferring fertilized eggs to these brood pouches. Furthermore, neither eggs nor brood would have fallen out when the carapace was opened. The reason for the rejection of such brood pouches may be that they could not afford the same advantages for the development of eggs and brood as the posterodorsal breeding rooms. As mentioned, the latter ones are especially favourable in being constantly traversed by water currents, and in keeping the eggs and brood clean by the cleaning extremity. Being situated laterally of the current, the anteroventral brood pouches were less favourable from the point of view that the supply of oxygen was less. Since, further, *Beyrichia kloedeni* was possibly a bottom dweller, it may easily have happened that mud particles came into the brood pouches. Their bottom is situated below the ventral part of the opening between the valves, and thus mud particles could easily be gathered in the pouches. On the other hand, it may have been more difficult to get the mud particles removed since the brood pouch was not traversed by a water current. Further, the two cleaning extremities, if any existed (the 3rd thorax extremities), may have reached far enough to clean the eggs and brood in the posterior part of the brood pouch, but it is scarcely probable that they extended to its anterior part (the region of mandibles and lower antennae).

The position of the brood pouch may also be unsuitable for another reason. I think it would be rather dangerous to carry eggs and brood in the immediate vicinity of the oral extremities. They may have run the risk of being eaten.

As now indicated, there are some arguments against the fitness of the position of brood pouches in the anterior part of the ventral region of the carapace. Would it not have been better if the brood pouches had been situated posteroventrally? The fertilized eggs would then have dropped direct from the genital opening into the brood pouch. The brood pouch could not be situated there for the reason that it would have been a serious hindrance during copulation or it might even have made this process impossible. According to observations by ELOFSON (1941, p. 359) the posteroventral margins of the valves lie close together during the copulation so that the copulatory organs may reach each other. If the protruding brood pouches of for instance *Beyrichia kloedeni* had been situated posteroventrally they would have caused a rather large distance between the posteroventral free margins of two copulating animals.

Another type of ventral swelling which is interpreted as a brood pouch will now be discussed. I studied it in *Chilobolbina dentifera* (BONNEMA), *Laccochilina dorsoplicata* n. sp., and *Eurychilina dorsotuberculata* n. sp. In *Chilobolbina* the so-called brood pouch is ellipsoidal, in the *Laccochilina* and *Eurychilina* species sausage-shaped (the latter type is here called the *Eurychilina* type). The former extends from about the anteroventral corner to about the midlength. In the *Eurychilina* type it is developed along the ventral margin, mainly along the post-midlength part. In *Eurychilina dorsotuberculata* it extends more anteriorly than in the *Laccochilina* species.

In these cases the so-called brood pouch is formed by a convex part of the velum (see next chapter). The space thus enclosed is separated from the interior of the carapace when the free margins of the carapace are lying close together (Pl. XV, Fig. 20).

In *Chilobolbina* the margins of the convex part of the velum seem to lie together when the carapace is closed (Pl. XV, Fig. 21). THORSLUND's drawing of the same specimen may not be quite correct as regards this detail (THORSLUND 1940, Fig. 57). The end of the velum, however, is somewhat diffuse in the thin section (Pl. XIV, Fig. 5). According to THORSLUND's drawing the margins of the velum should not reach each other when the carapace is closed.

Hinge arrangements along the free ventral margins were not observed to occur in *Chilobolbina*. A kind of corresponding arrangement seems instead to be developed along the margin of the velar pouch.

In the *Eurychilina* type there is a space between the margins of the convex part of the velum when the carapace is closed.

Did these spaces really serve as brood spaces? The transference of fertilized eggs from the genital openings is more difficult and uncertain than in *Beyrichia kloedeni*. In this species the transference was made within the closed carapace, but in the present case this had to be open, since the pouch is separated from the interior of the carapace when the latter is closed.

It might not have been quite impossible to transfer eggs to such pouches, but many eggs may have been lost during the transference. Those eggs which were safely transferred would have a very exposed situation. When the carapace was opened there was the risk that the eggs and brood would fall out. In recent marine ostracods the eggs are generally lying loose. I do not think that the eggs were attached to the walls in the present case. It is impossible that larvæ could be attached. Moreover, the eggs and brood would hardly be safe within the area of action of the powerful organs of locomotion (the antennæ) and the oral extremities. If in fact, in spite of all this, some eggs or a brood should be left, the development would be checked by insufficient supply of oxygen (no water current) and difficulty in keeping the eggs and brood clean (the cleaning extremities would not extend to the anterior part of the pouches).

It seems excluded that the sausage-shaped and ventrally open pouches of the *Eurychilina* type were breeding spaces. These animals were most likely bottom dwellers and the prowlike parts of the vela may have prevented the animals from sinking too deep in loose mud.

The plane vela of the other sex may also have acted rather like a pair of runners preventing the animal from sinking in the mud (Pl. XV, Fig. 12). The difference in appearance of the velum may have been developed for facilitating the copulation: the distance between the free margins is shorter in this case than if the vela of both sexes had been convex.

The egg-shaped pouch of *Chilobolbina* may not have been very suited to prevent deep sinking in the mud. It is also unfit as brood space, though not so impossible as the *Eurychilina* type. With respect to typology, it is intermediate between that of the *Eurychilina* type and that of *Beyrichia kloedeni* (Pl. XV, Figs. 20—22). It may be questioned whether it really, but exceptionally, could be utilized as a breeding pouch. It may be of interest that the type of pouch which was practically impossible as a brood pouch (the *Eurychilina* type) is that which first appears geologically (Lower Ordovician). The one which most certainly served as breeding space (*Beyrichia kloedeni*) is the youngest one (Gotlandian). The intermediate type (*Chilobolbina*) is of intermediate age (Middle Ordovician).

It has been imagined that all types of ventral swellings as now described were brood pouches. On the contrary, they have also been suggested to have served other purposes. TRIEBEL in his criticism of the former idea thought that specimens provided with such ventral swellings were possibly males: some of the sperms, which are extremely long in ostracods, might be suggested to have been stored up there (1941, p. 365). This interpretation may not be very likely, however. I assumed that these convex surfaces were formed in connection with development of marginal glands of the valves; later I found that TRIEBEL had proposed the same idea. This idea may not be tenable. In recent ostracods, marginal glands occur in swimming carnivorous animals (*Conchoesia*) for catching small organisms such as copepods. If glands were gathered in this part of the carapace it must be perforated by canals through which the glands opened outwards. I could not, however, detect any trace of canals in studying thin sections. Moreover, there is reason to believe that these animals were not swimming carnivores like the recent *Conchoesia.*

In those cases where the swellings served as brood pouches sexual dimorphism is but natural. However, as stated above, there is dimorphism also in those species where the swellings were impossible as brood spaces, i. e. *Laccochilina* and *Eurychilina*, where the velum is plane in some specimens and partly convex in others. This difference may also be sexual, as discussed above (facilitating copulation).

If both convex and plane vela served the same purpose (protecting the animal from sinking deep in mud) there is reason to believe that both the sexes belonged to the same biotope. TRIEBEL assumed that the two sexes lived in different biotopes (1941, p. 362).

Summary. The ventral swellings which are generally considered brood pouches may, in fact, have served different purposes.

Long, sausage-like pouches formed of convex velate sections (the *Eurychilina* type; Lower Ordovician) may not have been brood pouches, but, like the entirely plane vela, they may have prevented the animal from sinking too deep in mud. The sexual dimorphism as regards the velum may have been an arrangement for facilitating copulation.

Egg-shaped pouches (such as in *Chilobolbina*; Middle Ordovician), which are also swellings of the vela, were extremely uncertain breeding spaces, and it is questionable whether they were really used as such.

Swellings of the carapace wall may have served as brood pouches (the *Beyrichia* type; Gotlandian).

Names for the details of the carapace.

There is some confusion as regards the names of certain details of the carapace. This was especially discussed by SCHMIDT (1941, p. 13 f.).

The following names are used in this paper.

The animal is enclosed in a *carapace.* The carapace consists of two *valves.* The valves are connected dorsally along the *hinge line.* When inspecting the carapace in side view, one sometimes finds that the hinge line is concealed by the protruding dorsal part of the carapace (the *umbo*). The line which limits the carapace dorsally — be it the hinge line or the limit of the dorsal swelling — is called the *dorsal margin.* The other margins together form the *free margin.* In the free margin one may discern an anterior, a posterior, and a ventral section (*anterior, posterior,* and *ventral margins* resp.). The two angles between the dorsal margin and the free margin are named *anterodorsal* and *posterodorsal angle* respectively.

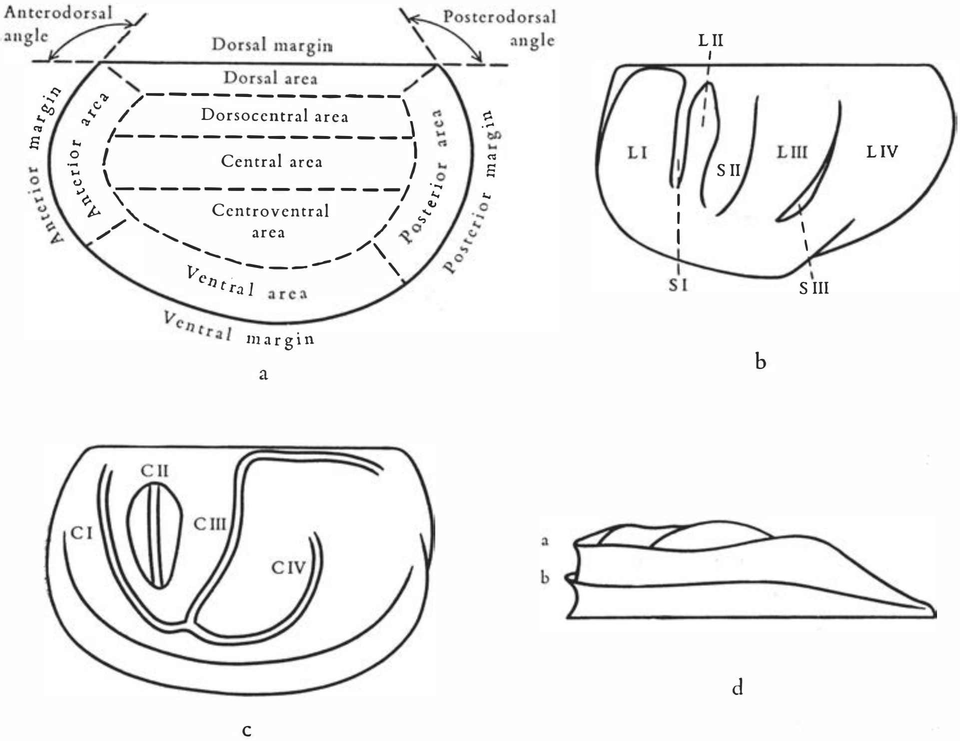

Fig. 3. Schematic drawings illustrating carapace morphology.

a. Position of dorsal angles; delimitation of margins and areas.
b. Position of lobes and sulci, and appearance of ventral carina.
c. Position of *Steusloffia* surface crests, and appearance of velum.
d. Position of ventral carina (*a*) and velate ridge (*b*).

In the descriptions it is necessary to use denominations for different parts of the valves. As a matter of fact, the borders between these areas are not distinct. I found that the surface of the valve may suitably be divided into the following areas (Fig. 3): *dorsal, dorsocentral, central, centroventral, ventral, anterior,* and *posterior.*

The deep, mainly dorsoventral, furrows are termed *sulci*, shallow furrows (generally only one present) are called *sulcate depressions.* The intervening more or less convex fields are called *lobes.* In the present material there are mainly mono- and trisulcate species: a few are bisulcate, viz. among the *Glossopsis* species (it is not known whether this means a lower stage of development or is a phenomenon of reduction).

In monosulcate specimens only "the sulcus" and the pre- and postsulcate regions are spoken of. In trisulcate genera (*Glossopsis* n. gen., *Ceratopsis, Ogmoopsis* n. gen., and *Tetradella*) I denominate the sulci with the letter *S* and the lobes with *L.* The most anterior sulcus is termed *S I,* the most posterior *S III*; the intervening is called *S II*. The lobes are denominated in the corresponding way as *L I—L IV*. The "sulcus" of monosulcate species corresponds to *S II*.

In real bisulcate species (which are not represented in the present material) the anterior sulcus corresponds to *S I* and the posterior one to *S II*. As to the lobes, one may speak of the presulcate lobes (mentioned *L I* and *L II*) and the postsulcate lobe. As anticipated, in some species of the genera *Glossopsis* and *Ceratopsis*, *L III* and *L IV* are more or less completely joined to form one lobe. In this case also I call it the postsulcate lobe.

Just in front of the *S II* (generally in the dorsocentral area) is a *node* (in monosulcate genera it is called the *presulcate node*). It is often visible externally, and practically always in the internal mould. In plurisulcate species it is invariably situated in *L II*.

The *surface crests* of *Steusloffia* are abbreviated *C I—C IV*; *C I* is the most anterior one, *C II* (often not developed) traverses dorsoventrally the presulcate node, *C III* runs just behind the sulcus, and *C IV* is the most posterior one.

In many species there is a narrow ridge running somewhat outside and mainly conforming to the free margin. Such a narrow ridge is proposed to be called a *velate structure*. A broad velate structure is termed a *velum*, a narrow one is proposed to be denominated a *velate ridge*. The velum is entirely plain or partly convex; the convex sections, which in most cases have certainly been erroneously taken for brood spaces, are generally sausage-shaped, ellipsoidal, or egg-shaped. Velate ridges are entirely plain. Velate structures, as a rule, run along the whole free margin. Examples of vela among the present species are offered by *Eurychilina*, *Laccochilina*, *Steusloffia*, and *Tetradella*; a velate ridge occurs for instance in *Euprimitia*.

Ventral carina is a denomination proposed for a keel-like and, as a rule, rather short but mostly very protruding ridge parallel to the ventral margin (except generally its most posterior part) and sometimes to parts of the anterior margin, the edge being directed ventrally.

Velate structure and ventral carina are not homologous. This is demonstrated by the genus *Ogmoopsis* n. gen. where both a ventral carina and a velate ridge occur. *O. nodulifera* n. sp. is the best example. In this species, the velate ridge runs from anterodorsal to posterodorsal corner between the ventral carina and the free margin. In certain species of *Glossopsis* (for instance *G. tenuilimbata* n. sp.) and the species of *Aulacopsis* n. gen. the velate ridge occurs as a rudiment, i. e. as a low and short ridge between the ventral carina and the ventral margin. Thus in this case the velate ridge is more poorly developed than in *Ogmoopsis*, but the ventral carina is somewhat more pronounced and of a little more typical appearance (cf. Pl. VIII, Figs. 19—20; Pl. VII, Figs. 15 and 21; Pl. XV, Figs. 11 and 15).

The figure by BONNEMA (1909, Pl. VI) demonstrates the appearance of a velate ridge and a ventral carina in *Glossopsis schmidti* (BONNEMA).

Ogmoopsis especially shows that the ventral carina is homologous to the *Umbiegungskante* of the German literature. This fact may also be discernible in genera provided with real vela, such as *Tetradella* and *Steusloffia*. The ventral ridge connecting *L I* and *L IV* of *Tetradella* and the crest connecting *C I* and *C IV* of *Steusloffia* correspond to the carina (cf. Pl. IX, Fig. 10 and Pl. X, Fig. 7).

SCHMIDT (1941, p. 14—15) discussed these questions but thought that the ridge of the *Umbiegungskante* and the velum were homologous, which, as appears from my new material, may not be correct.

There is reason to attach special interest to the appearance of these characters since they are undoubtedly of greater taxonomic importance than generally imagined.

Summary. Partly new names and markings for the morphological characters of the carapace have been used in this paper. Special distinctions have been made as regards the taxonomically important structures in the ventral region.

Remarks on the taxonomy.

The taxonomy of Paleozoic ostracods leaves a great deal to be desired. This applies both to species and to larger taxonomical units.

In recent ostracods the extremities and the sexual organs (especially the penis and the ejaculatory duct) are most important organs for the determination of the species. In fossil ostracods only the carapace or, more often, separate valves have been left. It is true that the carapaces of many Paleozoic ostracods are more distinctly sculptured than those of the majority of recent species, but the taxonomical treatment of this material is nevertheless difficult, mainly owing to the following reasons (which are common to all ostracodal necrocoenoses): the carapaces and valves are larval to a large extent, and the appearance of the larvae is due to their stage of development; there is a more or less distinct sexual dimorphism; and, in some cases, there is a rather considerable individual variation.

Larval development.

During the larval development the ostracods moult several times. In recent species they are mostly fertile first during the 9th stage.

The larval carapaces are more or less different from those of the adult animals. As illustrated by ELOFSON (1941, p. 377, Fig. 32), the outline varies during the larval development. The ornamentation also is changed. Systematic observations on the larval development of the ornamentation in recent ostracods are not published, as far as I know. As to fossil species, a few workers have examined ontogenetic sequences. Such a study was made by KELLETT as regards Upper Pennsylvanian ostracods (1933). LEROI made a very interesting quantitative investigation of the ontogenetic progress of certain characters in two Miocene and Pliocene *Cythereis* species (1945). He recognized sequences of their larval stages and studied, inter alia, the development of the reticulation, lateral expansions of the valves, surface nodes, a median ridge, muscle scars, the number of certain pore canals, and the hinge structure. COOPER, in 1945, studied the moult stages of a Pennsylvanian ostracod by statistical methods.

Especially during the development of the secondary sexual characters, differences in the shape of the carapace appear. The secondary sexual characters arise at the same time as the genesis of the sexual organs, i. e. during the appearance of the ultimate and, sometimes, the penultimate stage. The proportions of the posterior part of the carapace which are due to the sexual organs are then established. At this time also, real ventral brood pouches may have been formed.

In the present material, different post-embryonal stages are represented. Fairly long ontogenetic sequences were observed in several cases. Only a few general features are mentioned here; detailed observations are given in the descriptions of the species.

First may be mentioned the fact that larval stages (not only early ones but sometimes also late stages) are often so different from adult specimens that their conspecificity can be proved only if sequences of stages are secured.

Certain changes in the appearance of the carapace during the larval development are very common and possibly general. Many of these changes occur during young larval stages.

In the youngest stages the dorsal margin is proportionally longer and the free margin is proportionally shorter than in later stages and adult specimens. Further, the anterodorsal angle is less obtuse; the posterodorsal angle, on the contrary, is fairly constant in all stages. In *Aulacopsis bifissurata* n. sp., where 4 stages of development were discerned, the final magnitude of the anterodorsal angle was reached as early as the stage next to the youngest. In connection with this development of the anterodorsal angle, the anterior margin grows more convex. A very distinct change occurs at a late stage in *Ctenentoma plana* n. sp.: in this case the anterior margin is remarkably more convex in adult specimens than in late larvæ. In one species (*Conchoides meganotifera* n. sp.), it was observed that, during the larval development, the change of the anterodorsal angle is more pronounced in the group which was suggested to be male than in that supposed to be female.

The height of the carapace was in many cases observed to have decreased during early stages of the larval development; in the group of *Conchoides meganotifera* n. sp. which is suggested to be female, the height was, on the contrary, observed to have slightly increased. However, the height was also observed to be fairly constant in all stages (*Primitiella brevisulcata* n. sp.).

Young stages have been observed to be more gibbous than later stages. In monosulcate species the greatest gibbosity mostly occurs in the central and dorsocentral areas. In certain plurisulcate species having a broad lobe created by fusion of *L III* and *L IV* (owing to *S III* in very young stages being indistinct or not developed at all), this lobe is proportionally more arched ventrally than the posterior part of the carapace of later stages and adults. Also as regards the gibbosity, a certain sexual difference may occur. In *Conchoides meganotifera* n. sp. the dorsal area slopes almost equally in young stages of males and females, but later the slope becomes proportionally more steep in males but less steep in females. The dorsocentral-central swelling of this species, which is fairly conical in young stages, grows, in both sexes, more flattened during the further development. The difference in the degree of arching between anterior and posterior parts of the carapace, which is clearly visible in adult specimens of some species (e. g. *Conchoides micropunctata* n. sp.) and which is considered a secondary sexual character, is less pronounced in young stages.

These changes, which mean that the carapace during the larval development has grown proportionally lower and narrower, and which also mean that the anterior end has been more acute, may indicate an increased mobility of the animals. Further, the fact that males seem to grow proportionally lower and narrower than females and that the anterior part of their carapaces becomes more arched than in females (to give space for heavier locomotion organs, i. e. heavier lower antennæ) may indicate a higher mobility in males.

We shall now consider the ontogenetic development of some particular characters.

Sulci. *S II* is very permanent. Sometimes it is even deeper and more distinct in young stages (*Aulacopsis monofissurata* n. sp. and *Aulacopsis bifissurata* n. sp.). In *Ctenentoma plana* n. sp. it is longer than in adults. The sulcate depression of *Primitiella* is often very shallow in young stages, but it also happens to be fairly deep and distinct (differences as regards distinctness of the sulcate depression also occur in adult specimens of *Primitiella*). In young stages of the non-sulcate *Aparchites* (*A. depressulus* n. sp.) an extremely shallow sulcate depression may be discerned. — It may be noticed that the position of the sulcate structure seems to be fairly constant in all stages in relation to anterior and posterior margins of the carapace.

S I and *S III* are indistinct or may not be developed at all in very young stages, as is observed in *Glossopsis* and *Tetradella.* If present, only the dorsal end of *S I* is developed. Later the ventral part appears. Considering *S III*, there are generic differences as regards the order of its appearance: in very young stages of *Glossopsis* only the ventral part is developed but in *Tetradella* only the dorsal one. The sulcus grows successively longer and deeper during the further larval development.

The fissures of *Aulacopsis* are often observed even in the youngest stages, at least the presulcate fissure. The fissure of *A. monofissurata* n. sp. (situated posterior to the sulcus) is usually indistinct or indiscernible. In *A. bifissurata* n. sp. the presulcate fissure is generally developed. Occasionally it extends to the dorsocentral area (thus a true *S I*), but this was not observed in later stages. The postsulcate fissure is indistinct, or undeveloped.

Such young stages of *Glossopsis* and *Tetradella* where *S I* and *S III* are incompletely developed, may be so similar that they can be confused with corresponding stages of *Aulacopsis* provided with fissures. Even younger specimens of *Glossopsis* and of certain species of *Tetradella* and *Aulacopsis* where *S I* and *S III,* and the fissures resp. are not developed may be erroneously taken for young *Ctenentoma* or *Euprimitia*. There may be differences as regards other characters (for instance velate ridge contra ventral carina), but such differences are sometimes very slight, and ontogenetic sequences are most often necessary for the determination of such specimens.

The fact that *S II* occurs even in the youngest stages indicates that the central adductor muscle was developed, which agrees with recent conditions. The reason why the sulcus of this stage is sometimes deeper than in later stages may be due to the circumstance that depressions formed by muscular contractions during one of the first moultings were made permanent at the calcination of the young valves when these were still very thin. This may also be the reason for the mentioned depression in young larval valves of *Aparchites*.

The fact that the dorsal part of *S I* is developed earlier than the rest of this sulcus may mean that a muscle had appeared and had been attached there. This muscle must be that of the first antenna, which extremity in recent ostracods is the earliest developed and the muscle of which is attached just at that place. When later the further extremities appeared (lower antennæ and mandibulars) their muscles became attached ventrally of the attachments of the first antennæ and thus the ventral part of *S I* may have been developed. All the time the abdominal muscles seem to have existed and to have been attached dorsally of the central adductor, thus forming the dorsal muscle group. This group and the antennal and mandibular muscles are grouped around the presulcate node which had appeared even at the early stage now mentioned.

The reason why the presulcate fissure of *Aulacopsis* is more distinct in very young stages than in later ones may be the same as assumed above for the identical phenomenon as regards *S II*.

Finally, the fact that *S III* is sometimes first developed in the dorsal part and sometimes in the ventral one may indicate that this sulcus had nothing to do with muscular attachments and thus could be developed in a fairly arbitrary order.

Lobes. Characteristic features of certain lobes are recognizable even in very young stages. Thus, the flat *L I* of *Glossopsis lingua* n. sp. is distinguishable from the likewise flat *L I* of *Glossopsis clavata* n. sp., since the ventral end of the former is invariably broad, whereas that of the latter is narrow, as in adult specimens.

But often the appearance of the lobes changes during the larval development. This occurs in some *Glossopsis* species. In *G. acuta* n. sp., *L I* in young stages is rounded in transverse section, but in later larval stages and adults the outer surface of this lobe is flattened and slanting backwards, the ventral part of its anterior margin forming an angle with the steeply sloping prelobate area. The dorsal end of the lobe has been considerably raised during the latest ontogenetic stages. A corresponding change may appear at a very late stage in *G. robusta* n. sp. In *Tetradella teres* n. sp. the lobes are flattened in young stages (their anterior and posterior margins angled), but in later stages they grow higher, and anterior and posterior margins are rounded; in adult specimens the lobes may form slightly acute ridges.

Nodes. The presulcate node is very constant. The postsulcate node of *Steusloffia* was observed even in the youngest stages of *S. polynodulifera* n. sp.

Velum and velate ridge. In young stages, the velum often seems to be proportionally shorter than in later stages, as observed in *Tetradella teres* n. sp. and in species of *Laccochilina*. The velate ridge appears narrower and less distinct in young stages, especially along anterior and posterior margins (observations in *Ctenentoma macroreticulata* n. sp. and in *Euprimitia*).

The function of velate structures is not known, but it may be supposed that they acted rather like a pair of runners preventing the animal from sinking too deep in mud (cf. p. 127). It seems likely that these structures grew broader as the size and weight of the animal increased.

Ventral carina. The carina occurs in the youngest stages of carinate species observed, but it changes its appearance during the larval development. In *Aulacopsis bifissurata* n. sp. (which is here represented by a fairly good sequence of larval carapaces) the carina is very short (outline acute) in very young stages (group *d*), but it grows successively longer, and its outline becomes more and more broadly curved. Such a development was also observed in other species, for instance in *Aulacopsis monofissurata* n. sp. and *Ctenentoma plana* n. sp., but the carina does not protrude so much in very young stages as in *Aulacopsis bifissurata*. In adult specimens of *A. bifissurata*, the carinal edge has become sharply ridged and additionally pinched. Further, the area between the carinal edge and the ventral margin has become concave instead of having been practically plane in larval stages. Such a change of the area concerned is distinctly discernible in *Ctenentoma plana* n. sp.; in this case, the carinal edge has also become bent inwards after having been curved outwards in the larval stages.

In *Glossopsis* the posterior end of the ventral carina grows flange-like during the larval development (observed in many of the *Glossopsis* species occurring here).

The function of the ventral carina is unknown. The carinae are massive and heavy, and they possibly served as stabilizing organs to keep the carapace in an upright position. The need of such stabilizers may have been greater in late larval stages and adults than in young stages, and thus the fact may be explained that the carinae of the former stages are proportionally larger than those of the latter ones.

Surface crests. In young stages of *Steusloffia*, surface crests are lacking or are indistinct, as observed in *S. polynodulifera* n. sp. (cf. THORSLUND 1940, p. 177). During the larval development they increase in height. The backward directed dorsal extensions of *C I* and *C III* (cf. *S. polynodulifera*) appear in late larval stages and in adults.

In old adult specimens of the present species *Tetradella lanceolata* n. sp., calcium carbonate may be deposited in extra ridges. Extra deposits along the free margin of the shells are often observed in old specimens of brachiopods and molluscs.

Surface pattern. LEROY (1945) observed that in Tertiary species the surface reticulation expands during the larval development. Corresponding observations were made in some of the present species, but several examples of exceptions were also observed.

Very young α larvae of *Conchoides meganotifera* n. sp. (α group supposed to be male) are non-sculptured, but very young β larvae (β group supposed to be female) are minutely reticulate on one or both sides of the dorsocentral-central swelling. During the larval development, the α larvae gradually received the final surface pattern (which is similar to that of β but less distinct); the minute reticulation of the β larvae became successively replaced by the final pitted and reticulate pattern which, in both sexes, is best developed on both sides of the shield-like swelling.

This example indicates that the most distinct parts of the surface pattern are the earliest ones formed. In many other species, it was observed that the surface pattern (most observations on reticulation) in several young larvae is more indistinct than in adult specimens and later larval stages, but it happens that very young larvae among these species are just as distinctly reticulate as the adults (it may also be noted that the "meshes" of the reticulum, e. g. in *Ctenentoma macroreticulata* n. sp., are of practically the same width as in late larval stages and adults). In *Primitiella expresso-reticulata* n. sp. the distinct reticulum does not expand during the ontogenetic development studied, which comprises mainly later larval stages. The characteristic nodulation of *Steusloffia polynodulifera* n. sp. occurs invariably even in very young larvae.

It was mentioned above that the minute striation of young *Ctenentoma meganotifera* n. sp. is replaced by a reticulate surface. In *Ctenentoma plana* n. sp., it was observed that the reticulum along the outer side of the ventral carina of late larval stages (group *b*), in adult specimens (group *a*) is substituted by a striation. Further, it was observed that the area between the carinal edge and the ventral margin in late larval stages is reticulate but in adult specimens smooth (*Ctenentoma plana* n. sp. and *Aulacopsis monofissurata* n. sp.).

Sexual dimorphism.

In recent ostracods there is generally sexual dimorphism, but this is rather inconspicuous for the most part. In some cases, the difference is very distinct, as in *Philomedes* and *Asterope*. In this case, the sexes are different as regards the length of the carapace, the frontal sinus and the rostral prominences, the eyes (in the male large, in the female much reduced), and the lower antennae (more powerful in the male).

In *Philomedes globosus* (LILLJEBORG), "The males are very active, swimming about with great speed, and in some cases ascending to the very surface of the sea, the adult females are constantly bound to the bottom, dragging themselves slowly through the loose mud" (SARS 1922, p. 13).

The most striking external differences due to sexual dimorphism are those of size and outline. Among the ostracods of Norway (data compiled from SARS 1922—1928), 28 % have smaller males than females; in 16 % the males are larger; in 15 % the sexes are of practically equal size; in 41 % the male is unknown or imperfectly known. Often the male is narrower. There are also dissimilarities as to the height and the width of the posterior part of the carapace, and as to the convexity of the posterior margin. Concerning the sculpture of the surface there are no dissimilarities, or only minor ones, for instance as regards the punctation. In some cases, sculptural differences are distinct, such as in *Notodromas monachus* (JURINE), the female of which has a posterior dentiform projection absent in the male, and in *Cytherura gibba* (O. F. MÜLLER), the male of which has no trace of the lateral tuberosities occurring in the female (SARS 1925, p. 201).

In Paleozoic ostracods one finds minor differences among specimens occurring in the same necrocoenosis. Some of these differences may be due to sexual dimorphism. An example of this is *Conchoides micropunctata* n. sp. The types interpreted as different sexes are very similar in size and outline. Both are minutely punctate but one of them has, additionally, somewhat larger punctae scattered in the anterior part. It is also somewhat more arched anteriorly. Whether this type is male or female is impossible to decide; I think it is male. Its being somewhat more arched anteriorly may certainly be due to the fact that the muscles of the lower antennae were larger. Since these antennae are the most important organs of locomotion, this type may have been the better swimmer and thus presumably male, corresponding to the conditions in the recent genus *Philomedes* just mentioned. The fact that the eyes are better developed in males than in females of this genus is no doubt due to its mobile behaviour but it may also facilitate the finding of the females. *Conchoides micropunctata* may have been blind, but it is very probable that sensory bristles, situated in the larger anterior punctae of the type suggested as the male, served as guiding organs for, inter alia, the purpose mentioned. In *Primitiella dibulbosa* n. sp. the anterior part of the carapace is higher and broader in the type suggested as the male. This species is, moreover, interesting in that the type suggested as the female is slightly swollen posterodorsally. This is coincident with recent conditions; the females are often broader posterodorsally for the sake of brood care. In *Conchoides minuta* n. sp. the posterodorsal region is slightly more swollen in a group of individuals which may be females.

In those types which on such grounds as now mentioned are suggested as females, the surface pattern, as a rule, seems to be more distinct than in those suggested as males (*Conchoides micropunctata* n. sp. and *Conchoides meganotifera* n. sp.; in *Conchoides levis* n. sp. the type suggested as the male is entirely smooth). Furthermore, it seems to be the rule that the free margin is proportionally longer in females (dorsal margin often shorter) and the anterodorsal angle less obtuse.

Some Paleozoic ostracods have a most salient morphological structure which is interpreted as being sexually bound, i. e. the so-called brood pouch. The specimens provided with such a pouch were most often considered to be females; TRIEBEL, on the contrary, assumed the pouches of the *Beyrichiacea* to contain parts of the male reproduction apparatus (1941, p. 365). In the chapter of this paper "The brood pouch problem", reasons were put forward for the pouch's being, in some cases, a breeding space but, in others, serving other purposes. The former are bladders on the carapace, the latter are rooms formed by convex parts of the velum. Probably the dimorphism in the latter case is sexually inherent, too, since it may be of importance for the copulation, as discussed in the above-mentioned chapter.

In the present material, there are no real brood pouches. A few species belonging to *Eurychilina* and *Laccochilina* n. gen. are provided with partly convex vela, but their margins do not extend to each other, so there is a slit between them. These species appear in the upper part of the stratal sequence investigated.

Individual variation.

Among the present species, dissimilarities are often observed which are most certainly due to individual variation.

One might expect various irregularities in the shape of the carapace due to deformations of the newly formed carapace. The new carapaces are soft, and deformations during this period are usually fixed when the carapace becomes rigid (ELOFSON 1941, p. 382). However, the present material does not seem to have been influenced in this way (except young larval stages, where muscular contractions may have caused proportionally more pronounced sulci than in later stages, cf. p. 134).

Rather striking individual dissimilarities occur in the surface pattern. The reticulation is often of different distinctness; sometimes the surface appears shallowly pitted such as is observable in *Glossopsis lingua* n. sp., *Aulacopsis monofissurata* n. sp., and *Ctenentoma plana* n. sp. The reticulation is also often somewhat varying with regard to the extension. *Primitiella expresso-reticulata* n. sp., which is distinctly reticulate, is distinguished by the fact that the extent of the reticulation can vary widely. Sometimes only the anterior and posterior ends are reticulate; in other specimens, the whole surface (with the exception of the central muscle spot) is covered with the reticulate pattern. In many reticulate species, a central and centroventral field of different size is invariably smooth. Considering tuberculate species, there may be minor differences as regards size and frequency of the tubercles (*Steusloffia polynodulifera* n. sp.).

Sulci and nodes may also vary slightly for different individuals. This is seen in *Aulacopsis* n. gen. which is typologically intermediate between the real monosulcate *Ctenentoma* (*C. plana* group) and the generally trisulcate genus *Glossopsis* in having traces of *S III* and (or) *S I*. *Aulacopsis monofissurata* n. sp. is distinguished by the fact that "*S I*" is not at all visible in most specimens; in a few others it appears as a dark streak on the interior side of the carapace; in a third group it is an extremely shallow external depression. "*S III*" is constantly developed as a ventral scratch, the length and depth of which vary, however.

The limitation of the species.

It appears from the above discussion on the many moultings and the dissimilarities in the carapace of the different larval stages, the sexual dimorphism, and the individual variation, that it may sometimes be difficult to delimitate ostracod species. In many cases, these facts have not been duly considered. Neither has the material always been so extensive as to show larval stages, sexual dimorphism, or individual variation. Many forms considered to be particular species may, in fact, be a larval stage, a sexual dimorphism, or an individual variant. This is also pointed out by LEROY, who, moreover, mentions that "most investigators of the Ostracoda (including the writer) have failed to recognize or emphasize the significance of moult variants. As a result of this neglect, frequent generic and specific allocations have been made erroneously" (1945, p. 81). On the contrary, there sometimes seems to be a certain inclination for considering rather different forms only as different sexes where possibly a greater difference occurs.

To minimize taxonomic confusion, it is necessary to study extensive sequences of specimens as completely as possible. The importance of measurements has been pointed out earlier in this paper (p. 117). In this way, knowledge of the larval stages, the sexual dimorphism, and the individual variation is increased, and consequently, also of the range of the species and the subspecies.

Of course — in ostracods, as in other fossil animal groups — the difficulty remains to estimate the taxonomic importance of different characters.

As specific characters, are considered groups of distinct and constant features which are not connected by series of intermediate types. As examples may be mentioned *Glossopsis lingua* n. sp. (Pl. VIII, Fig. 8) and *Glossopsis tenuilimbata* n. sp. (Pl. VII, Fig. 21) which certainly are near relatives. They are distinctly and constantly different as regards the appearance of *L I* and *L II*, *S I* and *S II*, and the carina.

There are types which are similar to *Glossopsis lingua* as regards some characters but similar to *Glossopsis tenuilimbata* as regards others; in addition, they have certain characters of their own. These types are considered as particular species. One such species is *Glossopsis clavata* n. sp. (Pl. VIII, Fig. 2) which is similar to *G. lingua* as regards *L II*, *S II* and the carina, but which is slightly reminiscent of *G. tenuilimbata* in *L I* being claviform and *S I* being long and somewhat sigmoidal. The outer rim of the carina is striate which is not so in the two other species.

As subspecies, are considered those types which in important characters coincide with the type which is designated as the main species, but which are different as regards one or more special characters; intermediate types should not occur.

The condition that intermediate types should not occur, is indispensable. Intermediate types are due to individual variation. In order to be able to state whether such types occur, the material should be extensive, and characters should be measured or valued in accordance with a scale; the data thus received should be plotted in a graphic scheme. If the curve has two maxima, it represents two subspecies; a GAUSS curve represents the individual variation of a species.

This reasoning refers to biocoenoses. The associations of organisms in sedimentary rocks (the necrocoenoses) are not preserved biocoenoses, however. In fact, they consist both of autogene and allogene components. The question is, to what extent allogene intermediate types with the rank of subspecies occur.

Within one biotope, subspecies are developed when individual variations have proceeded so far that they are hereditarily fixed. In another biotope a hereditarily fixed type of intermediate appearance may be developed. If these types are deposited in the same necrocoenosis, one may erroneously think that the variability is due to individual variation.

Is such a development possible? As a rule, ostracods have rather distinct ecological requirements, especially as regards the character of the sediment, the hydrological conditions and the supply of food. If these conditions are different in different parts of an area, it is conceivable that so-called ecotypes might arise which during the further speciation process become subspecies. There is no reason to exclude the possibility of communication between such somewhat different biotopes; a certain reversible exchange of larvae and perhaps also of adults may occur, and one or other carapace of dead animals may be transferred to foreign necrocoenoses. But such xenogene constituents may not, as a rule, cause a GAUSS frequency on account of their small number in relation to the autogene constituents.

Considering the present area, the problem now debated may be fairly simple. Judging from the uniform sedimentology and the great faunal similarities the whole area may have afforded about equal ecological conditions, and the speciation may have proceeded rather uniformly in all its parts. A certain mutual exchange certainly took place. In fact, the ostracodal necrocoenoses consist of types from chiefly one biocoenosis. As for this area, the question made may be answered in the negative: transitional types may, as a rule, be referable to individual variation.

In the present investigation, such minor characters as those now considered are not measured or valued in accordance with a scale, such methods being difficult to apply to these small animals. Moreover, varieties of the rank of subspecies are not very common.

Sometimes, one may be uncertain whether a type is a species or a subspecies. *Glossopsis acuta* n. sp. may be mentioned as an example of this.

This species is very similar to *Glossopsis lingua* n. sp. Typical specimens are easily distinguishable owing mainly to the fact that *L I* is different (slight differences as regards other lobes), but in many specimens this difference is not large. One might be inclined to consider one type as the main type and the other as subspecies, or (since intermediate types occur) the whole group as one species with a large individual variation.

In reality, they are two species, judging by the fact, that the larvae are different. In *G. lingua* larvae, *L I* is invariably flat and low, as in adult specimens, but in *G. acuta* it is raised, its surface being curved in transverse section.

Considering *Glossopsis alata* n. sp., it may be questioned whether such a form is a species or merely a subspecies of *G. tenuilimbata.* One might also think of it as a theratological type of this species. It is similar to *G. tenuilimbata* in several respects, but there are important dissimilarities so that it may be considered a species of its own (in relation to *G. tenuilimbata* the ventral swing is more pronounced, *L I* is more shortly claviform, extending above the dorsal margin, which is not the case in *G. tenuilimbata*). It is evident, however, that the two species are very close relatives.

If the material is scarce, or if there is uncertainty as to the value of the differing characters, the form considered is denominated an aberration (abbr. *ab.*).

Higher taxonomic units.

Many of the existing genera are too wide and should be split. Furthermore, there are types which cannot be properly placed in existing genera, and, hence, new genera should be proposed. In several cases, the generic relations and the grouping of genera into subfamilies and families should be revised. In sum, the existing taxonomic systems are not acceptable in all their parts.

Like many other ostracodal investigations the present one gives rise to several taxonomic considerations. As mentioned in the introduction, I would have preferred to postpone the division of old genera, the establishment of new ones, and the discussion of generic relations until more material had been investigated. However, I think it is already necessary to take up some of these questions.

Groups of species which differ from existing genera in one or more distinct characters are now established as new genera.

Conchoprimitia ÖPIK has too wide a range. It is here proposed to be split up into 3 genera (for particulars cf. p. 149):

<table>
<tr><td>1. Conchoprimitia emend.
2. Conchoides n. gen.
a. leperditoid group
b. non-leperditoid group</td><td>Family Aparchitidae
(abundant in the Lower Ordovician)</td></tr>
<tr><td>3. Conchoprimites n. gen.</td><td>Family Primitiidae
(abundant in the Middle Ordovician)</td></tr>
</table>

Conchoprimitia emend. (which includes 2-grooved species) and *Conchoides* (1-grooved species) are non-sulcate.

Conchoprimitia emend. is a small genus (2 species), *Conchoides* seems to be more numerous: 3 species were known earlier, and 10 new ones are described in this paper. 8 of them belong to the leperditoid group, and 2 to the non-leperditoid. These groups are different as regards the outline and the dorsal corners, as appears from the denominations of the groups; the leperditoid group, moreover, is characterized by extremely shallow and diffuse depressions corresponding to muscular attachments, but such depressions are generally not discernible in the non-leperditoid group. Many large types belong to the leperditoid group.

Conchoprimites is monosulcate. The majority of the ostracods originally classed in *Conchoprimitia* ÖPIK belongs to this genus which is rather numerous (8 or 9 species).

Another genus that has had, until now, too wide a range is *Ceratopsis*. If this genus is taken in its current range, the species represented in the present material might be referred to one of these groups:

A. *L I* spiniform
   1. 4-lobate (not represented here; e. g. the genotype of *Ceratopsis*)
   2. 3-lobate (e. g. *Ceratopsis grandispinosa* n. sp.)
B. *L I* flattened
   1. 4-lobate
      a. Lobes rather equal (e. g. *Ogmoopsis nodulifera* n. sp.)
      b. Lobes unequal.
         α. *L I* linguiform (e. g. *Glossopsis lingua* n. sp.)
         β. *L I* claviform (e. g. *Glossopsis tenuilimbata* n. sp.)
   2. 3-lobate (e. g. *Glossopsis robusta* n. sp.)

A genus of such a range is obviously so heterogeneous that it should be split.

I propose that it be divided into 3 genera (for particulars, cf. p. 295):

1. *Ceratopsis* emend. (*L I* spiniform.)

2. *Glossopsis* n. gen. (*L I* flattened, either linguiform [about equally broad in all its extension], or claviform [ventral end tapering]; lobes mutually distinctly unequal; besides a ventral carina, sometimes a short rudiment of a velate ridge.)

3. *Ogmoopsis* n. gen. (Lobes mutually fairly equal; besides a ventral carina, a distinct velate ridge running from anterodorsal to posterodorsal corner.)

The genus *Ctenentoma* was established by SCHMIDT 1941, and this was a necessary action. However, this genus may in turn be split up, but I prefer not to do that, since my knowledge of the numerous species referred to this genus is too restricted. (Descriptions and figures of most of these species are unsatisfactory.) It is evident that in carrying out this revision, great importance should be attached to the question of whether a velate structure or a ventral carina occurs. The present material of *Ctenentoma* is referable to two groups (for particulars cf. p. 266 f.):

A. Group with velate ridge.
   1. Velate ridge extending along the whole free margin.
   2. Velate ridge extending along the free margin, except the dorsal part of anterior margin.

B. Group with ventral carina.
   1. Ventral carina not protruding; sulcus deep.
   2. Ventral carina much protruding; sulcus shallow.

The *A* group may be related to the subfamily Euprimitiinae n. subfam., the *B* group to the *Ceratopsis* group of Tetradellinae.

From *Euprimitia* a new genus, *Euprimites*, is proposed to be detached; this genus is distinguished by a horseshoe-shaped wall around the ventral part of the sulcus.

Laccochilina is the name which I propose for a new genus comprising eurychilinid species characterized by the sulcus forming a pit. ÖPIK was aware of the fact that this type is taxonomically important. The earlier described species, which are here proposed to be referred to *Laccochilina*, were referred to *Eurychilina* and *Coelochilina*.

A revision of the genera *Haploprimitia* and *Laccoprimitia* is desirable. Their relations to *Primitiella* and *Ectoprimitia* should be especially examined. The present material belonging to these genera is not sufficient, however, for such a task; only some considerations of *Laccoprimitia* have therefore been given in a tabular survey (p. 231). This survey does not pretend to be taxonomically representative, but it may indicate that the genus is not homogeneous and has therefore to be split.

Besides the above-mentioned genera which are all removed from existing genera, I have here proposed 2 further ones, viz. one comprising a group of species that takes an intermediate position between two existing genera (*Aulacopsis*) and another comprising a group of species with a unique character (*Pinnatulites*).

Aulacopsis n. gen. is not homogeneous. It comprises one group provided with a velate structure and another which is carinate. It will be necessary to split this genus when more material has been found. The group provided with a velate structure but lacking a ventral carina (*A. nodosa* n. sp.) is certainly nearest related to the section of *Ctenentoma* which is provided with a velate ridge (closest to the group of *C. macroreticulata* n. sp.); the carinate and partly velate group (*A. monofissurata* n. sp. and *A. bifissurata* n. sp.) is intermediate between the *Ctenentoma plana* group and *Glossopsis*.

Pinnatulites may be nearly related to *Ceratocypris* POULSEN. This genus, which hitherto was known to be represented by only one species (Gotlandian of North Greenland) but which is rather numerously represented by another species in Dalecarlia (mainly lower part of *R II*), is distinguished by a distinct posteroventral spine. In *Pinnatulites* there is merely a tubercle, as in *P. procera* (KUMMEROW), or a fin-like pinching in the corresponding spot. The genera *Ceratocypris* and *Pinnatulites* appear approximately simultaneously in the stratal sequence. I propose that they be referred to Aparchitidae (POULSEN provisionally referred *Ceratocypris* to Bairdiidae, cf. p. 195).

Some other genera are here also referred to other subfamilies and families than is generally done.

One of them is *Macronotella*, the opinion on the taxonomical position of which is somewhat different. Earlier it was ranked in the family Kirkbyidae (e. g. BASSLER and KELLETT), but later, KAY (1940) placed it in Aparchitidae. Like SCHMIDT 1941, I agree with KAY as to this arrangement.

As mentioned above, *Euprimitia* and *Euprimites* n. gen. are here proposed to form a subfamily (Euprimitiinae). This is certainly closely related to Eurychilininae (similarities as regards appearance of sulcus; both provided with a velate structure). The earlier known genera of these subfamilies have previously been referred to the family Primitiidae. They are here proposed to be classed in the family Hollinidae. In this way, the family Primitiidae will be more homogeneous, viz. in consisting exclusively of non-carinate and non-velate genera.

Within the family Hollinidae one may discern different divisions of species and sequences of development, which must be considered during the further discussions on the taxonomy of this family.

The subfamilies Euprimitiinae and Eurychilininae, and the sections of *Ctenentoma* and *Aulacopsis* which include species provided with a velate ridge, are affined to each other and are certainly near relatives (all are monosulcate and provided with a velate ridge).

Another division is formed by the following sequence:

the *Ctenentoma plana* group (monosulcate; ventral carina)

↓

the *Aulacopsis monofissurata* and *A. bifissurata* group (monosulcate with fissures indicating *S III* and (or) *S I* resp.; ventral carina, a short velate ridge in *A. monofissurata*)

↓

the *Ceratopsis-Glossopsis* group (generally trisulcate, sulci distinctly unequal; ventral carina, in *Glossopsis* sometimes an additional short velate ridge)

↓

Ogmoopsis (trisulcate, sulci fairly equal; ventral carina and velate ridge, the latter extending along the whole free margin)

↓

Tetradella (trisulcate, sulci fairly equal, velate; ventral ridge connecting *L I* and *L IV* corresponds to a ventral carina).

The taxonomic position of *Steusloffia* has been considered uncertain, but in my opinion it is closely related to this division, and most closely to the *Tetradella* group. Like this genus, it is velate, and the surface crests are arranged in exact coincidence with the lobes of *Tetradella*.

Internal moulds.

In many cases, internal moulds are easily identifiable as to the species, but there are species and genera which are difficult to recognize when occurring as internal moulds. Internal moulds should never be described as holotypes. The holotype of *Beyrichia nana* BRÖGGER is an internal mould of *Tetradella* cf. *grewingki* (BOCK).

As examples of species occurring in the present material certainly recognizable as internal moulds may be mentioned: *Ceratocypris longispina* n. sp., *Pinnatulites procera* (KUMMEROW), *Macronotella fabuliformis* n. sp., *Primitiella dibulbosa* n. sp., *Ctenentoma plana* n. sp., and *Ogmoopsis nodulifera* n. sp.

On the other hand, internal moulds of different genera are sometimes so equal that there may be difficulties in distinguishing them. Moulds of *Steusloffia* generally lack the typical ridges which characterize the carapace, and, therefore, they resemble *Ctenentoma* moulds. However, in *Steusloffia* there are often nodes which do not occur in *Ctenentoma*. *Steusloffia polynodulifera* has a distinctive ventral postsulcate node.

Special care must be taken in generical identification of internal moulds of at least young larval stages of several genera. As described on p. 134 in this paper, even carapaces of such stages are in many cases difficult to identify generically.

Summary. This chapter has pointed out the necessity of investigating extensive sequences of necrocoenoses as completely as possible to minimize taxonomic errors. Attention should be paid to the fact that ostracods moult up to 8 times before becoming fertile, and that the carapaces of the larval stages most often are more or less different from those of adult specimens. Furthermore, one must be attentive to sexual dimorphism and individual variation.

Examples are given of ostracodal genera the present range of which is too wide. Some of them are here proposed to be split; as regards other such genera, this must be postponed until more material is investigated.

The most important features of those genera which have been established on account of separation from existing genera are briefly mentioned, as well as the characteristic features of the new genera which include species of earlier not observed types.

Some evolutionary sequences of genera have been discerned and their taxonomic importance has been discussed. Changes in reference of existing genera to higher taxonomic units have been accounted for.

Finally, a few words were mentioned on the identification of internal moulds.

Descriptions of the species.

Abbreviations.

P.I.U.	= Paleontologiska institutionen i Uppsala (Institute of Paleontology of Uppsala)	*C III*	= crest corresponding to *L III*
H-type	= holotype	*C IV*	= » » » *L IV*
C	= carapace	*S I*	= anterior sulcus
V	= valve	*S II*	= median »
M	= internal mould	*S III*	= posterior »
$M_{(v)}$	= internal mould with remains of the valve	L	= length
I	= impression	H	= height
L I	= anterior lobe	G	= thickness
L II	= lobe next to the anterior	G pr. n.	= » including the height of the presulcate node
L III	= » » » » posterior	FM	= free margin
L IV	= posterior lobe	DM	= dorsal margin
C I	= crest corresponding to *L I*	Vel.	= velum
C II	= » » » *LII*	Λ ant	= anterodorsal angle
		Λ post	= posterodorsal angle

All lengths in mm; dimensions referable to the holotype and to characteristic specimens of particular types printed in italics, unless one singular specimen is measured.

Family *Aparchitidae* (Schmidt 1941, emend.).

Diagnosis. Non-sulcate ostracods, or occasionally provided with shallow sulcate depressions; length about 1—3 mm; hinge line straight; valves of equal or slightly unequal size, one overlapping the other all along the free margin or only along the ventral margin, the edge of the minor valve generally fitting into a corresponding groove of the larger one; greatest convexity in ventral, central, or dorsal region, the dorsal sometimes protruding over the hinge line; surface smooth, striate, or punctate, the punctae being sometimes widened in the inner part having probably contained sensory bristles; carapace non-structured or prismatic, sometimes consisting of an inner non-structured and an outer prismatic part.

Occurrence. Ordovician—Permian.

Discussion. The range of this family has been discussed by, among others, Schmidt (1941, p. 17 f.). Some remarks will be made here as regards a few genera in the present material which are referred to Aparchitidae.

Conchoprimitia ÖPIK. This genus is proposed to be split into three genera; two of them (*Conchoprimitia* emend. and *Conchoides* n. gen.) are referred to Aparchitidae.

Some of the species referred to the genera now mentioned are leperditoid. The genera may not belong to the family Leperditiidae, however, since the muscle attachments are different from those in this family. The attachment of the central adductor muscle is reticulate in Leperditiidae, as mentioned in SOLLE's revised diagnosis (1935, p. 18), and there are also networks at the attachments of the other muscles, as shown for instance by CHMIELEWSKI (1900, p. 3). These structures are magnificently developed in the Gotlandian species *Leperditia grandis* SCHENK. Muscle scars of this kind have not been observed in *Conchoprimitia* emend. and *Conchoides*.

In the family Leperditiidae the carapace — except for a thin inner layer — consists of extremely fine prisms, standing perpendicular to the surface. The carapace structure of many *Conchoprimitia* species is likewise prismatic, but this is also known from other genera. Among the present ones, it was observed in *Pinnatulites* (*P. procera* [KUMMEROW]) and in *Bythocypris*. Such structures are not yet sufficiently studied, and their taxonomic importance is not established, but so much may be said that they do not prove *Conchoprimitia* emend. and *Conchoides* to belong to Leperditiidae.

So-called eye-tubercles which are considered to be characteristic of Leperditiidae were not observed in *Conchoprimitia* emend. and *Conchoides*. The fact that the node on the internal mould corresponding to that of the moulds of Leperditiidae is distinctly developed does not indicate especial affinity to Leperditiidae since this node generally occurs in ostracods.

SCHMIDT (1941, p. 18), without discussion, considered that *Conchoprimitia* ÖPIK possibly belongs to Aparchitidae. It was referred by ÖPIK (1935 and 1937) to Primitiidae. KAY (1940) also referred *Conchoprimitia* ÖPIK to Primitiidae. This may have been in accordance with his idea of the genotype: he designated *Conchoprimites tallinnensis* (ÖPIK 1937) as genotype, not being aware that ÖPIK in 1935 had appointed *C. gammae* as genotype. After his erroneous proposal as regards the genotype had been pointed out to him, he corrected it, but did not alter his proposal to place *Conchoprimitia* in Primitiidae (KAY 1940 b).

Macronotella ULRICH. This genus was originally referred to Kirkbyidae, but was placed in Aparchitidae by KAY (1940, p. 240) and SCHMIDT (1941, p. 18). I agree with them in this arrangement. The possibility of its correctness is supported by the fact that the edge of the free margin in one valve fits into a corresponding groove of the opposite valve as is generally the case in Aparchitidae.

Ceratocypris POULSEN. In his description of the genotype, POULSEN (1934, p. 38) referred this genus provisionally to Bairdiidae. I am of the opinion that it may be enclosed in Aparchitidae, the dorsal margin being long and straight and the general shape for the rest (with the exception of the posteroventral spine) being of Aparchitidae-like appearance.

Pinnatulites n. gen. may be closely related to *Ceratocypris*, and, hence, it may be referable to Aparchitidae.

Genus *Conchoides* n. gen.

Derivation of name. *Conchoides* alludes to the fact that the genus has been removed from *Conchoprimitia* ÖPIK.

Genotype. *Conchoides micropunctata* n. sp.

Occurrence. Ordovician.

Diagnosis. Ostracods of leperditoid appearance; length about (0.5)—1—3 (4) mm; left valve larger, overlapping the right one along ventral margin and in some species also along anterior and posterior margins; valves with one groove conforming to parts of anterior and posterior margins (exceptionally the groove conforms to the whole free margin); central part of valves often slightly shield-like with undefined and extremely shallow depressions corresponding to muscle attachments; surface smooth, punctate, striate, or partly reticulate (the central shield-like swelling almost invariably smooth).

Discussion and remarks. *Conchoides* is removed from *Conchoprimitia* ÖPIK. The original diagnosis of this genus is very short (ÖPIK 1935, p. 4): "Small (1.5 to 3 mm length) Primitiidae with a straight hinge line, with one or two pairs of bands, limited by grooves resembling the growth lines of shells or brachiopods more or less developed." From the accompanying text it appears that "the left valve of *Conchoprimitia* is the large one." The outline is said to be leperditoid. The genotype is non-sulcate. In a later paper (1937, p. 10) ÖPIK states: "*Conchoprimitia* is a widely variable genus: sulcus and node, the concentric grooves, and the punctation are in some cases well developed, in other cases these appear undefined or lacking."

It may be necessary to split this genus, its range being too wide.

First of all, distinctly sulcate species may be removed. They are here proposed to form a new genus, *Conchoprimites,* referred to the family Primitiidae.

Among the non-sulcate species one may discern two different types: one 2-grooved and one 1-grooved. The genotype *Conchoprimitia gammae* ÖPIK and *Primitia conchoides* HADDING are 2-grooved, the rest are 1-grooved.

I found excellently preserved specimens of *C. gammae* in Estonian material belonging to the Institute of Paleontology of Uppsala, and was struck by the extreme distinctness of the 2 grooves (a paper on the ostracod fauna of the *Lepidurus* Zone of Estonia as preserved in the material mentioned is being prepared).

No correspondence as regards distinctness of the grooves has been seen among the 1-grooved species. In my opinion, the 2-grooved and the

1-grooved types are generically different. The 1-grooved group, which is proposed here to form the genus *Conchoides*, is abundant, both specifically and individually, contrary to the 2-grooved group, i. e. *Conchoprimitia* emend., which seems to include only a few species.

Inconveniences are associated with the name of *Conchoprimitia* which was unsuccessfully chosen and may be misleading in that it suggests that *Conchoprimitia* ÖPIK is a genus consisting of Primitiids, such as, in fact, ÖPIK imagined, which, as mentioned, is not true. As suggested, *Conchoprimitia* emend. instead is referable to Aparchitidae (a more appropriate name for the genus could have been *Conchaparchites*).

It would have been more convenient if the name of *Conchoprimitia* could have been used for the real Primitiidae group among the species which were originally classed in *Conchoprimitia* ÖPIK, i. e. the group which is here proposed as the genus *Conchoprimites*.

The following species described earlier may be referred to *Conchoides*: *C. glauconitica* (KUMMEROW), *C. socialis* (BRÖGGER) and *C. broeggeri* (ÖPIK).

C. broeggeri is mentioned as non-sulcate. *C. glauconitica* is not said to be sulcate, but the figure by ÖPIK (1935, Pl. I) gives the impression of the species having a slight sulcus. In the text (op. cit. p. 6) is mentioned "a slightly pronounced small, narrow, vertical ridge. That is the place for the sulcus and the nodes of *Primitia*." In KUMMEROW's original diagnosis, nothing is said about a sulcus, and in the adjoining figure not a trace of a sulcus is discernible. The surface depressions in *Conchoides* are, as mentioned, very shallow, but sometimes the one corresponding to the sulcus may be slightly deeper, as in *C. circumstriata* n. sp. The conditions may be somewhat similar in *C. glauconitica*. KUMMEROW, in the diagnosis, mentions the shield-like swelling, which is distinctive for *Conchoides*. Finally, *C. socialis* is said by ÖPIK to have a sulcus (1940, p. 139), but BRÖGGER, in the diagnosis (1882, p. 55), does not mention any sulcus and, judging by the figures presented by BRÖGGER and ÖPIK, the species is non-sulcate. This was checked by examining the specimen in the Oslo Museum which is probably identical to that described by BRÖGGER.

C. glauconitica is known from the Lower Ordovician (B II γ) of Estonia (ÖPIK 1935); the genotype of *C. glauconitica* was found in a Northern Germany drift boulder (KUMMEROW 1924, p. 419).

C. socialis and *C. broeggeri* are Norwegian species. The former is considered by ÖPIK to be an index fossil of the *Expansus* Slate (ÖPIK 1940, p. 140). The latter is reported by BRÖGGER (1882, p. 55) to occur very abundantly in some localities of the *Expansus* Slate and the lower part of the *Orthoceras* Limestone. *C. socialis* is represented in the present material.

In this paper, 10 new species are described. Thus the genus includes for the present 13 species, all Lower Ordovician.

Leperditoid group.

Conchoides micropunctata n. sp.

Pl. I, Figs. 1 and 2.

This species comprises two types, called α and β which may be male and female resp. (cf. discussion below).

They are slightly different as regards dimensions and the punctation of the surface. The surface differences are usually discernible on careful examination. The two types were observed to have practically the same vertical distribution (Pl. XIX).

The types are described separately.

Derivation of name. *micropunctata* alludes to the fact that the surface is minutely punctate.

Holotype. As holotype is designated the probable male specimen figured in Pl. I, Fig. 1 (P. I. U. No. ar. os. 101).

Locality of holotype. Leskusänget, in Dalecarlia, Sweden.

Stratum of holotype. Lower Ordovician: lower part of stratum *G* (about 1.5 m above *R I/G*).

Diagnosis. *Conchoides* of large size and leperditoid appearance; probably sexually dimorphic; an indistinct and short step-like marking mainly conforms to the dorsal half of the anterior margin, and a groove conforms to the dorsal part of the posterior one; surface minutely punctate, and in the type considered as male the area inside the step-like marking has scattered larger punctae among the minute ones.

Affinities. The species is reminiscent of *C. glauconitica* (KUMMEROW) in being leperditoid and minutely punctate, but they are different in that the anterior part of *C. glauconitica* is more elongated. As regards general shape, *C. micropunctata* is most closely related to *C. broeggeri* ÖPIK, but this species is smooth. *C. socialis* (BRÖGGER) is proportionally shorter and higher.

Among the species described in this paper, *C. meganotifera* may be somewhat reminiscent of *C. micropunctata*. They are different in *C. meganotifera* being smaller, its surface being minutely and very distinctly pitted, the central shield-like elevation being higher and more distinct, and the anterodorsal step-like marking being less developed than in *C. micropunctata*.

Type α (suggested as male).

Pl. I, Fig. 1.

Type. This type includes the holotype (P. I. U. No. ar. os. 101).

Locality and stratum of type. Cf. above.

Material. 9 carapaces and valves from 4 localities.

Dimensions.

No.	L	H	G	D M	F M	H/L	G/L	D M/L	F M/D M	∧ ant	∧ post	Re-mark
ar. os. 105	3.75	2.21	1.52	2.57	7.51	0.59	0.41	0.66	2.92	140	135	C
ar. os. 106	3.72	2.23	1.63	2.47	7.41	0.60	0.44	0.66	3.00	145	140	V
ar. os. 102	3.42	2.13	1.67	2.65	6.56	0.62	0.49	0.77	2.48	(135)	125	V
ar. os. 101	*3.33*	*2.13*	*1.50*	*2.31*	*6.48*	*0.64*	*0.45*	*0.69*	*2.81*	*145*	*135*	C
ar. os. 104	2.79	1.85	1.35	2.17	5.61	0.66	0.48	0.77	2.58	145	130	C
ar. os. 103	2.74	1.75	1.44	2.01	5.67	0.63	0.52	0.73	2.82	(140)	130	V
Mean	3.29	2.23 2.05 1.75	1.67 1.51 1.35	2.65 2.36 2.01	7.51 6.62 5.61	0.66 0.62 0.59	0.52 0.45 0.41	0.77 0.71 0.66	2.92 2.81 2.48	140	135	

Description. Carapace large; the left valve is the larger one, overlap prominent along ventral margin but slight along anterior and posterior margins; the right valve observed to have a fine ridge along the free margin fitting into a corresponding groove of the left valve.

Dorsal margin straight and long; anterior and posterior margins regularly rounded, the anterior slightly more convex than the posterior; ventral margin moderately convex.

Anterodorsal angle somewhat larger than the posterodorsal.

Posterior part of carapace inconsiderably higher than the anterior.

Valves moderately arched, the anterior part more arched than the posterior; in the central area (for the greater part anteriorly of the midlength), is a rounded shield-like spot (the highest part of the valve); surface of valves gently and regularly sloping to the margins.

Dorsal corners pinched, the posterior more than the anterior; in the posterodorsal pinched area is a short groove, conforming to corresponding part of posterior margin; mainly conforming to the dorsal half of the anterior margin is a slight step-like marking.

In the dorsocentral area, in front of the midlength, is a very shallow dorsoventral depression corresponding to *S II*; just in front of it, one may discern a very faint dorsoventral ridge; anterior to this is another shallow depression (attachment of antennal muscles; the mandibular attachment is discernible as a very shallow, rounded impression in the anterior part of the centroventral area; behind the first-mentioned depression (*S II*) one may discern a flat, glossy spot; sometimes the ventral half of this flat spot is surrounded by extremely fine radiating striae.

Surface crowded with minute punctae, with the exception of the central swelling (including the above-mentioned flat spot), which is smooth and glossy; sometimes the closely gathered punctae give the impression of an extremely fine reticulum; in the anterior part of the valve, especially just behind the step-like marking, there are scattered deeper punctae among the minute ones.

Carapace prismatic.

Occurrence. Lower Ordovician: lower part of stratum *G* (about 0.9—1.5 m above *R I/G*) at Leskusänget, Rävanäs, Granmor, and Gulleråsen, in Dalecarlia, Sweden.

Type β (suggested as female).

Pl. I, Fig. 2.

Type. A characteristic specimen is figured in Pl. I, Fig. 2 (P. I. U. No. ar. os. 107).

Locality of type. Leskusänget, in Dalecarlia, Sweden.

Stratum of type. Lower Ordovician: lower part of stratum *G* (about 1.5 m above *R I/G*).

Material. 24 carapaces and valves from 5 localities.

Dimensions.

No.	L	H	G	D M	F M	H/L	G/L	D M/L	F M/D M	Λ ant	Λ post	Remark
ar. os. 112	3.43	2.10	1.51	2.54	6.81	0.61	0.44	0.74	2.68	135	140	C
ar. os. 107	*3.28*	*2.18*	*1.30*	*2.10*	*6.96*	*0.67*	*0.39*	*0.64*	*3.31*	*135*	*145*	C
ar. os. 108	3.06	1.88	1.19	2.42	5.83	0.62	0.39	0.79	2.35	(130)	(130)	V
ar. os. 111	2.87	1.94	1.16	1.94	6.21	0.67	0.41	0.68	3.20	(130)	140	V
ar. os. 786	2.56	1.63	1.05	1.63	5.42	0.64	0.41	0.64	3.32	135	140	V
ar. os. 109	2.51	1.53	1.19	2.07	4.77	0.61	0.47	0.82	2.31	130	(125)	V
ar. os. 110	2.47	1.30	1.04	2.06	4.74	0.63	0.42	0.83	2.30	130	(125)	V
Mean	2.88	2.18 1.79 1.30	1.51 1.21 1.04	2.54 2.11 1.94	6.96 5.82 4.74	0.67 0.63 0.53	0.47 0.42 0.39	0.83 0.73 0.64	3.31 2.78 2.30	130	135	

Description. This type coincides mainly with type α.

As appears from the tables, it is, on the average, somewhat shorter, lower, and less gibbous than α; furthermore, both dorsal and free margins are shorter. Proportionally the dimensions are almost the same, except that the β type is somewhat less gibbous; the posterodorsal angles are, on the average, equal, but in β the anterodorsal angle is somewhat less obtuse.

Type β is often more distinctly punctate but has not the scattered deep punctae of the anterior part which are distinctive of the type α.

Occurrence. Lower Ordovician: lower part of stratum *G* (about 0.8—2.1 m above *R I/G*) at Leskusänget, Gulleråsen, Silverberg (sample 1), Stenberg, and Rävanäs, in Dalecarlia, Sweden.

Discussion. The types α and β are so equal that there is every reason merely to consider them different sexes of the same species.

In the section of this paper dealing with sexual dimorphism (p. 138), the probability that type α is male was suggested.

A comparison was made with the recent genus *Philomedes*, in which the male is more gibbous anteriorly to give space for the large lower antennal muscles.

Conchoides socialis (BRÖGGER).

Pl. I, Figs. 3 and 4.

Isochilina (?) *socialis* BRÖGGER 1882, p. 55.

Conchoprimitia socialis ÖPIK 1940, p. 139.

Holotype. The specimen described by BRÖGGER (1882, Pl. XII, Fig. 14) is the holotype.

Locality of holotype. Vestfossen, Norway.

Stratum of holotype. *Expansus* Slate (b 3 β); according to ÖPIK (1940, p. 139) the species does not occur in b 3 γ as mentioned by BRÖGGER.

Material. "Not very seldom, sometimes abundant" (BRÖGGER 1882, p. 55). "*C. socialis* may be considered an index fossil for the *expansus* time" (ÖPIK 1940, p. 139).

The present material consists of one carapace (Pl. I, Fig. 3), partly somewhat imperfect in the dorsal region, and one perfectly preserved valve (Pl. I, Fig. 4).

Affinities. Cf. p. 151.

Description of the present material. Carapace large; the left valve is the larger, and overlaps the right along the ventral margin and parts of the anterior and posterior margins.

Dorsal margin straight and long; anterior and posterior margins regularly rounded; ventral margin rather convex.

Anterodorsal angle somewhat more obtuse than the posterior.

Posterior part of carapace slightly higher than the anterior.

Carapace rather flattened, somewhat more arched in the anterior part than posteriorly; in the central area (just in front of the midlength) is a shield-like swelling; surface of the valves gently sloping to the margins.

Antero- and posterodorsal corners pinched, the posterodorsal more than

Dimensions.

No.	L	H	G	D M	F M	$\frac{H}{L}$	$\frac{G}{L}$	$\frac{DM}{L}$	$\frac{FM}{DM}$	∧ ant	∧ post	Re-mark
H-type [1]	4.37	2.75	—	4.50	9.25	0.63	—	1.02	2.05	110	130	
[2]	3.89	2.85	—	2.81	8.75	0.73	—	0.72	3.11	(110)	130	
ar. os. 426	3.60	2.25	1.58	2.56	6.97	0.62	0.44	0.71	2.72	135	130	V
ar. os. 113	3.45	2.23	1.43	2.60	7.16	0.65	0.42	0.76	2.76	135	130	C
Mean	3.84	2.85 2.52 2.23	1.50	4.50 3.72 2.56	9.25 8.03 6.97	0.73 0.66 0.62	0.43	1.02 0.80 0.77	3.11 2.66 2.05	125	130	

[1] Brögger 1882; Pl. XII, Fig. 14.
[2] Öpik 1940; Pl. I, Fig. 7.

the anterodorsal one; broad and shallow grooves conform to the dorsal parts of anterior and posterior margins.

In the dorsocentral area (just in front of the midlength) is a very shallow depression, anteriorly and posteriorly surrounded by minute swellings; in front of the anterior swelling one may discern an extremely minute depression (antennal muscle attachment).

Surface very shallowly pitted; the specimen which most likely is identical with the holotype is also shallowly pitted (the species is said to be smooth both by Brögger and Öpik).

Occurrence. Lower Ordovician. Norway: *Expansus* Slate = b 3 β (Brögger 1882, p. 55; Öpik 1940, p. 139); Öpik reports the species to be very frequent in the locality of Krekling. Sweden: Lower so-called *Expansus* Limestone in Dalecarlia (Stenberg: about 0.6 m above *R I/G*).

Conchoides meganotifera n. sp.

Pl. II, Figs. 1—6.

This species includes two types, called α and β, which may be sexual dimorphisms (cf. discussion below). They are very similar to each other; slight dissimilarities may be observed, however, as regards the sloping of the dorsal region, the gibbosity of the carapace, and the distinctness and extension of the surface pattern. Adult specimens are generally quite distinctive, but larval stages are often difficult to distinguish.

The two types are described separately.

Derivation of name. *meganotifera* alludes to the large, shield-like swelling in the central region.

Holotype. The type figured in Pl. II, Fig. 1 is designated holotype (P. I. U. No. ar. os. 114).

Locality of holotype. Leskusänget, in Dalecarlia, Sweden.

Stratum of holotype. Lower Ordovician: middle part of stratum *G* (about 1.9 m above *R I/G*).

Diagnosis. *Conchoides* of median size and leperditoid appearance; probably sexually dimorphic; dorsal parts of anterior and posterior margins conformed to by grooves (the posterior generally more distinct than the anterior), sometimes connected by a ventral groove; in the dorsocentral and central areas generally a large and distinct shield-like swelling (somewhat different in the two types); surface minutely and more or less distinctly pitted or reticulate, except the shield-like swelling, which is smooth and often glossy, and, in type β, the marginal zone, which in that case is smooth or extremely finely rugose.

Affinities. This species is scarcely confusable with other known species of *Conchoides,* owing to the characteristic appearance of the shield-like swelling and the surface pattern. Larvae of type β may be reminiscent of *Conchoides levis* n. sp. type β, but they are different in that the striae of the latter are extremely fine and directed mainly longitudinally, whereas those of *C. meganotifera* type β are more rough and directed antero- and postero-ventrally resp. Additionally, the carapaces of larvae of *C. meganotifera* are more arched.

Type α (suggested as male).

Pl. II, Figs. 4—6.

Type. A characteristic type is figured in Pl. II, Fig. 4 (P. I. U. No. ar. os. 138).

Locality of type. Leskusänget, in Dalecarlia, Sweden.

Stratum of type. Lower Ordovician: lower part of stratum *G* (about 1.2 m above *R I/G*).

Material. 25 carapaces and valves from 5 localities.

Dimensions. The table on p. 157 comprises adult specimens and presumably also later larval stages; younger larvae are detached and grouped in another table (cf. below).

Description. The present type is very similar to type β which includes the holotype. They are different as regards the following characters.

In type α, the dorsal region of adult specimens is less steeply sloping than in type β (cf. Pl. II, Fig. 4 and Pl. II, Fig. 1). The angle between the plane of the free margin and the surface of the dorsal area is generally acute in type α but right or obtuse in type β. In young stages there is generally no such difference.

In type α the shield-like swelling is not so distinctly limited as in type β; furthermore, it is usually less swollen and generally not glossy.

The surface pattern in type α is generally less distinct (sometimes scarcely discernible), but in adult specimens of this type it often extends to the

Dimensions.

No.	L	H	G	D M	F M	H/L	G/L	D M/L	F M/D M	∧ ant	∧ post	Re-mark
ar. os. 149	1.98	1.16	1.00	1.19	3.95	0.59	0.51	0.60	3.29	140	135	V
ar. os. 148	1.77	1.16	0.81	1.10	3.72	0.58	0.46	0.62	3.38	145	140	C
ar. os. 138	*1.60*	*0.99*	*0.79*	*1.14*	*3.37*	*0.62*	*0.49*	*0.71*	*2.98*	*135*	*135*	V
ar. os. 151	1.60	0.98	0.81	1.25	3.15	0.61	0.51	0.77	2.52	135	135	V
ar. os. 139	1.48	0.97	0.71	1.20	2.98	0.62	0.48	0.81	2.49	130	130	V
ar. os. 146	1.28	0.82	0.61	1.03	2.56	0.64	0.48	0.81	2.48	130	125	V
Mean	1.62	1.16 1.01 0.82	1.00 0.79 0.61	1.25 1.15 1.03	3.95 3.29 2.56	0.64 0.61 0.58	0.51 0.49 0.46	0.81 0.72 0.60	3.38 2.86 2.48	135	135	

margins, which is not the case in type *β*, where the marginal zone is smooth or very finely rugose.

Type *α* is, on the average, proportionally higher and more gibbous; furthermore, it has a proportionally somewhat longer dorsal margin but a shorter free margin; dorsal angles are nearly equal (posterodorsal angle of type *α* possibly slightly larger).

Notes on the larval development. This type is represented by rather many larval carapaces. In certain respects they are different from carapaces of adult specimens. The youngest stages are very different from those of adult specimens, but they are connected with them by an intermediate sequence of types.

The distinctness and extension of the surface pattern is largely proportional to the stage of development. Since adult specimens of type *β* are more distinctly sculptured than those of type *α*, the surface pattern disappears earlier in type *α* than in type *β* in a sequence of younger and younger stages. In fact, the youngest stages of type *α* are non-sculptured but those of type *β* are still sculptured, viz. on both sides of the dorsocentral swelling (these parts are most distinctly sculptured in adult specimens of both types). Young larvae of the two groups are also slightly different as regards the dimensional proportions.

The specimens ranged in the following table are non-sculptured or (in one case = No. ar. os. 135) extremely vaguely striate anterior and posterior to the dorsocentral swelling. The specimens ranged in the table above are, on the contrary, more distinctly sculptured. The former group consists of relatively young larval stages and the latter not only of adults but probably

Dimensions.

No.	L	H	G	D M	F M	H/L	G/L	D M/L	F M/D M	∧ ant	∧ post	Re-mark
ar. os. 153	1.11	0.69	0.56	0.80	2.26	0.62	0.50	0.72	2.82	135	130	V
ar. os. 135	0.98	0.59	0.51	0.74	1.93	0.60	0.52	0.76	2.61	130	(130)	V
ar. os. 133	0.95	0.64	0.51	0.74	1.96	0.67	0.54	0.78	2.65	130	135	V
ar. os. 158	0.77	0.51	0.44	0.61	1.53	0.64	0.57	0.79	2.52	135	130	V
ar. os. 134	0.61	0.42	0.39	0.47	1.30	0.69	0.64	0.77	2.76	130	135	V
ar. os. 137	0.58	0.42	0.35	0.45	1.30	0.72	0.61	0.78	2.88	135	130	V
ar. os. 136	0.53	0.36	0.33	0.44	1.09	0.68	0.62	0.83	2.48	130	130	V
Mean	0.79	0.69 0.52 0.36	0.56 0.44 0.33	0.80 0.61 0.44	2.26 1.62 1.09	0.72 0.66 0.60	0.64 0.56 0.50	0.83 0.78 0.72	2.88 2.66 2.48	130	130	

also of late larvae. Of course, it would have been more correct to separate adults from larvae, but this is not easy, since the amplitude of variation of the adults may be practically impossible to settle. The delimitation proposed here was made in accordance with practical reasons, since it may permit a certain idea of the difference in the shape of young larvae and later larval stages and adult specimens.

From the tables it appears that, on the average, the young larval carapaces are proportionally higher and more gibbous than those of the adults and the later larval stages. The dorsal margin is, on the average, proportionally longer, but the free margin is shorter; the dorsal angles are slightly less obtuse. Furthermore, the material indicates that, with decreasing size, the height, gibbosity, and dorsal margin are proportionally increased, but that the length of the free margin mainly decreases.

As anticipated, the larvae, probably with the exception of late larval stages, do not possess the surface pattern which distinguishes the adults. Also, the dorsal area slopes more steeply than in the adults, owing partly to the median swelling being situated somewhat more dorsally (mainly dorso-centrally). The swelling, being somewhat conical, is more prominent than in adult specimens. Anterior part of carapace is proportionally not as arched as in adults. Grooves conforming to the anterior and posterior margins are generally rather distinct and often connected by a slight ventral groove, which is more seldom the case in adult specimens. Surface is generally very slightly rugose.

Occurrence. Lower Ordovician: lower part of stratum *G* (about 0.3—1.5 m above *R I/G*) at Leskusänget, Granmor, Gulleråsen, Rävanäs, and Stenberg, in Dalecarlia, Sweden.

Type β (suggested as female).

Pl. II, Figs. 1—3.

Type. This type includes the holotype (P. I. U. No. ar. os. 114).

Locality and stratum of type. Cf. p. 156.

Material. 16 carapaces and valves from 3 localities.

Dimensions. The following table may include adult specimens and late larval stages; younger larvae are tabled separately below. This arrangement was made for comparison with corresponding groups of type α.

The young larval group within type α was distinguished on account of the fact that, contrary to later stages, these specimens are non-sculptured. In type β even the youngest stages are sculptured. For the sake of comparison, the β types are grouped according to size so that those which correspond in size to the larval group of type α are grouped in a larval β group.

Dimensions.

No.	L	H	G	D M	F M	H/L	G/L	D M/L	F M/D M	∧ ant	∧ post	Remark
ar. os. 114	*1.72*	*1.09*	*0.86*	*1.21*	*3.44*	*0.63*	*0.50*	*0.70*	*2.84*	*135*	*130*	C
ar. os. 118	1.36	0.87	0.72	0.97	2.77	0.64	0.53	0.71	2.86	135	140	C
ar. os. 115	1.33	0.85	0.70	0.98	2.60	0.64	0.53	0.74	2.66	135	135	V
ar. os. 145	1.32	0.90	0.72	1.02	2.72	0.68	0.55	0.77	2.66	135	130	V
ar. os. 117	1.27	0.84	0.68	0.95	2.58	0.66	0.54	0.75	2.72	140	(135)	C
ar. os. 116	1.27	0.85	0.70	0.95	2.65	0.67	0.55	0.74	2.81	135	135	C
ar. os. 150	1.27	0.83	0.72	0.89	2.63	0.65	0.57	0.70	2.95	130	130	V
ar. os. 152	1.22	0.79	0.65	0.91	2.56	0.65	0.53	0.75	2.82	135	(130)	V
ar. os. 144	1.21	0.79	0.70	0.98	2.42	0.65	0.58	0.81	2.47	125	130	V
ar. os. 141	1.21	0.83	0.67	1.02	2.43	0.69	0.55	0.84	2.38	125	125	V
Mean	1.32	1.09 0.86 0.79	0.86 0.71 0.65	1.21 0.99 0.89	3.44 2.68 2.42	0.69 0.66 0.63	0.58 0.54 0.50	0.84 0.75 0.70	2.95 2.72 2.38	135	130	

Description. Carapace moderately large; the left valve is the larger, and overlaps the right one ventrally and along the ventral part of anterior and posterior margins.

Dorsal margin straight and moderately long; anterior margin somewhat more curved than the posterior one, ventral margin moderately convex.

Dorsal angles about equal, or the anterior one is somewhat larger.

Posterior part of carapace slightly higher than the anterior.

Valves moderately arched, the anterior part more than the posterior; hinge region swollen, its median part sometimes protrudes slightly over the hinge line; in the dorsocentral and central areas is a large shield-like and relatively distinctly limited swelling; its posterior part rather regularly rounded, its anterior more or less lobate; the dorsal part of the non-lobate (posterior) section more swollen than the rest of the spot; just dorsal to the non-lobate section of the swollen area (the midlength of the valve) is another, much smaller and longitudinally elongated swelling; surface of carapace gently sloping to the free margin, but steeply to the dorsal one.

Dorsal corners pinched, the posterior more than the anterior; a generally broad and shallow groove conforms to the posterior margin; in the corresponding anterior part there is no groove or only a rather faint one; sometimes they are connected by a mostly narrow ventral groove.

Between the posterior, rounded section of the shield-like swelling and its anterior lobate section, is a dorsoventral shallow depression = *S II* (attachment for the central adductor muscle and possibly the dorsal muscle group); in front of the dorsal part of this one is another deeper depression (attachment for antennal muscles); a very indistinct centroventral depression ventral to this one may be the attachment of the mandibular muscle.

Surface minutely and distinctly pitted or reticulate with the exception of the shield-like swelling which is smooth and generally glossy, and a circum-marginal zone which is smooth or very faintly rugose; surface pattern especially distinct anterior and posterior to the shield-like swelling; pits and "meshes" of the reticulum ordered and lengthened resp. mainly antero- and posteroventrally.

Notes on the larval development. Type β is represented by larval carapaces of different size.

The larval dimensions appear from the following table (as regards the delimitation of larval types cf. p. 159).

The larvae are very similar to those of type α, but are different mainly in being sculptured. Late larval types are pitted and reticulate like the adults, but the younger the stages are the smaller is the sculptured surface and the less distinct is the sculpture, which also changes character, viz. in being striate in very young specimens. The surface parts which remain sculptured are those just anterior and posterior to the swollen dorsocentral spot.

The dorsal region is about equally sloping in young larvae of the two types. In the further development of the dorsal region it grows less steep in type α but more steep in type β. The swelling is proportionally more raised and of more conical shape than in the adults and thus more pro-

Dimensions.

No.	L	H	G	D M	F M	H/L	G/L	D M/L	F M/D M	∧ ant	∧ post	Re-mark
ar. os. 147	1.07	0.65	0.62	0.88	2.07	0.61	0.58	0.82	2.35	135	130	V
ar. os. 142	0.97	0.63	0.62	0.75	1.98	0.65	0.64	0.76	2.64	135	130	V
ar. os. 143	0.79	0.51	0.51	0.65	1.46	0.65	0.65	0.82	2.22	130	125	V
ar. os. 140	0.63	0.40	0.33	0.50	1.30	0.64	0.57	0.79	2.60	135	130	V
		0.65	0.62	0.88	2.07	0.65	0.65	0.82	2.64			
Mean	0.87	0.55	0.52	0.70	1.70	0.64	0.59	0.80	2.45	135	130	
		0.40	0.33	0.50	1.30	0.61	0.57	0.76	2.22			

nounced; in this respect it coincides with type α. The difference in arching between anterior and posterior parts of carapace is less pronounced than in adult specimens.

As in type α the grooves conforming to parts of the free margin are often better developed than in adult specimens of this type; not seldom a ventral groove is discernible.

A comparison of the dimensional proportions of the α and β larvae shows that, on the average, type β is proportionally slightly lower, but slightly more gibbous, and has a somewhat longer dorsal margin and somewhat shorter free margin. The anterodorsal angle is somewhat more obtuse, but the posterodorsal ones are equal.

Principally identical are the relations of the dimensional proportions between adults and larvae of type β.

A survey of the changes of the proportions between young larvae and later larval stages and adults in the two types indicates that, proportionally, in both cases, the carapace of the later group had become more gibbous, the dorsal margin had become shorter but the free margin longer; in α the height had decreased but in β increased. In β, the dorsal angles were, on the average, identical in the two groups, but in α the anterodorsal angle had increased.

Occurrence. Lower Ordovician: lower and middle part of stratum *G* (about 1.0—2.4 m above *R I*/*G*) at Leskusänget, Silverberg II, and Stenberg, in Dalecarlia, Sweden.

Discussion. At first sight, the types described above give the impression of being different species, but a careful examination of type sequences made me inclined to consider them merely as sexual dimorphisms. Adult specimens are very similar as regards general shape of the carapace, and their surface patterns are arranged in the same way, but they are clearly distinguishable, especially on account of the different slope of the dorsal region, the slight dissimilarities as regards the shield-like swelling, and the different distinctness and distribution of the surface pattern. On the other hand, late larval stages of the two types are often difficult to determine, since the dissimilarities are less pronounced. Young larvae are distinguishable practically only on account of one type being slightly striate on both sides of the dorsocentral swelling, whereas the other type is entirely smooth.

Carapaces of young larvae are so different from those of adult specimens that it is quite impossible to recognize the relationship between them if only separate specimens are available. It is necessary to study sequences of types. If this had not been done, the larvae and adults might have been erroneously described as different species.

It is practically impossible to determine the sexes of the two types, since they have no special characters which undoubtedly indicate the sex. Type β is somewhat more gibbous in the middle part of the carapace, but the reason for the different gibbosity is not known; it may be due to different size of the sexual organs or the sexual products, but whether the males or the females are the most space-requiring in this respect is unknown. Since adult specimens of type β are considerably higher than type α, one may suggest type β to be female, corresponding to what is true for many recent species. Type α is slightly more arched anteriorly, possibly owing to larger locomotion organs, which may suggest this species to be the male (cf. p. 138).

Conchoides ventropunctata n. sp.

Pl. III, Fig. 12.

Derivation of name. *ventropunctata* alludes to a punctate centroventral field.

Holotype. Holotype is the specimen shown in Pl. III, Fig. 12 (P. I. U. No. ar. os. 119).

Locality of holotype. Granmor, in Dalecarlia, Sweden.

Stratum of holotype. Lower Ordovician: upper part of stratum *G* (about 0.4 m below *G/R II*).

Material. One valve.

Dimensions.

No.	L	H	G	D M	F M	$\frac{H}{L}$	$\frac{G}{L}$	$\frac{DM}{L}$	$\frac{FM}{DM}$	$\wedge$ ant	$\wedge$ post	Remark
ar. os. 119	1.28	0.82	0.75	0.97	2.51	0.64	0.59	0.76	2.59	145	(115)	V

Diagnosis. *Conchoides* of medium size with a postmedian swing of the ventral margin; the concentric groove broad and shallow, traceable all along the free margin; surface slightly rugose, except for a centroventral, rather undefined field, which is punctate.

Affinities. The species is distinguished by the postmedian swing of the ventral margin and the punctate centroventral field.

Besides *C. ventropunctata*, the following *Conchoides* species are bulged out ventrally: *C. minuta* n. sp., *C. ventroincisurata* n. sp., and many late β larvae of *C. meganotifera* n. sp. The two first-mentioned are different in being non-leperditoid and smooth, the latter in being reticulate, especially anterior and posterior to the shield-like swelling.

Description. Carapace moderately large.

Dorsal margin straight and moderately long; anterior margin slightly more rounded than the posterior one; ventral margin has a swing just posterior to the midlength.

Anterodorsal angle more obtuse than the posterodorsal.

Anterior part of carapace slightly higher than the posterior.

Valves rather arched, the anterior part slightly more than the posterior; in the dorsocentral and central areas, just in front of the midlength, is an undefined, swollen area; surface of the valve sloping gently to the free margin and steeply to the dorsal one.

Dorsal corners pinched, the posterior more than the anterior; groove rather distinct anteriorly, posteriorly, and in the centroventral punctate field; in the intervening parts it is indistinct.

Surface for the greater part extremely slightly rugose; a centroventral field distinctly punctate; in the anterior part of the valve are a few punctae.

Occurrence. Lower Ordovician: upper part of stratum *G* (about 0.4 m below *G/R II*) at Granmor, in Dalecarlia, Sweden.

Conchoides dorsodepressula n. sp.

Pl. II, Fig. 12.

Derivation of name. *dorsodepressula* alludes to the depressed dorsal area.

Holotype. Holotype is the specimen shown in Pl. II, Fig. 12 (P. I. U. No. ar. os. 120).

Locality of holotype. Rävanäs, in Dalecarlia, Sweden.

Stratum of holotype. Lower Ordovician: lowermost part of stratum *G* (just above *R I/G*).

Material. One carapace.

Dimensions.

No.	L	H	G	D M	F M	$\frac{H}{L}$	$\frac{G}{L}$	$\frac{DM}{L}$	$\frac{FM}{DM}$	∧ ant	∧ post	Re-mark
ar. os. 120	1.34	0.91	0.63	1.02	2.72	0.68	0.47	0.76	2.67	135	(125)	V

Diagnosis. *Conchoides* of medium size and leperditoid appearance; valves somewhat depressed in the dorsal region; rather distinct grooves conformed to the dorsal part of anterior and posterior margins; surface smooth, except in the dorsocentral area which is extremely finely reticulate.

Affinities. The species is somewhat reminiscent of *C. socialis* (BRÖGGER), but it is only about $^1/_3$ as large as this species, and the surface ornamentation is different. Its dorsal area is more gently sloping than in some other species of about the same size (*C. levis* n. sp., *C. meganotifera* n. sp., and *C. ventro-punctata* n. sp.). Moreover, these species are different from *C. dorsodepressula* as regards the surface ornamentation.

Description. Carapace moderately large; the left valve is the larger and overlaps the right one along the whole free margin.

Dorsal margin straight and moderately long; anterior margin more rounded than the posterior; ventral margin rather convex.

Posterior part of carapace slightly higher than the anterior.

Carapace relatively slightly arched, anterior part somewhat more than the posterior, dorsal area flattened; central area only slightly swollen; surface gently and regularly sloping to the margins.

Posterodorsal corner distinctly pinched but the anterodorsal inconsiderably; a broad and shallow but distinct groove conforms to the dorsal part of the posterior margin; a narrow and shallow but clearly visible groove conforms to most of the anterior margin.

In the dorsocentral area, somewhat in front of the midlength, is a depression, corresponding to *S II*; it is short and very shallow but its anterior margin is rather distinct, since its anterior part is a little more depressed than the posterior which rises gradually backwards; the anterior margin of the depression is gently curved forwards; just in front of the depression is a small and very low swelling, corresponding to the presulcate node; in the area just in front of the swelling, one may discern faint impressions which may be due to attachments of antennal and mandibular muscles.

Surface smooth (the slightly swollen central area glossy), except for most of the dorsocentral area which is extremely finely reticulate.

Occurrence. Lower Ordovician: lowermost part of stratum *G* (just above *R I/G*) at Rävanäs, in Dalecarlia, Sweden.

Conchoides levis n. sp.

Pl. III, Figs. 8 and 10.

In this species are included two types, called α and β. They occur in the same horizon and are very similar to each other, but clearly distinguishable on careful examination (type α entirely smooth and type β partly microstriate). They may be different species, but more likely they constitute one species. Whether they are sexual dimorphisms or one of them is subspecies to the other is difficult to decide (cf. discussion below).

The two types are described separately.

Derivation of name. *levis* alludes to the smooth surface.

Holotype. The specimen shown in Pl. III, Fig. 8 is designated holotype (P. I. U. No. ar. os. 121).

Locality of holotype. Leskusänget, in Dalecarlia, Sweden.

Stratum of holotype. Lower Ordovician: upper part of stratum *G* (about 0.2 m below *G/R II*).

Diagnosis. *Conchoides* of medium or rather small size and leperditoid appearance; possibly sexually dimorphic; a small but distinctly elevated spot in the median part of dorsocentral area, dorsal area rather steeply sloping; valves somewhat depressed along the free margin; posterior margin conformed to by a mostly fairly distinct groove, in the anterodorsal corner is a short and indistinct groove; surface smooth, except (in type β) a microstriate area just in front of the dorsocentral swollen spot.

Affinities. The species is somewhat reminiscent of *Aparchites circumexaratus* n. sp. and *C. dorsodepressula* n. sp. in general shape, but the former is dorsally somewhat more swollen (additionally it is not grooved), and the latter is flatter dorsally. Further, type β resembles certain larval stages of *C. meganotifera* n. sp. as regards the surface pattern, but is different in the striae of type β occurring mainly anterior to the swollen dorsocentral spot and being directed longitudinally, whereas, in *C. meganotifera*, they occur both anterior and posterior to this spot and are directed antero- and posteroventrally resp.

Type α.

Pl. III, Fig. 8.

Type. This type includes the holotype (P. I. U. No. ar. os. 121).

Locality and stratum of type. Cf. above.

Material. 10 valves from 3 localities.

Description. Carapace of moderate size or rather small; left valve is the larger, the edge of the free margin of the right valve observed to fit into a groove of the left valve.

Dorsal margin straight and moderately long; posterior margin somewhat more widely curved than the anterior; ventral margin moderately convex.

Anterodorsal angle somewhat more obtuse than the posterodorsal.

Carapace somewhat higher in the posterior part than in the anterior.

Carapace moderately arched, anterior part somewhat more arched than the posterior; median part of dorsocentral area swollen; valves somewhat flattened along the margins; surface sloping rather steeply to the dorsal margin and gently to the free margin.

Dorsal corners pinched, the posterior more than the anterior; a rather distinct groove conforms to the posterior margin, and a short and indistinct groove to the dorsal part of the anterior margin.

Surface smooth and often glossy.

Dimensions.

No.	L	H	G	D M	F M	$\frac{H}{L}$	$\frac{G}{L}$	$\frac{DM}{L}$	$\frac{FM}{DM}$	∧ ant	∧ post	Re-mark
ar. os. 126	1.35	0.73	0.69	0.84	2.30	0.65	0.51	0.62	2.74	140	135	V
ar. os. 124	1.21	0.77	0.63	0.93	2.46	0.64	0.52	0.77	2.65	145	(130)	V
ar. os. 125	1.19	0.81	0.65	0.93	2.68	0.62	0.53	0.79	2.88	140	(135)	V
ar. os. 121	*1.12*	*0.81*	*0.70*	*0.91*	*2.62*	*0.63*	*0.54*	*0.71*	*2.88*	*140*	*135*	V
ar. os. 122	0.93	0.60	0.51	0.70	1.86	0.65	0.55	0.75	2.66	140	(130)	V
ar. os. 127	0.93	0.60	0.47	0.70	1.93	0.65	0.51	0.75	2.76	135	(130)	V
ar. os. 123	0.81	0.51	0.47	0.68	1.60	0.63	0.57	0.84	2.35	135	(120)	V
Mean	1.08	0.81 0.69 0.51	0.70 0.59 0.47	0.93 0.81 0.68	2.68 2.21 1.60	0.65 0.64 0.62	0.57 0.53 0.51	0.84 0.74 0.62	2.88 2.70 2.35	140	130	

Occurrence. Lower Ordovician: uppermost part of stratum *G* and lowermost part of stratum *R II* (from about 0.3 m below *G/R II* to about 0.1 m above this boundary) at Leskusänget, Rävanäs, and Gulleråsen, in Dalecarlia, Sweden.

Type *β*.

Pl. III, Fig. 10.

Type. A characteristic type is shown in Pl. III, Fig. 10 (P. I. U. No. ar. os. 128).

Locality of type. Born-Dådran, in Dalecarlia, Sweden.

Stratum of type. Lower Ordovician: lower part of stratum *R II* (about 0.6 m below *G/R II*).

Material. 16 specimens from 4 localities.

Description. This type is very similar to type α. The most striking difference is the fact that type α is entirely smooth, whereas type β is striate just in front of the swollen dorsocentral spot. The striae are minute, slightly crumpled and directed mainly longitudinally. Sometimes one may discern indistinct striae or a very indistinct reticulum posterior to the swollen spot.

As appears from the tables, the two types are of about the same size. Type β is, on the average, slightly more slender and rather considerably less arched; the two types are about equally arched in the anterior part. In type β, the free margin is somewhat longer than in type α. The dorsal angles are about equal in the two types.

Dimensions.

No.	L	H	G	D M	F M	$\frac{H}{L}$	$\frac{G}{L}$	$\frac{DM}{L}$	$\frac{FM}{DM}$	∧ ant	∧ post	Re-mark
ar. os. 128	*1.19*	*0.74*	*0.55*	*0.84*	*2.46*	*0.62*	*0.46*	*0.71*	*2.93*	*140*	*(130)*	V
ar. os. 132	1.12	0.70	0.56	0.84	2.26	0.63	0.50	0.75	2.69	140	(135)	V
ar. os. 129	1.09	0.67	0.54	0.72	2.30	0.62	0.50	0.66	3.20	(145)	135	V
ar. os. 131	1.06	0.63	0.51	0.88	2.04	0.60	0.48	0.83	2.32	135	(130)	V
ar. os. 130	1.04	0.66	0.51	0.70	2.24	0.63	0.49	0.67	3.20	140	(135)	V
Mean	1.10	0.74 0.68 0.63	0.56 0.53 0.51	0.88 0.82 0.70	2.46 2.26 2.04	0.63 0.62 0.60	0.50 0.49 0.46	0.83 0.72 0.66	3.20 2.87 2.32	140	135	

Occurrence. Lower Ordovician: upper part of stratum *G* (about 1.0—0.1 m below *G*/*R II*) at Born-Dådran, Rävanäs, Gulleråsen, and Leskusänget, in Dalecarlia, Sweden.

Discussion. The types described above may scarcely be assumed to be different species; most likely they are sexual dimorphisms. However, only very vague suggestions may be allowed as regards the sexes of the two types.

The types are about equally arched in the anterior part; if they had been different in this respect, one might have imagined the more arched type to be male (cf. p. 138).

The larger gibbosity of type β, as appears from the tables, is referable to the median part of the dorsocentral area. The reason for this larger gibbosity is not known; probably it is due to the sexual organs of one sex having required larger space than those of the other sex. Whether this is referable to the ovaries or to the male copulatory apparatus (both being very voluminous) is impossible to decide.

Conchoides sp. ***D*** (sine nomine).

Pl. III, Figs. 1 and 4.

The present *Conchoides* species is represented by four imperfectly preserved specimens. On that account a full description cannot be presented.

Type. The best preserved specimen is shown in Pl. III, Fig. 1 (P. I. U. No. ar. os. 156).

Locality of type. Leskusänget, in Dalecarlia, Sweden.

Stratum of type. Lower Ordovician: lower part of stratum *G* (about 1.0 m above *R I*/*G*).

Material. 4 valves (partly damaged) from 3 localities.

Dimensions.

No.	L	H	G	D M	F M	$\frac{H}{L}$	$\frac{G}{L}$	$\frac{DM}{L}$	$\frac{FM}{DM}$	∧ ant	∧ post	Re-mark
ar. os. 156	*2.14*	*1.28*	*1.15*	*1.57*	*4.21*	*0.60*	*0.54*	*0.73*	*2.67*	*140*	(*130*)	V
ar. os. 157	1.63	1.05	0.90	1.13	3.37	0.64	0.55	0.69	2.97	(135)	140	V
Mean	1.89	1.16	1.03	1.35	3.79	0.62	0.55	0.71	2.82	140	135	

Affinities. This species resembles *C. meganotifera* n. sp. type α which occurs in the same horizon. It is different from this one in being larger and in being of proportionally greater height. Further, its appearance is rougher; the rugae are, moreover, directed more longitudinally than the pattern in *C. meganotifera.*

The species also resembles *C. circumstriata* n. sp. which occurs in a higher horizon. They are different, the central area of *C. circumstriata* being smooth and glossy, and in the arrangement of the striae and rugae resp., which in *C. circumstriata* follow the margins more closely; additionally, a marginal zone is smooth in this species.

C. rugosa n. sp., occurring in the same horizon as *C. circumstriata,* is distinguishable from the present species mainly in having a more irregularly rough surface and in the dorsal area being more steeply sloping.

Description. *Conchoides* of rather large size and somewhat rude appearance; carapace leperditoid.

Dorsal margin straight and probably moderately long; anterior margin regularly rounded, ventral one may be rather convex.

Dorsal angles seem to be about equal.

Posterior part of the carapace higher than the anterior.

Carapace moderately arched; surface sloping rather gently to the margins.

A broad and shallow but distinct groove was observed to conform to the dorsal part of the anterior margin.

Surface rugose (distinct rugae observed in anterior part of dorsocentral area; marginally they are less distinct); rugae short, narrow, and somewhat wrinkled, and to a great extent anastomosing, thus giving parts of the surface a reticulate appearance; rugae arranged mainly longitudinally; the concentric groove is smooth.

Occurrence. Lower Ordovician: lower part of stratum *G* (about 0.4—1.0 m above *R I/G*) at Leskusänget, Gulleråsen, and Granmor, in Dalecarlia, Sweden.

Conchoides rugosa n. sp.

Pl. II, Fig. 7.

Derivation of name. *rugosa* alludes to the rugose surface.

Holotype. The type shown in Pl. II, Fig. 7 is the holotype (P. I. U. No. ar. os. 154).

Locality of holotype. Leskusänget, in Dalecarlia, Sweden.

Stratum of holotype. Lower Ordovician: lower part of *R II* (about 0.7 m above *G/R II*).

Material. 5 valves from 3 localities.

Dimensions.

No.	L	H	G	D M	F M	H/L	G/L	D M/L	F M/D M	∧ ant	∧ post	Re-mark
ar. os. 165	1.83	1.15	0.99	1.22	3.79	0.63	0.54	0.67	3.11	130	140	V
ar. os. 154	*1.76*	*1.16*	*1.05*	*1.02*	*3.79*	*0.66*	*0.60*	*0.64*	*3.38*	*140*	*145*	V
ar. os. 155	1.75	1.11	0.96	1.24	3.54	0.64	0.54	0.72	2.85	135	140	V
Mean	1.78	1.16 1.14 1.11	1.05 1.00 0.96	1.24 1.19 1.02	3.79 3.70 3.54	0.66 0.64 0.63	0.60 0.56 0.54	0.72 0.67 0.64	3.38 3.11 2.85	135	140	

Diagnosis. *Conchoides* of moderate size and slightly leperditoid appearance; middle part of dorsocentral area rather swollen; a broad, very shallow, and indistinct groove conforms to the most dorsal part of the posterior margin; surface rugose; dorsocentral area partly indistinctly striate.

Affinities. The species slightly resembles *C. circumstriata* n. sp., which occurs in the same stratigraphic position, and also *C. meganotifera* n. sp. type α and the species called *Conchoides* sp. *D* both of which occur in a lower horizon.

C. circumstriata is different in being thickest centroventrally (*C. rugosa* is most gibbous dorsocentrally) and in the central area being smooth (in *C. rugosa* it is entirely rugose); furthermore, the striae of *C. circumstriata* are arranged in a circummarginal zone, whereas in *C. rugosa* they occur mainly anterior and posterior to the dorsocentral swelling. *C. meganotifera* is striate on spots corresponding to those of *C. rugosa* but is often striate even to the margins; furthermore, the dorsal area is less sloping in *C. meganotifera* α. In *Conchoides* sp. *D* the rugae are directed more longitudinally and occur also ventrally.

Description. Carapace moderately large.

Dorsal margin straight and of moderate length or rather short; anterior margin somewhat straightened in the dorsal part, otherwise regularly and rather greatly curved; posterior margin regularly and broadly curved; ventral margin moderately convex, slightly less rounded in the anterior part than in the posterior.

Anterodorsal angle somewhat less obtuse than the posterodorsal.

Carapace somewhat higher posteriorly than anteriorly.

Carapace rather flattened in the anterior and posterior ends, especially in the posterior; median part of dorsocentral area swollen; surface of the valves sloping rather steeply to the dorsal margin, more gently to the free margin.

Conforming to the most dorsal part of posterior margin is a broad and very shallow groove.

Surface rugose, except for the top of the dorsocentral swelling, which is smooth; areas anterior and posterior to the swelling often striate; in the former the striae are directed anteroventrally and in the latter posteroventrally.

Occurrence. Lower Ordovician: upper part of stratum *G* and lower part of stratum *R II* (from about 0.6 m below *G/R II* to about 0.7 m above this boundary) at Leskusänget, Rävanäs, and Born-Dådran, in Dalecarlia, Sweden.

Conchoides circumstriata n. sp.

Pl. III, Fig. 11.

Derivation of name. *circumstriata* alludes to the circum-marginal striate zone.

Holotype. The type shown in Pl. III, Fig. 11 is holotype (P. I. U. No. ar. os. 159).

Locality of holotype. Leskusänget, in Dalecarlia, Sweden.

Stratum of holotype. Lower Ordovician: lower part of stratum *R II* (about 0.7 m above *G/R II*).

Material. 27 carapaces and valves from 4 localities.

Diagnosis. *Conchoides* of moderate or rather large size and leperditoid appearance; greatest gibbosity centroventrally; grooves generally indistinct, mostly conforming to only the dorsal parts of anterior and posterior margins; central region glossy, surrounded by a broad circum-marginal, striate zone which anteriorly and posteriorly but not ventrally extends to the margins; in the glossy central region, a short and shallow depression, corresponding to *S II*, is often discernible.

Affinities. The circum-marginal striate zone makes this species distinguishable from other known species of *Conchoides*. It is somewhat reminiscent of *Conchoides rugosa* n. sp. which occurs in the same stratum, but is different in having the greatest gibbosity centroventrally (*C. rugosa* dorsocentrally) and in *C. rugosa* being striate only in the dorsocentral area.

Description. Carapace of moderate or rather large size; the left valve is the larger one and overlaps the right valve mainly ventrally.

Dimensions.

No.	L	H	G	DM	FM	$\frac{H}{L}$	$\frac{G}{L}$	$\frac{DM}{L}$	$\frac{FM}{DM}$	Λ ant	Λ post	Remark
ar. os. 161	2.89	1.76	1.26	2.15	5.85	0.61	0.44	0.75	2.72	135	125	C
ar. os. 160	2.56	1.42	1.35	1.87	5.25	0.55	0.53	0.73	2.81	145	125	V
ar. os. 164	2.26	1.27	0.92	1.79	4.22	0.56	0.41	0.79	2.35	140	125	V
ar. os. 162	1.76	1.04	0.91	1.39	3.52	0.59	0.52	0.79	2.53	140	130	V
ar. os. 163	1.73	0.99	0.72	1.33	3.38	0.58	0.42	0.76	2.54	140	130	C
ar. os. 244	1.58	1.07	0.92	1.18	3.25	0.68	0.58	0.75	2.75	145	120	V
ar. os. 159	*1.49*	*0.95*	*0.72*	*1.09*	*3.04*	*0.64*	*0.48*	*0.73*	*2.79*	*140*	*130*	C
Mean	2.04	1.76 1.21 0.95	1.35 0.97 0.72	2.15 1.54 1.09	5.85 4.07 3.04	0.68 0.60 0.55	0.53 0.48 0.41	0.79 0.76 0.73	2.81 2.64 2.35	140	125	

Dorsal margin straight and moderately long; anterior margin somewhat more curved than the posterior; ventral margin moderately convex.

Anterodorsal angle somewhat more obtuse than the posterior.

Posterior part of carapace somewhat higher than the anterior.

Carapace moderately arched, anterior part somewhat more than the posterior, which is rather flattened; often a slight swelling centroventrally; surface sloping gently to the margins, especially to the dorsal margin.

Antero- and posterodorsal corners pinched; indistinct grooves (broad and shallow) conform to the most dorsal part of anterior and posterior margins; occasionally slight grooves are discernible along the whole anterior and posterior margins and parts of the ventral one.

In the dorsocentral area, just in front of the midlength, a short and very shallow depression is often discernible which corresponds to *S II*; it is surrounded anteriorly and sometimes posteriorly by a very low swelling; in the ventral part of the sulcate depression the scar of the central adductor muscle, and in its dorsal part, scars of the dorsal muscle group are visible; in one specimen, just in front of the anterior swelling (which corresponds to the presulcate node), was observed an extremely shallow depression extending practically to the dorsal margin (attachment of antennal muscles); in the same specimen was observed a small pit anterior to the ventral part of the *S II*-depression (ventral attachment of lower antennal muscle or attachment of mandibular muscle).

Central region of valves smooth and glossy; it is surrounded by a distinctly striate zone; the striae minutely wrinkled and following the margins; in the dorsal section of the striate zone (mostly in its anterior and central parts) the striae are arranged to form a reticulum; anteriorly and posteriorly the striate zone generally extends to the margins, but dorsally and ventrally there is a smooth strip marginally of the striate zone.

Occurrence. Lower Ordovician: upper part of stratum *G* and lower part of stratum *R II* (from about 0.9 m below *G*/*R II* to about 0.8 m above this boundary) at Röjeråsvägen, Rävanäs, Born-Dådran, Silverberg II, and Leskusänget, in Dalecarlia, Sweden.

Non-leperditoid group.

Conchoides ventroincisurata n. sp.

Pl. II, Figs. 8 and 9.

In this species are included two types which are so similar to each other that they are distinguishable only after measuring. They are different mainly as regards their gibbosity; this difference is distinct, and no intermediate types considering this dimension were observed. Presumably, they are sexual dimorphisms (the more gibbous type may be suggested as female; cf. discussion below).

The two types, called α and β, are described separately.

Derivation of name. *ventroincisurata* alludes to the ventral score of the valves.

Holotype. The type shown in Pl. II, Fig. 8 is designated holotype (P. I. U. No. ar. os. 173).

Locality of holotype. Röjeråsvägen, in Dalecarlia, Sweden.

Stratum of holotype. Lower Ordovician: lower part of stratum *G* (about 1.1 m above *R I*/*G*).

Material. 2 carapaces (α) and 33 valves (α and β) from 4 localities.

Diagnosis. *Conchoides* of small size; presumably sexually dimorphic; posterodorsal part of carapace characteristically swollen; dorsal margin short, ventral margin of left valve bulged near the midlength; grooves conforming to parts of the free margin generally indistinct, often only dorsal part of posterior margin conformed to by an extremely shallow groove; ventral part of valves distinctly scored from about midlength to the anteroventral angle; surface smooth.

Affinities. The species is closely related to *Conchoides minuta* n. sp. The only important difference is the ventral score, which is always distinctly developed in the present species but entirely absent in *C. minuta*.

Type α (suggested as male).

Pl. II, Fig. 8.

Type. This type includes the holotype (P. I. U. No. ar. os. 173).

Locality and stratum of type. Cf. above.

Material. 2 carapaces and computably 19 valves from 3 localities.

Dimensions.

No.	L	H	G	D M	F M	$\frac{H}{L}$	$\frac{G}{L}$	$\frac{DM}{L}$	$\frac{FM}{DM}$	∧ ant	∧ post	Remark
ar. os. 173	*1.00*	*0.61*	*0.44*	*0.58*	*2.14*	*0.61*	*0.44*	*0.58*	*3.69*	*150*	*140*	C
ar. os. 175	0.98	0.58	0.44	0.60	2.05	0.59	0.45	0.61	3.42	150	135	V
ar. os. 169	0.93	0.56	0.39	0.51	1.98	0.60	0.42	0.55	3.87	150	145	V
ar. os. 172	0.86	0.56	0.39	0.49	1.77	0.65	0.45	0.57	3.61	150	140	C
ar. os. 171	0.86	0.56	0.37	0.47	1.88	0.65	0.43	0.55	4.00	150	145	V
ar. os. 168	0.79	0.56	0.39	0.37	1.97	0.71	0.49	0.47	5.33	150	145	V
Mean	0.90	0.61 0.57 0.56	0.44 0.40 0.37	0.60 0.50 0.37	2.14 1.97 1.77	0.71 0.64 0.59	0.49 0.45 0.42	0.61 0.56 0.47	5.33 3.99 3.42	150	140	

Description. Carapace small; the left valve is larger and overlaps the right one all along the free margin.

Dorsal margin straight and short; anterior margin very convex, its dorsal part almost straight; posterior margin broadly and regularly rounded; ventral margin of right valve moderately or rather convex, that of left valve has a broadly V-shaped swing near the midlength.

Anterodorsal angle more obtuse than the posterodorsal.

Anterior and posterior parts of carapace almost equally high, or the posterior part slightly higher.

Carapace moderately or rather inconsiderably arched; posterior part somewhat more arched than the anterior; the posterodorsal corner swollen in a characteristic way; surface slopes steeply to posterior margin, more gently to the others.

Grooves conforming to parts of the free margin are feeble, sometimes they are scarcely discernible; generally only the anterior and the dorsal part of the posterior margin conformed to by shallow and narrow grooves.

In the ventral part of the valves is a distinct, straight score extending from about the midlength to a point somewhat behind the anteroventral angle; it continues forwards in the above-mentioned anterior groove.

Surface smooth.

In internal moulds, the central muscle scar and a node in front of its dorsal part are clearly visible; this muscle scar is shallow and rounded, and situated just in front of the midlength and dorsally of the midheight; sometimes one may discern slight impressions of the dorsal muscle group (dorsally of the central muscle scar) and of the antennal and mandibular muscles (in front of the node).

Occurrence. Lower Ordovician: lower part of stratum *G* (about 0.6—1.4 m above *R I*/*G*) at Röjeråsvägen, Rävanäs, and Stenberg, in Dalecarlia, Sweden.

Type β (suggested as female).

Pl. II, Fig. 9.

Type. A characteristic specimen is shown in Pl. II, Fig. 9 (P. I. U. No. ar. os. 166).

Locality of type. Röjeråsvägen, in Dalecarlia, Sweden.

Stratum of type. Lower Ordovician: lower part of stratum *G* (about 1.0 m above *R I*/*G*).

Material. Calculated to be 4 valves from 3 localities.

Dimensions.

No.	L	H	G	D M	F M	$\frac{H}{L}$	$\frac{G}{L}$	$\frac{DM}{L}$	$\frac{FM}{DM}$	∧ ant	∧ post	Re-mark
ar. os. 166	*0.86*	*0.56*	*0.54*	*0.51*	*1.95*	*0.65*	*0.63*	*0.59*	*3.83*	*140*	*145*	V
ar. os. 170	0.86	0.56	0.54	0.44	1.95	0.65	0.63	0.51	4.43	145	140	V
ar. os. 174	0.79	0.51	0.49	0.37	1.81	0.65	0.62	0.47	4.91	150	140	V
ar. os. 167	0.74	0.47	0.47	0.42	1.72	0.64	0.64	0.58	4.09	145	150	V
Mean	0.81	0.56 0.53 0.47	0.54 0.51 0.47	0.51 0.44 0.37	1.95 1.86 1.72	0.65 0.65 0.64	0.64 0.63 0.62	0.59 0.54 0.47	4.91 4.32 3.83	145	145	

Description. This type is very similar to type α. Proportionally their heights and the lengths of the dorsal margins are, on the average, practically equal. The gibbosity is different: type β is proportionally considerably more gibbous than type α. Furthermore, the free margin of type β is proportionally longer. The dorsal angles of type β are, on the average, equal, but in type α the anterodorsal angle is somewhat more obtuse than the posterodorsal.

Occurrence. Lower Ordovician: lower part of stratum *G* (about 0.6—1.2 m above the boundary *R I*/*G*) at Röjeråsvägen, Stenberg, and Leskusänget, in Dalecarlia, Sweden.

Discussion. The remarkable difference in gibbosity may suggest that types α and β are sexual dimorphisms. The difference is due to dissimilar elevation of the posterodorsal area. The reason for this difference is not known. One may assume that the greater gibbosity of type β is due to the adaptation of the posterodorsal part of the carapace to the storage of eggs and possibly young larvæ, such as is the case in many recent ostracods. Thus, type β may be suggested as the female.

It may be noticed that the anterodorsal angle of type α (which may be suggested as the male) is somewhat more obtuse than that of type β, i. e. the anterior margin is more convex than in type β. Corresponding observations were made in other species (e. g. *Conchoides micropunctata* n. sp.) where the sexes were indicated by other arguments than those for the present species.

Conchoides minuta n. sp.

Pl. III, Figs. 2—3 and 5—6.

This species comprises two types which are very similar to each other. They are practically indistinguishable without measurings. Only the gibbosity shows important differences. It is assumed that the more gibbous type is the female (cf. discussion below).

The two types, called α and β, are described separately.

Derivation of name. *minuta* alludes to the minute size of the carapace.

Holotype. The type shown in Pl. III, Fig. 3 is designated holotype (P. I. U. No. ar. os. 200).

Locality of holotype. Stenberg, in Dalecarlia, Sweden.

Stratum of holotype. Lower Ordovician: lower part of stratum *G* (about 1.0 m above *R I/G*).

Material. The types α and β comprise 1560 carapaces and valves; the frequency of each type is computed from the data received at the measurings, cf. the type descriptions.

Diagnosis. *Conchoides* of small size; presumably sexually dimorphic; posterodorsal part of carapace distinctively swollen; dorsal margin short; ventral part of the left valve has a rather pronounced broadly V-shaped swing near at the midlength; grooves conforming to parts of free margin generally restricted to antero- and posterodorsal corners, as a rule indistinct, sometimes scarcely discernible; surface smooth.

Affinities. The species is very closely related to *C. ventroincisurata* n. sp. They are different, however, mainly in *C. ventroincisurata* being distinctively scored ventrally, which is not the case in the present species.

Type α (suggested as male).

Pl. III, Figs. 2 and 3.

Type. This type includes the holotype (P. I. U. No. ar. os. 200).

Locality and stratum of type. Cf. above.

Material. Calculated to be about 1040 carapaces and valves from 6 localities.

Dimensions.

No.	L	H	G	D M	F M	$\frac{H}{L}$	$\frac{G}{L}$	$\frac{DM}{L}$	$\frac{FM}{L}$	∧ ant	∧ post	Re-mark
ar. os. 187	0.90	0.59	0.44	0.52	1.98	0.66	0.49	0.53	3.81	150	150	C
ar. os. 204	0.85	0.52	0.49	0.49	1.79	0.61	0.51	0.58	3.65	140	150	V
ar. os. 176	0.83	0.53	0.40	0.50	1.79	0.64	0.48	0.60	3.58	150	140	C
ar. os. 193	0.82	0.50	0.42	0.49	1.72	0.62	0.51	0.60	3.51	150	145	V
ar. os. 189	0.79	0.53	0.38	0.44	1.70	0.67	0.48	0.56	3.86	150	140	C
ar. os. 183	0.78	0.49	0.38	0.44	1.58	0.63	0.49	0.57	3.59	150	150	C
ar. os. 179	0.76	0.49	0.38	0.37	1.58	0.65	0.50	0.49	4.27	145	150	V
ar. os. 182	0.73	0.47	0.33	0.45	1.58	0.64	0.45	0.62	3.51	145	140	C
ar. os. 184	0.73	0.47	0.34	0.39	1.60	0.64	0.46	0.53	4.11	145	150	C
ar. os. 185	0.73	0.48	0.36	0.39	1.53	0.66	0.49	0.53	3.93	145	145	C
ar. os. 188	0.71	0.48	0.35	0.42	1.49	0.68	0.49	0.59	3.55	150	145	C
ar. os. 201	0.68	0.42	0.33	0.38	1.46	0.62	0.49	0.56	3.85	150	145	V
ar. os. 191	0.68	0.44	0.35	0.42	1.49	0.65	0.51	0.62	3.55	150	135	V
ar. os. 180	0.64	0.42	0.30	0.36	1.40	0.66	0.47	0.56	3.90	150	145	C
ar. os. 200	*0.64*	*0.42*	*0.31*	*0.38*	*1.35*	*0.66*	*0.48*	*0.59*	*3.55*	*150*	*140*	C
ar. os. 186	0.63	0.42	0.30	0.35	1.32	0.67	0.48	0.56	3.77	150	145	C
ar. os. 181	0.63	0.42	0.30	0.37	1.35	0.67	0.48	0.59	3.65	150	140	C
ar. os. 203	0.61	0.37	0.30	0.33	1.25	0.61	0.50	0.54	3.79	145	145	V
ar. os. 192	0.61	0.38	0.28	0.36	1.25	0.62	0.46	0.59	3.47	145	140	V
ar. os. 190	0.42	0.26	0.18	0.26	0.84	0.62	0.43	0.62	3.45	145	145	C
Mean	0.71	0.59 0.46 0.26	0.49 0.35 0.18	0.52 0.41 0.26	1.98 1.51 0.84	0.68 0.64 0.61	0.51 0.48 0.43	0.62 0.57 0.49	4.27 3.71 3.77	150	145	

Description. Carapace small; left valve is larger and overlaps the right one along the free margin.

Dorsal margin straight and short; dorsal part of anterior margin only slightly convex or practically straight, its ventral part much rounded;

posterior margin broadly rounded; ventral margin broadly V-shaped near the midlength; this swing is most pronounced in the left (the larger) valve.

Anterodorsal angle more obtuse than the posterodorsal.

Anterior and posterior parts of carapace of about the same height, or the posterior part slightly higher.

Carapace moderately arched, the posterior part somewhat more than the anterior; posterodorsal corner distinctively swollen; surface sloping steeply to the posterior margin and gently to the others.

Surface smooth.

Occurrence. Lower Ordovician: lower part of stratum *G* (about 0.4—1.9 m above *R I/G*) at Leskusänget, Granmor, Röjeråsvägen, Stenberg, Silverberg (sample 2), and Rävanäs, in Dalecarlia, Sweden.

Type β (suggested as female).

Pl. III, Figs. 5 and 6.

Type. A characteristic type is shown in Pl. III, Fig. 6 (P. I. U. No. ar. os. 196).

Locality of type. Röjeråsvägen, in Dalecarlia, Sweden.

Stratum of type. Lower Ordovician: lower part of stratum *G* (about 1.6 m above *R I/G*).

Material. Calculated to be about 520 carapaces and valves from 6 localities.

Dimensions.

No.	L	H	G	D M	F M	H/L	G/L	D M/L	F M/L	∧ ant	∧ post	Remark
ar. os. 196	*0.82*	*0.51*	*0.52*	*0.49*	*1.70*	*0.62*	*0.63*	*0.60*	*3.27*	*145*	*140*	V
ar. os. 198	0.77	0.48	0.47	0.44	1.65	0.62	0.61	0.57	3.75	150	140	V
ar. os. 194	0.69	0.48	0.47	0.42	1.51	0.70	0.68	0.61	3.60	145	140	V
ar. os. 197	0.69	0.47	0.42	0.41	1.49	0.68	0.61	0.59	3.63	150	145	V
ar. os. 202	0.66	0.42	0.43	0.44	1.28	0.64	0.65	0.67	2.91	145	140	V
ar. os. 178	0.65	0.42	0.43	0.42	1.35	0.65	0.66	0.65	3.21	145	135	V
ar. os. 199	0.62	0.40	0.37	0.31	1.35	0.65	0.60	0.50	4.36	145	150	V
ar. os. 193	0.56	0.35	0.33	0.29	1.21	0.63	0.59	0.52	4.17	150	145	V
ar. os. 177	0.50	0.35	0.33	0.28	1.21	0.70	0.66	0.56	4.32	150	140	V
ar. os. 195	0.47	0.30	0.28	0.30	1.00	0.64	0.60	0.64	3.30	140	135	V
Mean	0.64	0.51 0.41 0.30	0.52 0.40 0.28	0.49 0.38 0.28	1.70 1.36 1.00	0.70 0.65 0.61	0.68 0.62 0.50	0.67 0.59 0.50	4.36 3.67 2.91	145	140	

Description. This type coincides with type α. The main difference is that type α is less gibbous.

Occurrence. Lower Ordovician = that of type α.

Discussion. The difference in gibbosity between the two types may be due to sexual dimorphism. The present case is identical with that of *C. ventroincisurata*, and for the same reasons as given in the discussion of this species (p. 174) type β may be female and type α male. However, this does not agree with the fact that type β is less frequent than type α; in recent ostracods the females are generally more abundant than the males.

Conchoides minuta n. sp. ab. *posteroreticulata.*

Pl. III, Fig. 7.

Derivation of name. *posteroreticulata* alludes to the extremely fine reticulum in the posterior end of the carapace.

Type. A characteristic type is shown in Pl. III, Fig. 7 (P. I. U. No. ar. os. 207).

Locality of type. Silverberg, in Dalecarlia, Sweden.

Stratum of type. Lower Ordovician: presumably lower part of stratum *G*; the exact distance from the boundary *R I*/*G* could not be ascertained, since this boundary was not observable at Silverberg.

Material. One carapace and one valve from 2 localities.

Dimensions.

No.	L	H	G	D M	F M	$\frac{H}{L}$	$\frac{G}{L}$	$\frac{DM}{L}$	$\frac{FM}{DM}$	Λ ant	Λ post	Re-mark
ar. os. 207	*0.76*	*0.49*	*0.37*	*0.42*	*1.56*	*0.64*	*0.49*	*0.55*	*3.72*	*150*	*140*	C
ar. os. 208	0.61	0.39	0.37	0.37	1.23	0.64	0.61	0.61	3.32	145	145	V
Mean	0.69	0.44	0.37	0.40	1.40	0.64	0.55	0.58	3.52	150	145	

Description. This type is merely an aberration of *C. minuta* n. sp. The difference from the main type is insignificant: the present type has a very fine and indistinct reticulum in the posterior end which is not found in the main type.

It may not be ranked as subspecies but considered an aberration of less value, since there are indications of slight reticulation in the posterior end of some very few examples among the main type (observed in specimen No. ar. os. 195).

One of the types measured may be male (No. ar. os. 207) and the other female, according to the discussion on the sexual dimorphism in the main type (p. 177).

Affinities. The type is slightly reminiscent of *Aparchites reticuliferus* n. sp. as regards the reticulation. They are different in that the reticulation of the present type is restricted to the posterior end of the carapace, whereas in *Aparchites reticuliferus* the surface is reticulate both ventrally and anteriorly; moreover, the reticulation is more distinct in the latter species. Furthermore, the shape of the carapace is different: *Aparchites reticuliferus* is rather flattened dorsally but the present type is more arched, especially postero-dorsally (moreover, the *Aparchites* species is not grooved).

Occurrence. Lower Ordovician: lower part of stratum *G* (about 1.4 m above *R I/G* at Leskusänget; at Silverberg in sample No. 1 [cf. Pl. XXV]).

Internal moulds.

In a few localities internal moulds were observed which most certainly belong to *Conchoides* but which could not be proved to be referable to any known species. They are possibly referable to the non-leperditoid group as appears from the discussion below.

Internal moulds of the present type are often difficult to determine, even as regards genus. One may first think of *Conchoides*, *Primitia*, or *Euprimitia*. In this case, *Conchoides* is very abundant in the horizon considered, but *Euprimitia* was observed only in higher strata, and *Primitia* not at all in the stratal sequences. In one specimen a very distinct line was observed just at the place corresponding to the groove which in *Conchoides* conforms to the free margin. Such a line is sometimes discernible under *Conchoides* valves when thy are treated with alcohol or liquids of high refractive index. The present internal moulds, therefore, certainly belong to *Conchoides*.

The surface of many of the moulds is very reminiscent of that of a carapace, which may be misleading. This similarity is due to impregnation of the internal moulds by colloidal iron compounds. The colour is blackish, brownish, or greenish.

Some data for these internal moulds are given in the following.

Conchoides sp. *B*.

Pl. II, Fig. 11.

Type. An internal mould is shown in Pl. II, Fig. 11 (P. I. U. No. ar. os. 215).

Locality of type. Rävanäs, in Dalecarlia, Sweden.

Stratum of type. Lower Ordovician: lower part of stratum *G* (about 1.4 m above *R I/G*).

Material. 25 internal moulds from 2 localities.

Dimensions.

No.	L	H	G	D M	F M	H/L	G/L	D M/L	F M/D M	∧ ant	∧ post	Re-mark
ar. os. 212	0.76	0.46	0.39	0.45	1.63	0.61	0.51	0.59	3.62	145	140	M
ar. os. 216	0.70	0.42	0.37	0.35	1.56	0.60	0.53	0.50	4.45	155	145	M
ar. os. 211	0.63	0.39	0.28	0.30	1.49	0.62	0.44	0.48	4.95	150	145	M
ar. os. 214	0.56	0.35	0.29	0.31	1.28	0.62	0.52	0.55	4.13	145	145	M
ar. os. 209	0.56	0.33	0.33	0.36	1.23	0.59	0.59	0.64	3.43	145	145	M
ar. os. 215	*0.50*	*0.30*	*0.21*	*0.21*	*1.19*	*0.60*	*0.42*	*0.42*	*5.65*	*155*	*150*	M
ar. os. 210	0.45	0.28	0.22	0.28	1.07	0.62	0.49	0.62	3.83	145	140	M
Mean	0.59	0.46 0.36 0.28	0.39 0.30 0.21	0.45 0.32 0.21	1.63 1.35 1.07	0.62 0.61 0.59	0.59 0.50 0.42	0.64 0.54 0.42	5.65 4.29 3.43	150	145	

Description. Internal moulds of small size. Dorsal margin slightly convex; anterior margin more rounded than the posterior; ventral margin moderately convex.

Sulcate depression situated in the dorsocentral area just in front of the midlength; it is short, shallow and very broad (the central muscle spot visible in its ventral part).

Presulcate node small, tuberculoid, and slightly elongated dorsoventrally.

Postsulcate region more arched than the presulcate, especially in the dorsal area; there is also a swelling just ventral to the sulcus; surface in the postsulcate region sloping more steeply than in the presulcate.

Surface smooth or very minutely and sparsely tuberculate.

Occurrence. Lower Ordovician: lower part of stratum *G* (about 1.4—1.7 m above *R I/G* at Rävanäs; at Silverberg it occurs in sample 1 [cf. Pl. XXV].

Conchoides sp. *C.*

Pl. III, Fig. 9.

Type. An internal mould is shown in Pl. III, Fig. 9 (P. I. U. No. ar. os. 220).

Locality of type. Silverberg, in Dalecarlia, Sweden.

Stratum of type. Lower Ordovician: stratum *G*.

Material. 46 internal moulds from 2 localities.

Description. This type is very similar to *Conchoides* sp. *B*. The main difference is that sp. *B* usually has scattered tubercles and is less swollen ventral to the sulcus.

Dimensions.

No.	L	H	G	D M	F M	$\frac{H}{L}$	$\frac{G}{L}$	$\frac{DM}{L}$	$\frac{FM}{DM}$	∧ ant	∧ post	Re-mark
ar. os. 220	*0.68*	*0.44*	*0.35*	*0.42*	*1.49*	*0.65*	*0.52*	*0.62*	*3.55*	*150*	*145*	M
ar. os. 221	0.66	0.44	0.37	0.46	1.37	0.67	0.56	0.69	2.98	145	145	M
ar. os. 217	0.56	0.30	0.23	0.42	1.07	0.54	0.41	0.75	2.55	140	155	M
ar. os. 223	0.51	0.31	0.23	0.34	1.09	0.61	0.45	0.67	3.21	155	140	M
ar. os. 219	0.50	0.33	0.27	0.28	1.21	0.66	0.54	0.56	4.32	150	145	M
ar. os. 222	0.42	0.28	0.23	0.28	0.86	0.67	0.55	0.67	3.07	140	140	M
ar. os. 218	0.33	0.20	0.14	0.21	0.72	0.61	0.42	0.64	3.43	145	150	M
Mean	0.52	0.44 0.33 0.20	0.37 0.26 0.14	0.46 0.34 0.21	1.49 1.12 0.72	0.67 0.63 0.54	0.56 0.49 0.41	0.75 0.66 0.56	4.32 3.30 2.55	145	145	

Occurrence. Lower Ordovician: lower part of stratum *G* (about 1.1 m above *R I/G* at Röjeråsvägen; at Silverberg in sample 1 [cf. Pl. XXV]).

Discussion. As mentioned above (p. 179) it is difficult to identify more closely the internal moulds now described. Owing to their small size and the fact that their posterior end is swollen they can be assumed to belong to the non-leperditoid group, which is very abundant in this horizon (especially *C. minuta* n. sp.). The dorsal angles also indicate that they belong to this group. The values of gibbosity are somewhat uncertain, the colloidal substance having possibly shrunk to different extents at the solidification.

Whether the two types *A* and *B* are referable to different species, or whether the slight dissimilarities are due to different states of preservation, is difficult to decide.

Survey of the dimensions of *Conchoides*.

It appears that the leperditoid types are larger than the non-leperditoid. The ratios $\frac{H}{L}$ are almost equal in all species (on the average 0.64). In *C. circumstriata* this ratio is remarkably low (0.58). The ratios $\frac{G}{L}$, on the contrary, are more variable; some species are narrow in relation to their lengths, in others one may discern two groups of different gibbosity which may be sexual dimorphisms. In the leperditoid group the greatest gibbosity occurs at the midlength or in front of the midlength but in the non-leper-

Leperditoid group:

	Number	L	H	G	DM	FM	$\frac{H}{L}$	$\frac{G}{L}$	$\frac{DM}{L}$	$\frac{FM}{DM}$	∧ ant	∧ post
C. socialis	3	3.90	2.61	1.43	3.30	8.39	0.67	0.42	0.83	2.64	115	130
C. micro-punctata α	6	3.29	2.05	1.51	2.36	6.62	0.62	0.45	0.71	2.81	140	135
C. micro-punctata β	7	2.88	1.79	1.21	2.11	5.82	0.63	0.42	0.73	2.77	130	135
C. circum-striata	6	2.12	1.22	0.98	1.60	4.21	0.58	0.47	0.76	2.63	140	130
C. sp. *D.* (sine nomine)	2	1.89	1.16	1.03	1.35	3.79	0.62	0.55	0.71	2.82	140	135
C. rugosa	3	1.78	1.14	1.00	1.19	3.70	0.64	0.56	0.67	3.11	135	140
C. megano-tifera α	6	1.62	1.01	0.79	1.15	3.29	0.61	0.49	0.72	2.86	135	135
juv.	7	0.79	0.52	0.44	0.61	1.62	0.66	0.56	0.78	2.66	130	130
C. megano-tifera β	10	1.32	0.86	0.71	0.99	2.68	0.66	0.54	0.75	2.72	135	130
juv.	4	0.87	0.55	0.52	0.70	1.70	0.64	0.59	0.80	2.45	135	130
C. dorso-depressula	1	1.34	0.91	0.63	1.02	2.72	0.68	0.47	0.76	2.67	135	(125)
C. levis α	7	1.08	0.69	0.59	0.81	2.21	0.64	0.53	0.74	2.70	140	130
C. levis β	5	1.10	0.68	0.53	0.82	2.26	0.62	0.49	0.72	2.87	140	135
C. ventro-punctata	1	1.28	0.82	0.75	0.97	2.51	0.64	0.59	0.76	2.59	145	(115)
						Mean	0.64	0.51	0.75	2.30	135	130

ditoid group it occurs posterior to the midlength. The dorsal margin is proportionally considerably longer in the leperditoid group than in the non-leperditoid $\left(\frac{DM}{L}\right.$ on the average 0.75 and 0.57 resp.$\left.\right)$. In the former group, it was observed that young larvae have proportionally longer dorsal margin than later larval stages and adult specimens. The free margin is proportionally shorter in the leperditoid group $\left(\frac{FM}{DM}\right.$ on the average 2.30 and 3.85 resp.$\left.\right)$. In the leperditoid group it was observed that young larvae have proportionally shorter free margin than later larval stages and adults. The anterodorsal angles are on the average more obtuse in the leperditoid group; in both groups the anterodorsal angle is more obtuse than the posterodorsal one, i. e. the anterior margin is generally more convex than the posterior.

Non-leperditoid group:

	Number	L	H	G	D M	F M	H/L	G/L	D M/L	F M/D M	∧ ant	∧ post
C. ventro-incisurata α	6	0.90	0.57	0.40	0.50	1.97	0.64	0.45	0.56	3.99	150	140
C. ventro-incisurata β	4	0.81	0.53	0.51	0.44	1.86	0.65	0.63	0.54	4.32	145	145
C. minuta α	20	0.71	0.46	0.35	0.41	1.51	0.64	0.48	0.57	3.71	150	145
C. minuta β	10	0.64	0.41	0.40	0.38	1.36	0.65	0.62	0.59	3.67	145	140
C. minuta ab. *postero-reticulata*	2	0.69	0.44	0.37	0.40	1.40	0.64	0.55	0.58	3.52	150	145
						Mean	0.64	0.55	0.57	3.85	150	145

Genus *Aparchites* Jones 1889.

Genotype. *Aparchites whiteavesi* Jones 1889.

Occurrence. Ordovician—Devonian.

Diagnosis. The original diagnosis by Jones (1889, p. 384) was revised by Ulrich and Bassler (1923, p. 296). Bouček, in 1936 (p. 37), proposed that one group should be detached, i. e. those species which have rounded dorsal angles. He called this group *Neoaparchites* n. subg.

The diagnoses presented by these authors may be revised as regards the statement of the surface. The addition may be made that the surface is smooth or reticulate.

Remarks. Bassler and Kellett (1934) enumerate 43 *Aparchites* species, all of which, however, may not be taxonomically quite definite. Later, a few new species have been added, for instance by Bouček 1936 (3 species) and by Kay 1940 (1 species). The species listed by the authors now mentioned occur in the following manner:

	Europe	N. America	
Devonian	2	4	6
Gotlandian	12	6	18
Ordovician	5	12	17
	19	22	41

Besides these tabled species, there are 5 (4 American and 1 European) which are Ordovician or Gotlandian, and 1 American which is Gotlandian or Devonian.

Among the European Ordovician species 2 were observed in bed-rocks (Bala beds, England; Middle Ordovician) and 3 in North German drifts. The stratigraphic position of the latter ones is very uncertain. One of these species is reported from Sweden, i. e. *Aparchites canaliculatus* (KRAUSE) from the Island of Öland (ANDERSSON 1893).

In the present material there are 3 more new species. In two of them the dorsal corners are distinct, but in the third (*A. circumexaratus*) they are somewhat rounded.

Aparchites depressulus n. sp.

Pl. III, Figs. 15 and 16.

This species includes two types which are dissimilar mainly as regards the gibbosity; the dissimilarity appears from measurements. The types are possibly sexual dimorphisms; the sexes of the types are difficult to identify (cf. discussion below).

The two types, called α and β, are described separately.

Derivation of name. *depressulus* alludes to the rather depressed valves.

Holotype. The type figured in Pl. III, Fig. 15 is designated holotype (P. I. U. No. ar. os. 231).

Locality of holotype. Silverberg II, in Dalecarlia, Sweden.

Stratum of holotype. Lower Ordovician: stratum *G* (about 1 m below *G/R II.*)

Diagnosis. *Aparchites* of small size; possibly sexually dimorphic; valves lengthened and slightly flattened in the central and dorsal regions; most anterior end slightly arched, surface smooth.

Affinities. The species is somewhat reminiscent of *Aparchites circumexaratus* n. sp. which occurs in a higher horizon (lower part of *R II*). They are different in that *A. circumexaratus* is channelled along the free margin. Moreover, the dorsal margin is proportionally longer in *A. depressulus.*

Type α.

Pl. III, Fig. 15.

Type. This type includes the holotype (P. I. U. No. ar. os. 231).

Locality and stratum of type. Cf. above.

Material. 5 carapaces and valves from 2 localities.

Description. Carapace small; valves of practically equal size; overlap along free margin not observed; median part of dorsal region very slightly protruding over hinge line.

Hinge line straight and rather long; anterior margin slightly more curved than the posterior; ventral margin moderately convex.

Anterodorsal angle somewhat more obtuse than the posterodorsal.

Posterior part of carapace slightly higher than the anterior.

Dimensions.

No.	L	H	G	D M	F M	H/L	G/L	D M/L	F M/D M	∧ ant	∧ post	Remark
ar. os. 231	*0.57*	*0.35*	*0.26*	*0.48*	*1.09*	*0.62*	*0.46*	*0.84*	*2.28*	*130*	*125*	C
ar. os. 233	0.47	0.29	0.23	0.40	0.91	0.62	0.49	0.85	2.27	135	135	V
ar. os. 226	0.43	0.28	0.19	0.30	0.88	0.65	0.44	0.70	2.93	135	130	V
Mean	0.49	0.35 0.31 0.28	0.26 0.23 0.19	0.48 0.39 0.30	1.09 0.96 0.88	0.65 0.63 0.62	0.49 0.46 0.44	0.85 0.80 0.70	2.93 2.49 2.27	135	130	

Carapace rather flattened in the central and dorsal regions; the zone around the free margin steeply sloping; this steeply sloping zone is highest along anterior margin; surface sloping gently to dorsal margin.

Surface smooth.

In internal moulds a slight central muscle scar (just in front of the midlength and dorsal to the midheight) and a minute presulcate node are discernible; presulcate part slightly swollen, postsulcate flattened.

Occurrence. Lower Ordovician: lower part of stratum *G* (about 0.8 m above *RI/G* at Stenberg; at Silverberg II about 1.0 m below *G/RII*).

Type *β*.

Pl. III, Fig. 16.

Type. A characteristic type is shown in Pl. III, Fig. 16 (P. I. U. No. ar. os. 228).

Locality of type. Stenberg, in Dalecarlia, Sweden.

Stratum of type. Lower Ordovician: lower part of stratum *G* (about 0.8 m above *RI/G*).

Material. 8 valves from 2 localities.

Description. This type is very similar to type *α*; it is different mainly in being somewhat more gibbous. The other differences are insignificant: on the average, the dorsal margin seems to be proportionally somewhat shorter in type *β* and the free margin somewhat longer; furthermore, the anterodorsal angle may be somewhat more acute in type *β* and its posterodorsal angle somewhat more obtuse.

Notes on the larvae. In very young larvae, it was observed that the anterior end of the carapace is slightly swollen; the dorsal part of the swollen area is limited posteriorly by a very shallow depression. From the table it appears that in young larvae the anterodorsal angle is less obtuse than the posterodorsal; in later stages they are about equal.

Dimensions.

No.	L	H	G	D M	F M	$\frac{H}{L}$	$\frac{G}{L}$	$\frac{DM}{L}$	$\frac{FM}{DM}$	∧ ant	∧ post	Re-mark
ar. os. 232	0.59	0.37	0.35	0.39	1.19	0.63	0.59	0.66	3.05	135	135	V
ar. os. 225	0.54	0.35	0.37	0.42	1.05	0.65	0.69	0.78	2.50	135	135	V
ar. os. 228	*0.51*	*0.33*	*0.30*	*0.41*	*1.02*	*0.65*	*0.59*	*0.80*	*2.49*	*130*	*130*	V
ar. os. 224	0.47	0.30	0.28	0.40	0.93	0.64	0.60	0.85	2.33	125	135	V
ar. os. 230	0.43	0.26	0.26	0.33	0.86	0.60	0.60	0.77	2.60	125	140	V
ar. os. 227	0.37	0.23	0.23	0.27	0.79	0.62	0.62	0.73	2.93	130	140	V
ar. os. 229	0.26	0.18	0.17	0.16	0.57	0.69	0.65	0.62	3.56	130	140	V
Mean	0.45	0.37 0.29 0.18	0.37 0.28 0.17	0.42 0.34 0.16	1.19 0.92 0.57	0.69 0.64 0.60	0.69 0.62 0.59	0.85 0.74 0.62	3.56 2.78 2.33	130	135	

Occurrence. Lower Ordovician: lower part of stratum *G* (about 0.7—1.0 m above *R I*/*G*) at Stenberg and Granmor, in Dalecarlia, Sweden.

Discussion. The two types, distinguishable mainly in having different gibbosities, are possibly sexual dimorphisms, but it is scarcely possible to identify their sexes. The different gibbosity appears in the centroventral area, but the reason for the difference is unknown. Slight differences in the arching of the anterior part of the carapace were observed; as suggested (p. 138) the specimens which are more arched anteriorly may be males. However, distinct differences in this respect between the two groups could not be established.

Aparchites circumexaratus n. sp.

Pl. III, Fig. 14.

Derivation of name. *circumexaratus* alludes to the groove along the edge of the free margin.

Holotype. The type shown in Pl. III, Fig. 14 is holotype (P. I. U. No. ar. os. 234).

Locality of holotype. Röjeråsvägen, in Dalecarlia, Sweden.

Stratum of holotype. Lower Ordovician: lower part of *R II* (about 0.1 m above *G*/*R II*).

Material. 4 carapaces and valves from 4 localities.

Diagnosis. *Aparchites* of small size; valves slightly unequal, generally rather indistinctly channelled along the free margin; surface smooth or slightly rugose.

Dimensions.

No.	L	H	G	D M	F M	$\frac{H}{L}$	$\frac{G}{L}$	$\frac{DM}{L}$	$\frac{FM}{DM}$	Dorsal angles		Re-mark
ar. os. 237	1.01	0.63	0.56	0.81	2.03	0.62	0.55	0.80	2.51	135	125	V
ar. os. 236	0.59	0.38	0.28	0.47	1.18	0.64	0.48	0.80	2.51	130	125	V
ar. os. 234	*0.44*	*0.30*	*0.22*	*0.29*	*0.93*	*0.68*	*0.50*	*0.66*	*3.21*	*140*	*135*	C
ar. os. 235	0.40	0.26	0.26	0.31	0.78	0.65	0.65	0.78	2.51	125	120	V
Mean	0.61	0.63 0.39 0.26	0.56 0.33 0.22	0.81 0.47 0.29	2.03 1.23 0.78	0.68 0.65 0.62	0.65 0.54 0.48	0.80 0.76 0.66	3.21 2.68 2.51	130	125	

Affinities. The species is somewhat reminiscent of *Aparchites depressulus* n. sp. but differs in the valves of the present species being channelled along the free margin. *Aparchites canaliculatus* (KRAUSE), on the contrary, is more distinctly channelled than the present species.

Description. Carapace small; valves very slightly unequal; whether the left or the right valve is the larger could not be ascertained owing to the fact that positive characters for orientation of the carapace were not visible exteriorly.

Dorsal margin straight and generally rather long; anterior and posterior margins broadly and about equally rounded, ventral one moderately convex.

Dorsal angles slightly different (5—10°; angles 120—140°).

Carapace of about the same height anteriorly and posteriorly.

Carapace somewhat flattened in the central region; free marginal zone steeply sloping, dorsal region gently sloping; the marginal zone channelled, generally rather indistinctly.

Surface smooth; no traces of muscle marks visible.

In internal moulds a round central muscle spot is discernible at the midlength and somewhat dorsal to the midheight.

Occurrence. Lower Ordovician: upper part of stratum *G* and lower part of stratum *R II* (from about 0.1 m below *G*/*R II* to about 0.3 m above this boundary) at Röjeråsvägen, Leskusänget, Born-Dådran, and Rävanäs in Dalecarlia, Sweden.

Aparchites reticuliferus n. sp.

Pl. III, Fig. 13.

Derivation of name. *reticuliferus* alludes to the reticulate surface.

Holotype. The type shown in Pl. III, Fig. 13 is holotype (P. I. U. No. ar. os. 238).

Locality of holotype. Stenberg, in Dalecarlia, Sweden.

Stratum of holotype. Lower Ordovician: lower part of stratum *G* (about 0.2 m above *R I/G*).

Material. 3 valves from 1 locality.

Dimensions.

No.	L	H	G	D M	F M	H/L	G/L	D M/L	F M/D M	Dorsal angles		Remark
ar. os. 238	*0.50*	*0.31*	*0.26*	*0.40*	*0.98*	*0.62*	*0.52*	*0.80*	*2.45*	*135*	*130*	V
ar. os. 239	0.33	0.19	0.15	0.29	0.57	0.58	0.46	0.88	1.73	130	120	V
Mean	0.42	0.25	0.21	0.35	0.78	0.60	0.49	0.84	2.09	135	125	

Diagnosis. *Aparchites* of small size; valves reticulate anteriorly and posteriorly, sometimes also slightly reticulate ventrally; other parts smooth.

Affinities. The characteristic reticulation excludes confusion with other *Aparchites* species known.

Description. Carapace small and bean-like; whether the species is equivalved or not was not observed; also, owing to the fact that external characters indicating the orientation of the carapace were not apparent in this species, it was not definitely decided which end is anterior and which is posterior.

Dorsal margin straight and rather long; anterior and posterior margins broadly rounded, the one that corresponds to the larger dorsal angle somewhat more convex than the other; ventral margin rather much convex.

Dorsal angles slightly different: one of them 5—10° more obtuse than the other (angles 120—135°).

Carapace slightly higher at the end that corresponds to the smaller dorsal angle.

Carapace moderately arched; surface sloping rather gently to the dorsal margin; along a rather narrow free marginal zone it slopes steeply, especially at the end that corresponds to the smaller dorsal angle; along this part of the free margin, a very fine scratch was observed.

Surface distinctly reticulate in the anterior and posterior parts; "meshes" elongated conforming to the margins; an indistinct reticulum observed in young specimens in the ventral part of the valve, joining the anterior and posterior fields; central and dorsal areas, and a narrow limbate zone, are smooth.

Occurrence. Lower Ordovician: lower part of stratum *G* (about 0.2 m above *R I/G*) at Stenberg, in Dalecarlia, Sweden.

Survey of the dimensions of *Aparchites*.

The following mean data are based on few specimens and therefore not very representative.

The data indicate, however, that the 3 species described are of small

	Number	L	H	G	D M	F M	H/L	G/L	D M/L	F M/D M	∧ ant	∧ post
A. depressulus α	3	0.49	0.31	0.23	0.39	0.96	0.63	0.46	0.80	2.49	135	130
A. depressulus β	7	0.45	0.29	0.28	0.34	0.92	0.64	0.62	0.74	2.78	130	135
A. circumexaratus	4	0.61	0.39	0.33	0.47	1.23	0.65	0.54	0.76	2.68	—	—
A. reticuliferus	2	0.42	0.25	0.21	0.35	0.78	0.60	0.49	0.84	2.09	—	—
						Mean	0.63	0.53	0.79	2.51		

size. The data on the dimensional proportions are very reminiscent of those for the leperditoid group of *Conchoides* (p. 182). From this group the present *Aparchites* species are dimensionally different mainly in their having a proportionally longer dorsal margin and a shorter free margin.

Genus *Macronotella* ULRICH 1894.

Genotype. *Macronotella scofieldi* ULRICH 1894.

Occurrence. Ordovician—Gotlandian (Devonian?).

Diagnosis. The original diagnosis was completed by BONNEMA (1909, p. 55).

Discussion and remarks. Originally, the genus was suggested by ULRICH to belong to the family Kirkbyidae, but KAY referred it to the family Aparchitidae (1940, p. 244). This arrangement was supported by SCHMIDT (1941, p. 18), who drew the attention to the similarity to *Aparchites*, especially as regards the development of the free marginal zone. I agree with their opinion as regards the taxonomic position of *Macronotella*.

BASSLER and KELLETT (1934) enumerate 10 *Macronotella* species. BOUČEK (1936), ÖPIK (1937), TEICHERT (1937), KAY (1940), and SCHMIDT (1941) have referred 7 further species to this genus. These 17 species are distributed in the following way:

	Europe	N. America	Arctic Canada	
Devonian?		1		1
Gotlandian	2			2
Ordovician	7	6	1	14
	9	7	1	17

The American and Arctic Canadian Ordovician species belong to its middle part.

This is also the case as regards the 3 European ones which were found in bedrocks; 4 European Ordovician species are known only from North German drifts. From Sweden 2 *Macronotella* species have earlier been reported by THORSLUND (1940, p. 181).

3 Lower Ordovician species are described in this paper.

Macronotella fabuliformis n. sp.

Pl. IV, Figs. 3 and 4.

Derivation of name. *fabuliformis* alludes to the bean-like appearance of the carapace.

Holotype. The type shown in Pl. IV, Fig. 3 is holotype (P. I. U. No. ar. os. 246).

Locality of holotype. Gulleråsen, in Dalecarlia, Sweden.

Stratum of holotype. Lower Ordovician: upper part of stratum *G* (about 0.3 m below *G*/*R II*).

Material. 20 carapaces and valves from 6 localities.

Dimensions.

No.	L	H	G	D M	F M	H / L	G / L	D M / L	F M / D M	∧ ant	∧ post	Remark
ar. os. 246	*0.85*	*0.58*	*0.41*	*0.54*	*1.79*	*0.68*	*0.48*	*0.64*	*3.31*	*135*	*140*	C
ar. os. 247	0.76	0.51	0.40	0.51	1.63	0.68	0.53	0.67	3.20	130	140	M
ar. os. 240	0.73	0.50	0.35	0.50	1.55	0.69	0.48	0.69	3.10	135	135	M
ar. os. 241	0.73	0.53	0.42	0.44	1.67	0.73	0.58	0.60	3.80	140	145	M
ar. os. 242	0.72	0.50	0.35	0.45	1.58	0.70	0.49	0.63	3.51	135	145	M
ar. os. 243	0.72	0.49	0.42	0.48	1.45	0.68	0.58	0.75	3.02	135	140	M
ar. os. 245	0.65	0.44	0.33	0.47	1.45	0.68	0.51	0.72	3.08	130	135	C
Mean	0.74	0.58 0.51 0.44	0.42 0.38 0.33	0.54 0.49 0.44	1.79 1.59 1.45	0.73 0.69 0.68	0.58 0.52 0.48	0.75 0.67 0.60	3.80 3.28 3.02	135	140	

Diagnosis. *Macronotella* of small size, shape resembling a small bean; hinge line rather short, concealed by the slightly protruding dorsal areas; right valve overlaps the left; valves circum-marginally channelled; surface pitted, except the central muscle spot and a limbate zone; pits are openings of bulbously swollen perforations of the valves.

Affinities. The species is very reminiscent of *Macronotella kuckersiana* BONNEMA from Estonian Middle Ordovician strata. They are different in that the pits of *M. kuckersiana* are arranged in rows conforming to the margins, which is not the case in *M. fabuliformis.*

Description. Carapace small and formed like a bean; the right valve is larger and overlaps the left; the edge of the left valve fits into a corresponding groove of the right valve.

Hinge line straight and rather short, concealed by the slightly protruding dorsal areas; anterior and posterior margins broadly and regularly rounded; ventral margin moderately convex.

Dorsal protrusions over hinge line (umbones) narrow and ridged, and running parallel to the hinge line throughout its length; the umbo of the right valve slightly higher and more acute than that of the left.

Posterodorsal angle generally somewhat more obtuse than the anterodorsal.

Valves moderately arched; surface gently and regularly sloping; in adult specimens both valves are distinctly channelled along the free margin, in younger stages the channels are indistinct or lacking.

Central muscle spot large, rounded, and situated just in front of the midlength and just above the midheight; externally it is smooth but in internal moulds minutely pitted.

Surface distinctly pitted, except the central muscle spot and a marginal zone which is smooth; this zone is narrow anteriorly, posteriorly and ventrally; dorsally it is relatively but variably broad (sometimes it is very broad extending to the dorsal part of the central muscle spot).

Surface pits small but distinct; they are openings of perforations which very likely contained sensory bristles; the perforations are bulbously swollen in the middle part (Pl. XII, Fig. 5); they open inwards through a short and very narrow tube; owing to the bulbous swellings, the inner side of carapace is elevated around the openings of the fine tubes causing corresponding pits in the internal moulds; these pits are wider and situated more closely together than those of the carapace.

Occurrence. Lower Ordovician: upper part of stratum *G* and lower part of stratum *R II* (from about 0.3 m below *G*/*R II* to about 0.7 m above this boundary) at Gulleråsen, Leskusänget, Röjeråsvägen, Born-Dådran, Rävanäs, and Silverberg II, in Dalecarlia, Sweden.

Macronotella planosalebrosa n. sp.

Pl. IV, Fig. 1.

Derivation of name. *planosalebrosa* alludes to the fact that the carapace is shallowly pitted.

Holotype. The type shown in Pl. IV, Fig. 1 is holotype (P. I. U. No. ar. os. 253).

Locality of holotype. Leskusänget, in Dalecarlia, Sweden.

Stratum of holotype. Lower Ordovician: middle part of stratum *G* (about 1.6 m below *G/R II*).

Material. 2 specimens (one carapace) from 1 locality.

Dimensions.

No.	L	H	G	D M	F M	H/L	G/L	D M/L	D M/F M	∧ ant	∧ post	Re-mark
ar. os. 254	0.91	0.63	0.50	0.59	1.97	0.69	0.55	0.65	3.34	135	140	V
ar. os. 253	*0.84*	*0.57*	*0.48*	*0.57*	*1.71*	*0.68*	*0.57*	*0.68*	*3.00*	*130*	*140*	C
Mean	0.88	0.60	0.49	0.58	1.84	0.69	0.56	0.67	3.17	135	140	

Diagnosis. *Macronotella* of small size, bean-shaped; hinge line rather short, concealed by slightly protruding, narrow, and elongated umbones; left valve overlapped along the free margin; valves shallowly channelled along the free margin; central muscle spot very indistinct, scarcely discernible; surface pitted, especially in a broad free marginal zone, pits rather wide but very shallow.

Affinities. The species is very reminiscent of *M. fabuliformis* n. sp. and *M. kuckersiana* BONNEMA in general shape, all three being bean-like. They are also practically equal as regards umbones and the appearance of the free margin. The differences comprise the central muscle spot and the surface pits. The present species and *M. fabuliformis* are different from *M. kuckersiana* in that they have an indistinct muscle spot and that the pits are not arranged in rows conforming to the margins. *M. planosalebrosa* and *M. fabuliformis* are different in that the pits of the former species are relatively wide and shallow and those of the latter being relatively deep and narrow. Furthermore, in the former the pits are situated mainly in a broad free marginal zone, in the latter they occupy the central region.

Description. Carapaces small and bean-like; right valve larger, overlapping the left one along the free margin; edge of left valve minutely ridged, ridge fits into a corresponding groove of the right valve.

Hinge line straight and rather short, concealed by the slightly protruding dorsal areas, which thus form umbones; anterior and posterior margins regularly and about equally rounded, ventral one moderately convex.

Umbones elongated and narrow, and parallel to the hinge line; that of the right valve considerably larger.

Posterodorsal angle seems to be somewhat more obtuse than the anterodorsal one.

Valves moderately arched; surface gently and regularly sloping; a shallow channel runs along the free margin.

Central muscle spot situated in a smooth central field, very indistinct and scarcely discernible.

Surface irregularly pitted, especially in a broad free marginal zone; pits rather wide but very shallow (in one specimen the pits are most abundant in the ventral area, in another they are most numerous in the posterior part of the valve).

Occurrence. Lower Ordovician: middle part of stratum *G* (about 0.8—1.6 m below *G/R II*) at Leskusänget, in Dalecarlia, Sweden.

Macronotella reticulata n. sp.

Pl. IV, Figs. 2, 5, and 6.

Derivation of name. *reticulata* alludes to the fact that the carapace is reticulate.

Holotype. The type shown in Pl. IV, Fig. 5 is holotype (P. I. U. No. ar. os. 248).

Locality of holotype. Silverberg II, in Dalecarlia, Sweden.

Stratum of holotype. Lower Ordovician: lower part of stratum *G* (just above *G/R II*).

Material. 9 valves from 3 localities.

Diagnosis. *Macronotella* of small size; distinctly channelled along the free margin; shallow and short dorsocentral and central depression, the ventral part of which is occupied by the large central muscle spot; just in front of the depression a very low node; surface, except the channelled zone and the central muscle spot, reticulate.

Affinities. The species is reminiscent of *Euprimitia* but may not belong to this genus since it has no real sulcus but merely a very shallow depression. The large and, in weathered specimens, clearly distinguishable central muscle spot indicates the species to belong to *Macronotella* (cf. Pl. IV, Fig. 5).

The reticulate surface allows this species to be differentiated from other known species of *Macronotella*.

Description. Carapace small; whether or not it is equivalved was not determined, since only separate valves were observed.

Dorsal margin straight and moderately long; anterior and posterior margins nearly equally rounded, ventral one slightly convex.

Anterodorsal angle mostly somewhat more obtuse than the posterodorsal.

Free margin surrounded by a very distinct channel; margins of the channels extended into ridges, one running along the free margin; the other starts exactly in the anterodorsal angles, and its distance from the free margin grows continually larger in the ventral direction; it does not protrude sufficiently, however, to conceal the free margin.

The carapace moderately arched, posterior part more than anterior; surface regularly sloping.

Dimensions.

No.	L	H	G	D M	F M	H/L	G/L	D M/L	F M/D M	∧ ant	∧ post	Re-mark
ar. os. 252	0.93	0.58	0.51	0.70	1.83	0.62	0.55	0.75	2.61	140	130	V
ar. os. 248	*0.81*	*0.51*	*0.44*	*0.55*	*1.69*	*0.63*	*0.54*	*0.68*	*3.07*	*150*	*140*	V
ar. os. 250	0.79	0.51	0.44	0.54	1.72	0.64	0.56	0.68	3.44	135	135	V
ar. os. 249	0.67	0.43	0.36	0.47	1.37	0.64	0.54	0.70	2.91	135	130	V
ar. os. 251	0.63	0.40	0 37	0.47	1.28	0.63	0.59	0.75	2.72	145	135	V
Mean	0.77	0.58 0.49 0.40	0.51 0.42 0.36	0.70 0.55 0.47	1.83 1.58 1.28	0.64 0.63 0.62	0.59 0.55 0.54	0.75 0.71 0 68	3.44 2.95 2.61	140	135	

In the dorsocentral and central areas and somewhat in front of the midlength is a short and very shallow dorsoventral depression (corresponding to *S II*); its ventral part occupied by the large but somewhat indistinct central muscle spot; just in front of the depression (in the dorsocentral area) a very low node is discernible; faint swellings occur just ventrally and posteriorly of the depression.

Surface reticulate, with the exception of the central muscle spot and the channelled area, which are smooth; in its marginal part the reticulum is elongated conforming to the margin (in some specimens the surface in this zone is covered with wrinkled lines).

Occurrence. Lower Ordovician: upper part of stratum *G* and lower part of stratum *R II* (from about 0.1 m below *G/R II* to about 0.5 m above this boundary) at Silverberg II, Born-Dådran, and Rävanäs, in Dalecarlia, Sweden.

Survey of the dimensions of *Macronotella*.

	Num-ber	L	H	G	D M	F M	H/L	G/L	D M/L	F M/D M	∧ ant	∧ post
M. fabuliformis	7	0.74	0.51	0.38	0.49	1.59	0.69	0.52	0.67	3.28	135	140
M. planosalebrosa	2	0.88	0.60	0.49	0.58	1.84	0.69	0.56	0.67	3.17	135	140
M. reticulata	5	0.77	0.49	0.42	0.55	1.58	0.63	0.55	0.71	2.95	140	135
						Mean	0.67	0.54	0.68	3.13	135	140

From the survey it appears that the 3 *Macronotella* species described in this paper are of small size. Furthermore, it appears that there are only minor differences as regards the dimensional proportions. In this respect, there are closer affinities between *M. fabuliformis* and *M. planosalebrosa* than between any of these species and *M. reticulata*. This coincides with the morphological characters.

Genus *Ceratocypris* POULSEN 1934.

Genotype. *Ceratocypris symmetrica* POULSEN 1934.

Occurrence. Ordovician—Gotlandian.

Diagnosis. POULSEN gave only a short description of the genotype (1934, p. 38). BASSLER and KELLETT (1934) summed up the most important characters on the basis of POULSEN's now mentioned description.

As will be shown in the following discussion there is reason to give the carapace a different orientation from that proposed by POULSEN. Since, moreover, the present investigation yields some additional data of this genus which was hitherto considered monotypic, the following generic diagnosis may be proposed:

Ostracods of rather small size ($<$ 1—about 1.5 mm); dorsal margin straight, ventral region of carapace swollen and protruding over ventral margin and extending backwards into a hollow spine; free marginal area slightly channelled; surface smooth.

Discussion and remarks. POULSEN provisionally referred *Ceratocypris* to Bairdiidae but he adds that "it is very questionable whether it really belongs to that family" (1934, p. 38). In my opinion the genus most likely belongs to the family Aparchitidae.

POULSEN orientates the carapace so that the spiniferous region is situated dorsally. This orientation may not be correct. If the carapace is given this orientation, the ventral margin should be straight and long and the ventral corners should be distinctly angled. More likely, this margin is the dorsal one (Pl. IV, Fig. 7). The correctness of this orientation is supported by the appearance of dorsal and ventral margins, as visible in transverse sections (Pl. XII, Fig. 7): the dorsal margin is of about uniform thickness but the ventral one is swollen and then acute, thus forming an edge which probably fitted into a corresponding furrow in the opposite valve, as is generally seen in transverse sections of ostracods.

As regards the anterior-posterior orientation, the spiniferous part of the carapace is the posterior one. In this orientation the spine is directed backwards as is the case in recent ostracods. Furthermore, the central muscle spot is situated in the anterior part of the carapace which is also true for recent species.

Ceratocypris is similar to *Aparchites* in several respects: in the appearance of outline, in the ventral region being swollen and protruding over the ventral margin, in the marginal zone being partly channelled, and in the surface being smooth. The spine, which by POULSEN is considered a character of generic value, distinguishes *Ceratocypris* from *Aparchites*. From the reasons now mentioned it may be appropriate to refer *Ceratocypris* to the family Aparchitidae.

The genotype was the only *Ceratocypris* species hitherto known. This was found in an Upper Llandovery deposit in North Greenland. *Primitiella cornuta* KUMMEROW, found in a North German Ordovician drift, is possibly a *Ceratocypris* (cf. below).

Ceratocypris longispina n. sp.

Pl. IV, Figs. 7—12.

This species is separable into 2 groups as regards the gibbosity. Whether the different gibbosity is accidental or whether it is due to sexual dimorphism is very difficult to say (cf. discussion below).

The groups are described separately under the type denominations α and β.

Derivation of name. *longispina* alludes to the rather long spine.

Holotype. The type shown in Pl. IV, Fig. 7 is holotype (P. I. U. No. ar. os. 256).

Locality of holotype. Leskusänget, in Dalecarlia, Sweden.

Stratum of holotype. Lower Ordovician: lower part of stratum *G* (about 0.2 m above *G*/*R II*).

Material. 34 valves of α and β types from 3 localities.

Diagnosis. *Ceratocypris* of moderate or fairly large size with a rather long and acuminate spine directed somewhat posterodorsally; ventral region swollen and protruding over the margin; free marginal zone minutely channelled; surface smooth.

Affinities. The present species is different from the genotype (the only species hitherto referred to *Ceratocypris*) in that the spine is longer and directed posterodorsally (that of the genotype directed posteroventrally) and in that the anterior end is widely curved (that of the genotype is truncate).

The species described by KUMMEROW as *Primitiella cornuta* (1924, p. 420, Pl. 20, Fig. 13) is possibly a *Ceratocypris*. It is similar to *C. longispina* in many respects, but the spine is different, according to both the description and the figure, so the species may not be identical. Identity would really be conceivable, since KUMMEROW's type is said to occur together with *Pinnatulites procera* (KUMMEROW); *C. longispina* and *P. procera* form in the Siljan District very characteristic associates.

Occurrence. Lower Ordovician: upper part of stratum *G* and lower part of stratum *R II* (from about 0.1 m below *G*/*R II* to about 0.8 m above this boundary) at Leskusänget, Born-Dådran, and Rävanäs, in Dalecarlia, Sweden.

Type α.

Pl. IV, Figs. 8 and 10.

Type. One characteristic specimen is shown in Pl. IV, Fig. 10 (P. I. U. No. ar. os. 258).

Locality of type. Leskusänget, in Dalecarlia, Sweden.

Stratum of type. Lower Ordovician: lower part of stratum *R II* (about 0.7 m above *G*/*R II*).

Material. Cf. p. 196.

Dimensions.

No.	L	H	G	D M	F M	H/L	G/L	D M/L	F M/D M	∧ ant	∧ post	Re-mark
ar. os. 258	*1.45*	*0.92*	*1.02*	*1.21*	*2.70*	*0.63*	*0.70*	*0.84*	*2.33*	*125*	*110*	V
ar. os. 259	1.32	0.88	0.92	1.08	2.56	0.67	0.70	0.82	2.37	125	100	V
ar. os. 255	1.08	0.67	0.77	0.88	2.14	0.62	0.71	0.82	2.46	125	105	V
ar. os. 261	0.84	0.50	0.57	0.75	1.63	0.60	0.68	0.89	2.17	125	110	V
ar. os. 263	0.63	0.37	0.42	0.55	1.14	0.59	0.67	0.87	2.04	130	105	V
Mean	1.06	0.92 0.67 0.37	1.02 0.74 0.42	1.21 0.90 0.55	2.70 2.04 1.14	0.67 0.63 0.59	0.71 0.69 0.67	0.89 0.85 0.82	2.46 2.27 2.04	125	105	

Description. This type is identical with type *β*, except in being somewhat more gibbous. One large specimen of this type was observed to have a proportionally small spine.

Occurrence. Cf. p. 196.

Type *β*.

Pl. IV, Figs. 7 and 9.

Type. This type includes the holotype (P. I. U. No. ar. os. 256).

Locality and stratum of type. Cf. p. 196.

Material. Cf. p. 196.

Description. Carapace moderately large; whether or not it is equivalved was not observed, since only separate valves were found.

Dorsal margin straight and long; anterior margin broadly rounded, posterior one somewhat truncate; ventral margin moderately convex, concealed by the swollen ventral region.

Anterodorsal angle more obtuse than the posterodorsal.

Posterior part of carapace slightly higher than the anterior.

Valves differently arched in different parts: dorsally and especially posteriorly flattened, anterior part somewhat more arched and slightly

Dimensions.

No.	L	H	G	D M	F M	$\frac{H}{L}$	$\frac{G}{L}$	$\frac{DM}{L}$	$\frac{FM}{DM}$	∧ ant	∧ post	Re-mark
ar. os. 260	1.35	0.79	0.79	1.08	2.44	0.59	0.59	0.80	2.26	130	110	V
ar. os. 257	1.08	0.65	0.67	0.92	2.04	0.60	0.62	0.85	2.21	130	100	V
ar. os. 262	0.98	0.60	0.57	0.82	1.98	0.61	0.58	0.84	2.41	125	100	V
ar. os. 256	*0.93*	*0.57*	*0.57*	*0.77*	*1.79*	*0.61*	*0.61*	*0.83*	*2.32*	*125*	*100*	V
ar. os. 264	0.49	0.29	0.29	0.42	0.94	0.59	0.59	0.86	2.24	130	105	V
Mean	0.96	0.79 0.58 0.29	0.79 0.58 0.29	1.08 0.80 0.42	2.44 1.84 0.94	0.61 0.60 0.59	0.62 0.60 0.58	0.86 0.83 0.80	2.41 2.30 2.21	130	105	

protruding over anterior margin, ventral region swollen and protruding over ventral margin; the swollen region regularly convex, except in the area between the spine and corresponding part of the ventral margin which is slightly concave (much more concave in internal moulds [Pl. IV, Fig. 11]).

Valves minutely channelled along the free margin.

Posterior part of the swollen ventral region extended into a rather long and slender spine with acute end; it is hollow and directed somewhat posterodorsally.

Surface smooth; in some specimens, especially in internal moulds, one may observe near the midheight and just in front of the midlength the very indistinct central muscle spot.

The valves are rather thick, except at the dorsal margin.

Occurrence. Cf. p. 196.

Discussion. It is difficult to decide the significance of the difference in gibbosity which was observed in the measurements and upon which the separation of the species in the groups α and β is based. The possibility that the groups are sexual dimorphisms may not be excluded. The more gibbous group (α) seems to be somewhat more arched not only in the swollen midlength part of the ventral region but also in the anterior part of the carapace. This indicates more powerful locomotive organs; possibly this type is male (cf. p. 138).

Genus *Pinnatulites* n. gen.

Derivation of name. *Pinnatulites* alludes to the fact that the posterior part of the swollen ventral region is slightly pinched so that it has a fin-like appearance.

Genotype. *Primitiella procera* KUMMEROW 1924.

Occurrence. Ordovician.

Diagnosis. Ostracods of moderate size (< 1—about 2 mm); right valve observed to overlap the left one; dorsal margin straight and rather long; anterior margin more rounded than the posterior; ventral region (rounded or angled) usually more or less protruding over ventral margin; surface smooth, rugose, or punctate; muscular attachments generally not visible on the carapace.

Affinities. This genus is certainly closely related to *Ceratocypris* POULSEN. The genera are very similar in general shape (dorsal margin straight and long; posterodorsal angle distinctly more obtuse than the anterodorsal; anterior part of carapace slightly arched, posterior part flattened; ventral region swollen and often more or less protruding over ventral margin). They are particularly reminiscent of each other as regards the appearance of the posterior part of the swollen ventral area: in *Ceratocypris* it is extended into a spine, in *Pinnatulites* it is projected into only a very small process that is somewhat depressed laterally, which gives this part of the carapace a slightly fin-like appearance.

Pinnatulites procera is the species which most resembles *Ceratocypris* as regards the appearance of the posterior part of the ventral region.

Pinnatulites procera (KUMMEROW).

Pl. IV, Figs. 14 and 15.

1924. *Primitiella procera* KUMMEROW, p. 419.

Holotype. The type shown by KUMMEROW is the holotype (1924, Pl. 20, Fig. 12).

Locality of holotype. Drift boulder of red *Orthoceras* Limestone from East Prussia. Origin unknown.

Stratum of holotype. Unknown.

Material. The frequency of the species in the East Prussian drift is not mentioned by KUMMEROW. In the present material 1 carapace, and 100 valves and internal moulds were observed in 6 localities.

Diagnosis. *Pinnatulites* of moderate or rather large size; right valve overlaps the left; anterior part of carapace distinctly broader than the posterior; the slightly swollen ventral region most gibbous just behind the midlength; its posterior part extended into a minute protrusion (in internal moulds often scarcely visible); surface distinctly pitted in one anterior and one posterior field; the pits rounded and sometimes somewhat longitudinally elongated (reminiscent of cuneiform characters); in internal moulds the pits are very distinct and rounded; valves prismatic.

Affinities. This species is easily distinguishable and may not be confused with any species on account of its general shape and its very characteristic pitted fields.

Dimensions.

No.	L	H	G	D M	F M	H/L	G/L	D M/L	F M/D M	∧ ant	∧ post	Remark
[1]	1.93	1.00	0.80	1.40	3.60	0.53	0.42	0.73	2.57	140	135	
ar. os. 267	1.89	1.01	0.81	1.58	3.52	0.54	0.43	0.84	2.23	130	110	V
ar. os. 278	1.83	1.05	0.79	1.46	3.37	0.58	0.43	0.80	2.31	130	115	V
ar. os. 280	1.56	0.88	0.68	1.26	2.89	0.56	0.44	0.81	2.29	130	115	V
ar. os. 275	1.17	0.72	0.51	0.90	2.32	0.62	0.44	0.77	2.58	130	115	V
ar. os. 281	1.15	0.65	0.54	0.88	2.17	0.57	0.47	0.77	2.47	135	115	C
ar. os. 273	0.96	0.49	0.42	0.73	1.75	0.51	0.44	0.76	2.40	140	130	M
ar. os. 279	0.95	0.50	0.41	0.73	1.72	0.53	0.43	0.77	2.36	130	120	M
ar. os. 276	0.94	0.54	0.42	0.73	1.73	0.58	0.45	0.78	2.37	125	115	M
ar. os. 277	0.89	0.47	0.35	0.73	1.47	0.53	0.40	0.82	2.01	130	120	M
ar. os. 268	0.87	0.51	0.44	0.71	1.65	0.59	0.51	0.82	2.32	135	115	M
ar. os. 266	0.84	0.47	0.42	0.69	1.56	0.56	0.50	0.82	2.26	135	115	V
ar. os. 269	0.83	0.48	0.37	0.69	1.53	0.57	0.45	0.83	2.22	135	105	M
ar. os. 270	0.80	0.42	0.35	0.65	1.35	0.53	0.44	0.81	2.07	140	120	M
ar. os. 271	0.80	0.42	0.35	0.67	1.40	0.53	0.44	0.84	2.10	135	115	V
ar. os. 272	0.67	0.35	0.32	0.55	1.16	0.52	0.48	0.82	2.11	130	120	M
ar. os. 274	0.64	0.35	0.30	0.49	1.18	0.55	0.47	0.77	2.40	125	120	M
Mean	1.10	1.01 0.61 0.35	0.81 0.48 0.30	1.58 0.87 0.49	3.60 2.02 1.16	0.59 0.55 0.51	0.51 0.44 0.40	0.84 0.79 0.73	2.58 2.30 2.01	130	120	

[1] = Holotype as drawn by KUMMEROW (1924, Pl. 20, Fig. 12); possibly an internal mould, cf. below.

The identity of the present specimens with *Primitiella procera* KUMMEROW may scarcely be doubted. KUMMEROW's side view drawing of the species is not quite in agreement, but the drawings from ventral and anterior views agree well with the appearance of the present specimens. The lack of agreement mentioned comprises mainly the fact that KUMMEROW's specimen is not pinched posteroventrally. This feature is less distinctly developed in internal moulds than in carapaces. KUMMEROW's specimen seems to be an internal mould and he may have overlooked the pinching. Furthermore, the posterodorsal angle of his specimen is different from that of the present ones, and the position of the central muscle spot is also different, but owing to my experience of this species I think these discrepancies are due to a slight error in the drawing by KUMMEROW. A consequence of the fact that the posterodorsal angle of KUMMEROW's specimen may be too large is that the dorsal margin has become proportionally somewhat shorter than that of the present specimens and the free margin proportionally somewhat longer; otherwise there is good correspondence between KUMMEROW's specimen and the present ones.

Description. Carapace of moderate or rather large size, somewhat elongated; right valve overlaps the left one along ventral margin and along ventral parts of anterior and posterior ones.

Dorsal margin straight and long; anterior margin regularly rounded, posterior one straight or slightly concave in the dorsal part and broadly convex in the ventral; ventral margin slightly convex.

Anterodorsal angle more obtuse than the posterodorsal.

Carapace about equally high in anterior and posterior parts; anterior part distinctly broader than posterior.

Carapace forms an angle (*Umbiegungskante*) conforming to anterior and ventral margins, separating anterior and ventral areas from the rest of the carapace (this angle very distinct in internal moulds); angle acute anteriorly where a very slight protrusion is formed over ventral part of anterior margin, but obtuse ventrally; angled area projected backwards in a very short process (generally scarcely discernible in internal moulds).

Carapace between the angle and the dorsal margin rather flat; most gibbous part just at the angle and near the midlength or slightly posterior to the midlength; surface somewhat concave in front of it, and very slightly concave or plane behind it (these parts distinctly concave in internal moulds); surface gently sloping to dorsal and posterior margins.

Surface between the angle and the dorsal area pitted in two fields: one anterior and one posterior, both situated mainly in the ventral half of the carapace (a few scattered pits just ventral to the central muscle spot join the two fields); in the anterior field are about 20—25 pits, in the posterior about 25—30; those in the anterior field are slightly larger and more distinct than those in the posterior; in the carapace the pits are rounded and partly somewhat elongated, thus resembling cuneiform characters, the "arrows" pointing anteriorly and posteriorly resp.; in internal moulds the pits are invariably rounded and deeper than those of the carapace; in transverse sections of the carapace it is seen that the pits are funnel-shaped, the broader part generally directed inwards: they possibly contained sensory bristles; non-pitted parts of the surface smooth.

Muscular attachments generally not visible externally; in internal moulds, an indistinct and rounded central muscle spot discernible just in front of the midlength and dorsal to the midheight.

Valves prismatic; they are often very thick ventrally.

Occurrence. East Prussian drifts of unknown origin (KUMMEROW 1924, p. 419); Sweden: lower Ordovician: upper part of stratum *G* and lower part of stratum *R II* (from about 0.8 m below *G/R II* to about 1.0 m above this boundary) at Leskusänget, Gulleråsen, Born-Dådran, Rävanäs, Silverberg II, and Röjeråsvägen, in Dalecarlia.

Pinnatulites microrugosa n. sp.

Pl. IV, Fig. 13.

This type is represented by one specimen only. The type is very characteristic, however, and hence I describe it as a new species.

Derivation of name. *microrugosa* alludes to the fact that the surface is minutely rugose for the most part.

Holotype. The type shown in Pl. IV, Fig. 13 is holotype (P. I. U. No. ar. os. 281).

Locality of holotype. Leskusänget, in Dalecarlia, Sweden.

Stratum of holotype. Lower Ordovician: upper part of stratum *G* (about 1.0 m below the boundary *G/R II*).

Material. One valve, somewhat imperfectly preserved in the dorsal corners.

Dimensions.

No.	L	H	G	D M	F M	$\frac{H}{L}$	$\frac{G}{L}$	$\frac{DM}{L}$	$\frac{FM}{DM}$	$\wedge$ ant	$\wedge$ post	Remark
ar. os. 281	1.14	0.68	0.65	1.00	2.04	0.60	0.57	0.88	2.04	125	120	V

Diagnosis. *Pinnatulites* of moderate size; ventral region angled conforming to the ventral margin, and protruding over the margin; its posterior part slightly pinched; surface minutely rugose.

Affinities. The species may not be confused with other *Pinnatulites* species. It is somewhat reminiscent of *P. tumida* n. sp. but is different in several respects (cf. p. 203).

Description. Carapace moderately large; since only one valve was observed, it is not known whether or not the carapace is equivalved.

Dorsal margin straight and presumably long; anterior margin seems to be somewhat more rounded than the posterior; ventral margin moderately convex.

Anterodorsal angle seems to be somewhat more obtuse than the posterodorsal.

Carapace of about equal height in anterior and posterior parts; it is distinctly broader in the anterior end than in the posterior.

Ventral margin concealed by an angled (carinoid) protrusion of the ventral region; it runs parallel to the greater part of the ventral margin; its edge is slightly acute, in the posterior part somewhat pinched.

Area between the carinoid edge and the ventral margin broad and plane; region between the edge and the dorsal margin flattened; surface sloping very gently to dorsal margin and to the dorsal part of posterior margin; to the ventral part of posterior margin sloping more steeply, to the anterior margin very steeply.

Surface of the region between the carinoid edge and the dorsal margin smooth in the central part, otherwise minutely but distinctly rugose; area between the edge and ventral margin smooth.

Occurrence. Lower Ordovician: upper part of stratum *G* (about 1.0 m below *G/R II*) at Leskusänget, in Dalecarlia, Sweden.

Pinnatulites tumida n. sp.

Pl. IV, Fig. 16.

Only one carapace of the present type was observed, but since it is very characteristic it is described as a new species.

Derivation of name. *tumida* alludes to the slightly swollen carapace.

Holotype. The type shown in Pl. IV, Fig. 16 is holotype (P. I. U. No. ar. os. 282).

Locality of holotype. Gulleråsen, in Dalecarlia, Sweden.

Stratum of holotype. Lower Ordovician: upper part of stratum *G* (about 0.7 m below *G/R II*).

Material. One carapace, slightly damaged at the dorsal corners.

Dimensions.

No.	L	H	G	D M	F M	$\frac{H}{L}$	$\frac{G}{L}$	$\frac{D M}{L}$	$\frac{F M}{D M}$	Λ ant	Λ post	Remark
ar. os. 282	0.81	0.56	0.49	0.65	1.68	0.69	0.61	0.80	2.59	130	115	C

Diagnosis. *Pinnatulites* of rather small size; carapace slightly tumid and proportionally short and high; ventral region swollen, that of the left valve concealing the ventral margin; surface minutely rugose, rugae directed longitudinally.

Affinities. The species is scarcely confusable with other *Pinnatulites* species. It is somewhat reminiscent of *P. microrugosa* n. sp. but they are distinguishable in that *P. tumida* is proportionally shorter, higher and somewhat tumid; furthermore, the ventral region is different in that the swollen part of *P. microrugosa* is proportionally shorter and edged throughout its length (in *P. tumida* it is rounded).

Description. Carapace rather small; ventral overlap not definitely ascertained.

Dorsal margin seems to be straight or slightly convex, and long; anterior and posterior margins regularly rounded, ventra one moderately convex.

Anterodorsal angle seems to be somewhat more obtuse than the posterodorsal.

Carapace rather higher in the anterior part than in the posterior.

Carapace somewhat tumid; surface sloping rather gently to dorsal, anterior, and posterior margins; ventral region swollen; valves a little different in some respects: left valve more swollen ventrally than the right, so that the ventral margin is concealed, which is not the case as regards the right valve; posterior part of the swollen ventral region slightly pinched in left valve but distinctly in the right; posterior area more flattened in the right valve than in the left.

Surface minutely rugose; rugae wrinkled and running mainly longitudinally; ventral area smooth; muscular attachments not observed.

Occurrence. Lower Ordovician: upper part of stratum *G* (about 0.7 m below *G/R II*) at Gulleråsen, in Dalecarlia, Sweden.

Survey of the dimensions of *Pinnatulites.*

Owing to the fact that 2 of the 3 *Pinnatulites* species are represented by only one specimen each (also none of them quite perfectly preserved), the following data may not be very representative. The table indicates, however, that as a rule the dorsal margin is long, and that the anterodorsal angle is somewhat more obtuse than the posterodorsal. It appears that *P. procera* is proportionally low and slightly gibbous, whereas *P. tumida* is proportionally high and rather gibbous; *P. microrugosa* takes an intermediate position in these respects.

	Number	L	H	G	D M	F M	$\frac{H}{L}$	$\frac{G}{L}$	$\frac{DM}{L}$	$\frac{FM}{DM}$	∧ ant	∧ post
P. procera	17	1.10	0.61	0.48	0.87	2.02	0.55	0.44	0.79	2.30	130	120
P. microrugosa	1	1.14	0.68	0.65	1.00	2.04	0.60	0.57	0.88	2.04	125	120
P. tumida	1	0.81	0.56	0.49	0.65	1.68	0.69	0.61	0.80	2.59	130	115
						Mean	0.61	0.54	0.82	2.31	130	120

Family *Primitiidae* Ulrich and Bassler 1923.

Diagnosis. Ulrich and Bassler 1923, p. 297.

Discussion. The taxonomy of this family has been extensively discussed. Different opinions have appeared both as regards its range and the grouping of its genera to subfamilies.

Originally, 23 genera were referred to Primitiidae; 5 of them were grouped in a subfamily (Eurychilininae). The remaining 18 genera + 2 others were grouped in the subfamily Primitiinae by Bassler and Kellett 1934.

BOUČEK, in 1936, detached 6 (possibly 8) genera from Primitiinae (the subfamilies Bollinae and Aechmininae). In the same year, SWARTZ revised Primitiidae. He proposed 3 new families to be erected (Drepanellidae, Acronotellidae and Primitiopsidae) and classed *Bursulella* JONES as a provisional member of the family Leperditellidae. "*Eurychilina* and its allies" were transferred to Beyrichiidae. The rest constitute the family Primitiidae emend. (*Primitia, Primitiella, Haploprimitia, Laccoprimitia, Euprimitia, Halliella, Hallatia, Pyxiprimitia,* and *Milleratia*; provisionally *Jonesites* and *Hippa* are referred to this family).

These taxonomical proposals were partly accepted and modified by KAY (1940) and SCHMIDT (1941).

According to KAY the family Primitiidae includes the following subfamilies:

Primitiinae ULRICH and BASSLER 1923: *Primitia, Laccoprimitia, Haploprimitia, Conchoprimitia.*

Eurychilininae ULRICH and BASSLER 1923: *Eurychilina, Euprimitia, Halliella, Hallatia, Parabolbina, Winchellatia, Apatochilina.*

Dilobellinae KAY 1940

Bollinae BOUČEK 1936

Aechmininae BOUČEK 1936

The genera *Primitiopsis* and *Primitiella*, according to KAY, constitute the family Primitiopsidae.

SCHMIDT transferred some of the genera originally referred to Primitiidae ULRICH and BASSLER to the families Hollinidae SCHMIDT 1941 (SWARTZ 1936 emend.) and Drepanellidae SCHMIDT 1941 (SWARTZ 1936 emend.). He also transferred 2 genera (*Mooreina* and *Monoceratina*) to the family Cytheridae as partly proposed by earlier authors. According to SCHMIDT's opinion, the family Primitiidae comprises 3 subfamilies:

Primitiinae BASSLER and KELLETT 1934: *Primitia, Haploprimitia, Ectoprimitia, Euprimitia, Primitiella*, and, among a few taxonomically uncertain genera, *Conchoprimitia.*

Eurychilininae ULRICH and BASSLER 1923 (SCHMIDT, like SWARTZ 1936, excludes *Parabolbina* and adds *Mirochilina* BOUČEK 1936 in accordance to BOUČEK 1936).

Primitiopsinae (SVARTZ 1936).

According to my opinion, Primitiidae consists of only two subfamilies: Primitiinae and Primitiopsinae. Eurychilininae and the new subfamily Euprimitiinae, now proposed, are referred to Hollinidae.

Primitiinae.

ULRICH and BASSLER, in the description of the species belonging to this subfamily, paid special attention to the development of the sulcus and the marginal zone. BOUČEK attached particular importance to the appearance of the dorsal margin and the dorsal corners. All those characters have to be considered, but I think that greater importance should be attached to the appearance of the free marginal zone than ostracologists in later times seem to have been inclined to give.

The Primitiinae genera are, in typical cases, different in several characters, but in many individuals these differences are not very distinct and it is therefore sometimes difficult to perform correct generic determinations of small collections. The depressed border along the free margin which is typical for *Primitiella* and *Laccoprimitia* is, for instance, mostly indistinct and often not preserved at all. The appearance of the sulcus is rather variable in the same species. In *Primitiella brevisulcata* n. sp. it is generally a short, moderately broad, and rather shallow depression; sometimes it is very shallow and undefined; sometimes one may discern specimens with a narrow and somewhat slit-like sulcus. Concerning the appearance of the sulcus, these last-mentioned specimens resemble *Haploprimitia*, but they are different from this genus in having a depressed border along the free margin and in having distinct dorsal angles.

Laccoprimitia, having like *Primitiella* a depressed border along the free margin, is different from *Primitiella* mainly in having a pit-like sulcus, but sometimes the sulcus is slightly dorsoventrally elongated, which might cause confusion with *Primitiella*.

As mentioned above, KAY referred *Conchoprimitia* ÖPIK to Primitiinae; SCHMIDT is somewhat uncertain in this respect. I am of the opinion that *Conchoprimitia* ÖPIK is heterogeneous and that it should be divided (cf. p. 149). The sulcate species are proposed to form a new genus, *Conchoprimites*, which is classed in the subfamily Primitiinae. *Conchoprimitia* emend. and the new genus *Conchoides* are referred to the family Aparchitidae.

The following Primitiinae genera are represented in the present material:

Primitiella ULRICH 1894
Ectoprimitia BOUČEK 1936
Haploprimitia ULRICH and BASSLER 1923
Laccoprimitia ULRICH and BASSLER 1923
Conchoprimites n. gen.

Primitiopsinae.

SWARTZ (1936) proposed that *Primitiopsis* should form the monotypic family Primitiopsidae. KAY (1940) added the genus *Primitiella*.

Distinctive for this subfamily (resp. family) are "the well marked dimorphic terminal flanges" (SWARTZ 1936, p. 555). The terminal space formed by these flanges is situated anteriorly. Spaces of this kind certainly did not serve as brood chambers. In fact, such structures have been observed in different species of Mesozoic and recent genera, for instance *Chlamydotheca rudolphi* TRIEBEL (TRIEBEL 1941, Pl. 13, Fig. 150) and *Cypris pubera* O. FR. MÜLLER (SARS 1925, Pl. LI). The wall between the anterior chamber and the main cavity of the carapace is the margin of the larval carapace; in adult specimens it is also traceable along the ventral margin. According to FASSBINDER (1912), its anterior part is displaced proximally during the ontogenesis; it serves as the real anterior margin of the adult carapace.

As long as this anterior terminal chamber was suggested as a brood chamber of special type, it might be considered a character of high taxonomic value. But, since it has appeared that, in fact, it is not a brood chamber but a structure which in recent and geologically later types is rather common, there may not be reason to give it a greater importance than as a detail of generic character. The genus is distinguished by this character and by the fact that the valves are "borderless with sharply defined but small, deep, subcentral pit, and reticular ornament" (diagnosis by ULRICH and BASSLER). The genus is so different from other Primitiidae genera that it may be appropriately classed in a special subfamily.

The affinity between *Primitiopsis* and *Primitiella* as suggested by KAY (1940) is not proved. He stated that *Primitiella* is "probably dimorphic, anterior lobe, depressed in the male form, rising anteriorly in the female to form thickest part of valve" (1940, p. 262). In fact, KAY's "anterior lobe" is the posterior and thus not comparable with the chambered anterior part of *Primitiopsis*. Furthermore, he has not, as a matter of fact, observed any terminal chambers in *Primitiella*. Obviously, KAY's proposal to class *Primitiella* in Primitiopsinae is to be rejected.

Subfamily ***Primitiinae*** BASSLER and KELLETT 1934.

Diagnosis. SCHMIDT 1941, p. 25.

Discussion and remarks. Cf. above p. 205.

Genus ***Primitiella*** ULRICH 1894.

Genotype. *Primitiella constricta* ULRICH 1894.

Occurrence. Ordovician—Devonian.

Diagnosis. The original diagnosis is only slightly emended by later authors, for instance by BONNEMA (1909), who showed that the carapace is not equivalved. Later authors (e. g. ULRICH and BASSLER 1923, BASSLER and KELLETT 1934, and KAY 1940) say that it is equivalved.

Discussion and remarks. In the present material, the "broad and undefined median depression" is somewhat differently developed within the same species: sometimes it is very short and shallow, sometimes it is rather long and distinct; intermediate types are the most abundant. As a rule, the anterior part of the sulcus is deeper, owing to the fact that its anterior margin is steep but its posterior margin gently sloping. Generally a low but distinct presulcate node is present (this is practically always visible in internal moulds). In the ventral part of the depression, the central muscle spot is often discernible. It may also be mentioned that the depressed zone along the free margin is often imperfectly preserved. Generally it is very narrow, usually giving the impression that the free marginal zone is shallowly channelled. Furthermore, the anterodorsal angle seems invariably to be more obtuse than the posterodorsal.

Primitiella resembles *Ectoprimitia* BOUČEK and *Laccoprimitia* ULRICH and BASSLER in having a depressed free marginal zone, but in typical cases, their sulci are clearly different: those of *Ectoprimitia* are slit-like as in *Haploprimitia*, and those of *Laccoprimitia* are pit-like.

The genus seems to comprise somewhat more than 40 species. The following tabular survey gives an idea of their distribution (data from BASSLER and KELLETT 1934 [revised], BOUČEK 1936, SWARTZ 1936, ÖPIK 1937, KAY 1940, THORSLUND 1940, and SCHMIDT 1941).

	Europe	N. America	Australia	
Devonian	5	4		9
Gotlandian	4	3	1	8
Ordovician	12	12		24
	21	19	1	41

One species, reported only as Lower Paleozoic, is known from Asia. CHAPMAN (1920) thinks that he has recognized in Australia one European species and one species which is reported both from Europe and America.

All the tabulated Ordovician species except two, which are only reported as Ordovician (*P. cornuta* KUMMEROW and *P. umbilicata* KUMMEROW), are Middle Ordovician. About half of them were found in England and Estonia, and the rest in North German drifts, and in Bohemia and Sweden.

Lower Ordovician species do not seem to have been known, the Lower Ordovician *Primitiella glauconitica* KUMMEROW having been referred to *Conchoprimitia* (ÖPIK 1935), i. e. *Conchoides* n. gen.

In this paper 5 Lower Ordovician *Primitiella* species are described.

Primitiella brevisulcata n. sp.

Pl. IV, Figs. 17—22 and Pl. V, Figs. 1 and 2.

This species is rather variable in certain respects. The mutual differences are not large, and usually there are intermediate types. All the specimens occur in a rather restricted vertical zone on both sides of *R I/G*.

The aberrations may be mainly due to individual variation. A few differently developed characters may be sexually bound. Characteristic aberrant types are described separately.

Derivation of name. *brevisulcata* alludes to the generally shallow and short sulcus.

Holotype. The type shown in Pl. IV, Fig. 17 is holotype (P. I. U. No. ar. os. 285).

Locality of holotype. Leskusänget, in Dalecarlia, Sweden.

Stratum of holotype. Lower Ordovician: lower part of stratum *G* (about 0.8 m above *R I/G*).

Diagnosis. *Primitiella* of about median size, subparallelepipedic in outline; depressed free marginal zone very narrow and partly concealed by protruding parts of the free marginal area; sulcus short and shallow; presulcate node tuberculoid and small but generally rather distinct; surface smooth.

Affinities. Besides the present one, there are 2 other Lower Ordovician species known which are smooth: *P. dibulbosa* n. sp. and *P.* sp. *A* (sine nomine). The former is distinguishable in having two distinctly swollen spots at the posterior end of the carapace. The latter has a very shallow sulcate depression, and the presulcate node is extremely low; furthermore, the valves are more depressed than in *P. brevisulcata,* except in the ventral area. In *P. brevisulcata*, the sulcus is rather variably developed and among shallowly sulcate types of this species there are specimens (ab. *obscura*) which are reminiscent of *Primitiella* sp. *A* in this respect. Others also resemble this species in having a low presulcate node. However, these characters are scarcely so slightly developed as in *Primitiella* sp. *A*, nor are the valves so flat.

The main type.

Pl. IV, Figs. 17 and 18.

Type. This type includes the holotype (P. I. U. No. ar. os. 285).

Locality and stratum of type. Cf. above.

Material. 145 valves from 7 localities; a few specimens with slightly elevated ventral part of sulcus classed in this group (cf. ab. *maculata*, p. 212).

Description. Carapace moderately large; since only separate valves were observed, it could not be determined whether or not it is equivalved.

Dorsal margin straight and rather long; anterior margin more curved than posterior one; ventral margin slightly convex (median part sometimes practically straight).

Anterodorsal angle more obtuse than posterodorsal.

Carapace moderately arched, posterior part more than anterior; posterior end (especially its posteroventral part) swollen and protruding over the corresponding section of free margin; also parts of ventral area swollen; a narrow free marginal zone depressed, forming a very narrow border, partly concealed by protruding parts of the free marginal area; surface gently sloping to dorsal margin, free marginal zone steeply sloping.

Sulcus situated mainly dorsocentrally, and distinctly in front of the mid-

Dimensions.

No.	L	H	G	D M	F M	H/L	G/L	D M/L	F M/D M	∧ ant	∧ post	Re-mark
ar. os. 787	0.73	0.42	0.35	0.56	1.42	0.57	0.48	0.77	2.53	145	125	V
as. os. 285	*0.67*	*0.37*	*0.33*	*0.51*	*1.23*	*0.55*	*0.49*	*0.76*	*2.79*	*145*	*120*	V
ar. os. 298	0.67	0.36	0.30	0.49	1.28	0.54	0.45	0.73	2.61	145	125	V
ar. os. 300	0.67	0.35	0.35	0.55	1.25	0.52	0.52	0.82	2.27	140	120	V
ar. os. 294	0.66	0.35	0.33	0.47	1.21	0.53	0.50	0.71	2.57	150	130	V
ar. os. 296	0.65	0.35	0.35	0.47	1.25	0.54	0.54	0.72	2.66	145	120	V
ar. os. 301	0.65	0.35	0.35	0.51	1.18	0.54	0.54	0.78	2.04	(140)	115	V
ar. os. 303	0.65	0.35	0.34	0.47	1.18	0.54	0.52	0.72	2.51	140	125	V
ar. os. 283	0.65	0.35	0.30	0.51	1.18	0.54	0.46	0.78	2.31	140	120	V
ar. os. 291	0.64	0.37	0.35	0.47	1.23	0.58	0.55	0.73	2.62	140	120	V
ar. os. 299	0.64	0.33	0.30	0.47	1.14	0.52	0.47	0.73	2.43	140	125	V
ar. os. 286	0.63	0.35	0.30	0.49	1.16	0.56	0.48	0.78	2.37	140	125	V
ar. os. 290	0.63	0.35	0.30	0.44	1.14	0.56	0.48	0.70	2.59	140	130	V
ar. os. 289	0.63	0.33	0.31	0.49	1.07	0.52	0.49	0.78	2.18	140	115	V
ar. os. 295	0.63	0.33	0.28	0.48	1.14	0.52	0.44	0.76	2.53	140	120	V
ar. os. 284	0.63	0.30	0.28	0.51	1.09	0.48	0.44	0.81	2.14	135	120	V
ar. os. 293	0.60	0.35	0.33	0.47	1.14	0.58	0.55	0.78	2.43	145	120	V
ar. os. 302	0.60	0.35	0.33	0.48	1.07	0.58	0.55	0.80	2.23	145	120	V
ar. os. 297	0.60	0.33	0.30	0.44	1.14	0.55	0.50	0.73	2.59	150	130	V
ar. os. 288	0.58	0.33	0.33	0.42	1.02	0.57	0.57	0.72	2.43	135	115	V
ar. os. 287	0.52	0.30	0.28	0.41	0.93	0.58	0.54	0.79	2.27	145	125	V
ar. os. 292	0.49	0.28	0.23	0.37	0.91	0.57	0.47	0.75	2.46	145	125	V
Mean	0.63	0.42 0.35 0.28	0.35 0.31 0.23	0.56 0.47 0.37	1.42 1.16 0.91	0.58 0.56 0.48	0.57 0.50 0.44	0.82 0.75 0.70	2.79 2.44 2.04	140	125	

length; it is short and shallow (its anterior part more distinct than its posterior owing to the fact that its anterior margin is more steeply sloping than its posterior); its ventral part sometimes deepest, in internal moulds the rounded central muscle scar is discernible in this spot (in a few specimens it is also discernible externally, cf. ab. *maculata*, p. 212). In internal moulds, one may sometimes also discern scars of the dorsal muscle group and, in front of the presulcate node, scars of the antennal and mandibular muscles.

Presulcate node small and tuberculoid (very characteristic of this species).

Surface smooth.

Notes on the larval development.

The table on p. 210 comprises adult specimens and mainly later larval stages. There is a rather close mutual similarity as regards the proportions and the dorsal angles.

Some few younger stages were also observed and two of them were in such a state of preservation that they could be measured.

Dimensions.

No.	L	H	G	D M	F M	$\frac{H}{L}$	$\frac{G}{L}$	$\frac{DM}{L}$	$\frac{FM}{DM}$	∧ ant	∧ post	Re-mark
ar. os. 315	0.41	0.23	0.23	0.34	0.74	0.56	0.56	0.85	2.17	125	115	V
ar. os. 316	0.27	0.15	0.19	0.21	0.45	0.51	0.60	0.87	1.96	115	125	V
Mean	0.34	0.19	0.21	0.28	0.60	0.54	0.58	0.86	2.07	120	120	

A comparison between this table and that on p. 210 indicates that the young larval stages have a proportionally longer dorsal margin. Furthermore, it seems that the free margin is shorter in the very young stage (specimen No. ar. os. 316) and as if this one is also proportionally more gibbous. The height seems to be proportionally rather constant in all stages. The antero-dorsal angle in the young stages is different from those of later stages in being less obtuse (it seems as if this angle should diminish in younger and younger stages); the posterodorsal angle seems to be rather constant in all stages.

Furthermore, it may be noted that, in the young stages, the sulcus is extremely shallow (scarcely discernible) and that the presulcate node is not developed at all. The difference in arching of anterior and posterior parts of carapace is clearly visible as in adult specimens and later larval stages, but it is not so pronounced.

Occurrence. Lower Ordovician: upper part of stratum *R I* and lower part of stratum *G* (from about 0.2 m below *R I/G* to about 1.4 m above this boundary) at Leskusänget, Gulleråsen, Röjeråsvägen, Rävanäs, Granmor, Stenberg, and Silverberg, in Dalecarlia, Sweden.

ab. *maculata.*

Pl. IV, Figs. 19, 21, and 22.

Derivation of name. *maculata* alludes to a rounded raised spot in the ventral end of the sulcus.

Type. A characteristic type is shown in Pl. IV, Fig. 22 (P. I. U. No. ar. os. 305).

Locality of type. Leskusänget, in Dalecarlia, Sweden.

Stratum of type. Lower Ordovician: lower part of stratum *G* (about 0.8 m above *R I/G*).

Material. 33 valves from 5 localities.

Dimensions.

No.	L	H	G	DM	FM	$\frac{H}{L}$	$\frac{G}{L}$	$\frac{DM}{L}$	$\frac{FM}{DM}$	$\wedge$ ant	$\wedge$ post	Remark
ar. os. 306	0.67	0.38	0.37	0.47	1.35	0.57	0.55	0.70	2.87	145	120	V
as. os. 304	0.66	0.35	0.33	0.49	1.16	0.53	0.50	0.74	2.37	140	120	V
ar. os. 307	0.64	0.35	0.35	0.48	1.14	0.55	0.55	0.75	2.37	145	115	V
ar. os. 309	0.64	0.38	0.33	0.47	1.23	0.59	0.52	0.73	2.61	140	120	V
ar. os. 308	0.62	0.35	0.28	0.44	1.16	0.58	0.45	0.71	2.63	140	125	V
ar. os. 310	0.62	0.35	0.29	0.44	1.16	0.58	0.47	0.71	2.63	145	125	V
ar. os. 305	*0.60*	*0.35*	*0.30*	*0.44*	*1.14*	*0.58*	*0.50*	*0.73*	*2.59*	*145*	*125*	V
Mean	0.64	0.38 0.36 0.35	0.37 0.32 0.28	0.49 0.46 0.44	1.35 1.19 1.14	0.59 0.57 0.53	0.55 0.51 0.45	0.75 0.72 0.70	2.87 2.58 2.37	145	125	

Remarks. Identical with the main type of *Primitiella brevisulcata*, except that there is a rounded raised spot (a macula) in the ventral end of the sulcus; outline of macula imperfectly circular or broadly luneiform (convex part turned towards the dorsal margin). A few specimens referred to the main species have slight traces of a rounded macula in the ventral part of the sulcus.

The macula is certainly not a character of specific value: the remaining characters of the carapace and its dimensions are practically identical with those of the main type; additionally, the types occur in the same restricted vertical zone. It may indicate a subspecies or a sexual dimorphism. They can scarcely be due to individual variation, since there is a broad difference in distinctness between them and the slight traces of a macula which are discernible in a few specimens classed among the main type.

Occurrence. Lower Ordovician: upper part of stratum *R I* and lower part of stratum *G* (from about 0.2 m below *R I/G* to about 0.8 m above this boundary) at Leskusänget, Stenberg, Granmor, Rävanäs, and Gulleråsen, in Dalecarlia, Sweden.

ab. ***obscura.***

Pl. V, Fig. 1.

Derivation of name. *obscura* alludes to the very shallow and indistinct sulcate depression.

Type. A characteristic specimen is shown in Pl. V, Fig. 1 (P. I. U. No. ar. os. 311).

Locality of type. Leskusänget, in Dalecarlia, Sweden.

Stratum of type. Lower Ordovician: middle part of stratum *G* (about 2.0 m above *R I/G*).

Material. 2 valves from 2 localities.

Dimensions.

No.	L	H	G	D M	F M	H/L	G/L	D M/L	F M/D M	∧ ant	∧ post	Re-mark
ar. os. 311	0.67	0.40	0.37	0.49	1.35	0.60	0.55	0.73	2.75	145	120	V

Remarks. Similar to the ordinary main type of *Primitiella brevisulcata* in dimensions and in general characters, but different in that the sulcus is extremely shallow and indistinct, and that the presulcate node is very minute.

The type is somewhat reminiscent of *Primitiella indistincta* ÖPIK.

Apparently, within *Primitiella brevisulcata* there are marked tendencies to split the species population into new types, judging from its great variability. Especially the sulcus and the presulcate node are very variable. In these respects the present type is strikingly different from the ordinary main type and, if represented in a small collection, it might have been described as a definite species. However, among the main type specimens there are a few which have a more shallow sulcus and a lower presulcate node than the majority. In these respects they take a somewhat intermediate position in relation to the present type, and, hence, it may be most correct to consider the present type an extreme in the *P. brevisulcata* population. The fact that it is proportionally somewhat higher and more gibbous than the main type also argues for its having diverged considerably from the main type.

Occurrence. Lower Ordovician: lower half of stratum *G* (about 0.4—2.0 m above *R I/G*) at Leskusänget and Stenberg, in Dalecarlia, Sweden; main type specimens of intermediate appearance as regards sulcus and presulcate node observed also in other horizons; thus a specimen rather resembling ab. *obscura* was found just above *R I/G* (Gulleråsen).

ab. ***linepunctata.***

(Specimen unfortunately lost before having been drawn.)

Derivation of name. *linepunctata* alludes to a row of punctae on the carapace.

Locality of type. Gulleråsen, in Dalecarlia, Sweden.

Stratum of type. Lower Ordovician: lower part of stratum *G* (about 0.3 m above *R I/G*).

Material. One valve.

Dimensions.

No.	L	H	G	D M	F M	H/L	G/L	D M/L	F M/D M	∧ ant	∧ post	Re-mark
ar. os. 308	0.60	0.33	0.33	0.40	1.14	0.55	0.55	0.67	2.85	145	120	V

Remarks. Chiefly like the main type of *Primitiella brevisulcata*; presulcate node small but distinct, sulcus very shallow, however. It is different in having a row of punctae obliquely over the valve.

The row of punctae is a very characteristic feature of this type. Since only one specimen was found, nothing is known about the permanence of the punctation. Since the specimen is otherwise very similar to *P. brevisulcata*, it may, for the present, be considered merely as an individual aberrant type of this species.

Occurrence. Lower Ordovician: lower part of stratum *G* (about 0.3 m above *R I/G*) at Gulleråsen, in Dalecarlia, Sweden.

ab. ***bituberculata.***

Pl. V, Fig. 2.

Derivation of name. *bituberculata* alludes to the two presulcate tubercles.

Type. A characteristic species is shown in Pl. V, Fig. 2 (P. I. U. No. ar. os. 313).

Locality of type. Leskusänget, in Dalecarlia, Sweden.

Stratum of type. Lower Ordovician: lower part of stratum *G* (about 1.0 m above *R I/G*).

Material. One internal mould.

Dimensions.

No.	L	H	G	D M	F M	H/L	G/L	D M/L	F M/D M	∧ ant	∧ post	Re-mark
ar. os. 313	0.54	0.29	0.27	0.43	1.05	0.54	0.50	0.80	2.45	145	115	M

Remarks. Similar to the main type of *P. brevisulcata*, except in having a second (smaller) node in front of the presulcate node of the main type. Since only one internal mould of this type was found, it is not known whether the second node is visible also on the surface of the carapace. Nor is it known whether this node is permanent. Thus, it is not possible to decide the importance of such a character now. Since the internal mould is identical with that of *P. brevisulcata* as regards remaining characters, I think it is appropriate, provisionally to consider it an individual aberration of this species.

Occurrence. Lower Ordovician: lower part of stratum *G* (about 1.0 m above *R I/G*) at Leskusänget, in Dalecarlia, Sweden.

ab. ***paucituberculata.***

Pl. IV, Fig. 20.

Derivation of name. *paucituberculata* alludes to a small number of minute tubercles in the presulcate area.

Type. A characteristic specimen is shown in Pl. IV, Fig. 20 (P. I. U. No. ar. os. 314).

Locality of type. Leskusänget, in Dalecarlia, Sweden.

Stratum of type. Lower Ordovician: lower part of stratum *G* (about 1.0 m above *R I/G*).

Material. 2 internal moulds from 2 localities.

Dimensions.

No.	L	H	G	D M	F M	$\frac{H}{L}$	$\frac{G}{L}$	$\frac{DM}{L}$	$\frac{FM}{DM}$	∧ ant	∧ post	Re-mark
ar. os. 314	0.60	0.35	0.29	0.44	1.16	0.58	0.48	0.73	2.64	140	120	M

Remarks. Similar to the main type of *P. brevisulcata*, except in having a few small tubercles in front of the presulcate node (one of them is larger than the rest; it seems to correspond to the anterior node of *P. brevisulcata* ab. *bituberculata*). These small tubercles were observed in internal moulds encrusted with limonite. Whether they are also visible on the surface of the carapace is not known. Since this type is very similar to the main type of *P. brevisulcata* and occurs in the same horizon as this one, it may be an individual aberration of this species.

Occurrence. Lower Ordovician: lower part of stratum *G* (about 0.8—1.0 m above *R I/G*) at Leskusänget and Granmor, in Dalecarlia, Sweden.

Survey of the dimensions of *Primitiella brevisulcata*. To facilitate the study of the dimensions of *Primitiella brevisulcata* and the types which are suggested aberrations of this species, the mean data are gathered in the following table. For comparison the mean dimensions of 2 young larval stages are also given.

	Number	L	H	G	D M	F M	$\frac{H}{L}$	$\frac{G}{L}$	$\frac{DM}{L}$	$\frac{FM}{DM}$	∧ ant	∧ post
main type	22	0.63	0.35	0.31	0.47	1.16	0.56	0.50	0.75	2.44	140	125
ab. *maculata*	7	0.64	0.36	0.32	0.46	1.19	0.57	0.51	0.72	2.58	145	125
ab. *obscura*	1	0.67	0.40	0.37	0.49	1.35	0.60	0.55	0.73	2.75	145	120
ab. *linepunctata*	1	0.60	0.33	0.33	0.40	1.14	0.55	0.55	0.67	2.85	145	120
ab. *bituberculata*	1	0.54	0.29	0.27	0.43	1.05	0.54	0.50	0.80	2.45	145	115
ab. *pauci-tuberculata*	1	0.60	0.35	0.29	0.44	1.16	0.58	0.48	0.73	2.64	140	120
Mean		0.60	0.35	0.31	0.45	1.18	0.57	0.52	0.73	2.62	145	120
young larval stages	2	0.34	0.19	0.21	0.28	0.60	0.54	0.58	0.86	2.07	120	120

Primitiella sp. ***A*** (sine nomine).

Pl. V, Fig. 11.

The species described below is most probably a definite species, different from other known species of *Primitiella*. However, only one specimen was found and its state of preservation is not so perfect as to allow a holotype description. Therefore, no name will be given to this type before better preserved specimens are found. In the present brief description it is called *Primitiella* sp. *A*.

Type. The only specimen known is shown in Pl. V, Fig. 11 (P. I. U. No. ar. os. 320).

Locality of type. Stenberg, in Dalecarlia, Sweden.

Stratum of type. Lower Ordovician: lower part of stratum *G* (about 0.6 m above *R I/G*).

Material. One valve.

Affinities. The species is reminiscent of indistinctly sulcate specimens of *Primitiella brevisulcata* (especially ab. *obscura*); it is different in that the ventral area is more swollen and the rest of the valve somewhat more flattened. Furthermore, it is somewhat reminiscent of *Primitiella indistincta* Öpik.

Dimensions.

No.	L	H	G	D M	F M	H/L	G/L	DM/L	FM/DM	∧ ant	∧ post	Remark
ar. os. 320	0.67	0.38	0.33	0.52	1.33	0.57	0.49	0.78	2.56	140	120	V

Description. Carapace moderately large; since only one valve was found it could not be observed whether or not it is equivalved.

Dorsal margin straight and moderately long; anterior margin somewhat more rounded than the posterior one; ventral margin slightly convex.

The valve investigated flattened, except in the ventral area which is somewhat swollen; surface sloping steeply to the ventral margin but gently to the others.

A broad and extremely shallow sulcate depression may be discerned in front of the midlength in the dorsocentral area: presulcate node not observed.

Occurrence. Lower Ordovician: lower part of stratum *G* (about 0.6 m above *R I/G*) at Stenberg, in Dalecarlia, Sweden.

Primitiella dibulbosa n. sp.
Pl. V, Figs. 7—10.

This species comprises two types (α and β), which are possibly sexual dimorphisms (cf. discussion below).

They are described separately.

Derivation of name. *dibulbosa* alludes to the two swellings in the posterior part of the valves.

Holotype. The type shown in Pl. V, Fig. 7 is holotype (P. I. U. No. ar. os. 340).

Locality of holotype. Born-Dådran, in Dalecarlia, Sweden.

Stratum of holotype. Lower Ordovician: upper part of stratum *G* (about 0.6 m below *G/R II*).

Diagnosis. *Primitiella* of about median size; ends sometimes somewhat truncate and oblique; sulcus and presulcate node rather indistinct; two rounded swellings at the posterior end of the valves; surface smooth.

Affinities. The two rounded swellings in the posterior part of the valves are very characteristic of this species; they exclude confusion with *P. brevisulcata* n. sp. which is somewhat similar in being smooth (this species has one elongated posteroventral swelling). These two species occur in different horizons.

Type α (suggested as male).
Pl. V, Fig. 8.

Type. An internal mould is shown in Pl. V, Fig. 8 (P. I. U. No. ar. os. 343).

Locality of type. Leskusänget, in Dalecarlia, Sweden.

Stratum of type. Lower Ordovician: upper part of stratum *G* (about 0.2 m below *G/R II*).

Material. One internal mould with fragments of carapace.

Dimensions.

No.	L	H	G	D M	F M	H/L	G/L	DM/L	FM/DM	∧ ant	∧ post	Re-mark
ar. os. 343	0.70	0.38	0.31	0.56	1.30	0.54	0.45	0.80	2.32	140	120	M

Description. Chiefly like type *β* which is more thoroughly described below, but different mainly in the following respects: anterior end higher and more truncate, its ventral part more distinctly bulged forward; in front of the presulcate node is a minute second node; muscle scars more distinct; posterodorsal rounded swelling smaller than in type *β*.

Occurrence. Lower Ordovician: upper part of stratum *G* (about 0.2 m below *G/R II*) at Leskusänget, in Dalecarlia, Sweden.

Type *β* (suggested as female).

Pl. V, Figs. 7, 9, and 10.

Type. This type includes the holotype (P. I. U. No. ar. os. 340).

Locality and stratum of holotype. Cf. p. 217.

Material. 5 valves and internal moulds from 4 localities.

Dimensions.

No.	L	H	G	D M	F M	H/L	G/L	DM/L	FM/DM	∧ ant	∧ post	Re-mark
ar. os. 340	*0.65*	*0.33*	*0.30*	*0.50*	*1.23*	*0.51*	*0.46*	*0.77*	*2.46*	*140*	*120*	V
ar. os. 342	0.65	0.34	0.33	0.52	1.07	0.52	0.51	0.80	2.06	145	115	V
ar. os. 387	0.56	0.30	0.28	0.50	1.02	0.54	0.50	0.89	2.04	125	120	V
ar. os. 341	0.53	0.30	0.30	0.47	0.93	0.57	0.57	0.89	1.98	135	115	M
Mean	0.60	0.34 0.32 0.30	0.33 0.30 0.30	0.52 0.50 0.47	1.23 1.06 0.93	0.57 0.54 0.51	0.57 0.51 0.46	0.89 0.84 0.77	2.46 2.14 1.98	135	120	

Description. Carapace of about median size; whether or not it is equivalved is not known, since only separate valves were observed.

Dorsal margin straight and rather long; anterior margin rounded (dorsal part sometimes only slightly convex, ventral part in this case forming a forward swing); posterior margin regularly and considerably convex; ventral margin slightly convex or practically straight.

Anterodorsal angle more obtuse than the posterodorsal.

Posterior part of carapace of about the same height as the anterior.

Carapace moderately arched, postsulcate region slightly more than the presulcate; in the postsulcate region are two rounded swellings; the most distinct situated in the posteroventral corner, the other in the dorsal part somewhat in front of the posterodorsal corner (the swellings are most clearly visible in internal moulds); a very narrow free marginal zone depressed; surface gently sloping to dorsal margin, free marginal zone steeply sloping to the narrow depressed area.

Sulcus situated dorsally and dorsocentrally and in front of the midlength; it is shallow and rather broad; ventral end slightly widened (central muscle spot, visible in internal moulds, situated in this spot; in internal moulds, scars of the dorsal muscle group, and of antennal and mandibular muscles are also visible in front of the presulcate node.

Presulcate node situated just anterior to the ventral part of sulcus; it is low and indistinct; in internal moulds it is more distinct: it is tuberculoid and elongated dorsoventrally.

Surface smooth.

Occurrence. Lower Ordovician: upper part of stratum *G* and lower part of stratum *R II* (from about 0.6 m below *G*/*R II* to just above this boundary) at Rävanäs, Silverberg II, Leskusänget, and Born-Dådran, in Dalecarlia, Sweden.

Discussion. The types described above are certainly conspecific. Whether they are individual variants or sexual dimorphisms is scarcely decidable. It is not unlikely that they are sexual dimorphisms. If so, type α may be male and type β female.

In recent ostracods, the male has been observed to be more mobile than the female. For this purpose the swimming organs (the lower antennae) are better developed and require more space than those of the female. In such cases, the anterior part of the male carapace is more voluminous than in females. In females, on the other hand, the posterodorsal part of the carapace may be broader than in males owing to the fact that this part in females is storage room for eggs and early larval stages.

The anterior part of type α is proportionally higher than in type β, but in type β the posterodorsal part of the carapace is broader (the dorsal swelling is better developed than in type α). This may indicate type α to be male and type β to be female. The fact that type α seems to be less abundant may support this idea, judging by the general numeric relations between the sexes in recent ostracods.

Primitiella expressoreticulata n. sp.

Pl. V, Figs. 3—6.

Derivation of name. *expressoreticulata* alludes to the distinctly reticulate carapace.

Holotype. The type shown in Pl. V, Fig. 3 is holotype (P. I. U. No. ar. os. 324).

Locality of holotype. Leskusänget, in Dalecarlia, Sweden.

Stratum of holotype. Lower Ordovician: lower part of stratum *G* (about 1.4 m above *R I*/*G*).

Material. 60 valves from 7 localities.

Dimensions.

No.	L	H	G	D M	F M	H/L	G/L	D M/L	F M/D M	∧ ant	∧ post	Re-mark
ar. os. 331	0.60	0.35	0.28	0.46	1.16	0.58	0.47	0.77	2.52	140	120	V
ar. os. 325	0.60	0.31	0.26	0.48	1.11	0.52	0.43	0.81	2.31	135	115	V
ar. os. 322	0.60	0.31	0.33	0.48	1.18	0.58	0.55	0.80	2.46	140	125	V
ar. os. 327	0.59	0.33	0.28	0.45	1.09	0.56	0.47	0.76	2.42	140	120	V
ar. os. 323	0.59	0.33	0.23	0.46	1.16	0.56	0.39	0.78	2.52	140	120	V
ar. os. 330	0.58	0.34	0.30	0.44	1.16	0.59	0.52	0.76	2.63	140	120	V
ar. os. 324	*0.58*	*0.30*	*0.29*	*0.51*	*1.10*	*0.52*	*0.50*	*0.88*	*2.15*	*135*	*115*	V
ar. os. 321	0.56	0.34	0.28	0.41	1.14	0.55	0.50	0.73	2.78	140	115	V
ar. os. 770	0.54	0.31	0.26	0.42	1.07	0.57	0.48	0.78	2.54	140	120	V
ar. os. 329	0.52	0.28	0.28	0.39	1.05	0.54	0.54	0.76	2.70	145	115	V
ar. os. 326	0.51	0.28	0.27	0.39	1.05	0.55	0.53	0.77	2.69	140	120	V
ar. os. 328	0.51	0.28	0.23	0.38	1.05	0.55	0.45	0.75	2.77	140	120	V
Mean	0.56	0.35 0.31 0.28	0.33 0.27 0.23	0.51 0.44 0.38	1.18 1.11 1.05	0.59 0.56 0.52	0.55 0.49 0.39	0.88 0.78 0.73	2.78 2.54 2.15	140	120	

Note. Specimen No. ar. os. 331 deviates somewhat from the others in having a deeper sulcus and a less distinct reticulation.

Diagnosis. *Primitiella* of median size; surface covered with a deep and distinct reticulum of varying extension.

Affinities. The species resembles *Ectoprimitia tenuireticulata* n. sp. and *Primitiella anterodepressa* n. sp. in being reticulate.

The reticulum of *E. tenuireticulata* is more tenuous than in the present species; moreover, the whole surface (except a narrow marginal zone) is invariably covered by the reticulum which is generally not true of *P. expressoreticulata*. *P. anterodepressa* also has a tenuous network which, contrary to the reticulum of the present species, is elongated longitudinally. Furthermore, the present species resembles the American Middle Ordovician *Primitiella constricta* ULRICH, which is different in that the marginal zone is much more steeply sloping, and the Estonian Middle Ordovician *Primitia molli* BONNEMA which may be referred to *Primitiella*. The reticulum of this species is narrower than that of *P. expressoreticulata*.

Description. Carapace moderately large; since only separate valves were observed it was not determined whether or not it is equivalved.

Dorsal margin straight and rather long; anterior margin more convex than posterior; ventral margin slightly convex.

Anterodorsal angle more obtuse than the posterodorsal.

Posterior part of carapace sometimes higher than anterior, sometimes of about equal height.

Carapace moderately arched, postsulcate region more than the presulcate; a very narrow, free marginal zone depressed; surface gently sloping to dorsal margin and generally gently sloping to free margin, but in a few cases it was observed to slope rather steeply to the free margin (e. g. the holotype).

Sulcus situated dorsocentrally, somewhat in front of the midlength; it is short and generally shallow, anterior part deepest and the most distinct owing to the fact that the anterior margin of sulcus is steep (posterior margin of sulcus, on the contrary, gently sloping); at ventral end of sulcus a small and slightly raised and rounded macula sometimes discernible (central muscular attachment).

Presulcate node situated just in front of ventral or middle part of sulcus; it is low and generally rather indistinct.

Surface in some parts deeply and distinctly reticulate; extension of reticulum variable: as a rule, the most posterior part of the carapace is reticulate, and very often also the most anterior; reticulation around sulcus occurring rather often when surface is otherwise smooth; sometimes the whole surface is reticulate, except for a marginal zone (and often except for parts of central and centroventral areas), entirely reticulate valves were not observed; meshes of reticulum marginally elongated but otherwise rather equally polygonal; non-reticulate areas smooth.

Occurrence. Lower Ordovician: lower part of stratum *G* (about 0.1—1.5 m above *R I/G*) at Leskusänget, Stenberg, Gulleråsen, Rävanäs, Röjeråsvägen, Granmor, and Silverberg, in Dalecarlia, Sweden.

Discussion. The present species is above all distinguished by its surface pattern; the extension of the reticulation is very variable.

If only some few specimens had been available, one would presumably have been inclined to consider them different species or subspecies on account of the different extensions of the surface pattern. My material is not large, but large enough to show that the extremes as regards the surface ornamentation are connected by types of intermediate appearance in this respect. For this reason the specimens may constitute one species.

LEROY (1945) has shown that the surface pattern of a few Tertiary species expands during the ontogenetic development. One would have expected the same in the present species, but this does not seem to be the case. Among the specimens tabulated above, the most reticulate specimen (the holotype = No. 324) is not the largest one. Another specimen of exactly the same length (No. 330) is only reticulate at the posterior end. Among the slightly longer specimens, two are reticulate over the greater part of the valves (Nos. 322 and 323), but two other are reticulate only posteriorly, and one only around the sulcus. The specimens that are smaller than the holotype are reticulate at the anterior and posterior ends as well as around the sulcus (Nos. 321 and 329), or at the anterior and posterior ends (Nos. 326 and 328), or only at the posterior end (No. 320).

As expressed also by other authors (for instance SCHMIDT 1941, p. 16) there is reason for not attaching too much taxonomic importance to the extension of surface ornamentation; the present species may be a striking example of this.

Primitiella anterodepressa n. sp.

Pl. V, Figs. 12 and 13.

Derivation of name. *anterodepressa* alludes to the fact that the presulcate region is depressed.

Holotype. The type shown in Pl. V, Fig. 13 is holotype (P. I. U. No. ar. os. 345).

Locality of holotype. Stenberg, in Dalecarlia, Sweden.

Stratum of holotype. Lower Ordovician: lower part of stratum *G* (about 0.8 m above *R I/G*).

Material. 14 valves from 3 localities.

Diagnosis. *Primitiella* of moderate size; presulcate region depressed, especially its ventral part; postsulcate region somewhat swollen; surface (except a marginal zone) tenuously reticulate, reticulum elongated longitudinally.

Affinities. The species is characterized by the fact that the presulcate region is depressed and that the tenuous reticulation is elongated longitudinally. In these respects it is distinguishable from *Primitiella expresso-reticulata* n. sp. (which is more irregularly and distinctly reticulate) and from *Ectoprimitia tenuireticulata* n. sp. (which, moreover, has a deeper and more distinct sulcus).

Description. Carapace moderately large; since only separate valves were observed it is not known whether or not the carapace is equivalved.

Dimensions.

No.	L	H	G	D M	F M	H/L	G/L	D M/L	F M/D M	∧ ant	∧ post	Re-mark
ar. os. 338	0.67	0.36	0.28	0.54	1.16	0.54	0.42	0.81	2.15	130	120	V
ar. os. 336	0.67	0.31	0.23	0.56	1.14	0.46	0.34	0.84	2.04	130	125	V
ar. os. 346	0.62	0.31	0.26	0.47	1.09	0.50	0.47	0.76	2.32	140	125	V
ar. os. 345	*0.58*	*0.31*	*0.23*	*0.48*	*1.09*	*0.53*	*0.40*	*0.83*	*2.27*	*140*	*120*	V
ar. os. 339	0.58	0.33	0.24	0.45	1.14	0.57	0.41	0.78	2.53	135	125	V
ar. os. 337	0.58	0.30	0.31	0.44	1.07	0.52	0.53	0.76	2.43	140	125	V
ar. os. 347	0.57	0.32	0.30	0.44	1.11	0.56	0.53	0.77	2.52	140	120	V
Mean	0.61	0.36 0.32 0.30	0.31 0.26 0.23	0.56 0.48 0.44	1.16 1.11 1.07	0.57 0.53 0.46	0.53 0.44 0.34	0.84 0.79 0.76	2.53 2.32 2.04	135	125	

Dorsal margin straight and rather long; anterior margin somewhat more convex than posterior; ventral margin slightly convex or practically straight.

Anterodorsal angle somewhat more obtuse than posterodorsal.

Posterior part of carapace somewhat higher than anterior.

Carapace differently arched: presulcate region rather depressed, especially in its ventral part; postsulcate region somewhat swollen and slightly protruding over free margin, especially posteroventrally; parts of free margin narrowly and indistinctly depressed; surface gently sloping to dorsal margin, free marginal zone steeply sloping.

Sulcus situated mainly dorsocentrally and distinctly in front of the midlength; it is short, rather broad, and shallow; its anterior margin steeply sloping, its posterior gently sloping: hence, sulcus most distinct in its anterior part.

Presulcate node rather small.

Surface tenuously reticulate, except for a marginal zone, which is smooth; "meshes" of network distinctly elongated longitudinally.

Occurrence. Lower Ordovician: lower part of stratum *G* (about 0.6—1.4 m above *RI*/*G*) at Stenberg, Rävanäs, and Röjeråsvägen, in Dalecarlia, Sweden.

Survey of the dimensions of *Primitiella.*

The data of *Primitiella* sp. *A* and *P. dibulbosa* are less representative than those of the other species, since they are represented by very few specimens.

	Number	L	H	G	DM	FM	H/L	G/L	DM/L	FM/DM	∧ ant	∧ post
P. brevisulcata	33	0.60	0.35	0.31	0.45	1.18	0.57	0.52	0.73	2.62	145	120
P. sp. *A* (sine nomine)	1	0.67	0.38	0.33	0.52	1.33	0.57	0.49	0.78	2.56	140	120
P. dibulbosa α	1	0.61	0.32	0.31	0.50	1.08	0.53	0.51	0.82	2.17	140	115
P. dibulbosa β	3	0.70	0.38	0.31	0.56	1.30	0.54	0.45	0.80	2.32	140	120
P. expresso-reticulata	12	0.56	0.31	0.27	0.44	1.11	0.56	0.49	0.78	2.54	140	120
P. anterodepressa	7	0.61	0.32	0.26	0.48	1.11	0.53	0.44	0.79	2.32	135	125
						Mean	0.55	0.48	0.78	2.42	140	120

From the table it appears that the species are rather similar as regards outline (dorsal angles and proportions between free margin and dorsal margin); *P. anterodepressa* is somewhat different in this respect, viz., in the difference between the dorsal angles often being smaller than in the other species. Otherwise, it appears that in *P. brevisulcata* the dorsal margin is proportionally shorter than in the other species, furthermore, that *P. brevisulcata* is proportionally higher and more gibbous than the others. *P. anterodepressa* is, on the average, proportionally lower and distinctly less gibbous than the majority.

Genus *Ectoprimitia* Bouček 1936.

Genotype. *Primitia corrugata* Krause 1892.

Occurrence. Ordovician—Gotlandian.

Diagnosis. Bouček 1936, p. 45.

Discussion and remarks. Bouček erected *Ectoprimitia* as a subgenus of *Haploprimitia*. Schmidt, 1941, suggested it as a genus.

It seems appropriate to have distinguished *Ectoprimitia*, but its closer relationships and taxonomic rank are debatable.

Ectoprimitia may not be so nearly related to *Haploprimitia* as imagined by Bouček. They are similar as regards the appearance of the sulcus, but different mainly in that *Ectoprimitia* is depressed along the free margin, which is not the case in *Haploprimitia*. Furthermore, in *Haploprimitia*, the dorsal margin seems to be shorter and the dorsal angles less distinct. It may be noted, however, that, except for the sulcus, the characters of *Haploprimitia* are not perfectly stated (cf. Schmidt 1941, p. 25).

The species which in the present work is classed as *Ectoprimitia* is in certain respects reminiscent of the species referred to *Primitiella*. They are rather similar in proportions and outline, and in that a very narrow free marginal zone is depressed (as in the *Primitiella* species of the present material, this zone is narrower and more poorly developed than in the genotype). *Primitiella* and *Ectoprimitia* are different in that the sulcus of *Ectoprimitia* is deeper, narrower, and extended more dorsally; furthermore, anterior and posterior margins of sulcus are both steeply sloping (in *Primitiella*, as a rule, the anterior margin is steeply sloping but the posterior one gently sloping).

Thus it appears that *Ectoprimitia* is in certain respects affined to *Haploprimitia* (sulcus), and in others (outline, depressed free margin) to *Primitiella*. However, further investigations of *Haploprimitia*, *Primitiella* and *Ectoprimitia* are required to settle the question of the relationship of *Ectoprimitia*. As regards the taxonomic rank of *Ectoprimitia*, I think that it may properly be considered a definite genus (as suggested by SCHMIDT 1941, p. 26), since there are important differences from both the nearest related genera as discussed above.

BOUČEK referred two of KRAUSE's species to *Ectoprimitia* (the genotype *E. corrugata* and *E. elongata*), which were found in North German drifts of unknown origin. BOUČEK described one subspecies of the genotype from the Ludlow of Bohemia (1936, p. 45) and THORSLUND recognized *E.* (*Primitiella*) *elongata* in Swedish Middle Ordovician (1940, p. 163).

In the present work, one Lower Ordovician *Ectoprimitia* species is presented.

Ectoprimitia tenuireticulata n. sp.

Pl. V, Fig. 15.

Derivation of name. *tenuireticulata* alludes to the tenuous reticulation of the surface.

Holotype. The type shown in Pl. V, Fig. 15 is holotype (P. I. U. No. ar. os. 333).

Locality of holotype. Stenberg, in Dalecarlia, Sweden.

Stratum of holotype. Lower Ordovician: stratum *G* (about 1.7 m above *R I/G*).

Material. 3 valves (2 slightly damaged) from 2 localities.

Diagnosis. *Ectoprimitia* of moderate or rather large size; parts of free marginal zone narrowly and indistinctly depressed; sulcus deep and distinct; surface covered with a tenuous reticulum, except in a narrow limbate zone.

Affinities. The species resembles *Primitiella anterodepressa* n. sp. and *Primitiella expressoreticulata* both of which are reticulate. The tenuous reticulum of the former is longitudinally elongated which is not the case

Dimensions.

No.	L	H	G	D M	F M	H/L	G/L	D M/L	F M/D M	∧ ant	∧ post	Re-mark
ar. os. 332	0.86	0.44	0.37	0.74	1.46	0.51	0.43	0.86	1.97	(130)	(130)	V
ar. os. 333	*0.79*	*0.40*	*0.34*	*0.60*	*1.39*	*0.51*	*0.49*	*0.76*	*2.32*	*130*	*125*	V
ar. os. 334	0.70	0.37	0.30	0.56	1.16	0.53	0.43	0.80	2.07	130	130	V
Mean	0.78	0.44 0.40 0.37	0.37 0.34 0.30	0.74 0.63 0.56	1.46 1.34 1.16	0.53 0.52 0.51	0.49 0.45 0.43	0.86 0.81 0.76	2.32 2.12 1.97	130	130	

in the present species; furthermore, the anterior margin of *P. anterodepressa* is more depressed and the sulcus less distinct. The reticulum of *P. expresso-reticulata* is much rougher than that of *E. tenuireticulata.*

The genotype of *Ectoprimitia* is corrugate dorsoventrally, and the second *Ectoprimitia* species described earlier (*E. elongata* [KRAUSE]) is tuberculiferous.

Description. Carapace of moderate or rather large size; since only separate valves were observed it is not known whether or not it is equivalved.

Dorsal margin straight and rather long: anterior margin somewhat more curved than posterior; ventral margin slightly convex.

Dorsal angles about equal, or the anterodorsal slightly more obtuse.

Anterior and posterior parts of carapace of about the same height, or posterior part slightly higher.

Carapace moderately arched; surface gently sloping to the margins, especially to the postsulcate part of free margin; marginal zone scarcely depressed at all (slight traces of a very narrow depression discernible along anterior part of free margin).

Sulcus situated mainly dorsocentrally and distinctly in front of the mid-length; it is short, deep, and practically straight; its anterior and posterior margins steeply sloping.

Presulcate node low and elongated dorsoventrally.

Surface covered with a tenuous network, except for a narrow limbate zone, which is smooth; "meshes" of the network mainly equilaterally polygonal.

Occurrence. Lower Ordovician: middle and upper part of stratum *G* (about 1.7—2.4 m above *R I/G*) at Stenberg and Leskusänget, in Dalecarlia, Sweden.

Genus *Haploprimitia* ULRICH and BASSLER 1923.

Genotype. *Primitia minutissima* ULRICH 1894.

Occurrence. Ordovician—Gotlandian.

Diagnosis. The original diagnosis by ULRICH and BASSLER (1923, p. 297) was completed by SCHMIDT (1941, p. 25).

Discussion and remarks. In the original diagnosis only the appearance of the sulcus and the free marginal zone was mentioned. SCHMIDT also points to other characters, such as the fact that the carapace is equivalved (noticed earlier by MATERN 1929). He further states that the dorsal margin is short and that the dorsal corners are rounded. However, SCHMIDT adds that his diagnosis may not be very reliable, since the genotype is said by him to have "practically no distinguishing characters".

Apparently, the delimitation of *Haploprimitia* is not perfect in all respects, and a revision of the genus is desirable. Especially the question of the length of the dorsal margin and the appearance of the dorsal corners should be reexamined. The other characters (slit-like sulcus, non-bordered marginal zone, carapace equivalved) seem to be definite. Following these characters, one can with a fair amount of certainty distinguish *Haploprimitia* from *Primitiella* and *Ectoprimitia*, which may be considered its closest relatives. In typical cases, these genera differ from *Haploprimitia*, viz. in that their marginal zones are depressed. At least in typical cases, the sulcus of *Primitiella* is also different, viz. in being shallow and rather broad, but sometimes it is fairly deep and distinct. In the latter case it may be somewhat reminiscent of the sulcus of *Haploprimitia*. However, as far as I have observed, the sulci of these genera are different in other respects: in that the transverse section of the sulcus of *Haploprimitia* is symmetric, but asymmetric in *Primitiella* (the anterior margin of the sulcus is more steeply sloping than the posterior one); furthermore, the anterior margin of the *Primitiella* sulcus is generally more or less curved backwards owing to the fact that the presulcate node is often so large that the anterior margin of the sulcus becomes curved backwards. In *Ectoprimitia* the sulcus seems to be more similar to that of *Haploprimitia* (viz. in being symmetric) and this was possibly an important reason for ranking *Ectoprimitia* as a subgenus of *Haploprimitia*, as proposed by BOUČEK (1936).

Only a few specimens have been referred to *Haploprimitia* as appears from the following survey (BASSLER and KELLETT 1934, BOUČEK 1936, ÖPIK 1937, and SCHMIDT 1941).

MATERN (1929) referred 4 Upper Devonian species to *Haploprimitia*, but this was rejected by SCHMIDT (1941, p. 73).

ÖPIK (1937, p. 14) proposed *Primitia molli* BONNEMA to be referred to *Haploprimitia*, but I think that it can be classed in *Primitiella*. Its sulcus is

	Europe	N. America	
Gotlandian	1 (?)		1
Ordovician	3	1	4
	4	1	5

rather deep and distinct, but in this respect and in its being situated rather a long way in front of the midlength (sulcus in *Haploprimitia* generally situated only just in front of the midlength) it is very similar to more distinctly sulcate specimens among the present *Primitiella* species. In outline it is very similar to these species.

All the Ordovician *Haploprimitia* species are Middle Ordovician. Two of the European ones were found in Estonia (ÖPIK 1937) and one (generically somewhat uncertain) in Bohemia (SCHMIDT 1941).

In the present paper a Lower Ordovician *Haploprimitia* species is described.

Haploprimitia lenticuloidea n. sp.

Pl. V, Fig. 16.

Derivation of name. *lenticuloidea* alludes to the fact that the carapace is lenticular.

Holotype. The type shown in Pl. V, Fig. 16 is holotype (P. I. U. No. ar. os. 820).

Locality of holotype. Leskusänget, in Dalecarlia, Sweden.

Stratum of holotype. Lower Ordovician: middle part of stratum *G* (about 2.0 m above *R I*/*G*).

Material. One carapace.

Dimensions.

No.	L	H	G	D M	F M	$\frac{H}{L}$	$\frac{G}{L}$	$\frac{DM}{L}$	$\frac{FM}{DM}$	∧ ant	∧ post	Remark
ar. os. 820	0.81	0.50	0.32	0.58	1.65	0.62	0.40	0.72	2.84	145	135	C

Diagnosis. *Haploprimitia* of moderate size; carapace lenticular; sulcus situated mainly in the dorsal area and only slightly in front of the midlength, it is short, straight, and rather narrow and shallow; surface smooth.

Affinities. The species is reminiscent of *Conchoprimites* as regards general shape of carapace and the appearance of sulcus, but is different in lacking grooves conforming to the free margin.

From the smooth Middle Ordovician *Haploprimitia* species of Estonia the present species is distinguishable as regards position and appearance of sulcus: in *H. kogermani* ÖPIK the sulcus is situated distinctly in front of the midlength, and *H. inconstans* ÖPIK has a much deeper sulcus.

Description. Carapace of moderate size; equivalved.

Dorsal margin straight and moderately long; anterior margin more convex than posterior one; ventral margin moderately convex.

Anterodorsal angle somewhat more obtuse than posterodorsal.

Anterior and posterior parts of carapace of about the same height.

Carapace rather inconsiderably arched; surface gently sloping to the margins; anteroventral and posterodorsal parts slightly swollen (for the space of lower antennae and presumably for eggs resp.); in the posterior part of the valves is a broad and very shallow depression directed mainly dorsoventrally (most distinct in the ventral part which is slightly curved forwards).

Sulcus situated mainly in the dorsal area and only slightly in front of the midlength; it is short, straight, and rather narrow and shallow.

Presulcate node small and indistinct.

Surface smooth.

Occurrence. Lower Ordovician: middle part of stratum *G* (about 2.0 m above *R I/G*) at Leskusänget, in Dalecarlia, Sweden.

Genus *Laccoprimitia* ULRICH and BASSLER 1923.

Genotype. *Primitia centralis* ULRICH 1890.

Occurrence. Ordovician—Gotlandian—Devonian.

Diagnosis. ULRICH and BASSLER 1923, p. 300; the distinction "without surface nodes" may be rejected (cf. below).

Discussion and remarks. The most distinguishing character of *Laccoprimitia* is the subcircular and pit-like sulcus, which is completely surrounded by equally high walls. The sulcus is generally deep (except in the genotype and *L. subcentralis* BOUČEK). As a rule, it is situated just in front of the midlength (except in *L. subcentralis* BOUČEK), and most often in the central area (in the genotype in the dorsocentral area).

Primitiopsis shares the sulcus characters with *Laccoprimitia*, but, contrary to *Laccoprimitia*, this genus is borderless and provided with an anterior chamber (space between real margin and the persisting larval margin).

In the present material, the sulcus of one species referred to *Laccoprimitia* has a typical *Laccoprimitia* sulcus, but in a second species which is provisionally referred to this genus (*L. ? foveosulcata* n. sp.) the appearance of the sulcus is sometimes different. The sulcus of the holotype of *L. ? foveosulcata* forms a distinct but slightly dorsoventrally elongated pit. It is situated in the dorsocentral area and distinctly in front of the midlength. This means that it is situated somewhat more dorsally and anteriorly than is the rule in *Laccoprimitia*. It is different also in the following respect. Since the section of the dorsal area around the dorsal part of sulcus is rather low, the dorsal limitation of the sulcus is not as high and distinct as the limitation for the rest. In the other specimens this difference is more pronounced and, furthermore, the pit is more dorsoventrally elongated.

Concerning other characters in *Laccoprimitia*, there are important differences among the species, especially as regards the presulcate node, the outline, and the free marginal area.

In the original diagnosis, *Laccoprimitia* was stated to be "without surface nodes", but in *L.? mitis* ÖPIK 1937 a presulcate node occurs. In the present material presulcate nodes occur in both the species referred to *Laccoprimitia*.

As regards the outline, there are important differences between the species. The genotype is proportionally rather short $\left(\frac{H}{L}\right.$ on the average 0.65 judging by ULRICH 1890, Pl. 10$\left.\right)$, its dorsal margin is also proportionally short $\left(\frac{DM}{L}\right.$ on the average 0.64$\left.\right)$, and "both ends are meeting the dorsal edge without forming distinct angles" (ULRICH 1890, p. 130). *L. subcentralis* BOUČEK 1936, likewise, is proportionally rather short $\left(\frac{H}{L}\right.$ of the holotype $= 0.68\left.\right)$, but the dorsal margin is long $\left(\frac{DM}{L} = 0.81\right)$, and the dorsal angles are distinct. *L. reticulata* THORSLUND 1940 represents another type of outline: carapace is proportionally very long $\left(\frac{H}{L} = 0.35\right)$, the dorsal margin is long $\left(\frac{DM}{L} = \text{about } 0.90\right)$, and the dorsal angles are distinct. *L.? mitis* ÖPIK 1937 is above all characterized by the fact that the anterior margin is symmetrically curved in relation to the longitudinal axis of the carapace, but the posterior one is asymmetric and forms a right or an acute angle with the dorsal margin. The outline of *L.? foveosulcata* has the same appearance. These examples may show that there is a great heterogeneity as regards the appearance of the outline within *Laccoprimitia*.

Concerning the appearance of the free marginal zone, this, according to the diagnosis, forms "a border along the free edge." This is also illustrated by the picture of the genotype (ULRICH 1890, Pl. 10, Fig. 1); in ULRICH's text (1890, p. 130) is mentioned "free borders with a narrow flange," which, however, may be misleading, since by "flange," is often meant a velate structure or a ventral carina. ÖPIK, in his description of *L.? mitis* (1937, p. 18), said that the valves are surrounded by a "false border." By false border is generally also meant a velate structure or a carina. Whether in this case the valves are provided with such a structure or whether the free marginal zone is depressed cannot be stated from the pictures, since this species is only reproduced in side view. BOUČEK (1936, p. 43) spoke of "Randsaum" which is generally another expression for a velate structure; from his text and the accompanying picture it appears, however, that by "Randsaum" in this case seems to be meant a depressed free margin. The depressed zone of the species alluded to by BOUČEK is extremely narrow. In *L.? foveosulcata* n. sp. the depressed zone is very narrow, but in *L. ventroturgida* n. sp. it is broader. In *L. reticulata* THORSLUND, which was mentioned above, the depressed free marginal zone is broad and distinct.

From these examples, it may appear that the characters of *Laccoprimitia* are very variable. In fact, it may be questioned whether those species which are now referred to this genus can be referable to one genus. For the present, only a few *Laccoprimitia* species are known, but when more species are found, a division of this genus will probably be realized.

A typological grouping of characteristic species may be performed as follows:

A. Sulcus typical (surrounded all round by equally high walls), shallow; situated inconsiderably in front of the midlength or distinctly in front of it; no presulcate node; free marginal zone distinctly or indistinctly depressed.

1. The genotype (sulcus situated inconsiderably in front of the midlength; dorsal corners rounded; free marginal zone distinctly depressed).
2. *L. subcentralis* BOUČEK (sulcus situated distinctly in front of the midlength; dorsal corners distinct; free marginal zone indistinctly depressed).

B. Sulcus typical (completely surrounded by equally high walls), deep, situated inconsiderably in front of the midlength; with or without presulcate node.

I. Without presulcate node.

1. *L. cristata* (JONES and HOLL) (carapace proportionally rather short; dorsal margin moderately long; free marginal zone rather broad and distinctly depressed).
2. *L. reticulata* THORSLUND (carapace long; dorsal margin long; depressed free marginal zone rather broad).

II. With presulcate node.

1. *L. ventroturgida* n. sp. (anterior and posterior margins rather symmetrically curved in relation to the longitudinal axis of the carapace).
2. *L.? mitis* ÖPIK (anterior margin symmetrically rounded; posterior one asymmetric, forming nearly a right angle with the dorsal margin).

C. Sulcus not typical (dorsal limitation low, sulcus dorsoventrally elongated), deep; presulcate node distinct.
   1. *L.? foveosulcata* n. sp. (outline similar to that of *L.? mitis*, see above B II 2; free marginal zone imperfectly depressed).

As appears from this survey, the monotypic group C is different from other species referred to *Laccoprimitia* mainly in the appearance of the sulcus, which, however, is rather variable in this species: a few specimens among the paratypoids are so different that, if observed separately, they would even provisionally scarcely have been referred to *Laccoprimitia*, but other specimens, among them the holotype, are, as regards the sulcus, more closely affined to *Laccoprimitia* than to any other genus established. Until further material is obtained, the species is provisionally referred to *Laccoprimitia*, but very likely it will later be classed in a new genus.

Possibly group B also (at least partly) will be removed from *Laccoprimitia* and referred to one or more new subgenera or genera.

The following table may give an idea of the distribution of *Laccoprimitia* (Bassler and Kellett 1934, Bouček 1936, Öpik 1937, and Thorslund 1940):

	Europe	N. America	
Devonian	1		1
Gotlandian	7	1	8
Ordovician	2	1	3
	10	2	12

(I agree with Bouček's proposal to refer to *Laccoprimitia*: *Primitia valida* Jones 1886, *Primitia cristata* Jones and Holl 1865, and *Primitia tersa* Jones and Holl 1865, but *Primitia cincta* Krause 1889 may be excluded, since it seems to be an Eurychilininae; *Primitia umbilicata* Jones and Holl 1865 and *Primitia striata* Krause 1891 may be added.)

The European Ordovician species originate from Estonia and Sweden (Öpik 1937 and Thorslund 1940). They are Middle Ordovician, like the American Ordovician species. In the present paper two new Lower Ordovician species are presented.

Laccoprimitia ventroturgida n. sp.

Pl. V, Fig. 18.

Derivation of name. *ventroturgida* alludes to the swollen ventral area.

Holotype. The type shown in Pl. V, Fig. 18 is holotype (P. I. U. No. ar. os. 359).

Locality of holotype. Born-Dådran, in Dalecarlia, Sweden.

Stratum of holotype. Lower Ordovician: upper part of stratum *G* (about 0.6 m below *G/R II*).

Material. 3 valves (partly slightly damaged) from 2 localities.

Dimensions.

No.	L	H	G	D M	F M	$\frac{H}{L}$	$\frac{G}{L}$	$\frac{DM}{L}$	$\frac{FM}{DM}$	∧ ant	∧ post	Re-mark
ar. os. 359	*0.57*	*0.31*	*0.23*	*0.41*	*1.11*	*0.54*	*0.40*	*0.72*	*2.72*	*145*	*140*	V
ar. os. 352	0.56	0.30	0.23	0.42	1.07	0.54	0.41	0.75	2.54	140	140	V
Mean	0.56	0.31	0.23	0.42	1.09	0.54	0.41	0.74	2.63	145	140	

Diagnosis. *Laccoprimitia* of moderate size; ventral area swollen, a narrow zone along free margin depressed; the pit-like sulcus small and deep, situated in dorsal part of central area and slightly in front of the midlength; presulcate node small but distinct; dorsal muscle group attachments clearly visible; surface reticulate and shallowly pitted, except marginally.

Affinities. Like the present species, *L. reticulata* THORSLUND and *L.? mitis* ÖPIK are reticulate. The former is different from *L. ventroturgida* in being proportionally more elongated and in the dorsal angles being less obtuse. The latter differs as regards the dorsal angles, and in the surface being more coarsely reticulate or punctate.

L.? foveosulcata n. sp., which is also reticulate, is different in the sulcus being often continued by a dorsal furrow, and in the posterodorsal end being elongated and tapering.

Description. Carapace of moderate size; whether or not it is equivalved was not seen, since only separate valves were observed.

Dorsal margin straight and moderately long; anterior and posterior margins about equally rounded; ventral margin slightly convex.

Dorsal angles about equal (rather obtuse).

Anterior and posterior parts of carapace of about the same height.

Posterior part of carapace more arched than the anterior which is rather flat; ventral area swollen; a narrow zone along free margin depressed (best developed ventrally); surface gently sloping to dorsal margin, somewhat more steeply to anterior and posterior margins, and very steeply to the ventral one.

Sulcus is a small and rather deep, rounded pit, situated dorsocentrally and just in front of the midlength.

Presulcate node situated just in front of dorsal part of sulcus; it is small and rounded but rather distinct.

Just dorsal to sulcus and the presulcate node there are distinct impressions of the dorsal muscle group; furthermore, a single impression is visible just anterodorsal to the node, and two others just anteroventral to it; a single impression is discernible in the anterodorsal corner of the valve (these scars referable to antennal and mandibular muscular attachments).

Surface reticulate and shallowly and narrowly pitted, except marginally.

Occurrence. Lower Ordovician: upper part of stratum *G* (about 0.6—0.2 m below *G/R II*) at Born-Dådran and Leskusänget, in Dalecarlia, Sweden.

Laccoprimitia? foveosulcata n. sp.

Pl. V, Figs. 14 and 17.

Derivation of name. *foveosulcata* alludes to the fact that the sulcus is a pit which may be connected with a dorsal furrow.

Holotype. The type shown in Pl. V, Fig. 14 is holotype (P. I. U. No. ar. os. 357).

Locality of holotype. Granmor, in Dalecarlia, Sweden.

Stratum of holotype. Lower Ordovician: lower part of stratum *G* (just above *R I/G*).

Material. 7 valves from 3 localities.

Dimensions.

No.	L	H	G	D M	F M	H/L	G/L	D M/L	F M/D M	Λ ant	Λ post	Re-mark
ar. os. 357	*0.43*	*0.23*	*0.19*	*0.42*	*0.81*	*0.54*	*0.44*	*0.97*	*1.93*	*130*	*90*	V
ar. os. 356	0.41	0.24	0.17	0.41	0.79	0.58	0.41	1.00	1.93	120	85	V
ar. os. 355	0.40	0.23	0.18	0.35	0.74	0.57	0.45	0.88	2.11	130	90	V
ar. os. 358	0.40	0.23	0.19	0.40	0.70	0.57	0.47	1.00	1.75	120	90	V
ar. os. 354	0.40	0.21	0.17	0.36	0.70	0.53	0.42	0.90	1.94	130	105	V
Mean	0.41	0.24 0.23 0.21	0.19 0.18 0.17	0.42 0.39 0.35	0.81 0.75 0.70	0.58 0.56 0.53	0.47 0.44 0.41	1.00 0.95 0.88	2.11 1.93 1.75	125	90	

Diagnosis. Ostracods of small size, provisionally referred to *Laccoprimitia*; posterodorsal part of carapace elongated and tapering; sulcus forms a deep and distinct pit, the dorsal limitation of which is lower than the limitation for the rest, sometimes continued by a dorsal furrow; surface relatively coarsely and generally distinctly reticulate.

Affinities. This species is not a typical *Laccoprimitia* and therefore only provisionally referred to this genus.

As regards outline, the species is reminiscent of *L.? mitis* ÖPIK, but is different as regards surface pattern: *L.? mitis* is only slightly pitted, but the present species is reticulate.

From other reticulate *Laccoprimitia* species known it is different in that the sulcus of these species is surrounded dorsally by a higher wall than in the present species.

Description. Carapace rather small; whether or not it is equivalved was not determined, since only separate valves were observed.

Dorsal margin straight and long; anterior margin broadly curved and rather symmetric in relation to the longitudinal axis of the carapace; posterior margin very broadly curved and asymmetric in relation to the longitudinal axis so that the posterodorsal part of carapace is elongated and tapering; ventral margin moderately convex.

Anterodorsal angle more obtuse than posterodorsal, which is almost a rightangle.

Anterior part of carapace slightly higher than posterior.

Carapace moderately arched, postsulcate region somewhat more arched than the presulcate; surface gently sloping to dorsal margin, somewhat more steeply to anterior and posterior, and very steeply to ventral margin, which posteroventrally is slightly concealed by a protruding part of the valve; a very narrow free marginal zone depressed (not distinctly observable in all specimens).

Sulcus is a deep and slightly dorsoventrally elongated pit situated in the dorsocentral area and distinctly in front of the midlength. Its dorsal limitation is lower than the limitation for the rest; sometimes dorsally connected with a short furrow.

Presulcate node small and low but clearly visible; situated just in front of the sulcate pit.

Surface relatively coarsely and most often rather distinctly reticulate, except a narrow limbate zone which is smooth; peripherally the reticulum is somewhat elongated conforming to the margins.

Occurrence. Lower Ordovician: upper part of stratum *R I* and lower part of stratum *G* (from about 0.2 m below *R I/G* to about 0.8 m above this boundary) at Stenberg, Granmor, and Leskusänget, in Dalecarlia, Sweden.

Survey of the dimensions of *Laccoprimitia*.

In spite of the fact that only few specimens of each species were measurable, the mean data surveyed in the following table may give an idea of the considerable difference between the species as regards the relative length of the margins and the size of the dorsal angles.

	Number	L	H	G	DM	FM	H/L	G/L	DM/L	FM/DM	∧ ant	∧ post
L. ventroturgida	2	0.56	0.31	0.23	0.42	1.09	0.54	0.41	0.74	2.63	145	140
L.? foveosulcata	5	0.41	0.23	0.18	0.39	0.75	0.56	0.44	0.95	1.93	125	90
						Mean	0.55	0.43	0.85	1.28	135	115

Genus *Conchoprimites* n. gen.

Derivation of name. *Conchoprimites* is chosen to point to the fact that this genus is removed from *Conchoprimitia* ÖPIK.

Genotype. *Conchoprimites reticulifera* n. sp.

Occurrence. Ordovician.

Diagnosis. Ostracods of Primitiid appearance; length 0.7—3.2 mm; left valve larger than the right, which is distinctly overlapped along the ventral margin and generally less distinctly along anterior and posterior margins; valves generally provided with a groove conforming to the whole free margin or anterior and (or) posterior margins, the groove sometimes combined with a step-like marking; sulcus generally deep or rather deep, its anterior margin often more steeply sloping than its posterior; presulcate node often present, sometimes also a postsulcate; surface smooth, punctate (entirely or partly), or reticulate.

Discussion and remarks. In splitting the genus *Conchoprimitia* ÖPIK the distinctly sulcate species are proposed to form the new genus *Conchoprimites*. This genus is 1-grooved or has a corresponding step-like margin. In *C. deminuta* ÖPIK traces of a second groove may be discernible (cf. ÖPIK 1937, Pl. XI, Fig. 8). The taxonomic importance of the number of grooves is not yet investigated. The central region of *Conchoprimites* does not seem to be swollen like a shield, such as is distinctive for *Conchoides* n. gen.

Most of the species referred to *Conchoprimitia* ÖPIK may be transferred into *Conchoprimites*:

C. tolli (BONNEMA 1909)
C. tolli integra ÖPIK 1937
C. tallinnensis ÖPIK 1937
C. deminuta ÖPIK 1937
C.? inusitata ÖPIK 1937
C. elongata THORSLUND 1940
C. leperditoides THORSLUND 1940
C. hallensis THORSLUND 1940

In the 3 last-mentioned species the sulcus is less deep than in the others. It may be added that in these species the punctation is more poorly developed or even totally lacking.

One species (*C.? inusitata*) is stated by ÖPIK to be sexually dimorphic. One type provided with "lateral carinae" without argumentation was mentioned as female, whereas another lacking such "carinae" was considered male. The term "lateral carina" was not defined. In describing another species (ÖPIK 1937, p. 19), a "carina (false border)" is mentioned, but since false border is a very dubious term, the information is of little value. Judging from Pl. XIII, Figs. 10 and 11 (ÖPIK 1937), with lateral carina is in this case meant a carinoid ridge. "It seems the carinae of *C.? inusitata* correspond probably to the concentric grooves of other species of the genus *Conchoprimitia*" (ÖPIK 1937, p. 12). The type considered male has no lateral carina and no groove conforming to the free margin.

Judging from Pl. XIII, Fig. 12 (ÖPIK 1937), the surface, moreover, is not punctate like the "female" type, and the sulcus also gives the impression of being of different appearance. One may really wonder whether these types represent the same species.

ÖPIK's statement that the carinate type is female and the non-carinate is male of the same species is groundless and has to be rejected. KAY's statement (1940, p. 249) on sexual dimorphism in the taxonomically very dubious American species *Conchoprimitia* (*Eurychilina?*) *symmetrica* (ULRICH 1894) KAY 1940, which may possibly, but not very likely, be referable to *Conchoprimites*, seems equally groundless. Without further argumentation he states as regards this species: "dimorphic, female form bearing flange within free margins". In fact, nothing is known with certainty about sexual dimorphism in *Conchoprimites*.

The hitherto known species which may be referable to *Conchoprimites* (9 in number) are all European. Those described by BONNEMA and ÖPIK (5 species) were found in Estonia and those described by THORSLUND (3 species) were found in Sweden. They are all Middle Ordovician. The Estonian species are generally distinctly punctate, the Swedish ones are indistinctly punctate or smooth.

In the present work is presented a Swedish Lower Ordovician *Conchoprimites* species which is reticulate.

Conchoprimites reticulifera n. sp.

Pl. V, Fig. 20.

Derivation of name. *reticulifera* alludes to the reticulate surface.

Holotype. The type shown in Pl. V, Fig. 20 is holotype (P. I. U. No. ar. os. 366).

Locality of holotype. Stenberg, in Dalecarlia, Sweden.

Stratum of holotype. Lower Ordovician: lower part of stratum *G* (about 1.2 m above *RI*/*G*).

Material. 1 carapace and 9 valves from 4 localities.

Dimensions.

No.	L	H	G	D M	F M	H/L	G/L	DM/L	FM/DM	∧ ant	∧ post	Re-mark
ar. os. 362	1.32	0.89	0.65	0.95	2.79	0.67	0.49	0.72	2.93	135	125	V
ar. os. 363	1.06	0.70	0.47	0.79	2.28	0.66	0.44	0.74	2.89	130	125	V
ar. os. 366	*1.01*	*0.66*	*0.44*	*0.79*	*1.98*	*0.65*	*0.44*	*0.78*	*2.51*	*130*	*120*	C
ar. os. 361	0.98	0 67	0.40	0.74	2.04	0.68	0.41	0.75	2.76	135	125	V
ar. os. 364	0.80	0.55	0.40	0.60	1.72	0.69	0.50	0.75	2.87	135	125	V
Mean	1.03	0.89 0.69 0.55	0.65 0.47 0.40	0.95 0.77 0.60	2.79 2.16 1.72	0.69 0.67 0.65	0.50 0.46 0.41	0.78 0.75 0.72	2.93 2.79 2.51	135	125	

Diagnosis. *Conchoprimites* of moderate or rather small size; grooves conforming to anterior and posterior margins; sulcus rather short and broad but distinct; presulcate node very low; surface reticulate, except for a marginal zone.

Affinities. The species is unique in being reticulate and is therefore not confusable with other known species of *Conchoprimites*.

Description. Carapace of moderate or rather small size; the left valve is the larger, overlapping the right one along ventral margin.

Dorsal margin straight and rather long; anterior margin more convex than posterior one; ventral margin moderately convex.

Anterodorsal angle somewhat more obtuse than the posterior.

Anterior and posterior parts of carapace of about the same height, or the posterior part somewhat higher.

Carapace moderately arched, presulcate region somewhat more than postsulcate (the former slightly swollen just in front of sulcus; the latter swollen just posteroventral to sulcus, its remaining part flattened); surface gently sloping to the margins, especially to the posterior; dorsal corners pinched, the posterodorsal more than the anterodorsal.

Mostly only the dorsal part of anterior margin and generally the whole posterior one conformed to by grooves; anterior groove shallow and rather broad, posterior one broad and shallow in the dorsal part but otherwise scratch-like.

Sulcus situated mainly dorsocentrally and distinctly in front of the midlength; it is practically straight and rather short, deep, and broad; its anterior wall more steeply sloping than the posterior.

Presulcate node mostly minute and slightly dorsoventrally elongated.

Surface reticulate, except for a marginal zone of different breadth, which is smooth or faintly rugose; reticulum somewhat tenuous but generally distinct (as a rule most distinct in the presulcate region).

Occurrence. Lower Ordovician: lower part of stratum *G* (about 1.1—1.4 m above *R I/G*) at Leskusänget, Stenberg, Röjeråsvägen, and Rävanäs, in Dalecarlia, Sweden.

Subfamily *Primitiopsinae* (SWARTZ 1936).

Diagnosis. SWARTZ 1936, p. 555.

Discussion and remarks. Cf. above p. 206.

Genus *Primitiopsis* JONES 1887.

Genotype. *Primitiopsis planifrons* JONES 1887.

Occurrence. Ordovician—Gotlandian—Devonian.

Diagnosis. The original diagnosis by JONES (1887, p. 5 and 1888, p. 406) was completed by later authors, e. g. ULRICH and BASSLER 1923, p. 300 (their diagnosis seems to be based mainly on the genotype), and SWARTZ 1936, p. 555.

Discussion and remarks. In the original diagnosis, JONES especially pointed to the small anterior chamber, "which is partitioned off from the rest of the cavity by a cross wall". "This constitutes the generic distinction" (1888, p. 406 f.). JONES (1888, p. 407) was aware of the fact that the chambered end is the anterior, "because that end has its analogue in the structure of the recent *Chlamydotheca* SAUSSURE". Later authors erroneously considered this end posterior in suggesting the chamber to be a brood pouch. Specimens considered males have no such pouch as illustrated by ULRICH and BASSLER (1923, p. 298). Judging by HARRIS (DECKER 1931, p. 91) also the "males" of *Primitiopsis bassleri* HARRIS should have a chamber, though less prominently developed than in "females".

Specimens provided with an anterior chamber may be recognizable as *Primitiopsis* also externally, since the surface covering the chamber is smooth but the rest of the surface is reticulate. Specimens lacking anterior chamber may not always be so easily distinguishable. They may be confused with *Laccoprimitia*, since both have a pit-like sulcus and since, like *Primitiopsis*, many *Laccoprimitia* species are reticulate. The marginal zone is differently developed: that of *Laccoprimitia* is depressed but that of *Primitiopsis* is not depressed. However, this difference may often not be distinct, since the depressed marginal zone of *Laccoprimitia* does not seem to be distinctly developed in all species. Therefore, a species may not be determined as *Primitiopsis* unless the presence of an anterior chamber is proved.

This was not always made. Earlier in this paper was mentioned (p. 207) that KAY proposed to refer *Primitiella* to the subfamily Primitiopsinae on account of the fact that the carapace is more arched in the end which, according to his conception of the orientation of the carapace, is anterior (in fact it is the posterior end). Thus, he does not compare the same ends and, additionally, he has not observed (either internally or externally) whether there is a chamber or not. His proposal has to be rejected.

KAY (1940, p. 261) described a new species as *Primitiopsis ? bella* since it is "similar to the genotype in having a shallow sulcus with a doubtful median pit, in being coarsely punctate, and, from comparison with *Primitiella constricta*, being dimorphic in the anterior". His statement about the similarity to *Primitiella* is obviously of no importance for his reference of the species to *Primitiopsis*; furthermore it may be added that in the genotype the sulcus is a small but distinct pit and not "a shallow sulcus with a doubtful median pit" (cf. ULRICH and BASSLER 1923, Fig. 15, p. 298). The continuation of KAY's discussion on the taxonomical position of the species considered is also very curious: "*Primitiella planifrons* (the genotype) also has dimorphism at the opposite end of the valve from the sulcus, but differs in having a terminal brood pouch." The "terminal brood pouch", as mentioned, is the deciding criterium for the genus *Primitiopsis*. If the species under consideration has no anterior chamber, as stated by KAY, it may not be a *Primitiopsis*.

P. oblonga (JONES and HOLL) and *P. obsoleta* (JONES and HOLL) are different from other *Primitiopsis* species and might properly be removed from this genus, as proposed by SWARTZ (1936, p. 555). They are non-pitted and non-reticulate.

Inclusive of these two species, 10 species seem to be referable to *Primitiopsis* (one reported as uncertain); *P. ? bella* KAY which was discussed above is not included. The 10 species are distributed in the following way (BASSLER and KELLETT 1934, and SWARTZ 1936, who adds *Primitia reticristata* JONES and HOLL, op. cit. p. 558).

	Europe	N. America	
Devonian	2	2	4
Gotlandian	5[1]		5
Ordovician		1	1
	7	3	10

[1] 4 of them from the Island of Gotland.

The Ordovician species is Middle Ordovician.

In the present work, one Lower Ordovician species is described, which is provisionally referred to *Primitiopsis*. Since the only specimen secured could not be investigated internally, it was not observed whether or not an anterior chamber is present, and, hence, its generic position is somewhat uncertain.

Primitiopsis (?) *circumreticulatum* n. sp.

Pl. V, Fig. 19.

Derivation of name. *circumreticulatum* alludes to the fact that the reticulation is elongated conforming to the margins.

Holotype. The type shown in Pl. V, Fig. 19 is holotype (P. I. U. No. ar. os. 360).

Locality of holotype. Silverberg, in Dalecarlia, Sweden.

Stratum of holotype. Lower Ordovician: presumably lower part of stratum *G*; the exact distance from the boundary *R I/G* could not be established, since this boundary was not observable at Silverberg.

Material. One valve.

Dimensions.

No.	L	H	G	D M	F M	H/L	G/L	D M/L	F M/D M	∧ ant	∧ post	Re-mark
ar. os. 360	0.62	0.35	0.28	0.49	1.16	0.56	0.45	0.79	2.36	140	120	V

Diagnosis. Ostracod of moderate size, most likely referable to *Primitiopsis*; free marginal zone not depressed; sulcus small and pit-like; surface distinctly reticulate; reticulum elongated conforming to the margins.

Affinities. The species is provisionally considered a *Primitiopsis* on account of the distinct pit in the central area, the distinctly reticulate surface, and the fact that the free marginal zone is not depressed. The species could not be proved to be a *Primitiopsis*, since it was not possible to observe whether an anterior chamber is present.

The circummarginal arrangement of the reticulum distinguishes the present species from other *Primitiopsis* species known.

Description. Carapace of moderate size; whether or not it is equivalved was not ascertainable, since only one separate valve was observed.

Dorsal margin straight and rather long; anterior and posterior margins regularly curved, anterior somewhat more than posterior; ventral margin nearly straight, parallel to the dorsal margin.

Anterodorsal angle somewhat more obtuse than the posterodorsal.

Anterior and posterior parts of carapace of about the same height.

Carapace moderately and rather regularly arched, anterior area somewhat more arched than the posterior; ventral area slightly protruding over ventral margin.

Sulcus situated in the dorsal part of central area and just in front of the midlength; it is a small, rounded, and rather deep and distinct pit.

Surface distinctly reticulate; reticulum elongated conforming to the margin.

Occurrence. Lower Ordovician: stratum *G*, presumably lower part; the exact distance from *R I/G* or *G/R II* not known, since these boundaries were not observable in the only locality where the present species was found, viz. Silverberg (sample 4), in Dalecarlia, Sweden.

Family *Hollinidae* SCHMIDT 1941.

Diagnosis. SCHMIDT 1941, p. 31.

Discussion and remarks. According to SCHMIDT, this family is separable into 4 new subfamilies:

Hollininae
Ctenentominae
Tetradellinae
Ctenonotellinae.

I propose to refer two additional subfamilies to Hollinidae: Eurychilininae ULRICH and BASSLER 1923 and Euprimitiinae n. subfam. The genera of these subfamilies are usually classed in Primitiidae.

It may not be appropriate to class the velate subfamily Eurychilininae in Primitiinae as has hitherto been done; in fact it may be more closely related to Hollinidae subfamilies, especially to Ctenentominae. This suggestion is based mainly on the important fact that both have a velate structure. But there is also essential agreement as regards sulcus and presulcate node. For the same reasons, *Euprimitia* and some allied genera here proposed to form the subfamily Euprimitiinae are referred to Hollinidae; in this case the velate structure is not a velum but a velate ridge.

After exclusion of these subfamilies, Primitiinae becomes an entirely non-velate subfamily.

Besides these now presently proposed subfamilies, Ctenentominae and Tetradellinae are represented in the material investigated here.

Subfamily *Euprimitiinae* n. subf.

Diagnosis. A group of genera provided with a velate ridge; sulcus most often rather straight, short, broad, and moderately deep, sometimes its ventral part is surrounded by a horseshoe-shaped ridge; presulcate node generally present, surface mostly reticulate or punctate (often very coarsely), sometimes granulate, granoreticulate, lineate, or smooth.

Discussion and remarks. *Euprimitia* and the allied genera *Euprimites*

n. gen., *Halliella* ULRICH and *Hallatia* KAY may be closely related to Eurychilininae. However, they are different from Eurychilininae and may form a new subfamily called Euprimitiinae. The most distinctive difference is in the appearance of the velate structure. In Eurychilininae it forms a broad velum and is often dimorphic: in some specimens it is partly convex so that an extraneous chamber is formed between the vela. In Euprimitiinae it consists of a generally rather low ridge which is narrow or moderately broad (most often called "the false border"). An extraneous chamber like that of Eurychilininae may not occur. KAY's remark that "female" carapaces of *Euprimitia* have "a posteroventral flange obscuring a marginal, channellike pouch" (1940, p. 252) should have been completed by illustrations to verify such a remarkable statement. The accompanying illustrations do not yield information in this respect.

On account of this dimorphism and of similarity in the appearance of the sulcus KAY ranked *Euprimitia* in Eurychilininae.

Genus *Euprimitia* ULRICH and BASSLER 1923.

Genotype. *Primitia sanctipauli* ULRICH 1894.

Occurrence. Ordovician—Gotlandian.

Diagnosis. ULRICH and BASSLER 1923, p. 300.

Discussion and remarks. Important additions to the original diagnosis have not been made.

(KAY's statement about sexual dimorphism (1940, p. 252) cannot be considered proved, cf. above.)

From *Euprimitia* ULRICH and BASSLER I propose to remove those species in which the ventral part of sulcus is surrounded by a horseshoe-shaped ridge. They form the new genus *Euprimites*.

Only 6 species belonging to *Euprimitia* emend. may be known; revised data from BASSLER and KELLETT 1934, ÖPIK 1937, THORSLUND 1940, and KAY 1940. They are distributed in the following way:

	Europe	N. America	
Gotlandian	1		1
Ordovician	2	3	5
	3	3	6

The Ordovician species are Middle Ordovician. The European ones originate from Estonia.

In the present paper are described three Lower Ordovician *Euprimitia* species from Sweden.

Euprimitia tenuireticulata n. sp.

Pl. V, Figs. 25 and 26.

Derivation of name. *tenuireticulata* alludes to the tenuously reticulate surface.

Holotype. The type shown in Pl. V, Fig. 25 is holotype (P. I. U. No. ar. os. 370).

Locality of holotype. Leskusänget, in Dalecarlia, Sweden.

Stratum of holotype. Lower Ordovician: lower part of stratum *R II* (about 0.2 m above *G/R II*).

Material. 3 valves from 2 localities.

Dimensions.

No.	L	H	G	D M	F M	H/L	G/L	D M/L	F M/D M	∧ ant	∧ post	Re-mark
ar. os. 370	*1.00*	*0.65*	*0.42*	*0.93*	*2.09*	*0.65*	*0.42*	*0.93*	*2.25*	*115*	*100*	V
ar. os. 371	0.70	0.43	0.29	0.64	1.42	0.62	0.41	0.91	2.22	115	100	V
Mean	0.85	0.54	0.36	0.79	1.76	0.64	0.41	0.92	2.24	115	100	

Diagnosis. *Euprimitia* of moderate size; free margin surrounded by a narrow velate ridge; area between velate ridge and free margin convex and very narrow; sulcus short, rather broad and deep, dorsal part widened; presulcate node rather low but distinct, rounded or dorsoventrally slightly elongated; surface tenuously reticulate.

Affinities. The species is different from *E. macroreticulata* n. sp. in being more tenuously reticulate and in the velate ridge being narrower.

Regarding the reticulation, the species resembles *Euprimites reticulogranulata* n. sp., but the generic character of *Euprimites*, i. e. the ventral part of sulcus being surrounded by a horseshoe-shaped ridge, is sufficient to distinguish *E. reticulogranulata* from the present species.

Furthermore, *Macronotella reticulata* n. sp. is somewhat reminiscent of *Euprimitia tenuireticulata* as regards general shape and the reticulation. They are distinguishable in that the sulcate depression of *Macronotella reticulata* is very shallow and the presulcate node of that species is extremely low; moreover, the most distinguishing generic character of *Macronotella* (the large and rounded central muscle spot) is often discernible externally in *M. reticulata.*

Description. Carapace moderately large; whether or not it is equivalved could not be determined, since only separate valves were observed.

Dorsal margin straight and long; anterior and posterior margins broadly rounded, anterior slightly more than posterior; ventral margin rather convex.

Dorsal angles only slightly obtuse, posterodorsal somewhat less obtuse than the anterodorsal.

Anterior and posterior parts of carapace of about the same height.

Valves moderately arched, presulcate region somewhat more than the postsulcate, which is rather flattened in the posterior part; posterodorsal corner pinched; area between free margin and velate ridge concave and very narrow.

Velate ridge narrow, extending from anterodorsal to posterodorsal corner.

Sulcus situated mainly in the dorsocentral area and somewhat in front of the midlength; it is short, rather broad and deep; dorsal part broader and less distinct.

Presulcate node low and rounded, or slightly dorsoventrally elongated.

Central muscle spot discernible in ventral part of sulcus; in the broadened dorsal part of sulcus the impressions of the dorsal muscle group are visible; in front of the presulcate node impressions of antennal and mandibular muscles occur (mainly anterodorsally of it, but also anteroventrally); in the anterodorsal corner is a rather distinct muscle impression.

Surface tenuously reticulate (the narrow zone between velate ridge and free margin smooth); "meshes" elongated, mainly conforming to the margins; the reticulum seems to be better developed in later stages than in earlier (in specimen No. 371 [0.70 mm] the reticulum is more tenuous than in No. 370 [1.00 mm]; moreover, in No. 371 the postsulcate region is very indistinctly reticulate).

Occurrence. Lower Ordovician: upper part of stratum *G* and lower part of stratum *R II* (from about 0.1 m below *G*/*R II* to about 0.2 m above this boundary) at Leskusänget and Rävanäs, in Dalecarlia, Sweden.

Euprimitia macroreticulata n. sp.

Pl. V, Figs. 22 and 23.

Derivation of name. *macroreticulata* alludes to the widely reticulate surface.

Holotype. The type shown in Pl. V, Fig. 22 is holotype (P. I. U. No. ar. os. 373).

Locality of holotype. Stenberg, in Dalecarlia, Sweden.

Stratum of holotype. Lower Ordovician: lower part of stratum *G* (about 0.6 m above *R I*/*G*).

Material. 6 valves from 3 localities.

Diagnosis. *Euprimitia* of small size; posterodorsal part of carapace slightly extended and tapering; velate ridge relatively broad, not extending to dorsal corners; area between velate ridge and free margin slightly

Dimensions.

No.	L	H	G	D M	F M	H/L	G/L	D M/L	F M/D M	∧ ant	∧ post	Re-mark
ar. os. 376	0.57	0.38	0.30	0.48	1.13	0.67	0.53	0.84	2.35	130	110	V
ar. os. 373	*0.49*	*0.36*	*0.23*	*0.40*	*0.95*	*0.73*	*0.47*	*0.82*	*2.37*	*130*	*110*	V
ar. os. 378	0.49	0.36	0.26	0.41	1.00	0.73	0.53	0.84	2.44	125	115	V
ar. os. 374[1]	0.44	0.27	0.20	0.39	0.88	0.61	0.45	0.89	2.26	130	105	V
ar. os. 377	0.43	0.30	0.23	0.38	0.87	0.70	0.54	0.89	2.29	115	110	V
ar. os. 375	0.41	0.27	0.20	0.36	0.75	0.66	0.49	0.88	2.08	105	115	V
Mean	0.47	0.38 0.32 0.27	0.30 0.24 0.20	0.48 0.40 0.36	1.13 0.93 0.75	0.73 0.68 0.61	0.54 0.51 0.45	0.89 0.86 0.82	2.44 2.30 2.08	125	110	

[1] Specimen encrusted with limonite and shrunken, length in reality 0.56 mm (cf. Pl. V, Fig. 23).

concave and fairly broad; sulcus deep and rather broad, ventral end somewhat curved forwards; presulcate node relatively large; surface widely reticulate.

Affinities. The species is distinguishable from other *Euprimitia* species on account of the appearance of the outline (posterodorsal part slightly extended and tapering), the velate ridge (proportionally broad and not reaching the dorsal corners), the deep sulcus and the distinct presulcate node, and the reticulation (meshes more equilateral and relatively larger than in other known species of *Euprimitia*).

Description. Carapace small; whether or not it is equivalved could not be ascertained, since only separate valves were observed.

Dorsal margin straight and long; anterior margin widely curved, and rather symmetric to the longitudinal axis of the carapace; posterior margin asymmetric so that posterodorsal part of carapace is slightly extended and tapering; ventral margin rather much convex.

Anterodorsal angle somewhat more obtuse than posterodorsal.

Anterior part of carapace somewhat higher than posterior.

Carapace moderately arched, postsulcate region more than presulcate (area just posteroventral to sulcus somewhat swollen, posterodorsal area slightly flattened); area between velate ridge and free margin slightly concave.

Velate ridge broadest anteroventrally (thus constituting a forward swing), successively diminishing in breadth towards the ends, extending to dorsal part of anterior and posterior margins.

Sulcus situated distinctly in front of the midlength; it is deep, rather broad, and long, extending from about the midheight of dorsal area to about middle part of central area; its dorsal half directed dorsoventrally, its ventral slightly curved forwards.

Presulcate node situated dorsocentrally (just in front of the middle part of sulcus); it is rounded or slightly dorsoventrally elongated and rather low but distinct.

Surface reticulate, except sulcus and presulcate node which are smooth; reticulation distinct, especially in the presulcate region, but very indistinct in the area between velate ridge and free margin; reticulum proportionally wide and fairly equilateral.

Notes on the larval development. Judging by the specimens measured, it seems as if the anterodorsal angle grows more and more obtuse during the ontogenesis. Other ontogenetic changes were not observed.

Occurrence. Lower Ordovician: lower part of stratum *G* (about 0.6—0.7 m above *R I*/*G*) at Stenberg and Leskusänget, in Dalecarlia, Sweden; furthermore, one specimen was observed at Silverberg in Dalecarlia, viz. in sample No. 2 (stratum *G*; distance from *R I*/*G* not known, this boundary not having been observed at Silverberg).

Euprimitia planopunctata n. sp.

Pl. V, Figs. 21 and 24.

Derivation of name. *planopunctata* alludes to the shallowly pitted surface.

Holotype. The type shown in Pl. V, Fig. 21 is holotype (P. I. U. No. ar. os. 390).

Locality of holotype. Born-Dådran, in Dalecarlia, Sweden.

Stratum of holotype. Lower Ordovician: lower part of stratum *R II* (about 0.3 m above *G*/*R II*).

Material. 2 valves and 26 internal moulds from 2 localities.

Diagnosis. *Euprimitia* of rather small size; ventral margin and ventral part of anterior and posterior margins surrounded by a low velate ridge; area between velate ridge and free margin distinctly concave and rather narrow; sulcus short, shallow, and fairly broad; presulcate node small and tuberculoid, distinct; surface shallowly pitted; surface of internal mould additionally slightly tuberculate.

Affinities. The characteristic shallowly pitted surface makes this species distinguishable from other known species of *Euprimitia*.

The species may be reminiscent of certain specimens of *Macronotella reticulata* n. sp., viz. those in which the large central muscle spot is indistinct and a slight sulcate depression and a minute presulcate node are developed. *M. reticulata* is different mainly in that the entire region between the dorsal margin and the velate ridge is reticulate; in the present species this zone is smooth and shallowly pitted.

Dimensions.

No.	L	H	G	D M	F M	H / L	G / L	D M / L	F M / D M	∧ ant	∧ post	Re-mark
ar. os. 388	0.72	0.46	0.35	0.60	1.39	0.64	0.49	0.83	2.32	120	115	M
ar. os. 389	0.66	0.42	0.28	0.52	1.16	0.64	0.42	0.79	2.23	125	115	M
ar. os. 386	0.64	0.38	0.26	0.49	1.16	0.59	0.41	0.77	2.52	130	120	M
ar. os 384	0.63	0.41	0.26	0.51	1.16	0.65	0.41	0.81	2.27	130	120	M
ar. os. 381	0.60	0.40	0.26	0.46	1.25	0.67	0.43	0.77	2.72	120	130	M
ar. os. 390	*0.55*	*0.33*	*0.24*	*0.42*	*1.09*	*0.60*	*0.44*	*0.76*	*2.60*	*135*	*120*	M
ar. os. 380	0.54	0.33	0.26	0.40	1.09	0.61	0.48	0.74	2.72	135	120	M
ar. os. 382	0.50	0.29	0.21	0.42	0.95	0.58	0.42	0.84	2.26	125	110	M
ar. os. 387	0.44	0.26	0.19	0.37	0.84	0.59	0.43	0.84	2.27	130	115	M
ar. os. 385	0.43	0.28	0.20	0.35	0.86	0.65	0.47	0.81	2.46	130	110	M
Mean	0.57	0.46 0.36 0.26	0.35 0.25 0.19	0.60 0.45 0.35	1.39 1.10 0.84	0.67 0.62 0.58	0.49 0.44 0.41	0.84 0.79 0.74	2.72 2.44 2.23	130	120	

Description. Carapace rather small; whether or not it is equivalved could not be established, since only separate valves were observed.

Dorsal margin straight and moderately long; anterior margin slightly more convex than posterior; ventral margin moderately convex.

Anterodorsal angle somewhat more obtuse than posterodorsal.

Anterior and posterior parts of carapace of about the same height.

Carapace moderately arched, postsulcate region slightly more than presulcate; posterodorsal corner somewhat pinched; area between velate ridge and free margin narrow and concave.

Velate ridge low, not entirely concealing corresponding parts of free margin, extending to dorsal parts of anterior and posterior margins.

Sulcus situated in the dorsocentral area distinctly in front of the mid-length; it is shallow, short, and fairly broad.

Presulcate node small and tuberculoid.

Surface mainly posterior and ventral to sulcus shallowly pitted; surface of internal moulds variably developed: extremely shallow pits distinctly developed in a few specimens, in others the pits are indistinct, and in many specimens they are not discernible at all; scattered minute tubercles occur permanently, however.

Muscular impressions mostly distinctly discernible in internal moulds; central muscle spot large and rounded; dorsal muscle group impressions often distinct; in front of presulcate node (partly anterodorsally and partly anteroventrally) antennal and mandibular muscle scars often visible; sometimes an impression occurs in the anterodorsal corner of the internal mould.

Occurrence. Lower Ordovician: lower part of stratum *R II* (from just above *G/R II* to about 0.3 m above this boundary) at Silverberg II and Born-Dådran, in Dalecarlia, Sweden.

Survey of the dimensions of *Euprimitia*.

The extent to which the following mean data are representative is restricted, owing partly to the fact that the measurable specimens of *E. tenuireticulata* are few and partly to the fact that *E. planopunctata* is represented mainly by internal moulds.

It may be noticed that the dorsal margin seems to be long in all species; it is especially long in *E. tenuireticulata* and *E. macroreticulata*.

	Number	L	H	G	D M	F M	$\frac{H}{L}$	$\frac{G}{L}$	$\frac{DM}{L}$	$\frac{FM}{DM}$	∧ ant	∧ post
E. tenuireticulata	2	0.85	0.54	0.36	0.79	1.76	0.64	0.41	0.92	2.24	115	100
E. macroreticulata	6	0.47	0.32	0.24	0.40	0.93	0.68	0.51	0.86	2.30	125	110
E. planopunctata	10	0.57	0.36	0.25	0.45	1.10	0.62	0.44	0.79	2.44	130	120
						Mean	0.65	0.45	0.86	2.31	125	110

Genus *Euprimites* n. gen.

Derivation of name. *Euprimites* is chosen to point to the fact that this genus is removed from *Euprimitia*.

Genotype. *Euprimitia reticulogranulata* n. sp.

Occurrence. Ordovician—Gotlandian.

Diagnosis. Monosulcate ostracods of rather small or moderate size: length about 0.7—1.5 mm; carapace practically equivalved; free margin surrounded by a velate ridge; sulcus deep and straight, its ventral part surrounded by a horseshoe-shaped, rounded ridge; presulcate node small, constituting the continuation of the anterior part of the horseshoe-shaped ridge; surface smooth (?), lineate and granulate, reticulate, reticulogranulate, or punctate.

Discussions and remarks. The horseshoe-shaped ridge enclosing the ventral part of the sulcus is the character which mainly distinguishes

Euprimites from *Euprimitia*, from which genus *Euprimites* is detached. Moreover, in the new genus the sulcus is generally longer and deeper. These characters are so typical that generic value may be attached to them.

ÖPIK (1937, p. 19) and THORSLUND (1940, p. 164 and 165) have noticed the horseshoe-shaped ridge in the following species: *Euprimitia plena* ÖPIK 1937, *Euprimitia minor* THORSLUND 1940, and *Euprimitia* (?) *locknensis* THORSLUND 1940. I propose that these species be referred to *Euprimites*. Judging by the pictures, the following species may also belong to *Euprimites*: *Euprimitia buttsi* ULRICH and BASSLER 1923 and possibly *Euprimitia* sp. aff. *bilabrata* ÖPIK 1937. Possibly some or other of the "*Primitia*" species of the German Geschiebe geologists appear to belong to *Euprimites*, such as *Primitia bursa* KRAUSE 1889 (referred to *Eurychilina* by BASSLER and KELLETT 1934 without discussion and presumably erroneously, considered by SCHMIDT 1941 to be a *Craspedobolbina*; SCHMIDT's suggestion requires further confirmation).

The above-mentioned species referred to *Euprimites* are distributed in the following way:

	Europe	N. America	
Gotlandian		1	1
Ordovician	4		4
	4	1	5

The Ordovician species originate from Sweden and Estonia; they are all Middle Ordovician.

In this paper one Lower Ordovician *Euprimites* species is described.

Euprimites reticulogranulata n. sp.

Pl. V, Fig. 27.

Derivation of name. *reticulogranulata* alludes to the fact that the surface is reticulate and additionally partly granulate.

Holotype. The type shown in Pl. V, Fig. 27 is holotype (P. I. U. No. ar. os. 392).

Locality of holotype. Leskusänget, in Dalecarlia, Sweden.

Stratum of holotype. Lower Ordovician: lower part of stratum *R II* (about 0.2 m above *G/R II*).

Material. 2 carapaces (in part unsatisfactorily preserved) and 2 valves from 3 localities.

Diagnosis. *Euprimites* of moderate size; ventral region swollen and concealing ventral margin; velate ridge running along the most protruding

Dimensions.

No.	L	H	G	D M	F M	H/L	G/L	D M/L	F M/D M	∧ ant	∧ post	Remark
ar. os. 392	*1.08*	*0.60*	*0.60*	*0.90*	*1.98*	*0.56*	*0.56*	*0.83*	*2.20*	*120*	*115*	V
ar. os. 393	0.88	0.54	0.42	0.70	1.74	0.61	0.48	0.80	2.49	135	120	C
ar. os. 391	0.64	0.35	0.26	0.54	1.16	0.55	0.41	0.84	2.15	130	120	C
Mean	0.87	0.60 0.50 0.35	0.60 0.43 0.26	0.90 0.71 0.54	1.98 1.63 1.16	0.61 0.57 0.55	0.56 0.49 0.41	0.84 0.82 0.80	2.49 2.28 2.15	130	120	

part of the swollen ventral region, forming there a gentle curve arcuated outwards; sulcus straight, long, rather deep, and broad; surrounding horse-shoe-shaped ridge distinct; presulcate node small; surface wrinkly reticulate and slightly granulate.

Affinities. The species somewhat resembles *Euprimites minor* (THORSLUND), *E. locknensis* (THORSLUND), and *E. plena* (ÖPIK). These species have different surface patterns (*E. minor*: very finely reticulate, ventrally smooth, no granulation; *E. locknensis*: a dorsal row of tubercles; *E. plena*: surface minutely lineate).

Description. Carapace of moderate size; it seems to be practically equivalved.

Dorsal margin straight and long; anterior margin slightly more convex than the posterior; ventral margin moderately or slightly convex.

Anterodorsal angle somewhat more obtuse than the posterodorsal.

Anterior and posterior parts of carapace of about the same height, or the anterior part inconsiderably higher.

Carapace moderately arched, presulcate region inconsiderably more arched than the postsulcate; ventral region regularly swollen and concealing ventral margin (the velate ridge runs along its most protruding part); area between velate ridge and free margin slightly concave; closely along the free margin (observed in a right valve) runs a distinct, acute ridge.

Velate ridge narrow and acute, extending to dorsal parts of anterior and posterior margins, forming in the ventral part a gentle curve arcuated outwards (cf. Pl. V, Fig. 27 c); the ends of the ridge join the free margin anteriorly and posteriorly.

Sulcus very distinct; it extends from the dorsal area to about the midheight; it is straight, long, rather broad, and deep; its dorsal section is about equally broad in all parts, the ventral slightly widened; the walls of the sulcus steeply sloping, except for the ventral one, which slopes gently.

Ventral part of sulcus surrounded by a narrow, rounded, and low but distinct horseshoe-shaped ridge.

Presulcate node minute, situated about at the midheight of sulcus, causing a slight sinuosity in the anterior margin of the sulcus.

Surface distinctly reticulate, except for the sulcus and the horseshoe-shaped ridge which are smooth (owing to the fact that the lines of the reticulum are somewhat irregularly thick, the surface has a somewhat wrinkled appearance); surface is partly additionally granulate; granulae most numerous on both sides of the velate ridge.

Occurrence. Lower Ordovician: upper part of stratum *G* and lower part of stratum *R II* (from about 0.2 m below *G*/*R II* to about 0.3 m above this boundary) at Leskusänget, Silverberg II, and Born-Dådran, in Dalecarlia, Sweden.

Subfamily *Eurychilininae* Ulrich and Bassler 1923.

Diagnosis. A group of broadly velate ostracodal genera; velum in some genera plane and in others convex; in some genera parts of the specimens have a plane velum and in others the velum is partly convex (this difference generally interpreted as sexual dimorphism); sulcus a more or less deep and distinct furrow, a subcircular pit, an undefined depression, or substituted by a slightly raised flattened spot or by a rounded node; presulcate node present or lacking; sometimes also a postsulcate node present; pre- and postsulcate nodes in some species connected by a more or less distinct wall enclosing the ventral part of the sulcus; surface smooth, tuberculate, punctate, or reticulate; velum often radiately plicated.

Discussion and remarks. Different opinions have been expressed as regards the taxonomic position of this subfamily: Schmidt (1941, p. 28) suggests it to be intermediate between Hollinidae and Beyrichiidae ("only for historical reasons and not from his own judgement" he referred it to Primitiinae).

The most important generic characters of Eurychilininae comprise the sulcus, the presulcate node, and the velum.

The sulcus and the presulcate node are variably developed in different genera. The sulcus may be more or less deep, and it may be "open" dorsally, or limited by a wall which gives it a pit-like appearance. In a few genera, the ventral part of the sulcus is surrounded by a low ridge connected anteriorly with the presulcate node. This node may be large and distinct (rounded or dorsoventrally elongated), or small and indistinct, or lacking.

The velum is entirely plane, or parts of it are convex so that sausage- or egg-shaped rooms are formed.

These spaces are generally considered to be brood pouches. However, as appears from the discussion on the function of these formations (p. 127), the velate chambers of *Eurychilininae* scarcely served such a purpose.

Further investigations of transverse sections of an extensive and representative material may possibly be able to elucidate the function of the velate swellings. Such investigations will also determine their taxonomic value. The latter question is insufficiently studied and, therefore, taxonomic discussions cannot yet be based upon the velate swellings.

THORSLUND (1940, p. 165 f.), on the basis of the appearance of the velum, discussed the range of *Chilobolbina*. He suggests that "primarily (in male and probably also in unfertilized or unproductive females) the border of the free margin of *Chilobolbina* was not bent inwards or 'curved on its under side so as to form a concave area around the true contact edges of the valves' as in *Coelochilina* and *Eurychilina* (ULRICH and BASSLER 1923, p. 303). In reality, this feature is restricted to certain specimens of species of *Chilobolbina*."

Thus, THORSLUND seems to mean that the velum of *Eurychilina* and *Coelochilina* should be invariably convex, whereas that of *Chilobolbina* should be entirely plane in some specimens but in others partly convex. This is not tenable. In fact, such dimorphism also occurs in other genera, such as *Eurychilina* and *Laccochilina* n. gen.

The range of Eurychilininae has been discussed by several authors. I think that the following genera may be referred to Eurychilininae:

Eurychilina ULRICH 1889
Craspedobolbina KUMMEROW 1924
Mirochilina BOUČEK 1936
Laccochilina n. gen.
Chilobolbina ULRICH and BASSLER 1923
Apatochilina ULRICH and BASSLER 1923
Apatobolbina ULRICH and BASSLER 1923
Coelochilina ULRICH and BASSLER 1923
Platychilina KUMMEROW 1933, nomen nudum; in fact THORSLUND 1940
(?) *Neochilina* MATERN 1929

In the present material only 2 Eurychilininae genera are discerned, i. e. *Eurychilina* (2 species) and *Laccochilina* n. gen. (4 species). The latter includes, besides the species described here, some species which were previously mainly referred to *Eurychilina* and *Coelochilina*.

Genus *Eurychilina* ULRICH 1889.

Genotype. *Eurychilina reticulata* ULRICH 1889.

Occurrence. Ordovician—Gotlandian—Devonian.

Diagnosis. ULRICH 1894, p. 658. The character "velum on the inner side deeply concave" is not of general application; it is referable only to the sausage-shaped part of the velum in certain individuals.

Discussion and remarks. Eurychilininae species in which the sulcus is shallow, absent, or substituted by an elevation, and the presulcate node poorly developed or absent, have previously been grouped in special genera. In this paper a new genus, *Laccochilina,* is proposed for those species which have a deep, pit-like sulcus and a distinct presulcate node; velate swellings are sausage-shaped. The following characters may be especially distinctive for *Eurychilina* in the extension as here proposed: sulcus deep and "open" dorsally, presulcate node distinct, and the ventral part of sulcus not seldom surrounded by a slight elevation; velum in certain specimens sausage-shaped.

BASSLER and KELLETT (1934) referred 26 species to *Eurychilina*, but 9 (possibly 12) of them are referable to other genera; thus 14 (possibly 17) species are referable to *Eurychilina* (*E. bursa* [KRAUSE], *E. bursa scanensis* [TROEDSSON], and *E. decumana* [BONNEMA] are the 3 uncertain species). KAY (1940) referred 2 additional species to *Eurychilina,* but, judging from the descriptions and the illustrations, they may scarcely be referable to this genus; the new subspecies *E. reticulata parvifrons* KAY may be a real *Eurychilina*, however. TEICHERT (1937) added one species from Arctic Canada.

The *Eurychilina* species and subspecies now mentioned are distributed in the following way:

	Europe	N. America	Asia	Antarctic	
Devonian		1			1
Gotlandian	2 (?)	1		1	4
Ordovician	1 (?)	12	1		14
	3 (?)	14	1	1	19

The Asiatic Ordovician species is not more closely dated. The other are Middle Ordovician, except 2 American species which are Lower Ordovician.

In this paper 2 Lower Ordovician *Eurychilina* species from Sweden are presented.

Eurychilina dorsotuberculata n. sp.

Pl. V, Figs. 28—31.

Derivation of name. *dorsotuberculata* alludes to a row of tubercles along the dorsal margin.

Holotype. The type shown in Pl. V, Fig. 28 is holotype (P. I. U. No. ar. os. 421).

Locality of holotype. Gulleråsen, in Dalecarlia, Sweden.

Stratum of holotype. Lower Ordovician: lower part of stratum *R II* (about 1.0 m above *G/R II*).

Material. 1 carapace (valves somewhat dislocated), and 20 valves and internal moulds from 4 localities.

Dimensions.

No.	L	H	G	D M	F M	Vel.	H / L	G / L	D M / L	Vel. / L	F M / D M	∧ ant	∧ post	Remark
ar. os. 421	*1.19*	*0.64*	*0.37*	*1.11*	*2.07*	*0.16*	*0.54*	*0.31*	*0.93*	*0.13*	*1.87*	(*120*)	*110*	V
ar. os. 803	1.16	0.69	—	1.05	2.10	0.16	0.59	—	0.90	0.14	2.00	115	110	V
ar. os. 418	0.92	0.55	0.33	0.79	1.75	0.19	0.60	0.36	0.86	0.21	2.22	125	110	V
ar. os. 422	0.91	0.54	0.32	0.77	1.65	0.12	0.59	0.35	0.85	0.13	2.14	120	(115)	V
ar. os. 417	0.79	0.48	0.22	0.67	1.53	—	0.61	0.28	0.85	—	2.28	125	110	M
ar. os. 416	0.70	0.44	0.22	0.63	1.32	0.09	0.63	0.31	0.90	0.13	2.10	120	110	V
ar. os. 415	0.70	0.40	0.21	0.63	1.23	0.08	0.57	0.30	0.90	0.11	1.96	120	110	M
ar. os. 414	0.69	0.40	0.20	0.63	1.23	0.09	0.58	0.29	0.91	0.13	1.96	115	105	V
Mean	0.88	0.69 0.52 0.40	0.37 0.27 0.20	1.11 0.79 0.63	2.10 1.61 1.23	0.19 0.13 0.08	0.63 0.59 0.54	0.36 0.31 0.28	0.93 0.89 0.85	0.21 0.14 0.11	2.28 2.07 1.87	120	120	

Diagnosis. *Eurychilina* of moderate size; sulcus rather broad and shallow; presulcate node low; velum moderately broad, entirely plane, or plane posteriorly and convex ventrally and anteriorly, convex section distinctly striate conforming to the margin; surface of carapace smooth and scatteredly tuberculate; along the dorsal margin is a row of tubercles.

Affinities. The species is scarcely confusable with other known species of *Eurychilina* mainly on account of the shallow sulcus, the flat dorsal area, and the row of tubercles along the dorsal margin. *E. rugosotuberculata* n. sp. which, like the present species, is irregularly and only partly tuberculate, has not such a dorsal row of tubercles, and is, furthermore, slightly rugose, whereas the present species is smooth.

Description. Carapace of moderate size; whether or not it is equivalved could not be determined, since only separate valves were observed.

Dorsal margin straight and long; anterior and posterior margins regularly and widely curved, the anterior slightly more curved; ventral margin moderately convex.

Anterodorsal angle slightly more obtuse than the posterodorsal.

Anterior and posterior parts of carapace of about the same height, or the posterior part slightly higher.

Carapace slightly arched, presulcate region more flattened than the postsulcate, which is slightly swollen just posterior to sulcus; surface gently and regularly sloping to the base of the velum and to the dorsal margin.

Velum moderately broad; in some individuals it is plane, in others it is plane posteriorly but convex anteriorly and ventrally; the margins of the convex velate sections do not meet, so that the enclosed sausage-shaped space is open; plane vela and plane velate sections radially ribbed, ribs (especially posteriorly) broad, steep-margined and flat on the top; convex sections radially ridged; ridges rounded in transverse section; additionally, the convex sections are distinctly striate conforming to the margin.

Sulcus situated mainly centrally and distinctly in front of the midlength; it is short, and fairly broad and shallow; dorsocentrally it forms a broad, very shallow, and undefined depression.

Presulcate node small, low, and somewhat elongated dorsoventrally; it continues ventrally in a very flat ridge surrounding ventral part of sulcus.

Surface smooth (velum: see above); small tubercles partly irregularly scattered and partly arranged in a row along the dorsal margin.

Muscle scars often distinctly visible in internal moulds: besides the central rounded muscle spot in the ventral part of sulcus, one may discern scars of the dorsal muscle group as well as scars of antennal and mandibular muscles anterodorsal and anteroventral to the presulcate node, and one scar in the anterodorsal corner of the internal mould.

Occurrence. Lower Ordovician: upper part of stratum *G* and lower part of stratum *R II* (from about 0.1 m below *G/R II* to about 1.0 m above this boundary) at Gulleråsen, Born-Dådran, Silverberg II, Leskusänget, and Granmor, in Dalecarlia, Sweden.

Eurychilina rugosotuberculata n. sp.

Pl. VI, Fig. 1.

Derivation of name. *rugosotuberculata* alludes to the fact that the surface is rugose and has scattered small tubercles.

Holotype. The type shown in Pl. VI, Fig. 1 is holotype (P. I. U. No. ar. os. 412).

Locality of holotype. Silverberg II, in Dalecarlia, Sweden.

Stratum of holotype. Lower Ordovician: upper part of stratum *G* (about 0.1 m below *G/R II*).

Material. One valve (velum partly disturbed).

Dimensions.

No.	L	H	G	D M	F M	Vel.	H/L	G/L	D M/L	Vel./L	F M/D M	∧ ant	∧ post	Remark
ar. os. 412	1.02	0.63	0.35	0.88	1.95	0.14	0.62	0.34	0.86	0.14	2.22	120	110	V

Diagnosis. *Eurychilina* of moderate size; sulcus deep and slightly curved backwards; presulcate node rather large; surface rugose with small scattered tubercles.

Affinities. There is a certain similarity between the present species and *E. decumana* (BONNEMA); they are distinguishable mainly in that the surface of *E. decumana* is densely tuberculate (tubercles of *E. rugosotuberculata* scattered) and in that its presulcate node is insignificant, whereas that of *E. rugosotuberculata* is rather large. THORSLUND (1940, p. 166) referred *E. decumana* to *Chilobolbina,* which, however, may not be tenable.

The main differences between the present species and *E. dorsotuberculata* n. sp. are mentioned on p. 255.

Description. Carapace of moderate size; whether or not it is equivalved was not observed, since only one valve was found.

Dorsal margin straight and long; anterior margin somewhat more curved than the posterior; ventral margin moderately convex.

Anterodorsal angle slightly more obtuse than the posterodorsal.

Anterior and posterior parts of carapace of about the same height.

Carapace moderately arched; postsulcate region slightly swollen just posterior to the sulcus; surface gently and regularly sloping to the dorsal margin and to the base of the velum.

Short and low ridges mainly parallel to the dorsal margin in dorsal corners.

Velum cannot be completely described, owing to its imperfect state of preservation; in the single specimen secured the posterior part of the velum was observed to be plane and provided with narrow, radiating ribs.

Sulcus rather long, extending over dorsocentral and central areas, deep, and moderately broad; anterior and posterior walls steep; it curves slightly backwards.

Presulcate node rounded and rather large.

Surface slightly rugose with small scattered tubercles (velum: see above).

Occurrence. Lower Ordovician: upper part of stratum *G* (about 0.1 m below *G/R II*) at Silverberg II, in Dalecarlia, Sweden.

Survey of the dimensions of *Eurychilina*.

	Number	L	H	G	DM	FM	Vel.	H/L	G/L	DM/L	Vel./L	FM/DM	∧ ant	∧ post
E. dorsotuberculata	8	0.88	0.52	0.27	0.79	1.61	0.13	0.59	0.31	0.89	0.14	2.07	120	110
E. rugosotuberculata	1	1.02	0.63	0.35	0.88	1.95	0.14	0.62	0.34	0.86	0.14	2.22	120	110
							Mean	0.61	0.33	0.88	0.14	2.14	120	110

Genus *Laccochilina* n. gen.

Derivation of name. *Laccochilina* alludes to the pit-like sulcus.

Genotype. *Laccochilina estonula* (ÖPIK 1935).

Occurrence. Ordovician.

Diagnosis. Ostracods referred to the Eurychilininae subfamily; length (inclusive of velum) about 1.0—2.2 mm; velum moderately broad, entirely plane, or partly plane and partly convex; sulcus deep and pit-like, rounded or slightly dorsoventrally elongated; presulcate node rounded and generally large or rather large; surface smooth, tuberculate, rugose, or reticulate; velum often radially plicate or additionally striate conforming to the margin.

Discussion and remarks. *Laccochilina* is similar to *Eurychilina* as regards the appearance of the velum (convex sections sausage-shaped) and in the presence of a generally distinct presulcate node. *Eurychilina* is different from *Laccochilina* in that the sulcus is "open" dorsally, whereas in *Laccochilina* the sulcus is pit-like. Considering the appearance of the sulcus, *Laccochilina* is similar to *Chilobolbina* (which is different in that it has no presulcate node but has an egg-shaped velate swelling).

ÖPIK noticed that in two species referred to *Eurychilina* the sulcus is pit-like and situated behind a distinct presulcate node, viz. *E. estonula* ÖPIK (1935, p. 9 f.) and *E. kuckersiana* BONNEMA (ÖPIK 1937, p. 20 f.). He was aware of the fact that these characters are taxonomically important. In his paper of 1937 ÖPIK says that "*Primitia kuckersiana* can be considered consequently as a representative of a new genus, closely related to *Eurychilina*". The species mentioned was provisionally placed by him in *Eurychilina.* Both the species quoted are referable to *Laccochilina.* THORSLUND (1940, p. 166) referred *L. kuckersiana* to *Chilobolbina.*

A few more species may be classed in this new genus. Two of KRAUSE's species may be referred to it, viz. *Primitia cincta* 1889 and *Primitia umbonata* 1892. The former is said to have a pit-like sulcus and a rounded presulcate node. The sulcus of the latter is characterized as a more or less distinct depression, which is situated behind a rounded presulcate node. BASSLER and KELLETT referred these species to *Eurychilina* (*L. cincta* questioned as a *Chilobolbina*). SCHMIDT (1941, p. 28) suggested *L. cincta* possibly to be a *Coelochilina,* but this may not be tenable, since, according to the diagnosis of *Coelochilina*, this genus "lacks the node".

Among American species, *Eurychilina* (?) *solida* RUEDEMANN (1901, p. 77) may be referred to *Laccochilina* ("sulcus forming here a small deep crescent-shaped pit" — "a break just in front of sulcus seems to indicate the presence of a node"). BASSLER and KELLETT, in my opinion, erroneously, referred this species to *Coelochilina.*

The KRAUSE species are Ordovician but not yet more closely datable. *L. kuckersiana* (BONNEMA) is Middle Ordovician and *L. estonula* (ÖPIK) is

Lower Ordovician (Upper *Megalaspis* Limestone, B II γ). The American species is Middle Ordovician.

In the present work 4 Lower Ordovician *Laccochilina* species are presented.

Laccochilina dorsoplicata n. sp.

Pl. VI, Figs. 5—10.

Derivation of name. *dorsoplicata* alludes to the distinct dorsal plica or ridge, concealing the hinge line.

Holotype. The type shown in Pl. VI, Fig. 6 is holotype (P. I. U. No. ar. os. 398).

Locality of holotype. Silverberg II, in Dalecarlia, Sweden.

Stratum of holotype. Lower Ordovician: lower part of stratum *R II* (just above *G/R II*).

Material. 47 valves and internal moulds from 5 localities.

Dimensions.

No.	L	H	G	G pr. n.	D M	F M	Vel.	H/L	G/L	G pr. n./L	D M/L	Vel./L	F M/D M	∧ ant	∧ post	Remark
ar. os. 396	1.37	0.86	0.70	0.73	1.02	2.72	0.19	0.63	0.51	0.53	0.74	0.14	2.67	135	125	V
ar. os. 398	*1.22*	*0.68*	*0.42*	*0.54*	*1.06*	*2.23*	*0.20*	*0.56*	*0.34*	*0.44*	*0.87*	*0.16*	*2.11*	*130*	*110*	V
ar. os. 401	1.20	0.71	0.51	0.58	0.98	2.23	0.21	0.59	0.42	0.48	0.82	0.18	2.27	140	125	V
ar. os. 404	1.18	0.63	0.44	0.52	1.05	2.09	—	0.53	0.37	0.44	0.89	—	1.92	135	115	M
ar. os. 395	1.03	0.67	0.47	—	0.73	2.21	0.16	0.65	0.46	—	0.71	0.16	3.01	135	125	V
ar. os. 399	1.01	0.58	0.56	—	0.86	1.86	—	0.57	0.55	—	0.85	—	2.16	140	120	M
ar. os. 405	0.95	0.58	0.30	0.36	0.80	1.81	0.15	0.61	0.32	0.38	0.84	0.16	2.26	135	115	V
ar. os. 397	0.91	0.58	0.42	—	0.66	1.81	0.13	0.64	0.46	—	0.73	0.14	2.74	130	125	V
ar. os. 413	0.87	0.51	0.31	—	0.68	1.70	0.10	0.59	0.36	—	0.78	0.12	1.96	140	115	V
ar. os. 403	0.85	0.52	0.34	—	0.69	1.68	—	0.61	0.40	—	0.81	—	2.44	130	110	M
ar. os. 402	0.83	0.52	0.35	—	0.68	1.64	—	0.63	0.42	—	0.82	—	2.41	140	115	M
ar. os. 400	0.74	0.45	0.40	0.44	0.61	1.43	—	0.61	0.55	0.59	0.82	—	2.35	135	120	M
Mean	1.02	0.86 0.61 0.45	0.70 0.44 0.30	0.73 0.53 0.36	1.06 0.82 0.61	2.72 1.95 1.43	0.21 0.16 0.10	0.65 0.60 0.53	0.55 0.43 0.32	0.59 0.48 0.38	0.89 0.81 0.71	0.18 0.15 0.12	3.01 2.36 1.92	135	120	

Diagnosis. *Laccochilina* of moderate or rather large size; velum moderately broad, plane vela radially wrinkled, non-tuberculate, and finely striate conforming to the margin; in some specimens the ventral section of the velum is convex, non-wrinkled, indistinctly striate, slightly rugose and tuberculate; sulcus deep and slightly dorsoventrally elongated; presulcate node large; hinge line concealed by a straight, distinct ridge, the ends of which are curved conforming to the dorsal corners; surface minutely tuberculate.

Affinities. The species, above all, is distinguished by the long dorsal ridge; other *Laccochilina* species also have dorsal ridges or plicae, but these are generally restricted to the dorsal corners. Furthermore, the species is characterized by regularly and fairly densely occurring minute tubercles and by the fact that the convex velate sections are non-wrinkled. *L. cincta* (KRAUSE) is similar in having a dorsal ridge along the whole dorsal margin, but, according to the drawings presented by KRAUSE 1889, this species is smooth or slightly tuberculate in the ventral region. It is mentioned in the text that "the surface in well preserved specimens is densily tuberculate." *L. cincta* seems to be closely related to *L. dorsoplicata*; however, whether or not they are identical is at present not possible to prove.

L. estonula (ÖPIK) — the genotype — is, as regards specific details, unsatisfactorily described and pictured. It seems, however, to be different from the present species in that it lacks dorsal plicae, and the presulcate node is proportionally smaller; furthermore, the convex velate section is distinctly radially wrinkled.

L. kuckersiana (BONNEMA) is different in that it has a very small presulcate node and is more densely and irregularly tuberculate; furthermore, it is distinguished by a low ridge connecting the presulcate node and the plica of the anterodorsal corner.

L. densituberculata n. sp. differs in that it has only short antero- and posterodorsal plicae, surface crowded with proportionally fairly large tubercles, and the dorsal area slightly depressed.

L. centrotuberculata n. sp. also has short antero- and posterodorsal plicae, and is further distinguishable from the present species in that only the central region is more permanently tuberculate.

Description. Carapace of moderate or rather large size.

Hinge line straight and long, concealed by a protruding dorsal ridge; anterior and posterior margins regularly and about equally rounded; ventral margin moderately or slightly convex.

Anterodorsal angle somewhat more obtuse than the posterodorsal.

Anterior and posterior parts of carapace of about the same height.

Carapace moderately arched; surface gently and regularly sloping to the base of the velum and to the dorsal ridge (see below).

Velum moderately broad; in some specimens it is entirely plane, rather distinctly striate conforming to the margin, and radially wrinkled, the wrinkles low, broad and rounded; in other specimens the ventral part of the velum is convex, velum in this case non-wrinkled, very indistinctly striate, slightly rugose, and tuberculate.

In the dorsal area is a distinct fold parallel to the hinge line; it forms an acute ridge (anterior and posterior sections very sharp-edged and distinct) protruding over hinge line; anterior and posterior ends declined, conforming to the most dorsal part of anterior and posterior margins (extending generally to the dorsocentral area); these sections gradually diminish in height and distinctness.

The sulcus is a deep pit, slightly dorsoventrally elongated, situated centrally or dorsocentrally and distinctly in front of the midlength; posterior wall in some specimens less steeply sloping than the anterior; in this case the sulcus is slightly crescent-shaped backwards.

Presulcate node large and rounded.

Surface crowded with minute tubercles; hinge side of dorsal fold smooth; velum: see above; surface of internal moulds smooth with scattered distinct tubercles.

Occurrence. Lower Ordovician: upper part of stratum *G* and lower part of stratum *R II* (from about 0.6 m below *G/R II* to about 1.0 m above this boundary) at Silverberg II, Born-Dådran, Leskusänget, Rävanäs, and Gulleråsen, in Dalecarlia, Sweden.

Laccochilina centrotuberculata n. sp.

Pl. VI, Figs. 2 and 3.

This species is denominated, in spite of the fact that none of the specimens secured is perfectly preserved. This may be appropriate, since the parts preserved show distinctive characters.

The description may be completed when more material is found.

Derivation of name. *centrotuberculata* alludes to the fact that the central region is tuberculate.

Holotype. The type shown in Pl. VI, Fig. 3 is the holotype (P. I. U. No. ar. os. 407).

Locality of holotype. Born-Dådran, in Dalecarlia, Sweden.

Stratum of holotype. Lower Ordovician: upper part of stratum *G* (about 0.3 m below *G/R II*).

Material. 3 valves (partly damaged) from 2 localities.

Diagnosis. *Laccochilina* of moderate size; velum moderately broad; plane vela finely striate conforming to the margin, convex velate sections radially plicate; sulcus rather deep and slightly dorsoventrally elongated; presulcate node fairly large, conical; surface in central region rather densely tuberculate, in ventral region slightly tuberculate, otherwise smooth.

Affinities. The species is scarcely confusable with other *Laccochilina* species known, owing to the specific distribution of the tubercles.

Description. Carapace of moderate size.

Dimensions.

No.	L	H	G	D M	F M	Vel.	H/L	G/L	D M/L	Vel./L	F M/D M	∧ ant	∧ post	Re-mark
ar. os. 406	1.19	0.70	0.35	1.06	2.19	0.16	0.59	0.29	0.89	0.13	2.06	130	—	V
ar. os. 407	*1.19*	*0.79*	*0.42*	*0.94*	*2.33*	*0.21*	*0.67*	*0.35*	*0.79*	*0.18*	*2.48*	*135*	—	V
ar. os. 409	1.01	0.63	0.33	0.78	2.00	—	0.62	0.33	0.77	—	2.57	130	—	V
Mean	1.13	0.79 0.71 0.63	0.42 0.37 0.33	1.06 0.93 0.78	2.33 2.17 2.00	0.21 0.19 0.16	0.67 0.63 0.59	0.35 0.32 0.29	0.89 0.82 0.77	0.18 0.16 0.13	2.57 2.37 2.06	130		

Dorsal margin straight and presumably long; anterior margin broadly curved; ventral margin moderately convex.

Carapace moderately arched, dorsal region slightly depressed; surface gently and regularly sloping to the dorsal margin and to the basis of velum.

Velum moderately broad; in some specimens it is entirely plane with fine striae conforming to the margin, in others its ventral section and the ventral half of the anterior one (posterior section not observed) is convex and radially plicate, plicae low and narrow but distinct, distance between them fairly large.

In the anterodorsal corner is a rather broad and low ridge conforming to the corresponding margin.

Sulcus situated dorsocentrally-centrally; it is rather narrow and deep, and slightly dorsoventrally elongated.

Presulcate node conical and fairly large.

Surface in central region rather densely tuberculate, ventrally slightly tuberculate, and otherwise smooth (velum: see above).

Occurrence. Lower Ordovician: upper part of stratum *G* (about 1.3—0.3 m below *G/R II*) at Born-Dådran and Leskusänget, in Dalecarlia, Sweden.

Laccochilina densituberculata n. sp.

Pl. VI, Figs. 11 and 14.

Derivation of name. *densituberculata* alludes to the fact that the carapace is crowded with tubercles.

Holotype. The type shown in Pl. VI, Fig. 11 is holotype (P. I. U. No. ar. os. 408).

Locality of holotype. Rävanäs, in Dalecarlia, Sweden.

Stratum of holotype. Lower Ordovician: lower part of stratum *R II* (about 0.3 m above *G/R II*).

Material. 5 valves (partly damaged) from 2 localities.

Dimensions.

No.	L	H	G	D M	F M	Vel.	$\frac{H}{L}$	$\frac{G}{L}$	$\frac{DM}{L}$	$\frac{Vel.}{L}$	$\frac{FM}{DM}$	∧ ant	∧ post	Remark
ar. os. 411	1.12	0.62	0.36	0.99	2.00	—	0.55	0.32	0.87	—	2.02	125	—	V
ar. os. 410	0.94	0.51	0.30	0.89	1.65	0.13	0.54	0.32	0.95	0.13	1.86	120	115	V
ar. os. 414	0.93	0.55	0.33	0.77	1.82	—	0.59	0.35	0.83	—	2.36	125	115	V
ar. os. 408	*0.91*	*0.54*	*0.33*	*0.79*	*1.65*	*0.10*	*0.54*	*0.36*	*0.87*	*0.11*	*2.09*	*125*	*110*	V
Mean	0.98	0.62 0.56 0.51	0.36 0.33 0.30	0.99 0.86 0.77	2.00 1.72 1.65	0.13 0.12 0.10	0.59 0.56 0.54	0.36 0.34 0.32	0.95 0.88 0.83	0.13 0.12 0.11	2.36 2.08 1.86	125	115	

Diagnosis. *Laccochilina* of rather small size; anterior part of dorsal region slightly depressed; in the anterodorsal corner is a curved and fairly distinct plica; velum of moderate breadth, smooth with broad radiating wrinkles; sulcus deep and slightly dorsoventrally elongated, sometimes somewhat crescent-shaped; presulcate node broadly conical; surface crowded with rounded and proportionally large tubercles.

Affinities. The species resembles *Laccochilina dorsoplicata* n. sp. but is different mainly in that the dorsal plica is restricted to the anterodorsal corner, the dorsal region anteriorly somewhat depressed, and the surface more densely tuberculate.

Description. Carapace of rather small size.

Dorsal margin straight and long; anterior and posterior margins broadly rounded, anterior somewhat more than posterior; ventral margin moderately convex.

Anterodorsal angle slightly more obtuse than the posterodorsal.

Anterior and posterior parts of carapace of about the same height.

Carapace moderately arched, anterior part of dorsal area slightly depressed; posterodorsal corner pinched; in the anterodorsal corner is a narrow, low ridge conforming to corresponding parts of dorsal and anterior margins; surface gently and regularly sloping to the dorsal margin and to the base of the velum.

Appearance of velum incompletely known; judging by preserved parts and impressions, it is moderately broad, broadly wrinkled, and smooth.

Sulcus situated in the dorsocentral-central area and somewhat in front of the midlength; it is pit-like, rather small, slightly dorsoventrally elongated, and fairly deep.

Presulcate node broadly conical.

Surface crowded with proportionally large and distinct, rounded tubercles (velum: see above).

Occurrence. Lower Ordovician: lower part of stratum *R II* (about 0.1—0.5 m above *G/R II*) at Born-Dådran and Rävanäs, in Dalecarlia, Sweden.

Laccochilina levis n. sp.

Pl. VI, Fig. 4.

Derivation of name. *levis* alludes to the smooth surface.

Holotype. The type shown in Pl. VI, Fig. 4 is holotype (P. I. U. No. ar. os. 785).

Locality of holotype. Born-Dådran, in Dalecarlia, Sweden.

Stratum of holotype. Lower Ordovician: upper part of stratum *G* (about 0.6 m below *G/R II*).

Material. 2 valves from 2 localities.

Dimensions.

No.	L	H	G	D M	F M	Vel.	H/L	G/L	D M/L	Vel./L	F M/D M	∧ ant	∧ post	Remark
ar. os. 785	*1.02*	*0.60*	*0.40*	*0.82*	*1.98*	*0.14*	*0.59*	*0.39*	*0.80*	*0.14*	*2.41*	*125*	*125*	V
ar. os. 413	0.72	0.44	0.30	0.60	1.39	—	0.61	0.42	0.83	—	2.32	125	125	V
Mean	0.87	0.52	0.35	0.71	1.69	0.14	0.60	0.41	0.82	0.14	2.37	120	125	

Diagnosis. *Laccochilina* of moderate size; velum moderately broad, plane vela practically smooth; sulcus deep and situated mainly centrally; presulcate node fairly low; surface smooth with very few scattered and small tubercles.

Affinities. The other *Laccochilina* species described in this paper are entirely or partly densely tuberculate and thus distinguishable from the present species which has only a few small tubercles scattered over the smooth surface.

Among species previously described which are referable to *Laccochilina*, certain specimens of *L. cincta* (KRAUSE) (judging by the drawings, 1889) seem to be smooth or somewhat tuberculate in the ventral part of the carapace, but (according to the description) well preserved specimens are entirely tuberculate; moreover, *L. cincta* has an acute ridge running along the whole dorsal margin, which excludes the possibility of confusion with the present species which has no such ridge.

Description. Carapace of moderate size.

Dorsal margin straight and rather long; anterior and posterior margins regularly and about equally rounded; ventral margin moderately convex.

Dorsal angles about equal.

Anterior and posterior parts of carapace of about the same height.

Carapace moderately arched; surface gently and regularly sloping to the dorsal margin and to the base of the velum.

Velum moderately broad; only one specimen with preserved velum observed: it is plane and practically smooth.

Sulcus situated mainly centrally and a little in front of the midlength; it is deep and somewhat dorsoventrally elongated.

Presulcate node rounded and fairly low.

Surface smooth with a few small and scattered tubercles.

Occurrence. Lower Ordovician: upper part of stratum *G* (about 0.6 m below *G/R II*) at Born-Dådran and Rävanäs, in Dalecarlia, Sweden.

Survey of the dimensions of *Laccochilina*.

As appears from the table below, the relative dimensions of the 4 *Laccochilina* species represented in the present material are rather similar to each other. Only as regards the gibbosity is there a fairly great difference between 2 species on one side and 2 on the other.

A comparison between the relative dimensions of the present *Laccochilina* and *Eurychilina* species shows that the proportional dimensions are almost the same in the two genera. It may especially be noted that the relative breadth of the velum is not very variable.

	No.	L	H	G	D M	F M	Vel.	H/L	G/L	D M/L	Vel./L	F M/D M	∧ ant	∧ post
L. dorsoplicata	12	1.02	0.61	0.44	0.82	1.95	0.16	0.60	0.43	0.81	0.15	2.36	135	120
L. centrotuberculata	3	1.13	0.71	0.37	0.93	2.17	0.19	0.63	0.32	0.82	0.15	2.37	130	—
L. densituberculata	4	0.98	0.56	0.33	0.86	1.78	0.12	0.56	0.34	0.88	0.12	2.08	125	115
L. levis	2	0.87	0.52	0.35	0.71	1.69	0.14	0.60	0.41	0.82	0.14	2.37	125	125
							Mean	0.60	0.37	0.83	0.14	2.29	130	120

Subfamily *Ctenentominae* SCHMIDT 1941.

Diagnosis. SCHMIDT 1941, p. 34.

Discussion and remarks. Some notes will be made on the appearance of the velate structure.

Formations corresponding to what is here called velate structures are by SCHMIDT said to be "completely absent in most cases; if present in rare cases, they are poorly developed and restricted to the anterior part of ventral margin" (1941, p. 34).

Real, broad vela running along the whole free margin have not been observed in Ctenentominae, but velate ridges running along the free margin from the anterodorsal to the posterodorsal corner occur. As a rule, however, the velate structure is shorter. It may be fairly broad in all its extension (e. g. *Parabolbina granosa* [ULRICH 1900], *Parabolbina limbata* [SWARTZ 1936], and *Ctenentoma diensti* [KUMMEROW 1924]), but usually it is narrow; only the anteroventral part may be broader.

In several genera is a short ventral carina, often extending only along the anterior part of the ventral margin and the ventral part of the anterior one.

The ventral spine of Acronotellinae (SWARTZ 1936) may substitute a ventral carina (but this is not applicable to the ventral spine of *Winchellatia* KAY 1940; in this case the spine is situated at the side of an existing ventral carina).

To Ctenentominae I propose to add a new genus, *Aulacopsis,* which is reminiscent of *Ctenentoma* in being monosulcate but which is different in having traces of the sulci *S I* and *S III.* In this respect it is reminiscent of the trisulcate genus *Glossopsis* n. gen. The sulcate traces are feeble and not equal to regular sulci.

Like *Ctenentoma*, *Aulacopsis* is not homogeneous. As in *Ctenentoma*, certain species are provided with a velate ridge, others with a ventral carina. Those provided with a velate ridge are similar to the corresponding group of *Ctenentoma* (*C. macroreticulata* n. sp.) but also of *Euprimitia* and *Euprimites.* Those provided with a ventral carina take an intermediate position between the carinate *Ctenentoma* group (*C. plana* n. sp.) and *Glossopsis.*

The heterogeneity as now mentioned is certainly taxonomically important and when more material is investigated, both *Ctenentoma* and *Aulacopsis* may necessarily be split.

Other Ctenentominae genera than *Ctenentoma* and *Aulacopsis* were not observed in the present material.

Genus *Ctenentoma* SCHMIDT 1941.

Genotype. *Entomis umbonata* STEUSLOFF 1894.

Occurrence. Ordovician—Gotlandian, Lower Carboniferous?

Diagnosis. SCHMIDT 1941, p. 35.

Discussion and remarks. The statement about the velum in SCHMIDT's diagnosis may be completed (velum according to SCHMIDT = velate structure or ventral carina). His statement is: "A small velum may be present; however, it does not extend to the anterodorsal corner."

Real, broad vela running along the whole free margin have not been observed in *Ctenentoma*, but in a few specimens the free margin is surrounded by a velate ridge.

An example of this is *C. macroreticulata* n. sp. (Pl. VI, Figs. 13 and 15—

16). The free margin of this species is rather regularly surrounded by a velate ridge which diminishes in breadth towards the dorsal corners, where it ends. As regards the appearance of the velate ridge, *C. macroreticulata* is very like certain *Euprimitia* and *Euprimites* species.

Among species previously described, one may also find examples of the whole free margin being surrounded by a narrow velate ridge of the same type as in *C. macroreticulata*. This seems to be true of *C. sigma* (KRAUSE).

Other species have velate ridges which anteroventrally are broad like real vela. An example of this is *C. canaliculata* n. sp. In this case, the velate ridge (which ends in the posterodorsal corner) is narrow, except anteroventrally where it is broad and forms a forward swing; it does not extend to the anterodorsal corner. In another species, *C. variolaris* (BONNEMA), the velate ridge, likewise, is distinctly broader anteroventrally than elsewhere (broader than appears from the figures given by BONNEMA 1909 and THORSLUND 1940; observations made on THORSLUND's original specimens 1940); in this species the velate ridge is short: it extends only along the ventral margin and the ventral part of the anterior margin.

Some *Ctenentoma* species have a short carina. In *C. rectangulocarinata* n. sp. it extends only along the anterior part of the ventral margin. Furthermore, it is only slightly protruding (corresponding part of ventral margin not concealed). Another species, *C. plana* n. sp., has a carina which protrudes considerably over the corresponding part of the ventral margin. It extends only along the anterior part of the ventral margin and the most ventral part of the anterior margin. The carina of *C. plana* is of the same form as those of *Glossopsis* n. gen. and *Ceratopsis* (subfamily Tetradellinae).

Thus, as regards the appearance of the velum, *Ctenentoma* includes a sequence of types connecting the subfamily Euprimitiinae and the *Ceratopsis* group of the subfamily Tetradellinae.

Concerning the appearance of the sulcus, two types occur: one deep and distinct and another shallow and partly undefined. The former type is the most abundant. The latter is demonstrated in *C. plana* n. sp.

In both these types one may occasionally discern extremely vague depressions partly in front of the presulcate node and partly behind the sulcus. Such occasional depressions may be interpreted as corresponding to *SI* and *SIII*, and indicate the close connection (via *Aulacopsis*) between *Ctenentoma* and the *Ceratopsis* group of Tetradellinae. It may be noticed that the *Aulacopsis* fissures on one or both sides of the sulcus are permanent.

A survey of the *Ctenentoma* species represented in the present material appears as follows:

1. The *C. macroreticulata* group (velate ridge extending along the whole free margin; sulcus deep)
   C. macroreticulata n. sp.
   C. falcatosulcata n. sp.

2. *C. canaliculata* n. sp. (velate ridge extending along the whole free margin, except dorsal part of anterior margin; sulcus deep)
3. *C. rectangulocarinata* n. sp. (ventral carina not or slightly protruding over ventral margin; sulcus deep)
4. *C. plana* n. sp. (ventral carina protruding over ventral margin; sulcus shallow).

C. plana, being very shallowly sulcate and very protrudingly carinate, is a peculiar type which probably will be referred to a new genus or subgenus, when more similar species have been found.

Ctenentoma comprises rather many species, which were earlier mainly referred to *Ctenobolbina* and *Entomis*. SCHMIDT (1941, p. 36), suggesting that his list is possibly incomplete, referred to it 17 previously described species (2 of them with reservation) and a new one. One of the 17 species, *Entomis impressa* STEUSLOFF, was erroneously listed; this species is bisulcate and thus presumably a *Ctenobolbina* (cf. STEUSLOFF 1894, Pl. LVIII, Fig. 19). The allocation of *Entomis* (*Bursulella?*) *quadrispina* KRAUSE 1892 seems very doubtful to me, and this species is excluded from the following survey of the age distribution of *Ctenentoma*.

One of the species referred by SCHMIDT to *Winchellatia* (loc. cit.) may, in fact, be a *Ctenentoma*, i. e. *C. variolaris* (BONNEMA), since ventral post-sulcate spines or ridges (which are distinctive for *Winchellatia*) do not occur in this species.

Two of the *Ctenentoma* species listed by SCHMIDT are of very uncertain age and, hence, excluded from the age survey, i. e. the *Geschiebe* species *C. sigma* (KRAUSE) and *C. simplex* (KRAUSE).

The age distribution of 15 at least fairly certain and datable *Ctenentoma* species appears from this table:

	Europe	N. America	
Carboniferous		1	1
Gotlandian	2	1	3
Ordovician, Upper		1	1
» , Middle	6	1	7
» , Lower	2	1	3
	10	5	15

The Lower Ordovician species are: *C. latisulcata* (STEUSLOFF) and *C. umbonata* (STEUSLOFF) (both found in North German drifts of Black *Orthoceras* Limestone), and *C. subcrassa* (ULRICH).

In this paper 5 Lower Ordovician *Ctenentoma* species are described.

Ctenentoma macroreticulata n. sp.

Pl. VI, Figs. 13, and 15—17.

Derivation of name. *macroreticulata* alludes to the widely reticulate surface.

Holotype. The type shown in Pl. VI, Fig. 16 is holotype (P. I. U. No. ar. os. 420).

Locality of holotype. Stenberg, in Dalecarlia, Sweden.

Stratum of holotype. Lower Ordovician: lower part of stratum *G* (about 0.8 m above *R I*/*G*).

Material. 41 valves from 2 localities.

Dimensions.

No.	L	H	G	D M	F M	H/L	G/L	D M/L	F M/D M	∧ ant	∧ post	Re-mark
ar. os. 427	1.36	0.79	0.72	1.16	2.58	0.58	0.53	0.85	2.22	125	115	V
ar. os. 419	1.30	0.72	0.66	1.11	2.44	0.55	0.51	0.85	2.20	120	115	V
ar. os. 420	*1.16*	*0.66*	*0.63*	*0.97*	*2.21*	*0.57*	*0.54*	*0.84*	*2.28*	*120*	*115*	V
ar. os. 418	0.98	0.56	0.46	0.88	1.83	0.57	0.47	0.90	2.08	120	110	V
ar. os. 424	0.95	0.53	0.53	0.85	1.74	0.56	0.56	0.89	2.20	120	110	V
ar. os. 425	0.88	0.56	0.53	0.74	1.83	0.64	0.60	0.84	2.47	120	110	V
ar. os. 431	0.81	0.51	0.47	0.71	1.61	0.63	0.58	0.88	2.27	120	110	V
ar. os. 423	0.70	0.42	0.42	0.63	1.32	0.60	0.60	0.90	2.09	115	110	V
ar. os. 430	0.66	0.43	0.37	0.56	1.28	0.65	0.56	0.85	2.28	115	105	V
ar. os. 422	0.62	0.40	0.35	0.56	1.16	0.65	0.57	0.90	2.07	115	110	V
ar. os. 788	0.58	0.37	0.33	0.51	1.18	0.64	0.57	0.88	2.32	115	110	V
ar. os. 416	0.52	0.34	0.32	0.49	1.07	0.65	0.63	0.94	2.18	110	110	V
ar. os. 428	0.50	0.29	0.33	0.47	0.89	0.58	0.66	0.94	1.89	105	105	V
ar. os. 429	0.50	0.30	0.33	0.48	0.91	0.60	0.66	0.96	1.90	105	100	V
ar. os. 421	0.47	0.29	0.28	0.45	0.91	0.62	0.60	0.96	2.02	105	95	V
ar. os. 417	0.42	0.26	0.28	0.40	0.74	0.62	0.67	0.95	1.76	105	95	V
ar. os. 800	0.37	0.23	0.25	0.35	0.63	0.62	0.65	0.95	1.80	105	100	V
Mean	0.75	0.79 0.45 0.26	0.72 0.43 0.28	1.16 0.67 0.40	2.58 1.43 0.74	0.65 0.60 0.55	0.67 0.58 0.47	0.96 0.90 0.84	2.47 2.12 1.76	115	105	

Diagnosis. *Ctenentoma* of moderate size; velate ridge surrounding the whole free margin; sulcus gently geniculate just behind the presulcate node, for a great part it is deep and distinct, ventrally it grows more and more shallow and narrow, and does not reach the edge of the velate ridge; presulcate node very low but distinct and slightly dorsoventrally elongated; surface fairly widely reticulate.

Affinities. The species is somewhat reminiscent of *C. falcatosulcata* n. sp., which, however, is different in that the sulcus is non-geniculate but gently curved like a scythe, and the presulcate node is extremely flattened and hardly rising above the surface.

Concerning the appearance of the sulcus, the present species is very similar to *C. sigma* (KRAUSE), but the sulcus in this species is longer (reaches the edge of the velate ridge), and the surface is, moreover, smooth.

Description. Carapace of moderate size; whether or not it is equivalved was not determinable, since only separate valves were observed.

Dorsal margin straight and long; anterior and posterior margins broadly curved, anterior somewhat more convex than posterior; ventral margin slightly convex (in very young specimens more convex).

Anterodorsal angle somewhat more obtuse than the posterodorsal.

Anterior and posterior part of carapace of about the same height, or anterior part slightly higher.

Carapace moderately arched, postsulcate region somewhat more than presulcate; area just behind sulcus slightly swollen; ventral area, especially its anterior part, somewhat protruding over ventral margin; surface gently and regularly sloping to the dorsal margin and to the velate ridge; the area between velate ridge and free margin concave, forming a channel just along the margin.

Velate ridge runs along the whole free margin; along the ventral margin it is narrow and distinct, and directed outwards, along anterior and posterior margins it grows continually lower and less distinct; especially along the dorsal part of anterior margin it is feeble.

Sulcus situated distinctly in front of the midlength; it extends from dorsocentral to centroventral or ventral area (it does not extend to the edge of the velate ridge); just behind the presulcate node it is gently geniculate backwards; dorsal to the geniculum it is directed dorsoventrally, ventral to the geniculum it is directed somewhat forwards; the dorsoventrally directed part broad and, except its dorsal section, deep; the part directed somewhat forwards V-shaped in transverse section, and in ventral direction growing continually narrower and shallower until finally disappearing.

In rare cases, one may discern one extremely shallow impression along the anterior margin of the presulcate node and another somewhat behind the sulcus; these occasional depressions certainly correspond to *S I* and *S III* resp.

In the posterodorsal corner of adult specimens, a short and shallow groove conforms to the dorsal part of posterior margin.

Presulcate node situated just in front of the geniculum of the sulcus; it is low but distinct, and slightly dorsoventrally elongated.

Surface widely reticulate, except the sulcus which is smooth, and the dorsal area which is most often smooth but sometimes slightly striate conforming to the dorsal margin; the area between the edge of the velate ridge and the ventral margin is smooth, except along the edge of the velate ridge where fine, anastomosing striae are present.

Notes on the larval development. From the table on the carapace dimensions it appears that many larval specimens are represented. The measurements indicate that larvae may be relatively higher than adult specimens. Furthermore, it appears that the larvae are relatively more gibbous, the dorsal margin relatively longer, and the dorsal angles less obtuse; the free margin is relatively shorter in very young stages than in later stages.

The proportions between the lengths of presulcate and postsulcate regions are rather equal in all stages measured.

The velate ridge also occurs in the youngest stages observed, but is less distinct, especially along the anterior and posterior margins, where, in some cases, it is not discernible at all.

Also the youngest stages observed are reticulate. The reticulation is more indistinct, however. It may be noticed that young stages are as widely reticulate as the adults.

Very young stages are confusedly similar to very young larval carapaces of species belonging to some other genera, such as *Aulacopsis monofissurata* n. sp. and *Glossopsis lingua* n. sp. They are similar in general shape. Furthermore, in such young stages, *S I* and *S III* of *Glossopsis* are poorly developed: they are often discernible only as weak impressions reminiscent of the fissures of *Aulacopsis* and of the very slight corresponding markings which occasionally occur in *Ctenentoma macroreticulata*. The young larvae of these species are different mainly in that the anterior part of the ventral area forms, in the *Aulacopsis* and *Glossopsis* species, a kind of protruding carina, but in *Ctenentoma macroreticulata* the rather regularly rounded free margin is surrounded, more or less completely, by a velate ridge.

Occurrence. Lower Ordovician: lower part of stratum *G* (about 0.4—0.8 m above *R I*/*G*) at Stenberg and Gulleråsen, in Dalecarlia, Sweden.

Ctenentoma falcatosulcata n. sp.

Pl. VI, Fig. 18.

Derivation of name. *falcatosulcata* alludes to the scythe-shaped sulcus.

Holotype. The type shown in Pl. VI, Fig. 18 is holotype (P. I. U. No. ar. os. 433).

Locality of holotype. Born-Dådran, in Dalecarlia, Sweden.

Stratum of holotype. Lower Ordovician: lower part of stratum *R II* (about 0.8 m above *G/R II*).

Material. One valve.

Dimensions.

No.	L	H	G	DM	FM	$\frac{H}{L}$	$\frac{G}{L}$	$\frac{DM}{L}$	$\frac{FM}{DM}$	∧ ant	∧ post	Remark
ar. os. 433	0.72	0.44	0.33	0.64	1.30	0.61	0.46	0.89	2.03	110	105	V

Diagnosis. *Ctenentoma* of rather small size; velate ridge running along the whole free margin; sulcus formed like a scythe, extending from dorsal to centroventral area, deep and very distinct; presulcate node extremely low; surface rather coarsely reticulate.

Affinities. The species is somewhat reminiscent of *C. macroreticulata* n. sp. The main differences are mentioned on p. 270.

Description. Carapace of rather small size; whether or not it is equivalved could not be determined, since only one single valve was observed.

Dorsal margin straight and long; anterior and posterior margins widely and about equally curved; ventral margin moderately convex.

Dorsal angles only slightly obtuse, anterodorsal somewhat more obtuse than the posterodorsal.

Anterior and posterior parts of carapace of about the same height.

Carapace moderately arched, postsulcate region slightly more than the presulcate one; ventral area protruding over ventral margin (anterior area seems to protrude over anterior margin but this could not be definitely decided); surface gently and regularly sloping to dorsal margin and velate ridge; area between velate ridge and free margin not perfectly preserved in all its extension: the well preserved section along posterior margin and posterior part of ventral margin is plane; along the edge of the free margin runs a distinct ridge (observed along the posterior margin).

Velate ridge runs along the whole free margin; it is distinct in all its extension, but the anterior and posterior sections are lower than the ventral one; ventral section directed outwards.

Sulcus situated distinctly in front of the midlength; it extends from the dorsal to the centroventral area; it is shaped like a scythe: dorsal end broad, ventral part tapering; dorsal part directed dorsoventrally, ventral part slightly forwards; greatest depth just behind presulcate node, ventral section successively diminishing in depth.

Presulcate node extremely low (scarcely discernible) and slightly dorsoventrally elongated.

Surface fairly coarsely reticulate; area between velate ridge and free margin smooth.

Occurrence. Lower Ordovician: lower part of stratum *R II* (about 0.8 m above *G/R II*) at Born-Dådran, in Dalecarlia, Sweden.

Ctenentoma canaliculata n. sp.

Pl. VII, Fig. 7.

Derivation of name. *canaliculata* alludes to the distinct channel along the postsulcate section of the velate ridge.

Holotype. The type shown in Pl. VII, Fig. 7 is holotype (P. I. U. No. ar. os. 435).

Locality of holotype. Rävanäs, in Dalecarlia, Sweden.

Stratum of holotype. Lower Ordovician: middle part of stratum *G* (about 1.7 m above *R I/G*).

Material. 2 valves from 1 locality.

Dimensions.

No.	L	H	G	DM	FM	H/L	G/L	DM/L	FM/DM	∧ ant	∧ post	Remark
ar. os. 435	0.80	0.48	0.37	0.70	1.51	0.60	0.46	0.87	2.16	140	125	V

Diagnosis. *Ctenentoma* of rather small size; velate ridge surrounding free margin, except dorsal part of anterior margin; anteroventral section broad like a velum and forming a pronounced forward swing; along the greater part of postsulcate section is a perpendicular wall, which is one side of a formation corresponding to a ventral carina; between this wall and the velate ridge runs a distinct groove or channel; sulcus deep, broad, and curved gently backwards; no presulcate node; surface indistinctly reticulate.

Affinities. The combination of characteristic features of this species (the perpendicular wall along one side of the ventral channel, the pronounced forward swing of the velate ridge, the very distinct sulcus with steep walls) makes this species distinguishable from other *Ctenentoma* species known. *C. rectangulocarinata* n. sp. may be slightly reminiscent of it since the ventral carina of this species is practically right-angled and one of its sides steeps like the perpendicular wall of the present species. However, the species are easily distinguishable in that, among other details, *C. rectangulocarinata* has no velate ridge.

Description. Carapace of moderate size; whether or not it is equivalved was not determinable, since only separate valves were observed.

Dorsal margin straight and long; anterior margin practically straight in the dorsal part, ventral part fairly widely curved, forming a slight forward swing; posterior margin rather convex dorsally, very widely curved ventrally; ventral margin slightly convex.

Anterodorsal angle more obtuse than the posterodorsal.

Anterior part of carapace slightly higher than the posterodorsal.

Carapace rather inconsiderably arched; surface gently sloping to dorsal margin and to the dorsal part of the anterior, to the velate ridge, and to the perpendicular wall mentioned below; near the passage to the broad anteroventral part of the velate ridge the surface is extremely shallowly concave; area between velate ridge and free margin is plane.

Velate ridge runs along the whole free margin, except dorsal part of anterior margin; pre- and postsulcate sections different: the former is protruded into a flat and fairly broad velum with wide and even outline giving the impression of the valves having a pronounced forward swing, the latter is a very distinct and outwardly directed ridge, extending to the posterodorsal corner (more and more flattened, broad, and indistinct towards the corner); between the distinct section and a very characteristic perpendicular wall is a fairly deep and narrow channel; the perpendicular wall is one side of a right-angled formation, which corresponds to a ventral carina.

Sulcus situated distinctly in front of the midlength; it extends from dorsal margin to centroventral area and is slightly curved backwards; it is deep, broad, and very distinct (walls steep), ventral end more and more shallow and narrow.

No presulcate node.

Surface smooth or very faintly rugose, except the posterior part of the postsulcate region which is fairly coarsely and indistinctly reticulate.

Occurrence. Lower Ordovician: middle part of stratum *G* (about 1.5—1.7 m above *R I/G*) at Rävanäs, in Dalecarlia, Sweden.

Ctenentoma rectangulocarinata n. sp.

Pl. VI, Fig. 12.

Derivation of name. *rectangulocarinata* alludes to the fact that the ventral carina is practically right-angled.

Holotype. The type shown in Pl. VI, Fig. 12 is holotype (P. I. U. No. ar. os. 434).

Locality of holotype. Stenberg, in Dalecarlia, Sweden.

Stratum of holotype. Lower Ordovician: middle part of stratum *G* (about 1.4 m above *R I/G*).

Material. One carapace from 1 locality.

Diagnosis. *Ctenentoma* of small size; sulcus rather narrow and about equally broad in all parts; presulcate node extremely low; edge of ventral carina practically right-angled; surface tenuously reticulate in the ventral half of the valves.

Affinities. The species is slightly reminiscent of *C. canaliculata* n. sp.

Dimensions.

No.	L	H	G	DM	FM	H/L	G/L	DM/L	FM/DM	∧ ant	∧ post	Remark
ar. os. 434	0.66	0.40	0.35	0.61	1.16	0.61	0.53	0.92	1.68	125	110	C

in that the ventral side of the carina is steeply sloping like the corresponding characteristic perpendicular wall of *C. canaliculata*. The fact that the present species has no velate ridge makes them easily distinguishable.

C. simplex (KRAUSE) is said to have a practically right-angled carina, but this species is different from the present one mainly in its surface being extremely flat and its sulcus being very shallow (KRAUSE 1892, p. 390).

Description. Carapace of small size, equivalved.

Dorsal margin straight and long; anterior margin regularly curved, posterior one rather convex in the most dorsal part, otherwise it is very widely curved; ventral margin moderately or slightly convex.

Anterodorsal angle somewhat more obtuse than the posterodorsal.

Anterior part of carapace slightly higher than the posterodorsal.

Carapace moderately arched, presulcate region somewhat less arched than the postsulcate (just posterior to the ventral part of the sulcus is a faint swelling); surface rather gently sloping to anterior and dorsal margins and to the ventral carina; region between the swollen area just behind sulcus and the posterior margin nearly plane; area between the edge of the carina and ventral margin practically plane or slightly concave.

The carina extends from about the middle of anterior margin to about the middle of ventral margin; it is practically right-angled or slightly acute; ventral margin is not (or only slightly) concealed by the carina.

Sulcus situated distinctly in front of the midlength; it extends from dorsal or dorsocentral to centroventral area (it does not exactly reach the edge of the carina); it is nearly straight or very faintly curved backwards, deep and fairly broad; the breadth practically the same in the entire length.

Presulcate node an extremely low dorsoventral swelling.

Ventral half of surface tenuously reticulate; in the area between the edge of the carina and the ventral margin the reticulum is elongated conforming to the margin; dorsal half of surface smooth or very finely rugose.

Occurrence. Lower Ordovician: lower part of stratum *G* (about 0.8—1.4 m above *RI/G*) at Stenberg, in Dalecarlia, Sweden.

Ctenentoma plana n. sp.

Pl. VII, Figs. 1—6.

This species includes two types which are easily distinguishable in several respects. The differences are found in the size, sulcus, carina, anterior margin, and parts of the surface ornamentation. They are together so important that they might very well be considered characteristic of two different species. But I think that the types are different moult stages of the same species (cf. discussion below).

The two types, called *a* and *b*, are described separately.

Derivation of name. *plana* alludes to the very flat region between the ventral carina and the dorsal margin.

Holotype. The type shown in Pl. VII, Fig. 1 is holotype (P. I. U. No. ar. os. 442).

Locality of holotype. Röjeråsvägen, in Dalecarlia, Sweden.

Stratum of holotype. Lower Ordovician: lower part of stratum *R II* (about 0.1 m above *G/R II*).

Diagnosis. *Ctenentoma* of moderate or rather large size; region between dorsal margin and the edge of ventral carina very flat; sulcus shallow and partly undefined, in type *a* short and in type *b* long (extending to the edge of the ventral carina); carina in type *a* rather long and broad, edge bent inwards, carina in type *b* short, pinched around the end of the sulcus, edge slightly bent outwards; presulcate node extremely low and dorso-ventrally elongated; surface reticulate.

Affinities. As far as I can see, the species has no closer affinities among the *Ctenentoma* species known. *C. simplex* (KRAUSE) is said to be very flat and shallowly sulcate, but the angle of the carina is quoted to be nearly acute (in the present species it is distinctly acute) and the surface, judging by the drawing, appears to be smooth (in the present species distinctly reticulate). KRAUSE's description is short and incomplete, and the drawing is not very helpful, so it is somewhat difficult to get a correct idea of the appearance of *C. simplex*, but it scarcely seems to be conspecific with *C. plana*. KRAUSE's single specimen was found in a drift boulder of dubious age, according to his own statement.

C. plana may be closely related to the genus *Aulacopsis* n. gen. The similarity as regards the ventral carina is especially striking. *A. monofissurata* n. sp. is the most similar of the *Aulacopsis* species known, but it is different, among other things, in that it has a short fissure just posterior to the ventral part of the sulcus.

Type *a* (presumably adult and possibly late larval stages).

Pl. VII, Figs. 1 and 2.

Type. This type includes the holotype (P. I. U. No. ar. os. 442).

Locality and stratum of type. Cf. above.

Material. 1 carapace (partly damaged) and 15 valves and internal moulds from 4 localities.

Description. Carapace rather large; equivalved.

Dorsal margin straight and long; anterior margin regularly rounded

Dimensions.

No.	L	H	G	D M	F M	H/L	G/L	D M/L	F M/D M	∧ ant	∧ post	Remark
ar. os. 440	1.32	0.86	0.56	1.15	2.56	0.65	0.42	0.87	2.22	115	125	V
ar. os. 445	1.16	0.78	0.63	0.92	2.32	0.67	0.54	0.79	2.52	125	125	C
ar. os. 442	*1.11*	*0.78*	*0.51*	*0.95*	*2.30*	*0.70*	*0.46*	*0.86*	*2.42*	*130*	*130*	V
Mean	1.20	0.86 0.81 0.78	0.63 0.57 0.51	1.15 1.01 0.92	2.56 2.39 2.30	0.70 0.67 0.65	0.54 0.47 0.42	0.87 0.84 0.79	2.52 2.37 2.22	125	130	

and forming a wide curve with a slight forward swing; posterior margin somewhat more curved; ventral margin rather much convex.

Anterodorsal angle less obtuse than the posterodorsal.

Anterior part of carapace somewhat higher than the posterior.

The region between the edge of the ventral carina and the dorsal margin only slightly arched: surface very gently sloping to the carinal edge and the margins, except to the ventral part of posterior margin where it is fairly steeply sloping; area between carinal edge and free margin rather convex.

Ventral carina very protruding, concealing the corresponding part of free margin; it extends from about the middle of anterior margin to a point somewhat in front of the midlength of postsulcate region; the edge of the carina is sharply acute and curved inwards.

Sulcus situated distinctly in front of the midlength, and in the dorsocentral and central areas, thus, it is short; moreover, it is very shallow; central section narrow and fairly distinct, dorsocentral section broadened backwards, forming an undefined depression which is the place of the dorsal muscle group attachments.

Presulcate node very low, situated just in front of the dorsal part of the central section of the sulcus; it causes a slight sinuosity of the anterior margin of the sulcus; posterior to sulcus, just opposite the presulcate node, is sometimes found an extremely slight node-like swelling.

Surface for the most part finely and shallowly, but distinctly reticulate; sometimes the reticulation is somewhat more coarse, in other cases it is partly indistinct or not developed: the greatest permanence in reticulation occurs around the ventral part of the sulcus and in the most anterior part of presulcate region; outer border of ventral carina finely striate, conforming to the edge of the carina; area between the carinal edge and the ventral margin smooth.

Occurrence. Lower Ordovician: upper part of stratum *G* and lower part of stratum *R II* (from about 0.1 m below *G/R II* to about 0.8 m above this boundary) at Röjeråsvägen, Leskusänget, Silverberg II, and Born-Dådran, in Dalecarlia, Sweden.

Type *b* (presumably larval stages).

Pl. VII, Figs. 3—6.

Type. A characteristic type is shown in Pl. VII, Fig. 5 (P. I. U. No. ar. os. 444).

Locality of type. Leskusänget, in Dalecarlia, Sweden.

Stratum of type. Lower Ordovician: lower part of stratum *R II* (about 0.7 m above *G/R II*).

Material. 22 valves and internal moulds from 4 localities.

Dimensions.

No.	L	H	G	D M	F M	H/L	G/L	DM/L	FM/DM	∧ ant	∧ post	Remark
ar. os. 439	1.00	0.63	0.52	0.93	1.81	0.63	0.52	0.93	1.95	110	130	V
ar. os. 443	0.99	0.63	0.42	0.91	1.88	0.64	0.43	0.92	2.06	110	120	V
ar. os. 441	0.90	0.60	0.42	0.79	1.74	0.67	0.47	0.88	2.20	115	125	V
ar. os. 444	*0.87*	*0.60*	*0.41*	*0.78*	*1.74*	*0.69*	*0.47*	*0.90*	*2.23*	*110*	*125*	V
ar. os. 438	0.70	0.43	0.30	0.62	1.30	0.61	0.43	0.89	2.10	115	130	M
ar. os. 446	0.63	0.40	0.33	0.56	1.16	0.64	0.52	0.89	2.07	115	125	V
Mean	0.85	0.63 0.55 0.40	0.52 0.40 0.30	0.93 0.77 0.56	1.88 1.61 1.16	0.69 0.65 0.61	0.52 0.47 0.43	0.93 0.90 0.88	2.23 2.10 1.95	115	125	

Description. This type is different from type *a* in several respects:

Type *b* is smaller; concerning the dimensional proportions, there are small differences as regards the dorsal margin (proportionally longer in *b*) and the free margin (proportionally shorter in *b*); furthermore, in type *b* the dorsal angles seem to be less obtuse.

Anterior margin is more broadly curved (middle part often nearly straight).

Ventra carina is shorter: it extends only along the anterior part of ventral margin (in type *a* also along the ventral section of anterior margin); it is pinched along the middle part; the very edge of the carina is faintly curved outwards (in type *a* it is curved inwards); area between the carinal edge and free margin is less convex.

Sulcus is longer: it extends to the edge of the ventral carina; the centroventral section is very shallow and indistinct; the ventral part is broader and often deeper.

The fine striation along the outer carinal margin in type *a* is substituted by a fine reticulum, elongated conforming to the margin; the area between carinal ridge and free margin is reticulate (that of type *a* smooth).

It may be noted that in internal moulds the sulcus is deep and broad in its whole extension; furthermore, in internal moulds the presulcate node, which externally is very flat, forms a fairly distinct crest directed backwards; antennal and mandibular muscular attachments are often distinctly discernible in front of the presulcate node.

Occurrence. Lower Ordovician: upper part of stratum *G* and lower part of stratum *R II* (from about 0.1 [1.4] m below *G*/*R II* [as regards 1.4 m: cf. discussion below] to about 0.7 m above this boundary) at Leskusänget, Röjeråsvägen, Silverberg II, and Born-Dådran, in Dalecarlia, Sweden.

Discussion. The differences between the types described above are so many and partly so striking that the types might be considered different species or subspecies. I think this is not the case, nor that they are individual variants or sexual dimorphisms; in my opinion, as anticipated above, they are different moult stages.

The close affinity between the two groups is unmistakable both as regards appearance and vertical distribution of the groups, and, since group *a*, as regards size, forms the direct continuation of the *b* sequence, it is very possible that group *a* consists of adult specimens plus some of the latest larval stages.

If this interpretation is correct, the present species is an interesting example of a fairly comprehensive change in the appearance of the carapace during the last or one of the latest moultings.

As appears from the survey of the vertical distribution of the ostracods (Pl. XXI), *C. plana* migrated to the Siljan District in connection with the reestablished permanent communication between this district and the ocean. The presence of 2 specimens about 1.3—1.4 m below *G*/*R II*, i. e. in a layer deposited during a period of very restricted communication with the ocean, is remarkable and of theoretical interest from a stratigraphic point of view.

The specimens found are larvae (the smallest ones observed); they are not quite typical in every respect: sulcus is more narrow and distinct than usual, and does not extend to the edge of the ventral carina which, moreover, is not so much pinched as is usually the case; furthermore, the reticulation is more indistinct than usual. For the rest, the appearance of the valve is closely coinciding with that of the larvae of *C. plana*, and I am rather positive of their belonging to this species.

The presence of these occasional larvae may indicate that *C. plana*, during this time, lived in the ocean outside the Siljan District, and that larvae were occasionally brought into this district. However, the ecological conditions were unsuitable there and the larvae did not give rise to a *C. plana* population. A *C. plana* population in the Siljan District first arose after the ecological conditions had become about the same as in the ocean, and that was realized when permanent communication with the ocean was reopened (*G*/*R II*).

Investigations of the ostracod fauna in other Lower Ordovician districts of Scandinavia will presumably show whether this interpretation is correct. If so, the investigations will also show whether those ocean populations of *C. plana* which correspond to the *G* stage of the Siljan District are morphologically perfectly identical with the lower *R II* populations. Since the occasional larvae from the *G* stratum are slightly different from the *R II* larvae, there is really reason to believe that minor morphological dissimilarities also occur among the corresponding populations of adult and later larval stages.

Survey of the dimensions of *Ctenentoma*.

	Number	L	H	G	D M	F M	$\frac{H}{L}$	$\frac{G}{L}$	$\frac{DM}{L}$	$\frac{FM}{DM}$	∧ ant	∧ post
C. macroreticulata	16	0.77	0.46	0.44	0.69	1.48	0.60	0.58	0.90	2.14	115	105
C. falcatosulcata	1	0.72	0.44	0.33	0.64	1.30	0.61	0.46	0.89	2.03	110	105
C. canaliculata	1	0.80	0.48	0.37	0.70	1.51	0.60	0.46	0.87	2.16	140	125
C. rectangulocarinata	2	0.76	0.42	0.34	0.67	1.33	0.56	0.46	0.89	1.87	130	115
C. plana a	3	1.20	0.81	0.57	1.01	2.39	0.67	0.47	0.84	2.37	125	130
C. plana b	6	0.85	0.55	0.40	0.76	1.61	0.65	0.47	0.89	2.13	115	125
						Mean	0.62	0.48	0.88	2.12	125	120

The data given in the above survey are not very representative as regards the species which occur as single specimens or in small number. Certain characteristic features may appear, however.

The dimensional proportions seem to be fairly uniform in the first four species, except those for the gibbosity of *C. macroreticulata*, which is considerably more gibbous than the other species. The anterodorsal angle is invariably more obtuse than the posterodorsal.

C. plana is different from the other species in that it is rather considerably higher, and that the posterodorsal angle is more obtuse than the anterodorsal.

Genus *Aulacopsis* n. gen.

Derivation of name. *Aulacopsis* alludes to the fact that there is a fissure on one or both sides of the sulcus.

Genotype. *Aulacopsis bifissurata* n. sp.

Occurrence. Ordovician.

Diagnosis. Monosulcate ostracods; length about (0.3)—0.6—1.2 mm; presumably equivalved; valves provided with a velate ridge or a ventral carina; on one or both sides of the sulcus is a fissure; presulcate node present, or not developed; surface smooth or reticulate.

Discussion and remarks. The more or less distinct fissure on one or both sides of the sulcus is considered a generic character. This character is not very striking to the eye, but in my opinion, it is of great phylogenetic and taxonomic importance. The presulcate fissure most certainly corresponds to *S I* and the postsulcate one to *S III*, and thus the genus takes an intermediate position between *Ctenentoma* and the trisulcate genera (nearest to the *Ceratopsis* group of Tetradellinae). Since, in fact, the genus is monosulcate I propose it to be placed in the subfamily Ctenentominae.

One of the three species (*A. nodosa* n. sp.) resembles those *Ctenentoma* species which are provided with a velate ridge; considering the appearance of the velate ridge, *A. nodosa* is closest reminiscent of *C. macroreticulata* n. sp.: the whole free margin is rather symmetrically surrounded by the ridge which diminishes in distinctness towards the ends.

The two remaining species known are provided with a ventral carina which in one case (*A. bifissurata* n. sp.) resembles that of *Ctenentoma plana* n. sp. and in the other (*A. monofissurata* n. sp.) those of the *Glossopsis* group; in this latter species also a velate ridge may be developed, just as is the case in some *Glossopsis* species.

As previously mentioned, *Aulacopsis*, like *Ctenentoma*, will most likely be divided into a carinate genus and a velate ridge genus, when more species become known.

I think that possibly one or other of the species referred by SCHMIDT (1941) to *Ctenentoma* will, on closer examination, appear to be referable to *Aulacopsis*.

Aulacopsis nodosa n. sp.

Pl. VII, Fig. 12.

Only one valve is known of this new type. However, this is satisfactorily preserved and, hence, I describe it as a new species.

Further finds will show whether it is an adult specimen or a larval stage.

Derivation of name. *nodosa* alludes to the distinct presulcate node.

Holotype. The type shown in Pl. VII, Fig. 12 is holotype (P. I. U. No. ar. os. 474).

Locality of holotype. Rävanäs, in Dalecarlia, Sweden.

Stratum of holotype. Lower Ordovician: upper part of stratum *G* (about 0.1 m below *G/R II*).

Material. One valve.

Dimensions.

No.	L	H	G	D M	F M	H/L	G/L	D M/L	F M/D M	∧ ant	∧ post	Remark
ar. os. 474	0.56	0.34	0.33	0.52	1.02	0.61	0.59	0.93	1.96	115	90	V

Diagnosis. *Aulacopsis* of small size; one short furrow just anterior to presulcate node and one long posterior to sulcus; area between sulcus and postsulcate furrow rather swollen, especially ventrally; ventral area considerably protruding; the whole free margin surrounded by a velate ridge, along the outer side of its ventral and posterior sections is a fine but distinct fissure; sulcus fairly deep and broad, extending practically from dorsal margin to the edge of the velate ridge; presulcate node rounded, proportionally large and distinct; surface slightly rugose (partly indistinctly reticulate).

Affinities. This species is different from the other two *Aulacopsis* species known mainly in that it has a velate ridge extending along the whole free margin (the two others have a ventral carina), and a distinct presulcate node (in the others the presulcate node is very low); moreover, the area between the sulcus and the postsulcate fissure is swollen which is not true of the others.

Description. Carapace rather small, whether or not it is equivalved could not be determined, since only one separate valve was observed.

Dorsal margin straight and long; anterior margin somewhat more rounded than the posterior; ventral margin moderately convex.

Anterodorsal angle more obtuse than the posterodorsal, which is practically straight.

Anterior part of carapace slightly higher than the posterior.

Carapace moderately arched, except the area between sulcus and the postsulcate fissure which is rather swollen, especially its ventral part; ventral area protruding considerably over ventral margin; surface gently sloping to dorsal margin and to anterior and posterior sections of the velate ridge, but fairly steeply to ventral section of the velate ridge; area between the velate ridge and free margin plane.

Velate ridge runs along the most protruding part of ventral area and also along anterior and posterior margins to the dorsal corners; its ventral section distinct and directed outward, anterior and posterior sections lower and more indistinct, especially towards the dorsal corners; close to the outer side of ventral and posterior section runs a fine but distinct fissure, which continues anteriorly as a broad and, especially dorsally, shallow and indistinct groove.

Sulcus situated distinctly in front of the midlength; it extends practically from dorsal margin to the edge of the velate ridge (it does not exactly reach the edge); it is fairly broad and deep, except towards the ends; its anterior margin straight and its posterior very slightly curved backwards.

Presulcate node situated mainly dorsocentrally; it is wide, rounded, and rather low but distinct.

Just in front of the presulcate node is a scarcely discernible short furrow parallel to the sulcus; the furrow may correspond to *S I*, and the area between the furrow and the sulcus (which includes the node) may correspond to *L II*.

The above-mentioned swollen area just behind the sulcus (which certainly corresponds to *L III*) is separated from the lower posterior part of the postsulcate region (corresponding to *L IV*) by a shallow and indistinct groove conforming to the sulcus (ventral part best developed); its dorsal part gently curved forwards exactly like *S III* in many *Glossopsis* species; the furrow certainly corresponds to *S III*.

Surface slightly rugose (most posterior part very indistinctly reticulate).

Occurrence. Lower Ordovician: upper part of stratum *G* (about 0.1 m below *G*/*R II*) at Rävanäs, in Dalecarlia, Sweden.

Aulacopsis monofissurata n. sp.

Pl. VII, Figs. 9—11.

To this species are referred two types which are considered different groups of moult stages (cf. discussion below).

The types, called *a* and *b*, are described separately.

Derivation of name. *monofissurata* alludes to a generally short fissure posterior to the ventral part of the sulcus.

Holotype. The type shown in Pl. VII, Fig. 9 is holotype (P. I. U. No. ar. os. 457).

Locality of holotype. Stenberg, in Dalecarlia, Sweden.

Stratum of holotype. Lower Ordovician: lower part of stratum *G* (about 0.8 m above *R I*/*G*).

Material. The mutual frequencies of the 2 groups were not established, since the groups were discerned after the measurements. As the measured specimens were picked out randomly, the total frequency of the groups may mainly correspond to the frequency of the measured groups.

The entire material of *A. monofissurata* comprises 118 valves from 7 localities.

Diagnosis. *Aulacopsis* of moderate size; group *b* (considered to be young moult stages) somewhat different from group *a* (considered to be late moult stages and adults); area between the edge of ventral carina and dorsal margin flattened, area between the edge of ventral carina and free margin in *a* very concave, in *b* slightly concave (nearly straight); a narrow stripe in front of the sulcus and another somewhat broader behind the sulcus very slightly swollen (these stripes certainly correspond to *L II* and *L III* resp.); one generally short and sometimes fairly indistinct fissure (corresponding to *S III*) posterior to ventral part of sulcus (in *b* very indistinct or not developed); ventral carina in *a* very protruding and long, extending along ventral part of anterior margin and greater part of ventral margin (in *b* it is less protruding, scarcely concealing corresponding part of ventral margin, and shorter than in *a*: it extends only along the greater part of ventral margin); velate ridge short; sulcus rather narrow and long, extending from dorsal or dorsocentral to centroventral area, in *a* it is fairly shallow but in *b* it is often somewhat deeper; surface reticulate, reticulation often indistinct or partly not developed.

Affinities. Small specimens of group *a* may be somewhat reminiscent of large specimens of *Aulacopsis bifissurata* n. sp., but they are different not only as regards the number of the fissures but also in that the carina of *A. bifissurata* is shorter (it does not extend along the ventral part of anterior margin), and the reticulation is, as a rule, more distinct.

Certain specimens of group *b* are indistinctly or practically not at all fissurate. These resemble *Ctenentoma rectangulocarinata* n. sp., especially as regards the appearance of the ventral carina and sulcus. However, the carinal edge of the present type is generally slightly acute, but that of *C. rectangulocarinata* is practically a right angle. Furthermore, *C. rectangulocarinata* is proportionally shorter.

Occurrence. Lower Ordovician: lower part of stratum *G* (from just above *R I/G* to about 1.4 m above this boundary) at Stenberg, Gulleråsen, Rävanäs, Granmor, Leskusänget, Silverberg (sample 1), and Röjeråsvägen, in Dalecarlia, Sweden.

Type *a* (presumably late larval stages and adults).
Pl. VII, Figs. 9 and 10.

Type. This type includes the holotype (P. I. U. No. ar. os. 457).

Locality and stratum of type. Cf. p. 283.

Material. As calculated, about 126 valves and internal moulds.

Description. Carapace of moderate size; whether or not it is equivalved was not ascertainable, since only separate valves were observed.

Dimensions.

No.	L	H	G	D M	F M	H/L	G/L	D M/L	F M/D M	∧ ant	∧ post	Re-mark
ar. os. 451	1.23	0.72	0.51	1.09	2.28	0.59	0.42	0.89	2.05	125	120	V
ar. os. 468	1.23	0.71	0.49	1.09	2.21	0.58	0.40	0.89	2.03	130	120	V
ar. os. 449	1.20	0.74	0.49	1.03	2.26	0.62	0.41	0.86	2.20	125	115	V
ar. os. 465	1.15	0.70	0.51	1.00	2.14	0.61	0.45	0.87	2.14	125	120	V
ar. os. 458	1.14	0.71	0.53	1.00	2.07	0.62	0.46	0.88	2.07	130	120	V
ar. os. 462	1.12	0.72	0.47	1.01	2.10	0.64	0.42	0.90	2.09	120	115	V
ar. os. 455	1.12	0.67	0.51	0.99	1.98	0.60	0.46	0.88	2.00	125	120	V
ar. os. 453	1.09	0.65	0.44	0.95	1.98	0.60	0.40	0.87	2.09	130	125	V
ar. os. 457	*1.08*	*0.70*	*0.44*	*0.89*	*2.16*	*0.65*	*0.41*	*0.83*	*2.43*	*125*	*120*	V
ar. os. 456	1.08	0.67	0.49	0.94	2.05	0.62	0.45	0.87	2.18	125	115	V
ar. os. 469	1.08	0.67	0.47	0.94	2.07	0.62	0.44	0.87	2.18	125	115	V
ar. os. 463	1.05	0.64	0.42	0.91	2.03	0.61	0.40	0.87	2.23	125	115	V
ar. os. 452	1.03	0.63	0.47	0.88	1.96	0.61	0.46	0.86	2.22	125	120	V
ar. os. 454	1.02	0.65	0.42	0.88	1.91	0.64	0.41	0.86	2.05	125	110	V
ar. os. 460	1.02	0.63	0.42	0.85	1.91	0.62	0.41	0.83	2.22	125	115	V
ar. os. 464	0.99	0.58	0.44	0.87	1.82	0.59	0.44	0.88	2.10	130	115	V
ar. os. 450	0.95	0.56	0.42	0.83	1.77	0.59	0.44	0.87	2.13	120	115	V
Mean	1.09	0.74 0.67 0.56	0.53 0.47 0.42	1.09 0.95 0.83	2.28 2.04 1.77	0.65 0.61 0.58	0.46 0.43 0.40	0.90 0.87 0.83	2.43 2.14 2.00	125	115	

Dorsal margin straight and long; anterior margin widely and regularly curved, ventral section more curved than the dorsal; ventral margin moderately convex.

Anterodorsal angle slightly more obtuse than the posterodorsal.

Region between the edge of ventral carina and dorsal margin very flattened; a narrow stripe just in front of the sulcus (corresponding to *L II*) and another somewhat broader just posterior to the sulcus (corresponding to *L III*) mostly very slightly swollen, the posterior most swollen in the ventral part; area between the edge of ventral carina and free margin very concave.

Ventral carina extends from about the middle of anterior margin to a point somewhat behind the fissure; it is very protruding and curved inwards; its anterior section forms a forward swing.

Velate ridge low and short, extending obliquely from posteroventral part of free margin to posterior part of ventral carina.

Sulcus situated distinctly in front of the midlength; it is practically straight and rather long, extending from dorsocentral to centroventral area; central and centroventral sections moderately deep and distinct, anterior margin of these sections more steeply sloping than the posterior one, anterior margin also curved slightly backwards, posterior straight; dorsocentral section shallow and undefined.

Presulcate node extremely flat or externally not discernible; it is situated just at the transition between dorsocentral and central areas, and causes a slight backward sinuosity of the anterior margin of the sulcus.

Near the midlength between ventral part of sulcus and posterior end of ventral margin is a generally short and sometimes somewhat indistinct fissure which certainly corresponds to *S III*; the fissure, in rare cases, is traceable to the dorsocentral area, the dorsal end is curved forwards just like *S III* in *Glossopsis* n. gen.

Along the anterior margin of the slightly swollen presulcate stripe is sometimes a very shallow depression, certainly corresponding to *S I*.

Surface tenuously reticulate, "meshes" conforming to free margin; reticulation often indistinct and partly not developed, most permanent along anterior margin and just behind posterior end of ventral carina; the slightly swollen stripes on both sides of sulcus, and most of the area between the edge of the ventral carina and free margin smooth.

Occurrence. Cf. p. 284.

Type *b* (presumably young larval stages).

Pl. VII, Fig. 11.

Type. A characteristic type is shown in Pl. VII, Fig. 11 (P. I. U. No. ar. os. 470).

Locality of type. Stenberg, in Dalecarlia, Sweden.

Stratum of type. Lower Ordovician: lower part of stratum *G* (about 0.8 m above *R I/G*).

Material. As calculated, about 37 valves and internal moulds.

Description. The present type is very similar to type *a*, but it is different as regards some details.

Carapace is proportionally longer; ventral carina is shorter (not extended along ventral part of anterior margin) and less protruding; the fissure ex-

Dimensions.

No.	L	H	G	D M	F M	$\frac{H}{L}$	$\frac{G}{L}$	$\frac{DM}{L}$	$\frac{FM}{DM}$	∧ ant	∧ post	Re-mark
ar. os. 436	0.85	0.43	0.34	0.72	1.49	0.51	0.40	0.85	2.07	130	120	V
ar. os. 481	0.74	0.42	0.33	0.67	1.37	0.57	0.44	0.91	2.04	125	115	V
ar. os. 467	0.66	0.37	0.28	0.58	1.23	0.56	0.42	0.88	2.12	125	115	V
ar. os. 476	0.64	0.36	0.28	0.55	1.09	0.56	0.44	0.86	1.98	125	115	V
ar. os. 470	*0.63*	*0.36*	*0.28*	*0.55*	*1.14*	*0.57*	*0.44*	*0.88*	*2.08*	*115*	*115*	V
Mean	0.70	0.43 0.39 0.36	0.34 0.30 0.28	0.72 0.61 0.55	1.49 1.26 1.09	0.57 0.55 0.51	0.44 0.43 0.40	0.91 0.88 0.85	2.12 2.06 1.98	125	115	

tremely indistinct, or mostly not developed; sulcus proportionally deeper and more distinct.

Surface mostly not reticulate but smooth, or minutely rugose like that of many specimens of type *a*; some specimens indistinctly reticulate at the ventral part of anterior margin and just behind the posterior end of the ventral carina; area between the edge of the carina and the free margin very finely reticulate, reticulation elongated conforming to the margin (in type *a* this area is mostly smooth).

Occurrence. Cf. p. 284.

Discussion. The differences between the types *a* and *b* may appear to be so important that the types might be considered different species. I think, however, that they are groups of different moult stages.

The mentioned differences as regards details (cf. description of type *b*) may not conceal the fact that the types are very similar concerning general features. The fact that the groups form a continuous sequence as regards the size makes me inclined to consider them different groups of moult stages. This idea may be supported by the fact that the types occur together in the same, rather restricted stratum.

Aulacopsis bifissurata n. sp.

Pl. VII, Figs. 13—20.

The material of this species forms a sequence which elucidates a great part of the larval development of the carapace.

Four groups of moult stages are discernible. They are named *a*, *b*, *c* and *d*, and are described separately; *a* is presumably adult, and *d* comprises the youngest stages observed.

Derivation of name. *bifissurata* alludes to two fissures, one on each side of the sulcus.

Holotype. The type shown in Pl. VII, Fig. 15 is holotype (P. I. U. No. ar. os. 821).

Locality of holotype. Stenberg, in Dalecarlia, Sweden.

Stratum of holotype. Lower Ordovician: lower part of stratum *G* (about 0.8 m above *R I/G*).

Material. The mutual frequencies of the 4 groups were not ascertained, since the groups were discerned after the measurements. As the measured specimens were picked out at random, the total distribution of the groups may mainly be corresponded by the frequency of the measured groups.

The entire material of *A. bifissurata* comprises 1 carapace and 112 valves and internal moulds from 6 localities.

Diagnosis. *Aulacopsis* of rather small size; four groups of moult stages discernible, different mainly as regards the appearance of ventral carina; area between the edge of ventral carina and dorsal margin very flattened; area between the edge of ventral carina and ventral margin practically plane (in adult specimens slightly concave just at the carinal edge); one distinct fissure on each side of the ventral part of sulcus; sulcus long, straight, and (especially in young stages) ventrally deep; ventral carina short and very protruding, it is shorter and its outline is more curved in successively younger stages; surface reticulate, reticulum sometimes indistinct or partly not developed.

Affinities. Adult specimens and late larval stages are somewhat reminiscent of *A. monofissurata* n. sp. as regards general shape; distinguishing features mentioned on p. 284. Young larvae are unique and scarcely confusable with young stages of this species, mainly on account of the fact that the carina is shorter and its outline more curved.

Occurrence. Lower Ordovician: upper part of stratum *R I* and lower part of stratum *G* (from about 0.2 m below *R I/G* to about 1.9 m above this boundary) at Stenberg, Gulleråsen, Rävanäs, Leskusänget, Granmor, and Röjeråsvägen, in Dalecarlia, Sweden.

Type *a* (presumably adults).

Pl. VII, Figs. 15 and 16.

Type. This type includes the holotype (P. I. U. No. ar. os. 821).

Locality and stratum of type. Cf. above.

Material. As calculated, about 16 specimens, cf. above.

Description. Carapace of moderate or rather small size; whether or not it is equivalved was not determined, since only separate valves were observed.

Dorsal margin straight and long; anterior margin fairly broadly curved, its ventral section sometimes bulged forward; posterior margin broadly curved, especially the ventral part; ventral margin slightly convex.

Dimensions.

No.	L	H	G	D M	F M	$\frac{H}{L}$	$\frac{G}{L}$	$\frac{D\,M}{L}$	$\frac{F\,M}{D\,M}$	∧ ant	∧ post	Re-mark
ar. os. 486	1.08	0.63	0.56	0.95	2.02	0.57	0.52	0.87	2.12	125	110	V
ar. os. 493	1.00	0.65	0.47	0.93	1.84	0.65	0.47	0.93	1.98	115	110	V
ar. os. 487	0.95	0.54	0.49	0.83	1.67	0.57	0.52	0.87	2.01	120	115	V
Mean	1.01	0.65 0.61 0.54	0.56 0.51 0.47	0.95 0.90 0.83	2.02 1.84 1.67	0.65 0.60 0.57	0.52 0.50 0.47	0.93 0.89 0.87	2.12 2.04 1.98	120	110	

Anterodorsal angle slightly more obtuse than the posterodorsal.

Region between the edge of ventral carina and dorsal margin fairly or much flattened (one very flat and another slightly more arched type discernible; they may possibly be sexual dimorphisms); area between ventral part of sulcus and the postsulcate fissure slightly swollen, most in the ventral section (this area between sulcus and postsulcate fissure certainly corresponding to *L III* of e. g. *Glossopsis* n. gen.); area between the edge of the carina and corresponding part of ventral margin practically straight, except in a narrow zone along the carinal edge which is slightly concave.

Ventral carina extends from a point just in front of the presulcate fissure to a point somewhat behind the postsulcate; it protrudes considerably, edge pinched and sharply ridged.

Sulcus situated distinctly in front of the midlength; it extends from dorsal or dorsocentral area nearly to the carinal edge; it is practically straight (its anterior margin slightly curved by the presulcate node); its anterior margin perpendicular, the posterior less steeply sloping; it is fairly deep and narrow, except dorsocentral and, especially, dorsal sections which are shallow, broad and, for the most part, undefined.

Presulcate node extremely low and small (externally scarcely discernible); it is situated dorsocentrally.

Presulcate fissure short and fairly broad, situated somewhat in front of the ventral end of sulcus; it may correspond to *S I* (sometimes one may discern an extremely shallow depression just in front of the presulcate node; this depression may correspond to a dorsal section of *S I*).

Postsulcate fissure situated somewhat posterior to ventral part of sulcus; it is longer than the presulcate fissure, dorsal end flagellate; sometimes, however, only the ventral part is developed forming an elongated pit, but the fissure has also been traced to the dorsocentral area (its dorsal end curved forwards just as in e. g. *Glossopsis lingua* n. sp.); the postsulcate fissure certainly corresponds to *S III*.

Surface minutely reticulate (the swollen area corresponding to *L III* generally smooth); reticulation sometimes indistinct, especially in the dorsal half of the valves; most distinct reticulation generally along the outside of ventral carina and along anterior and posterior margins; reticulation elongated and conforming to the margins, especially in the area between the carinal edge and ventral margin.

Occurrence. Cf. p. 288.

Type *b* (presumably late larval stages).

Pl. VII, Fig. 17.

Type. A characteristic type is figured in Pl. VII, Fig. 17 (P. I. U. No. ar. os. 485).

Locality of type. Stenberg, in Dalecarlia, Sweden.

Stratum of type. Lower Ordovician: lower part of stratum *G* (about 0.6 m above *R I/G*).

Material. As calculated, about 32 specimens, cf. p. 288.

Dimensions.

No.	L	H	G	DM	FM	$\frac{H}{L}$	$\frac{G}{L}$	$\frac{DM}{L}$	$\frac{FM}{DM}$	∧ ant	∧ post	Re-mark
ar. os. 471	0.94	0.52	0.51	0.85	1.61	0.57	0.54	0.93	1.89	115	110	V
ar. os. 492	0.93	0.61	0.45	0.86	1.79	0.66	0.48	0.93	2.08	115	110	V
ar. os. 478	0.93	0.53	0.47	0.82	1.63	0.57	0.50	0.88	1.90	120	115	V
ar. os. 475	0.91	0.52	0.48	0.81	1.63	0.57	0.51	0.89	2.01	120	110	V
ar. os. 459	0.90	0.55	0.42	0.79	1.61	0.61	0.47	0.88	2.04	120	110	V
ar. os. 551	0.88	0.56	0.40	0.78	1.60	0.64	0.46	0.90	2.05	125	115	V
ar. os. 485	*0.85*	*0.49*	*0.44*	*0.79*	*1.56*	*0.58*	*0.53*	*0.93*	*1.97*	*120*	*110*	V
Mean	0.91	0.61 0.54 0.49	0.51 0.45 0.40	0.86 0.81 0.78	1.79 1.63 1.56	0.66 0.60 0.57	0.54 0.50 0.47	0.93 0.90 0.88	2.08 1.90 1.89	120	110	

Description. This type is similar to type *a,* except mainly that the carina is relatively somewhat shorter, and in that its outline forms a more convex curve; furthermore, the edge of the carina is not pinched and not so distinctly ridged.

Area between the edge of ventral carina and ventral margin entirely plane, not concave in the zone close to the carinal edge as in type *a*.

Reticulation seems to be more often indistinct than in type *a*.

It may be noticed that in this group (as in group *a*) the postsulcate fissure is occasionally traceable to the dorsocentral area, dorsal end curved forwards.

Occurrence. Cf. p. 288.

Type *c* (intermediate larval stages).
Pl. VII, Fig. 18.

Type. A characteristic type is shown in Pl. VII, Fig. 18 (P. I. U. No. ar. os. 489).

Locality of type. Gulleråsen, in Dalecarlia, Sweden.

Stratum of type. Lower Ordovician: lower part of stratum *G* (about 0.4 m above *R I/G*).

Material. As calculated, about 38 specimens, cf. p. 288.

Dimensions.

No.	L	H	G	D M	F M	H/L	G/L	D M/L	F M/D M	∧ ant	∧ post	Re-mark
ar. os. 477	0.81	0.50	0.38	0.73	1.49	0.62	0.47	0.90	2.05	120	110	V
ar. os. 489	*0.79*	*0.53*	*0.40*	*0.69*	*1.56*	*0.67*	*0.51*	*0.88*	*2.27*	*120*	*110*	V
ar. os. 482	0.77	0.47	0.40	0.71	1.37	0.61	0.52	0.92	1.93	115	110	V
ar. os. 466	0.74	0.51	0.40	0.67	1.47	0.62	0.54	0.91	2.19	120	110	V
ar. os. 490	0.74	0.49	0.40	0.69	1.44	0.66	0.54	0.93	2.08	120	110	V
ar. os. 491	0.72	0.43	0.38	0.65	1.28	0.60	0.53	0.91	1.97	120	110	V
ar. os. 461	0.67	0.44	0.35	0.60	1.35	0.66	0.52	0.90	2.25	120	110	V
Mean	0.75	0.53 0.48 0.43	0.40 0.39 0.35	0.73 0.68 0.60	1.56 1.42 1.28	0.67 0.63 0.60	0.54 0.52 0.47	0.93 0.91 0.88	2.27 2.11 1.93	120	110	

Description. Ventral carina somewhat shorter and its outline somewhat more curved than in type *b*; sulcus may extend a little nearer to the edge of the ventral carina and it may also be proportionally slightly deeper in the most ventral part; it also happens that the fissures are not developed.

Otherwise, type *c* is the same as type *b*.

Occurrence. Cf. p. 288.

Type *d* (young larval stages).
Pl. VII, Figs. 19 and 20.

Type. A characteristic type is shown in Pl. VII, Fig. 20 (P. I. U. No. ar. os. 483).

Locality of type. Stenberg, in Dalecarlia, Sweden.

Stratum of type. Lower Ordovician: lower part of stratum *G* (about 0.8 m above *R I/G*).

Dimensions.

No.	L	H	G	DM	FM	$\frac{H}{L}$	$\frac{G}{L}$	$\frac{DM}{L}$	$\frac{FM}{DM}$	∧ ant	∧ post	Re-mark
ar. os. 483	*0.57*	*0.40*	*0.26*	*0.51*	*1.07*	*0.70*	*0.46*	*0.90*	*2.10*	*110*	*110*	V
ar. os. 488	0.55	0.33	0.28	0.49	0.95	0.60	0.51	0.89	1.94	115	110	V
ar. os. 480	0.48	0.33	0.23	0.47	0.88	0.69	0.48	0.98	1.87	110	110	V
ar. os. 484	0.48	0.30	0.22	0.43	0.84	0.63	0.46	0.90	1.95	115	110	V
ar. os. 479	0.30	0.19	0.14	0.29	0.56	0.63	0.47	0.97	1.94	105	105	V
Mean	0.48	0.40 0.31 0.19	0.28 0.23 0.14	0.51 0.44 0.29	1.07 0.86 0.56	0.70 0.65 0.60	0.51 0.48 0.46	0.98 0.93 0.89	2.10 1.96 1.87	110	110	

Material. As calculated, about 26 specimens, cf. p. 288.

Description. In this type, the ventral carina is very short, and its outline is even more convex than in type *c*; in some specimens it forms an acute angle.

Carapace proportionally somewhat higher than in the other groups, dorsal margin somewhat longer, and anterodorsal angle somewhat less obtuse.

Sulcus often deepest and broadest at the extreme ventral end.

Postsulcate fissure, as a rule, very indistinct and situated close to the carinal edge (mostly it is not developed at all); presulcate fissure generally occurring and often fairly distinct; it has been observed to be extended practically along the whole sulcus; in some specimens fissures were not developed.

Surface not seldom fairly distinctly reticulate, network about as wide as in later stages.

Occurrence. Cf. p. 288.

Notes on the larval development.

There is no doubt that the present material represents one species only: the changes of certain characters during the larval development are rather easy to follow.

A survey will be given of the development of the distinguishing characters.

The height of carapace and the length of dorsal margin diminish in proportion to the larval development.

Anterodorsal angle grows more obtuse, but the final dimension of this angle is reached as early as stage *c*.

Ventral carina, which in the youngest stages is short and has a very convex (sometimes acute) outline, becomes successively longer, and its outline becomes more and more broadly curved. In adult specimens its edge is pinched and more sharply ridged than in the larval stages. Furthermore, in adults, the area between the carinal edge and the free margin is slightly concave just along the edge, which is generally not the case in larval stages.

Sulcus in the youngest stages is usually deepest and broadest at the extreme ventral end, but this is not true of later stages.

The presulcate fissure is generally developed even in the youngest stages observed; occasionally, it is clearly discernible even in the dorsocentral area (thus a true *S I*); this was not observed in later stages.

The postsulcate fissure in young stages is, as a rule, very indistinct, or not developed at all, but in later stages it is more distinct, especially in adults; among them (and exceptionally in late larval stages), the fissure, dorsal end curved forwards, is occasionally traceable to the dorsocentral area (thus a true *S III*).

Reticulation is generally distinct in young stages, but in late stages it is often indistinct; among the adults, however, the reticulation is most often distinct.

It may be added that in adults the region between the edge of ventral carina and dorsal margin in one type is very flat but in another slightly arched: this difference may possibly be due to sexual dimorphism. If so, it is not possible, however, to decide which of them is male and which female.

Survey of the dimensions of *Aulacopsis*.

	Number	L	H	G	D M	F M	$\frac{H}{L}$	$\frac{G}{L}$	$\frac{DM}{L}$	$\frac{FM}{DM}$	∧ ant	∧ post
A. nodosa	1	0.56	0.34	0.33	0.52	1.02	0.61	0.59	0.93	1.96	115	90
A. monofissurata a	17	1.09	0.67	0.47	0.95	2.04	0.61	0.43	0.87	2.14	125	115
A. monofissurata b	5	0.70	0.39	0.30	0.61	1.26	0.55	0.43	0.88	2.06	125	115
A. bifissurata a	3	1.01	0.61	0.51	0.90	1.84	0.60	0.50	0.89	2.04	120	110
A. bifissurata b	6	0.91	0.54	0.46	0.82	1.64	0.59	0.51	0.91	1.98	120	110
A. bifissurata c	7	0.75	0.48	0.39	0.68	1.42	0.63	0.52	0.91	2.11	120	110
A. bifissurata d	5	0.48	0.31	0.23	0.44	0.86	0.65	0.48	0.93	1.96	110	110
						Mean	0.61	0.49	0.90	2.04	120	110

Two of the three species represented are rather abundant: 22 specimens of *A. monofissurata* and 21 of *A. bifissurata* were measured. They have been divided into groups, each including one or more stages of development.

From the table it appears that none of the species is large, and that height and gibbosity have fairly common dimensions; moreover, dorsal margin is proportionally long and the anterodorsal angle is the larger one (in very young stages of *A. bifissurata* it was observed to be equal to the posterodorsal one).

It may be noted that the length of dorsal margin seems invariably to be proportionally decreased in successively later stages.

Subfamily *Tetradellinae* SCHMIDT 1941.

Diagnosis. SCHMIDT 1941, p. 37.

Discussion and remarks. SCHMIDT 1941 referred 10 genera to this subfamily (4 of them with reservation). In the present paper, one of these genera is divided (*Ceratopsis*) and another genus, the taxonomic position of which has been considered uncertain (*Steusloffia*), is proposed to be referred to this subfamily. But its taxonomic range is too wide. I think that, after revision of certain incompletely described and drawn species, it will appear to be divisible into two subfamilies, one characterized by, inter alia, being velate, the second by being carinate.

However, there are species which are provided with both a carina and a velate structure. Such species are here proposed to form a new genus, *Ogmoopsis.*

Ogmoopsis takes an intermediate position between the two subfamilies which will possibly be erected later, but it may be referable to the one which is carinate but which sometimes has traces of a velate structure (in the following called group *A* or the *Ceratopsis* group). The appearance of *L I*, moreover, is the same as that of group *A*. Since lobes and sulci are mutually of fairly equal size, it more closely resembles the *B* group (the *Tetradella* group) in these respects.

Besides *Ogmoopsis*, another genus (belonging to the *A* group) is proposed to be erected, viz. *Glossopsis*, which is removed from *Ceratopsis.*

The genera referred to Tetradellinae SCHMIDT which are represented in this material are here classified in 3 groups:

A. *Ceratopsis* ULRICH
   Glossopsis n. gen.
   Ogmoopsis n. gen.

B. *Tetradella* ULRICH

C. *Steusloffia* ULRICH and BASSLER

Steusloffia is referred by SCHMIDT (with reservation) to the family Drepanellidae SCHMIDT 1941 (subfamily Bassleratiinae).

Group A (*Ceratopsis* group).

Discussion and remarks. *Ceratopsis* is said, by SCHMIDT, in his diagnosis of this genus (1941, p. 44), to be distinguished by the appearance of *L I*. However, the appearance of *L I* is very variable among the species referred to *Ceratopsis*. Its dorsal end may be protruded into a spine of considerable length, e. g. the genotype *C. chambersi* (MILLER), or into a shorter spine, e. g. *C. hastata* (BARRANDE), or into a short triangular knob directed backwards such as in *C. platyceras* ÖPIK. The spine is also said to "take the shape of a thickstemmed mushroom, the gently convex cap of which is beautifully fringed at the edge" (ULRICH 1894, p. 676); what is meant in this case is *C. oculifera* (HALL). Other species, again, are non-spiniferous. In some of them, the dorsal end of *L I* is formed as a more or less flattened bulb, entirely attached to the substratum and sitting on a curved "stalk" and directed backwards; examples are *C. obliquejugata* (SCHMIDT), and *C. perpunctata* ÖPIK. In another species, *C. bocki* ÖPIK, the dorsal end of *L I* is elongatedly claviform and practically entirely attached to the substratum; ventrally it tapers into a ridge which, in turn, continues along the edge of the ventral carina; the lobe is directed mainly dorso-ventrally.

Concerning the appearance of *L I*, some of the present species are similar to this last-mentioned type. In other closely related species, *L I* is of about equal breadth, but flattened and linguiform; it is attached to the substratum throughout its length, or (exceptionally) the very top is free. In most of these types the lobes and sulci are mutually unequal, but in certain types they are fairly equal in size and appearance.

It is obvious that all these different types should not be placed in the one genus *Ceratopsis*.

Ceratopsis is here proposed to comprise only spiniferous types. The rest are proposed to form two new genera: *Glossopsis* and *Ogmoopsis*.

Glossopsis includes types provided with lobes and sulci of distinctly unequal size. It comprises different types as regards the appearance of *L I* and, in turn, it may be divided into 3 groups (cf. p. 296). Concerning the other lobes, *L II* is the most variably developed, and *L III* and *L IV* are sometimes more or less completely fused.

Ogmoopsis, as mentioned, includes types provided with fairly equal lobes and sulci; furthermore, it is distinguished by a narrow velate ridge running in the area between the carinal edge and free margin (this ridge sometimes traceable also in certain *Glossopsis* species).

Genus *Glossopsis* n. gen.

Derivation of name. *Glossopsis* alludes to the appearance of *L I* which is most often linguiform.

Genotype. *Glossopsis lingua* n. sp.

Occurrence. Ordovician (Middle and Lower Ordovician).

Diagnosis. 4- or 3-lobate ostracods; length about (0.4)—0.7—1.3 mm; *L I* generally flattened, and linguiform or claviform, *L II* fairly variable in broadness (in the dorsal part there is often a node corresponding to the presulcate node of monosulcate genera), *L III* and *L IV* most often parted by a very narrow sulcus (*S III*) which, in some species, is restricted to a ventral fissure, *L III* and *L IV* in some species entirely fused; *S II* in most genera the broadest and deepest sulcus; ventral carina protruding over free margin, it extends along most of ventral margin and often along ventral part of anterior margin; surface smooth, or more or less distinctly reticulate or punctate.

Discussion and remarks. *L I* is somewhat differently developed in this genus and on that account it may be divided into 3 groups:

1. *Glossopsis lingua* group
   (*L I* linguiform, of about equal breadth, or ventral end broadest, throughout its length attached to the substratum, or the very top occasionally free; valves 4-lobate).
   G. lingua n. sp.
   G. acuta n. sp.

Occurrence. Lower Ordovician.

2. *Glossopsis tenuilimbata* group
   (*L I* claviform, ventral end tapering, throughout its length attached to the substratum, or the very top occasionally free; valves 4- or 3-lobate).

   a. 4-lobate section with long *S III*
      G. tenuilimbata n. sp.
      G. alata n. sp.
      G. clavata n. sp.
      G. schmidti (BONNEMA)[1]
      G. bocki ÖPIK

   b. 4-lobate section with short, ventral *S III*
      G. nodosa n. sp.
      G. depressolimbata n. sp.
      G. indistincta n. sp.
      G. mutilata n. sp.

Occurrence. Lower and Middle Ordovician.

[1] ÖPIK (1937, p. 25) mentioned that *G. obliquejugata* (SCHMIDT) and *G. schmidti* (BONNEMA) are conspecific. Whether this is true is difficult to prove owing to lack of evidence, the descriptions of *L I* of *G. obliquejugata* being vague and the figure of the badly preserved holotype of this species as given by ÖPIK (1937, Pl. II, Fig. 3) not being very helpful. So much seems to be certain, however, that some of the specimens referred

c. 3-lobate section (occasionally traces of *S III*).
G. robusta n. sp.

Occurrence. Lower Ordovician.

3. *Glossopsis perpunctata* group
(*L I* bulbiform, entirely attached to the substratum, anterior end fixed to a narrow ridge continuing along the edge of ventral carina; valves 4-lobate).
G. perpunctata (ÖPIK)
? *G. obliquejugata* (SCHMIDT) (cf. note on p. 296).

Occurrence. Middle Ordovician.

Glossopsis is, on the one hand, related to the carinate section of *Aulacopsis* n. gen. (subfamily Ctenentominae), and, on the other, the genus is closely related to *Ogmoopsis* n. gen. (closest similarities between *Ogmoopsis* and the *G. tenuilimbata* group, viz. as regards the appearance of *L I*, and the fact that in this group there are sometimes fairly distinct traces of a velate ridge; only occasionally, extremely indistinct traces discernible in the *G. lingua* group).

The relations between *Glossopsis* and the *Ceratopsis* species represented here are obvious: they are different mainly as regards the appearance of *L I* (closest relations to the 3-lobate section of the *G. tenuilimbata* group and to the 4-lobate section, where *S III* is short and ventral).

4 species described earlier may be referable to *Glossopsis*. They are all Estonian; one of them is also reported from Sweden, viz. *G. obliquejugata* (SCHMIDT) from Middle Ordovician (THORSLUND 1940).

3 of these species are Middle Ordovician: *G. schmidti* (BONNEMA), *G. obliquejugata* (SCHMIDT) and *G. perpunctata* (ÖPIK). The fourth, *G. bocki* (ÖPIK), is Lower Ordovician.

In this paper 10 new Lower Ordovician *Glossopsis* species are described.

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to *G. obliquejugata* are not identical with the holotype of *G. schmidti* (BONNEMA 1909, Pl. VI, Figs. 1—6).

The holotype of *G. schmidti* belongs evidently to the *G. tenuilimbata* group: *L I* is claviform as in *G. tenuilimbata*, the ridge along the edge of ventral carina is of identical appearance, and in both there are traces of a velate ridge running in the area between the carinal edge and the free margin.

One specimen referred by ÖPIK to *Ceratopsis obliquejugata* (1937, Pl. II, Fig. 4) may not be conspecific with *G. schmidti*, judging by the fact that *L I* is bulbous. As seen from the original, the species, which by THORSLUND was classed as *Ceratopsis obliquejugata* (1940, Pl. 3, Fig. 13) has a very distinct bulbous *L I*. This specimen is not conspecific with *G. schmidti*.

Whether the specimens mentioned here, which have been referred to *G. obliquejugata*, are really this species is difficult to decide, since, as mentioned, the holotype of *G. obliquejugata* is imperfectly described and figured.

In any case, the specimen referred by THORSLUND to *Ceratopsis obliquejugata* and possibly ÖPIK's above-mentioned specimen are to be grouped in the *G. perpunctata* group, and *G. schmidti* (BONNEMA) in the *tenuilimbata* group.

The *Glossopsis lingua* group.

This group is distinguished mainly by the fact that *L I* is linguiform (broadest ventrally) and that there is no ridge running along the outer side of the carinal edge.

Glossopsis lingua n. sp.

Pl. VIII, Figs. 7—9.

Derivation of name. *lingua* alludes to the linguiform *L I.*

Holotype. The type shown in Pl. VIII, Fig. 7 is holotype (P. I. U. No. ar. os. 525).

Locality of holotype. Granmor, in Dalecarlia, Sweden.

Stratum of holotype. Lower Ordovician: lower part of stratum *G* (just above *R I/G*).

Material. 131 valves and internal moulds from 6 localities.

Dimensions.

No.	L	H	G	D M	F M	$\frac{H}{L}$	$\frac{G}{L}$	$\frac{DM}{L}$	$\frac{FM}{DM}$	∧ ant	∧ post	Re-mark
ar. os. 556	1.25	0.74	0.56	1.09	2.33	0.59	0.45	0.87	2.14	125	115	V
ar. os. 541	1.15	0.72	0.47	0.98	2.16	0.63	0.41	0.85	2.20	130	120	V
ar. os. 569	1.15	0.71	0.50	0.94	2.23	0.62	0.44	0.82	2.37	125	115	V
ar. os. 534	1.05	0.68	0.44	0.93	2.01	0.65	0.42	0.89	2.16	125	115	V
ar. os. 553	1.03	0.63	0.48	0.86	1.95	0.61	0.47	0.84	2.26	130	115	V
ar. os. 533	1.02	0.65	0.40	0.86	1.95	0.64	0.39	0.84	2.26	130	115	V
ar. os. 525	*1.02*	*0.65*	*0.44*	*0.91*	*1.98*	*0.64*	*0.43*	*0.89*	*2.17*	*125*	*115*	V
ar. os. 543	1.02	0.63	0.47	0.91	1.86	0.62	0.46	0.89	2.04	130	115	V
ar. os. 529	1.01	0.62	0.47	0.85	1.89	0.61	0.47	0.84	2.22	130	115	V
ar. os. 568	1.01	0.66	0.48	0.85	2.01	0.65	0.48	0.84	2.38	125	115	V
ar. os. 544	0.98	0.61	0.39	0.81	1.84	0.62	0.40	0.83	2.27	130	115	V
ar. os. 528	0.97	0.63	0.47	0.82	1.91	0.65	0.48	0.84	2.32	125	115	V
ar. os. 540	0.97	0.63	0.44	0.82	1.91	0.65	0.45	0.84	2.32	130	120	V
ar. os. 549	0.94	0.56	0.47	0.84	1.84	0.60	0.50	0.89	2.19	130	115	V
ar. os. 579	0.96	0.61	0.42	0.87	1.86	0.64	0.44	0.91	2.14	125	110	V
Mean	1.04	0.74 0.65 0.56	0.56 0.46 0.39	1.09 0.89 0.81	2.33 1.98 1.84	0.65 0.63 0.59	0.50 0.45 0.39	0.91 0.86 0.82	2.38 2.23 2.04	130	115	

Diagnosis. *Glossopsis* of about moderate size; sulcate region flattened; valves 4-lobate; *L I* linguiform (ventral end broadest), very low and flat, throughout its length attached to the substratum, or the very top in rare cases free, top sometimes faintly bent outwards, mostly broadly rounded (in the flattest types even obtuse) and mostly not overlapping the dorsal margin; *L II* narrow, short and practically straight; *S III* generally a fissure; ventral carina broad and slightly bent inwards, it extends along ventral margin, except its most posterior part, and along ventral part of anterior margin, forming a forward swing; surface reticulate, reticulation sometimes partly indistinct.

Affinities. The species is closely related to *Glossopsis acuta* n. sp. They are different mainly as regards the appearance of *L I*: in the present species it is longer and in all its extension more flattened (in *G. acuta* it rises gently in dorsal direction), the dorsal end is generally broadly curved (in *G. acuta* acute), the outer side is not slanting backwards which is typical for *G. acuta.* Furthermore, in the present species, *S I* and *S III* are narrower than in *G. acuta.*

Moreover, the present species is very reminiscent of *G. clavata* n. sp. as regards the appearance of sulci and nodes, except *L I* which in the present species is broadest at the ventral end but which in *G. clavata* tapers at this end. Additionally, they are different in that the anterodorsal angle of the present species is more obtuse and its ventral carina longer and forming a forward swing.

From *G. tenuilimbata* n. sp. the present species is different mainly as regards the following characters: in *G. tenuilimbata* the ventral end of *L I* tapers (in *G. lingua* broadest), *L II* is slightly geniculate (in *G. lingua* straight), ventral carina is ridged along its margin (in *G. lingua* no ridge).

Description. Carapace of moderate size; whether or not it is equivalved was not determinable, since only separate valves were observed.

Dorsal margin straight and long; anterior margin broadly convex; dorsal part of posterior margin generally somewhat more curved than its ventral part; ventral margin moderately convex.

Anterodorsal angle somewhat more obtuse than the posterodorsal.

Sulcate region very flat; area between the edge of ventral carina and corresponding part of free margin very concave.

Ventral carina very protruding and slightly bent inwards; it extends along the ventral margin (except its most posterior part) and along ventral part of anterior margin, forming a forward swing; its posterior part forms a flange.

Valves 4-lobate:

L I linguiform, broad (broadest ventrally), and very flat; dorsal end somewhat variably developed: dorsal outline more or less broadly curved (in the flattest types even obtuse), in the relatively high types the end is bent slightly outwards but generally not in the flatter ones, the end does not usually overlap the dorsal margin (this sometimes happens in relatively high types).

S I practically straight, narrow, shallow, and fairly short.

L II practically straight (or curved very slightly backwards), narrow (about equally narrow in all its extension, sometimes a slight swelling discernible in the dorsocentral section = presulcate node of monosulcate genera); it is short (extending to dorsocentral area); dorsal end acuminate.

S II rather deep and broad, its anterior margin mostly straight, posterior one generally curved slightly backwards.

L III broad (broadest in the dorsocentral part, breadth continually diminishing towards the ventral end) and flattened (centroventral section very slightly arched).

S III forms a wide backward curve extending to the dorsocentral area (dorsocentral section generally more curved than the remaining part); ventral end distinct and fairly deep, but in dorsal direction *S III* grows narrower and shallower (central and, especially, dorsocentral section often somewhat indistinct).

L IV very broad in the dorsal half, this part slightly arched; ventral half narrower, surface fairly steeply sloping to posterior part of ventral margin.

Surface minutely reticulate, except sulci and usually ventral half of *L II* and *L III* which are smooth (dorsal half of *L I*, as a rule, most distinctly reticulate); reticulum along outer part of ventral carina elongated and conforming to the margin; reticulation sometimes partly indistinct.

Occurrence. Lower Ordovician: lower part of stratum *G* (from about 0.2 m below *R I/G* to about 1.9 m above this boundary) at Granmor, Gulleråsen, Röjeråsvägen, Rävanäs, Stenberg, and Leskusänget, in Dalecarlia, Sweden.

Glossopsis acuta n. sp.

Pl. VII, Figs. 23—25.

Derivation of name. *acuta* alludes to the slightly acute dorsal end of *L I*.

Holotype. The type shown in Pl. VII, Fig. 24 is holotype (P. I. U. No. ar. os. 542).

Locality of holotype. Stenberg, in Dalecarlia, Sweden.

Stratum of holotype. Lower Ordovician: lower part of stratum *G* (about 0.8 m above *R I/G*).

Material. 369 valves and internal moulds from 7 localities.

Diagnosis. *Glossopsis* of moderate size; sulcate region flattened; valves 4-lobate; *L I* linguiform (ventral end broadest), in all its length attached to the substratum, fairly short, gently rising in dorsal direction, outer side

Dimensions.

No.	L	H	G	D M	F M	H/L	G/L	D M/L	F M/D M	∧ ant	∧ post	Remark
ar. os. 600	1.22	0.73	0.51	1.00	2.28	0.60	0.42	0.82	2.28	130	115	V
ar. os. 542	*1.18*	*0.71*	*0.56*	*0.99*	*2.21*	*0.60*	*0.47*	*0.84*	*2.23*	*130*	*115*	V
ar. os. 552	1.16	0.71	0.51	0.99	2.25	0.61	0.44	0.85	2.27	125	115	V
ar. os. 606	1.08	0.69	0.51	0.88	2.07	0.64	0.47	0.89	2.35	130	115	V
ar. os. 545	1.07	0.67	0.47	0.93	2.02	0.63	0.44	0.87	2.17	130	115	V
ar. os. 527	1.06	0.65	0.49	0.91	2.02	0.61	0.46	0.86	2.22	130	115	V
ar. os. 531	1.02	0.58	0.50	0.88	1.89	0.57	0.49	0.86	2.14	130	115	V
ar. os. 536	1.00	0.61	0.51	0.87	1.89	0.61	0.51	0.87	2.17	125	115	V
ar. os. 557	0.95	0.58	0.42	0.80	1.81	0.61	0.44	0.84	2.26	130	115	V
ar. os. 538	0.95	0.56	0.44	0.79	1.81	0.59	0.46	0.83	2.29	130	115	V
ar. os. 570	0.93	0.58	0.42	0.77	1.84	0.62	0.45	0.83	2.39	130	115	V
ar. os. 532	0.79	0.49	0.35	0.70	1.47	0.62	0.44	0.89	2.10	130	115	V
ar. os. 539	0.78	0.50	0.35	0.70	1.51	0.64	0.45	0.90	2.15	130	120	V
ar. os. 537	0.69	0.40	0.30	0.61	1.16	0.58	0.44	0.88	1.90	130	115	V
ar. os. 505	0.67	0.43	0.35	0.62	1.28	0.64	0.52	0.93	2.06	115	110	V
Mean	0.97	0.73 0.59 0.40	0.56 0.45 0.30	1.00 0.83 0.61	2.28 1.83 1.16	0.64 0.61 0.57	0.52 0.46 0.42	0.93 0.86 0.82	2.39 2.20 1.90	130	115	

broader than the attaching surface, flattened, mostly distinctly slanting backwards, dorsal end acute and generally not overlapping dorsal margin; *SI* short and fairly broad; *SIII* fairly broad and distinct; ventral carina broad and gently bent inwards, extending along ventral margin, except for its most posterior part, and along ventral part of anterior margin forming a forward swing; surface reticulate, reticulation sometimes partly indistinct, surface in such cases of somewhat rough appearance.

Affinities. The species is closely related to *Glossopsis lingua* n. sp.; differences mentioned p. 299.

Description. Carapace of moderate size; whether or not it is equivalved was not determined, since only separate valves were observed.

Dorsal margin straight and long; anterior margin broadly convex; posterior margin generally more convex in the dorsal part than in the ventral which is often slightly convex; ventral margin moderately convex.

Anterodorsal angle somewhat more obtuse than the posterodorsal.

Sulcate region very flat; area between the edge of ventral carina and corresponding part of free margin very concave; in this area a short velate ridge may be visible, originating from the ends of the carinal edge and extending a short distance in the direction of the free margin.

Ventral carina protruding very much and bent slightly inwards; it extends along the whole ventral margin (except for the most posterior part) and along the ventral part of anterior margin, forming a forward swing; its posterior end forms a flange.

Valves 4-lobate:

L I linguiform, fairly broad and short, throughout its length attached to the substratum, gently rising in dorsal direction, dorsal end acute, top generally overlapping dorsal margin, outer side broader than its attaching surface (difference greatest in the dorsal part), flattened and usually distinctly slanting backwards.

S I fairly deep and broad but short, extending ventrally to central or centroventral area; curved slightly backwards, ventral part tapering.

L II fairly short, extending dorsally to the transition between dorsal and dorsocentral areas, dorsal end tapering but ventral successively broader; a small node discernible in the dorsocentral-central section (corresponding to the presulcate node of monosulcate genera); curved backwards.

S II rather deep and broad, greatest width in central section, where a small and extremely slight depression is often discernible (central muscle spot); curved backwards.

L III flattened and broad, about equally broad throughout its length, or narrowing slightly in ventral direction; curved backwards.

S III forms a wide backward curve, extending practically to the dorsal margin; fairly deep and broad, broadest and deepest at the ventral end, depth and breadth generally slightly diminishing in dorsal direction, dorsal and dorsocentral sections sometimes somewhat indistinct.

L IV very broad in the dorsal half, this part slightly arched, ventral half narrower, surface fairly steeply sloping to posterior part of ventral margin.

Surface minutely reticulate, except, in most cases, *L II* and ventral half of *L III*; *L I* and the area just behind posterior end of ventral carina the most distinctly reticulate, reticulation also often fairly persistent in the dorsal part of *L III*; reticulation sometimes indistinct or lacking even in areas where it is usually developed (surface in such cases appears somewhat rough).

Occurrence. Lower Ordovician: lower part of stratum *G* (from about 0.2 m below *R I/G* to about 1.7 m above this boundary) at Stenberg, Rävanäs, Gulleråsen, Granmor, Leskusänget, Röjeråsvägen, and Silverberg II (sample No. 2), in Dalecarlia, Sweden.

The *Glossopsis tenuilimbata* group.

This group includes species having a claviform *L I* (ventral end tapering).

4-lobate section with long *S III*.

Glossopsis tenuilimbata n. sp.

Pl. VII, Figs. 21 and 22.

Derivation of name. *tenuilimbata* alludes to the sharp-edged and outwardly directed narrow ridge running from *L I* to *L IV* along the edge of the ventral carina.

Holotype. The type shown in Pl. VII, Fig. 21 is holotype (P. I. U. No. ar. os. 497).

Locality of holotype. Stenberg, in Dalecarlia, Sweden.

Stratum of holotype. Lower Ordovician: lower part of stratum *G* (about 0.4 m above *R I/G*).

Material. 2 carapaces, and 533 valves and internal moulds from 7 localities.

Diagnosis. *Glossopsis* of moderate size; sulcate region slightly arched; valves 4-lobate; *L I* elongatedly claviform, throughout its length attached to the substratum, dorsal end rounded, not extending to dorsal margin, ventral end tapering and continuing as a distinct, narrow ridge along the edge of the ventral carina, outer surface generally slanting backwards; *L II* narrow and gently geniculate backwards in the central section; ventral carina extending along ventral margin, except for its most posterior part, edge slightly acute, posterior end forms a flange; in the area between the carinal edge and the free margin is sometimes found a low velate ridge forming a wide curve, convex side against the carinal edge; surface reticulate, reticulation sometimes indistinct.

Affinities. The species is very similar to *G. schmidti* (BONNEMA) and *G. alata* n. sp.

G. schmidti is different mainly as regards the appearance of *L I* and *L II*: *L I* extends more dorsally and its anterior margin (contrary to that of the present species) is distinctly ridged (continuation of the ridge along the edge of the ventral carina); *L II* is much broader (except for its most dorsal part) and somewhat shorter.

G. alata is different in that *L I* is shorter and more rounded in transverse section than that of the present species; *L II*, on the other hand, is longer, extending practically to the dorsal margin; furthermore, the carina (and the ventral margin) are much more bulged in *G. alata*, and its surface is shallowly and minutely but distinctly pitted (pits rounded), whereas the present species is reticulate.

Description. Carapace of moderate size, practically equivalved.

Dimensions.

No.	L	H	G	D M	F M	H / L	G / L	D M / L	F M / D M	∧ ant	∧ post	Re-mark
ar. os. 497	*1.20*	*0.65*	*0.58*	*1.06*	*2.09*	*0.54*	*0.48*	*0.88*	*1.97*	*130*	*115*	C
ar. os. 499	1.12	0.64	0.61	0.99	2.04	0.57	0.55	0.88	2.06	135	110	V
ar. os. 504	0.95	0.57	0.44	0.85	1.77	0.60	0.46	0.90	2.08	125	115	V
ar. os. 530	0.93	0.59	0.43	0.80	1.83	0.63	0.46	0.86	2.29	130	120	V
ar. os. 502	0.91	0.51	0.51	0.81	1.63	0.56	0.56	0.89	2.02	130	110	V
ar. os. 506	0.90	0.53	0.47	0.81	1.67	0.59	0.52	0.90	2.06	125	110	V
ar. os. 509	0.88	0.50	0.44	0.79	1.60	0.57	0.50	0.90	2.02	130	110	V
ar. os. 516	0.86	0.51	0.47	0.75	1.60	0.59	0.55	0.87	2.13	125	115	V
ar. os. 513	0.84	0.49	0.37	0.74	1.53	0.58	0.44	0.88	2.06	125	110	V
ar. os. 519	0.76	0.43	0.35	0.67	1.37	0.57	0.46	0.88	2.04	125	110	M
ar. os. 508	0.73	0.44	0.37	0.68	1.35	0.60	0.51	0.93	1.99	130	110	V
ar. os. 571	0.72	0.43	0.30	0.62	1.33	0.60	0.42	0.89	2.15	120	110	V
ar. os. 512	0.70	0.42	0.35	0.63	1.26	0.60	0.50	0.90	2.00	125	110	V
ar. os. 500	0.67	0.40	0.33	0.62	1.24	0.60	0.49	0.93	2.00	115	110	V
ar. os. 520	0.67	0.38	0.37	0.60	1.23	0.57	0.56	0.90	2.05	130	110	V
ar. os. 511	0.66	0.37	0.30	0.60	1.21	0.56	0.46	0.85	2.02	125	110	V
ar. os. 601	0.65	0.41	0.31	0.60	1.23	0.63	0.48	0.92	2.04	125	110	V
ar. os. 517	0.63	0.36	0.28	0.57	1.16	0.57	0.44	0.90	2.03	120	105	V
ar. os. 603	0.62	0.36	0.28	0.54	1.16	0.58	0.45	0.87	2.15	125	110	V
ar. os. 521	0.61	0.35	0.26	0.56	1.07	0.57	0.43	0.92	1.91	110	105	V
ar. os. 503	0.61	0.33	0.28	0.56	1.12	0.54	0.46	0.89	2.00	125	110	V
ar. os. 498	0.58	0.33	0.33	0.51	1.05	0.56	0.56	0.88	2.06	115	110	V
ar. os. 604	0.49	0.27	0.24	0.44	0.79	0.55	0.49	0.90	1.79	120	110	V
ar. os. 510	0.46	0.28	0.21	0.42	0.93	0.61	0.46	0.91	2.21	120	105	V
ar. os. 546	0.45	0.28	0.23	0.40	0.80	0.62	0.51	0.89	2.00	120	110	V
ar. os. 526	0.45	0.28	0.21	0.38	0.78	0.62	0.47	0.85	2.05	120	115	V
ar. os. 507	0.42	0.24	0.20	0.37	0.74	0.57	0.48	0.88	2.00	115	110	V
Mean	0.72	0.65 0.43 0.24	0.61 0.36 0.20	1.06 0.64 0.37	2.09 1.33 0.74	0.63 0.59 0.54	0.56 0.49 0.42	0.93 0.89 0.85	2.29 2.04 1.79	125	110	

Dorsal margin straight and long; anterior margin widely curved; posterior margin generally more curved dorsally than in the ventral part, which is often only slightly curved; ventral margin slightly convex.

Anterodorsal angle somewhat more obtuse than the posterodorsal.

Sulcate region slightly arched; area between the edge of ventral carina and corresponding part of free margin practically plane, and broad; in this area a low velate ridge is sometimes found, forming a wide curve, convex side turned towards the carinal edge (it does not reach the dorsal corners).

Ventral carina extends along ventral margin, except its most posterior part; it is somewhat protruded, concealing corresponding part of free margin, edge slightly acute; an outwardly directed, narrow ridge runs along the outer side of the very edge (continuation of the tapering ventral end of *L I*); in adult specimens the posterior end of the carina forms a flange extending to a point somewhat behind ventral part of *S III* (in young stages it is less distinct); between the carinal ridge and the ventral ends of *L II* and *L III* runs a shallow groove connecting *S I* and *S III*.

Valves 4-lobate:

L I elongatedly claviform, throughout its length attached to the substratum, dorsal end rounded, not extending to dorsal margin, ventral end tapering and continuing in the ridge running along the edge of the ventral carina (in adult specimens the ridge sometimes traceable along ventral part of the anterior margin of *L I*), outer side of *L I* in adult specimens flattened and slanting gently backwards (*L I* in larval stages rounded in transverse section); area between *L I* and anterior margin of carapace moderately steeply sloping, which is rather distinctive for this species.

S I fairly deep and broad; curved gently backwards, ventral end continuing in the shallow groove running along the outer side of ventral carina.

L II narrow, dorsal end tapering and rather short, extending to dorsocentral area; gently geniculate in the dorsocentral-central section where a very slight swelling may be discernible (= presulcate node of monosulcate genera); the lobe in transverse section rounded.

S II broad and deep, central section broadest; posterior margin of sulcus somewhat more curved backwards than anterior one.

L III curved backwards and broad, dorsal half broadest, the lobe in ventral direction slightly diminishing in breadth; dorsal half flat, ventral half slightly arched.

S III distinct, forming a wide backward curve extending to the dorsal-dorsocentral area; ventral section very curved, continuing in the shallow groove along the outer part of ventral carina which connects *S I* and *S III*; ventral section broadest and deepest (about as broad as *S I*), breadth and depth diminishing in dorsal direction (in very young specimens only the ventral section of *S III* is developed, or the sulcus is not developed at all; the broad lobe thus created [*L III* + *L IV*] is somewhat swollen, especially in the ventral half).

L IV very broad, dorsal half broadest and gently arched, ventral half narrower, fairly steeply sloping to the posterior part of ventral margin.

Surface minutely reticulate, except sulci, and generally the entire *L II*, ventral half of *L III*, and most of the dorsal area which are all smooth; reticulum along the outer side of ventral carina and in the area between the carinal edge and free margin elongate and conforming to the margin; reticulation sometimes somewhat indistinct, especially in many larvae.

Notes on the larval development. The larvae of this species, as a rule, are clearly recognizable, possibly with the exception of the youngest stages observed, which in certain respects are different from adults and later larval stages.

In these young stages, the sulcate region is proportionally more arched than in later stages, especially the broad lobe created by fusion of *L III* and *L IV* owing to the fact that *S III* is not developed or only its most ventral part. (However, it may be noted that *S III* may occasionally be distinctly developed to the dorsal-dorsocentral area even in fairly young stages.)

L I in younger larval stages is rounded in transverse section, but in later larval stages the outer side is flattened and gently slanting backwards as in adults, and the ventral part of its anterior margin may be slightly angled as in adults.

Posterior end of ventral carina is less flange-like than in adult specimens and later stages.

Surface in young stages is often somewhat indistinct, but fairly young stages have been observed to be very distinctly reticulate.

Occurrence. Lower Ordovician: upper part of stratum *R I* and lower part of stratum *G* (from about 0.2 m below *R I/G* to about 1.5 m above this boundary) at Stenberg, Röjeråsvägen, Rävanäs, Granmor, Gulleråsen, Leskusänget, and Silverberg II (sample No. 2), in Dalecarlia, Sweden.

Glossopsis alata n. sp.

Pl. VII, Figs. 26 and 27.

Derivation of name. *alata* alludes to the wing-like appearance of the carapace as seen in side view.

Holotype. The type shown in Pl. VII, Fig. 26 is holotype (P. I. U. No. ar. os. 584).

Locality of holotype. Silverberg II, in Dalecarlia, Sweden.

Stratum of holotype. Lower Ordovician: stratum *G* (about 1.5 m below *G/R II*).

Material. 2 valves from 2 localities.

Dimensions.

No.	L	H	G	D M	F M	H/L	G/L	DM/L	FM/DM	∧ ant	∧ post	Re-mark
ar. os. 583	0.74	0.48	0.40	0.67	1.30	0.65	0.55	0.91	1.94	115	110	V
ar. os. 584	*0.71*	*0.54*	*0.37*	*0.65*	*1.49*	*0.76*	*0.52*	*0.91*	*2.29*	*120*	*110*	V
Mean	0.73	0.51	0.39	0.66	1.40	0.71	0.54	0.91	2.12	120	110	

Diagnosis. *Glossopsis* of fairly small size; sulcate region flattened; valves 4-lobate; *L I* fairly shortly claviform, throughout its length attached to the substratum, in transverse section rounded, dorsal end rounded, not overlapping dorsal margin, ventral end tapering and continuing as a ridge running along the carinal edge; *S III* sometimes developed only in the ventral area; ventral carina (and ventral margin) protruded to form a large bulge, carinal edge acute; surface minutely but distinctly pitted.

Affinities. The present specimens are very closely related to *Glossopsis tenuilimbata* n. sp.: one might even think of them as being teratologically changed specimens of this species. However, they are different in many respects and I think they constitute a species of their own. The dissimilarities from *G. tenuilimbata* are mentioned on p. 303.

Description. Carapace of fairly small size; whether or not it is equ - valved was not determined, since only separate valves were observed.

Dorsal margin straight and long; anterior margin very widely curved, posterior one more convex, especially the dorsal part; ventral margin very convex.

Anterodorsal angle slightly more obtuse than the posterodorsal.

Sulcate region flattened; area between carinal ridge and corresponding part of free margin practically plane or slightly concave.

Ventral carina extends along ventral margin, except its most posterior part (it ends somewhat posterior to the ventral end of *S III*); it forms a large bulge (difference in convexity due to individual variation or possibly to sexual dimorphism); carinal edge acute, along its outer side there runs an outwardly directed ridge continuing in the tapering ventral end of *L I*.

Valves 4-lobate:

L I situated just in the anterodorsal corner; it is fairly shortly claviform, outline not perfectly ovate, in transverse section rounded; dorsal end rounded, not overlapping dorsal margin, ventral end tapering into a ridge continuing along the carinal edge.

S I fairly broad and deep; it is curved slightly backwards.

L II long, extending practically to dorsal margin, and about as broad as *S I*, in transverse section rounded, curved backwards.

S II deep and broad, ventral half successively gently broadening in ventral direction; slightly curved backwards.

L III broadest in the dorsal half and distinctly diminishing in breadth in ventral direction; dorsal half flattened, ventral half slightly arched.

S III forms a wide backward curve, extending to dorsocentral area, but it was also observed that only the ventral part was developed; the sulcus is deepest and broadest at the ventral end, in the dorsal direction it is diminishing in depth and breadth.

L IV very broad and gently arched in the dorsal half; ventral half narrower and in ventral direction diminishing in breadth, fairly steeply sloping to posterior part of ventral margin; in some specimens *L IV* and *L III* are fused, except in the ventral part (cf. above: *S III*).

Surface of sulcate region minutely, shallowly and densely but distinctly pitted, except for *L I*, *L II*, the most ventral part of *L III*, and the sulci which parts are all smooth; area between the carinal edge and free margin very finely reticulate, reticulation elongate and conforming to the margin.

Occurrence. Lower Ordovician: lower part of stratum *G* at Silverberg II (1.8 m below *G/R II*), and Granmor (0.7 m above *R I/G*), in Dalecarlia, Sweden.

Glossopsis clavata n. sp.

Pl. VIII, Figs. 1—6.

Derivation of name. *clavata* alludes to the claviform appearance of *L I*.

Holotype. The type shown in Pl. VIII, Fig. 2 is holotype (P. I. U. No. ar. os. 560).

Locality of holotype. Rävanäs, in Dalecarlia, Sweden.

Stratum of holotype. Lower Ordovician: lower part of stratum *G* (about 0.1 m above *R I/G*).

Material. 238 valves and internal moulds from 6 localities.

Diagnosis. *Glossopsis* of somewhat small size; sulcate region very flattened; valves 4-lobate; *L I* elongatedly and fairly broadly claviform, flattened, throughout its length attached to the substratum, dorsal end rather broadly rounded, not overlapping dorsal margin, ventral end gently tapering; ventral carina short (extending along ventral margin, except its posterior part), fairly broad, straight, or slightly bent inwards; surface reticulate, except for *L II*, *L III*, and anterior part of *L IV*; outer side of ventral carina in adult specimens striate, conforming to the margin.

Affinities. The species is referred to the *Glossopsis tenuilimbata* group, since the ventral end of *L I* is tapering. It is different from the other two species of this group in that the tapering ventral end of *L I* is not continued by a ridge along the carinal edge. The appearance of the carina is more similar to that of the *Glossopsis lingua* group.

From the other species in the *tenuilimbata* group, the present species

Dimensions.

No.	L	H	G	D M	F M	H/L	G/L	D M/L	F M/D M	∧ ant	∧ post	Remark
ar. os. 572	0.98	0.63	0.49	0.92	1.83	0.64	0.50	0.94	1.99	115	110	V
ar. os. 535	0.98	0.62	0.43	0.92	1.84	0.63	0.44	0.94	2.00	115	105	V
ar. os. 573	0.93	0.59	0.47	0.83	1.79	0.63	0.51	0.89	2.16	115	110	V
ar. os. 563	0.93	0.59	0.42	0.86	1.75	0.64	0.45	0.93	2.03	115	110	V
ar. os. 575	0.93	0.58	0.47	0.84	1.77	0.62	0.51	0.90	2.11	115	110	V
ar. os. 560	*0.91*	*0.59*	*0.49*	*0.81*	*1.79*	*0.65*	*0.54*	*0.89*	*2.21*	*115*	*110*	V
ar. os. 564	0.87	0.56	0.41	0.84	1.63	0.64	0.47	0.96	1.94	115	110	V
ar. os. 574	0.86	0.52	0.42	0.79	1.53	0.61	0.49	0.92	1.94	115	110	V
ar. os. 577	0.86	0.54	0.47	0.72	1.52	0.63	0.55	0.92	2.11	115	110	V
ar. os. 580	0.80	0.49	0.42	0.76	1.49	0.61	0.53	0.95	1.96	115	110	V
ar. os. 550	0.78	0.51	0.41	0.71	1.49	0.65	0.53	0.91	2.10	115	105	V
ar. os. 554	0.78	0.51	0.40	0.71	1.54	0.65	0.51	0.91	2.17	115	110	V
ar. os. 567	0.77	0.50	0.37	0.71	1.44	0.65	0.48	0.92	2.03	115	110	V
ar. os. 576	0.77	0.50	0.37	0.72	1.46	0.65	0.48	0.93	2.02	115	110	V
ar. os. 565	0.73	0.47	0.35	0.68	1.44	0.64	0.48	0.93	2.12	115	110	V
ar. os. 555	0.70	0.42	0.35	0.64	1.28	0.60	0.50	0.92	2.00	115	110	V
ar. os. 547	0.70	0.47	0.37	0.63	1.35	0.67	0.53	0.90	2.15	115	110	V
ar. os. 561	0.70	0.43	0.35	0.64	1.28	0.61	0.50	0.92	2.00	115	110	V
ar. os. 566	0.65	0.42	0.37	0.58	1.23	0.65	0.57	0.89	2.12	115	110	V
ar. os. 501	0.64	0.40	0.35	0.58	1.20	0.63	0.55	0.91	2.07	115	110	V
ar. os. 558	0.64	0.41	0.33	0.57	1.19	0.64	0.52	0.89	2.09	115	110	V
ar. os. 578	0.62	0.42	0.33	0.57	1.19	0.68	0.53	0.92	2.09	115	110	V
ar. os. 548	0.51	0.32	0.28	0.45	0.93	0.63	0.55	0.88	2.07	115	110	V
ar. os. 514	0.44	0.28	0.24	0.42	0.84	0.64	0.55	0.96	2.00	115	105	V
ar. os. 562	0.40	0.24	0.23	0.36	0.70	0.60	0.58	0.90	1.94	110	105	V
ar. os. 518	0.41	0.26	0.21	0.37	0.70	0.63	0.51	0.90	1.89	110	105	V
ar. os. 515	0.37	0.21	0.20	0.35	0.65	0.57	0.54	0.95	1.86	110	105	V
Mean	0.73	0.63 0.46 0.21	0.49 0.37 0.20	0.92 0.67 0.35	1.84 1.37 0.65	0.68 0.63 0.57	0.58 0.51 0.44	0.96 0.92 0.88	2.21 2.04 1.86	115	110	

is different not only as regards the appearance of the ventral carina but also as regards the details in the appearance of *L I*: it is broader and more flattened, and the ventral end is more gently tapering.

Description. Carapace of fairly small size; whether or not it is equivalved was not ascertained, since only separate valves were observed.

Dorsal margin straight and long; anterior margin very broadly convex, posterior one more curved in the dorsal part than in the ventral; ventral margin moderately convex.

Anterodorsal angle slightly more obtuse than the posterodorsal.

Sulcate region flattened; area between the carinal edge and corresponding part of free margin practically plane; in this area an extremely fine velate ridge is occasionally discernible running for some distance parallel to the carinal edge.

Ventral carina fairly broad, extending along the ventral margin, except its posterior part, slightly bent inwards or plane; posterior end forms a flange.

Valves 4-lobate:

L I elongatedly and fairly broadly claviform, flattened, throughout its length attached to the substratum, dorsal end rather broadly rounded, not overlapping dorsal margin, ventral end gently tapering (the very end relatively broad), posterior margin of the lobe forming a wide curve; area in front of the lobe fairly steeply sloping.

S I long and fairly narrow and shallow, ventral end broadened and slightly deepened; anterior margin gently curved backwards, posterior one generally straight.

L II straight, narrow, and long, extending to the dorsocentral area, in transverse section rounded, dorsal end tapering (a slight swelling in the dorsocentral-central part sometimes discernible = the presulcate node of monosulcate genera).

S II straight (dorsocentral part sometimes curved slightly backwards), broad and deep.

L III broad, dorsal half broadest, and flat (sometimes indistinctly separated from *L IV*, owing to the fact that *S III* is short), ventral half tapering and slightly arched.

S III forms a very gentle backward curve, extending to the dorsocentral-central area (sometimes only the centroventral-ventral sections developed); ventral end broadest and deepest (about as broad as ventral end of *S I*), breadth and depth diminishing in dorsal direction.

L IV very broad in the dorsal half, and gently arched (sometimes fused with *L III*; cf. above *L III* and *S III*); ventral half narrower, fairly steeply sloping to posterior part of ventral margin.

Surface reticulate, except the sulci, *L II*, *L III*, and anterior part of *L IV* (sometimes the whole *L IV*), which are all smooth; *L I* generally distinctly reticulate, reticulation elongate and conforming to the length of the lobe;

outer part of ventral carina in adult specimens striate, striation conforming to the margin, scattered anastomoses between the striae; area between carinal edge and free margin distinctly reticulate (even in very young stages), reticulum elongate and conforming to the margin.

Notes on the larval development. Larvae of this species are generally recognizable, possibly with the exception of the youngest stages which in certain respects are different from adult specimens and later larval stages. They are very similar to corresponding stages of *Glossopsis tenuilimbata* n. sp.

The larval development is for the rest very reminiscent of that of *G. tenuilimbata* (p. 306):

In very young larvae, *S I* is indistinct; often only its most dorsal part is developed (in *G. tenuilimbata*, *S I* is most often fairly distinct).

S III is not developed at all or only its most ventral part. The broad lobe thus created by fusion of *L III* and *L IV* is ventrally more arched than in later stages.

Posterior end of ventral carina is less flange-like than in later stages.

Reticulation in young stages is often indistinct, but sometimes it is very distinct, especially the elongate reticulum in the area between the carinal edge and the free margin.

Occurrence. Lower Ordovician: upper part of stratum *R I* and lower part of stratum *G* (from about 0.2 m below *R I/G* to about 1.5 m above this boundary) at Stenberg, Rävanäs, Gulleråsen, Granmor, Leskusänget, and Röjeråsvägen, in Dalecarlia, Sweden.

4-lobate section with short, ventral *S III*.

Glossopsis nodosa n. sp.

Pl. VIII, Fig. 17.

This type is represented by only a few specimens (partly damaged). However, they are sufficient to show the distinguishing features of the type which appears to be a new species.

Derivation of name. *nodosa* alludes to the distinct node of *L II*.

Holotype. The type shown in Pl. VIII, Fig. 17 is holotype (P. I. U. No. ar. os. 596).

Locality of holotype. Born-Dådran, in Dalecarlia, Sweden.

Stratum of holotype. Lower Ordovician: lower part of stratum *R II* (about 0.2 m above *G/R II*).

Material. 2 valves and 1 internal mould from 1 locality.

Diagnosis. *Glossopsis* of somewhat small size; sulcate region slightly arched, valves incompletely 4-lobate (*L III* and *L IV* fused to a great extent); *L I* elongatedly and rather narrowly claviform, rising fairly steeply in dorsal direction, throughout its length attached to the substratum, dorsal

Dimensions.

No.	L	H	G	D M	F M	H / L	G / L	D M / L	F M / D M	∧ ant	∧ post	Re-mark
ar. os. 610	0.94	0.52	0.51	0.86	1.68	0.55	0.54	0.91	1.96	125	110	M
ar. os. 596	*0.81*	*0.55*	*0.42*	*0.74*	*1.63*	*0.68*	*0.52*	*0.91*	*2.20*	*120*	*110*	V
Mean	0.88	0.54	0.47	0.80	1.66	0.62	0.53	0.91	2.08	125	110	

end narrowly rounded (not reaching to dorsal margin), ventral end very gently diminishing in breadth; *L II* gently geniculate and provided with a very distinct dorsocentral-central node, dorsal end tapering into a very acute point; *L III* distinctly arched in the ventral part; *S III* developed only in the centroventral-ventral areas; ventral carina extending along the ventral margin, except its most posterior part, edge acute; surface smooth, except the area between the carinal edge and ventral margin which is reticulate.

Affinities. The species is closely related to *Glossopsis depressolimbata* n. sp. In fact, one might think of them as belonging to one species. Though the material is scarce, I think, however, that it is sufficient to show that the types may be considered two different species.

They are, above all, similar as regards the appearance of *S III* (very short, conforming to the edge of the ventral carina), and as regards the ventral carina (depressed, posterior end forming a pronounced flange).

They are distinctly different in the appearance of *L I*: in the present species it rises markedly in the dorsal direction, in *G. depressolimbata* it is flattened.

Furthermore, there are minor differences: in the present species, the dorsal end of *L I* is more rounded, and the ventral end more gently narrowing; the node of *L II* is larger; ventral end of *S I* is tapering (in *G. depressolimbata* widened); the ventral carina is somewhat longer; contrary to *G. depressolimbata*, reticulation of the sulcate region is absent or very indistinct.

Description. Carapace of somewhat small size; whether or not it is equivalved was not determined, since only separate valves were observed.

Dorsal margin straight and long; anterior margin fairly broadly curved, posterior more curved in the dorsal part than in the ventral; ventral margin moderately convex.

Anterodorsal angle slightly more obtuse than the posterodorsal.

Sulcate region slightly arched; area between carinal edge and ventral margin straight and broad.

Ventral carina extends along ventral margin, except its most posterior part; it is straight, depressed, and protruding considerably, edge acute; its posterior end forms a pronounced flange.

Valves 4-lobate:

L I elongate and rather narrowly claviform, rising fairly steeply in dorsal direction, throughout its length attached to the substratum, dorsal end narrowly rounded, not reaching the dorsal margin, ventral end very gently diminishing in breadth; in transverse section the dorsal part of the lobe is slightly rounded (outer side slanting gently backwards), the ventral part flat and not slanting backwards; area in front of *L I* high and fairly steeply sloping.

S I narrow (dorsal end broadening somewhat, ventral end tapering), fairly deep (ventral end diminishing in depth in ventral direction); anterior margin practically straight, posterior one in the central section curved slightly backwards.

L II long and fairly broad, flattened; dorsocentral section distinctly widened and slightly swollen (swelling corresponding to the presulcate node of monosulcate genera); the lobe slightly geniculate just at the ventral end of the dorsocentral swelling, section dorsal to the swelling tapering into an elongate extremity, extending to the dorsal margin.

S II broad and deep, distinctly geniculate backwards in the dorsocentral part.

L III broad, only the centroventral-ventral part separated from *L IV*, owing to the fact that *S III* is developed only in these areas; ventral half of the lobe tapering, considerably arched, curved backwards.

S III short (developed only in centroventral and ventral areas), fairly narrow and shallow, forming a gentle backward curve which practically conforms to the edge of the carina.

L IV, except ventral part, fused with *L III*; ventral half fairly steeply sloping to posterior part of ventral margin.

Surface smooth in the sulcate region, tenuously reticulate in the area between the carinal edge and ventral margin.

Occurrence. Lower Ordovician: lower part of stratum *R II* (about 0.2—0.5 m above *G/R II*) at Born-Dådran, in Dalecarlia, Sweden.

Glossopsis depressolimbata n. sp.

Pl. VIII, Fig. 16.

Derivation of name. *depressolimbata* alludes to the depressed outer side of the ventral carina.

Holotype. The type shown in Pl. VIII, Fig. 16 is holotype (P. I. U. No. ar. os. 611).

Locality of holotype. Leskusänget, in Dalecarlia, Sweden.

Stratum of holotype. Lower Ordovician: lower part of stratum *R II* (just above *G/R II*).

Material. 40 valves and internal moulds from 4 localities.

Dimensions.

No.	L	H	G	D M	F M	H/L	G/L	D M/L	F M/D M	∧ ant	∧ post	Re-mark
ar. os. 628	0.93	0.62	0.37	0.87	1.75	0.67	0.40	0.94	2.00	115	110	V
ar. os. 611	*0.81*	*0.49*	*0.35*	*0.79*	*1.60*	*0.61*	*0.43*	*0.98*	*2.02*	*115*	*110*	V
ar. os. 612	0.65	0.42	0.28	0.62	1.30	0.65	0.43	0.95	2.10	115	110	V
ar. os. 617	0.61	0.38	0.28	0.54	1.12	0.62	0.46	0.89	2.07	115	110	V
Mean	0.75	0.62 0.48 0.38	0.37 0.32 0.28	0.87 0.71 0.54	1.75 1.44 1.12	0.67 0.64 0.61	0.46 0.43 0.40	0.98 0.94 0.89	2.10 2.05 2.00	115	110	

Diagnosis. *Glossopsis* of somewhat small size; sulcate region slightly arched; valves incompletely 4-lobate (*L III* and *L IV* fused to a great extent); *L I* claviform, throughout its length attached to the substratum, flattened, dorsal end fairly acute (not extending to dorsal margin), ventral end tapering, the ventral continuation of this end ridged (ridge traceable also along ventral part of anterior margin of the lobe); *L II* gently geniculate, provided with a fairly distinct dorsocentral-central node; *L III* somewhat arched in the ventral part; *S III* developed only in the ventral area; ventral carina extending along ventral margin, except most of its posterior part, fairly broad, depressed, edge acute, posterior end forming a pronounced flange; surface distinctly reticulate, except mainly the greater part of *L III* + *L IV*.

Affinities. The species is closely related to *Glossopsis nodosa* n. sp. Distinguishing features are mentioned on p. 312. It is also somewhat reminiscent of *G. indistincta* n. sp. (cf. p. 316).

Description. Carapace of fairly small size; whether or not it is equivalved was not determinable, since only separate valves were observed.

Dorsal margin straight and long; anterior margin broadly rounded, posterior one more convex in the dorsal than in the ventral part; ventral margin moderately convex.

Anterodorsal angle slightly more obtuse than the posterodorsal.

Sulcate region slightly arched; area between the carinal edge and ventral margin straight and broad.

Ventral carina extends along ventral margin, except most of its posterior part; it is straight, depressed, and very protruding, edge acute, posterior end forms a pronounced flange.

Valves 4-lobate:

L I rather elongate and claviform, flattened, throughout its length attached to the substratum, dorsal end fairly acute (not extending to dorsal margin), ventral end tapering and continuing in a narrow ridge (this ridge traceable also along ventral part of anterior margin of the lobe); area in front of the lobe fairly gently sloping.

S I practically straight, long, narrow and rather shallow; ventral end slightly widened; in internal moulds a small pit is discernible in the dorsocentral part (= antennal muscle spot).

L II long and fairly broad, in transverse section slightly rounded; anterior margin straight, posterior in the dorsocentral-central section has a slight sinuosity caused by a fairly distinct swelling of the node (corresponding to the presulcate node of monosulcate genera); dorsal end steadily lowering and tapering into an extremity extending practically to the dorsal margin.

S II broad and deep, distinctly geniculate backwards in the dorsocentral-central part, where it is slightly deepened (central muscle spot; more distinctly developed in internal moulds).

L III fused with *L IV*, except in the ventral part; ventral part of *L III* gently arched and distinctly tapering.

S III very short, developed only in the ventral area, fairly narrow and shallow, forming a gentle curve mainly conforming to the carinal edge.

L IV fused with *L III* (see above *L III*); surface gently sloping to posterior margin, but steeply to posterior part of ventral margin.

Surface reticulate, except sulci and *L III* + *L IV*, excluding their ventral parts; *L I, L II* (ventral part), and the area between carinal edge and ventral margin most distinctly reticulate, this reticulation fairly coarse, that of the mentioned sulci extended along their lengths; along outer side of ventral carina the reticulation is elongate, conforming to the margin, and appearing practically striate.

Occurrence. Lower Ordovician (upper part of stratum *G* and lower part of stratum *R II* (from about 0.6 m below *G*/*R II* to about 1.0 m above this boundary) at Leskusänget, Rävanäs, Gulleråsen, and Born-Dådran, in Dalecarlia, Sweden.

Glossopsis indistincta n. sp.

Pl. VIII, Fig. 10.

Derivation of name. *indistincta* alludes to the indistinct lobation of the valves.

Holotype. The type shown in Pl. VIII, Fig. 10 is holotype (P. I. U. No. ar. os. 614).

Locality of holotype. Leskusänget, in Dalecarlia, Sweden.

Stratum of holotype. Lower Ordovician: lower part of stratum *R II* (about 0.7 m above *G*/*R II*).

Material. One valve and one internal mould from 2 localities.

Dimensions.

No.	L	H	G	D M	F M	$\frac{H}{L}$	$\frac{G}{L}$	$\frac{DM}{L}$	$\frac{FM}{DM}$	∧ ant	∧ post	Re-mark
ar. os. 614	*0.80*	*0.49*	*0.47*	*0.72*	*1.39*	*0.61*	*0.59*	*0.90*	*1.93*	*115*	*115*	V
ar. os. 613	0.53	0.35	0.28	0.51	1.05	0.66	0.53	0.96	2.06	115	110	M
Mean	0.67	0.42	0.38	0.62	1.22	0.63	0.56	0.93	1.99	115	115	

Diagnosis. *Glossopsis* of fairly small size; ventral part of the region posterior to *S II* much swollen, area between carinal edge and free margin straight; lobation indistinct; *L I* extremely low, outline dorsally and anteriorly undefined, ventral end tapering and continuing in a ridge along the carinal edge; *S I* very narrow and shallow; *S III* developed only in the ventral part (broad and somewhat undefined); ventral carina short and rather narrow, edge acute; surface very indistinctly reticulate, except for the area between carinal edge and free margin which is fairly distinctly reticulate.

Affinities. The species is not a typical *Glossopsis* partly on account of the fact that *L I* is extremely low and the outline of this lobe somewhat undefined, and partly on account of the very short and somewhat indistinct *S III.* In these respects it resembles the genus *Aulacopsis* n. gen.

However, it may not be referable to this genus, since *S I* is a real sulcus, though narrow and shallow.

The species is slightly reminiscent of *Glossopsis depressolimbata* n. sp. which appears in the same stratum. This species is different from the present one mainly in the following respects: *L I* more distinctly claviform, *L III* more arched in the ventral part, *S I* deeper and broader, *S III* narrower and more distinct, posterior end of carinal edge much more flange-like, reticulation more distinct.

Description. Carapace of fairly small size; whether or not it is equi-valved could not be determined, since only one separate valve was observed.

Dorsal margin straight and long; anterior margin fairly broadly curved, posterior more curved in the dorsal part than in the ventral; ventral margin moderately convex.

Anterodorsal angle slightly more obtuse than the posterodorsal.

Region in front of *S II* slightly arched, that posterior to *S II* more arched, especially the ventral part of *L III*; area between carinal edge and ventral margin flat.

Ventral carina short, extending along ventral margin, except for most of its posterior part; edge acute, its median part slightly protruding over ventral margin.

Valves partly indistinctly lobate:

L I extremely low, outline dorsally and anteriorly undefined; ventral end tapering, continuing in a low ridge along the carinal edge; prelobate area fairly steeply sloping.

S I practically straight, very narrow and shallow; ventral end slightly widened.

L II flattened and fairly narrow, a very slight swelling discernible in the dorsocentral-central section, causing a very gentle sinuosity of the posterior margin of the lobe (anterior margin straight).

S II deep and broad, curved gently backwards.

L III fused with *L IV*, except in the centroventral and ventral parts; ventral part of *L III* very swollen; the rest of this lobe gently arched; ventral end tapering.

S III broad, shallow, and short, forming in the centroventral and ventral areas a gentle curve, for a short distance parallel to the carinal edge.

L IV for the greater part fused with *L III*; dorsal half only slightly arched, ventral one steeply sloping to posterior part of ventral margin.

Surface in the sulcate region for the greater part smooth or minutely rugose; a very indistinct reticulation discernible in *L I*, outer side of ventral carina, and behind the posterior end of the carina; area between carinal edge and free margin minutely reticulate, reticulation elongate conforming to the margin.

Occurrence. Lower Ordovician: lower part of stratum *R II* (about 0.2—0.7 m above *G/R II*) at Leskusänget and Born-Dådran, in Dalecarlia, Sweden.

Glossopsis mutilata n. sp.

Pl. VIII, Fig. 11.

Only one valve of this type was observed, but it is very characteristic and undoubtedly belongs to a new species.

Derivation of name. *mutilata* alludes to the fact that *S III* is very rudimentary.

Holotype. The type shown in Pl. VIII, Fig. 11 is holotype (P. I. U. No. ar. os. 597).

Locality of holotype. Stenberg, in Dalecarlia, Sweden.

Stratum of holotype. Lower Ordovician: lower part of stratum *G* (about 1.2 m above *R I/G*).

Material. One valve (slightly damaged in the posterodorsal part; surface partly somewhat weathered).

Diagnosis. *Glossopsis* of fairly small size; sulcate region only slightly arched; incompletely 4-lobate (*L III* and *L IV* practically completely fused); *L I* claviform, throughout its length attached to the substratum, in transverse section rounded, dorsal end rounded (extending to dorsal margin), ventral

Dimensions.

No.	L	H	G	D M	F M	$\frac{H}{L}$	$\frac{G}{L}$	$\frac{DM}{L}$	$\frac{FM}{DM}$	∧ ant	∧ post	Re-mark
ar. os. 597	0.96	0.66	0.47	0.90	1.86	0.69	0.49	0.94	2.07	120	110	V

end gently tapering; *S III* very short but fairly distinct, developed only in the ventral area; ventral carina short, extending along mainly anterior half of ventral margin, narrow, edge slightly acute (nearly rightangled); surface smooth, except the area between carinal edge and free margin, which is reticulate.

Affinities. The species is reminiscent of *Glossopsis robusta* n. sp. type *C*, which is interpreted as a late larval stage.

They are different mainly as regards the appearance of *L I* and the ventral carina. In the present species, *L I* is more rounded in transverse section, the dorsal end is more convex, and ventral end somewhat more narrowly tapering. The ventral carina is shorter and narrower; the posterior end of the ventral carina is not broadened and rounded as in *G. robusta.*

Description. Carapace of fairly small size; whether or not it is equivalved could not be determined, since only one separate valve was observed.

Dorsal margin straight and long; anterior margin very widely curved, posterior may be more convex in the dorsal than in the ventral part; ventral margin moderately convex.

Anterodorsal angle seems to be somewhat more obtuse than the posterodorsal.

Sulcate region only slightly arched; area between carinal edge and free margin straight and broad.

Valves incompletely 4-lobate:

L I claviform, throughout its length attached to the substratum, in transverse section rounded, dorsal end rounded (extending to dorsal margin), ventral end gently tapering.

S I fairly short, practically straight, rather deep and broad.

L II fairly short (extending to dorsocentral area), relatively broad (breadth about equal in all the extension of the lobe), rather high (dorsal end steadily diminishing in height), surface only gently arched.

S II deep and rather broad, curved very gently backwards.

L III fused with *L IV*, except in most ventral part, ventral part gently narrowing and somewhat more arched than the rest of the lobe.

S III extremely short, developed only as a shallow fissure in the ventral area.

L IV for the greater part fused with *L III*; surface in the dorsal half gently sloping to the margins, in the ventral steeply sloping to posterior part of ventral margin.

Surface in the sulcate region smooth (or minutely rugose); area between carinal edge and free margin tenuously reticulate.

Occurrence. Lower Ordovician: lower part of stratum *G* (about 1.2 m above *R I/G*) at Stenberg, in Dalecarlia, Sweden.

3-lobate species.

Glossopsis robusta n. sp.

Pl. VIII, Figs. 12—15.

To this species are referred 3 types. Two of them may be adult specimens (types *a* and *b*). They are different mainly as regards two characters (height and reticulation). The fact that they seem to occur in different horizons is of special interest. The third type (*C*) is possibly a late larval stage of type *a*.

The 3 types, which are described separately, are compared in the Discussion (p. 322).

Derivation of name. *robusta* alludes to the robust appearance of the carapace.

Holotype. The type shown in Pl. VIII, Fig. 12 is holotype (P. I. U. No. ar. os. 585).

Locality of holotype. Gulleråsen, in Dalecarlia, Sweden.

Stratum of holotype. Lower Ordovician: upper part of stratum *G* (just below *G/R II*).

Diagnosis. *Glossopsis* of moderate length and great height; sulcate region slightly arched, valves 3-lobate (sometimes *S III* developed as a very short fissure); *L I* throughout its length attached to the substratum, broadest in the ventral end (type *a* and *b*) or in the dorsocentral part (type *C*), outer side flat and sloping steeply backwards (*a* and *b*) or slightly rounded in transverse section and not sloping backwards (*C*), ventral carina broad, bent very slightly inwards, posterior end rounded and very protruding; surface smooth, except for the outer side of ventral carina which may be reticulate (occasionally and indistinctly in type *a*, and distinctly in type *b*).

Affinities. The species is somewhat similar to *Ceratopsis* sp. *A* concerning the appearance of the ventral carina. The carinae are different in that, for *Ceratopsis* sp. *C*, it is more arched and perfectly smooth (an extremely fine striation at the very edge may be discernible), whereas that of the present species which occurs in corresponding stratum (type *b*) is reticulate.

Type *C* may be somewhat reminiscent of *Glossopsis mutilata* n. sp.; differences are mentioned on p. 318.

Type *a* (presumably adult specimens; stratum *G*).

Pl. VIII, Figs. 12 and 13.

Type. This type includes the holotype (P. I. U. No. ar. os. 585).

Locality and stratum of type. Cf. p. 319.

Material. 1 carapace and 5 valves from 3 localities (all damaged in the posterodorsal part).

Dimensions.

No.	L	H	G	D M	F M	H/L	G/L	D M/L	F M/D M	∧ ant	∧ post	Remark
ar. os. 585	*1.18*	*0.93*	*0.52*	*0.93*	*2.63*	*0.79*	*0.44*	*0.79*	*2.83*	*125*	*(110)*	V
ar. os. 595	1.16	0.90	0.68	1.05	2.56	0.78	0.59	0.91	2.44	125	(110)	C
ar. os. 598	1.02	0.72	0.51	0.91	2.07	0.71	0.50	0.89	2.28	125	(110)	V
ar. os. 599	0.98	0.73	0.42	0.83	2.10	0.75	0.43	0.85	2.54	125	(110)	V
Mean	1.09	0.93 0.82 0.72	0.68 0.53 0.42	1.05 0.93 0.83	2.63 2.34 2.07	0.79 0.75 0.71	0.59 0.49 0.43	0.91 0.86 0.85	2.83 2.52 2.44	125	(110)	

Description. Carapace of moderate length and great height, equivalved.

Dorsal margin straight and long; anterior margin broadly curved, posterior seems to be more rounded in the dorsal part than in the ventral; ventral margin moderately convex.

Anterodorsal angle seems to be somewhat more obtuse than the posterodorsal.

Sulcate region flattened, except *L I* which is fairly high; area between carinal edge and ventral margin very concave.

Ventral carina extends along ventral part of anterior margin (forming a slight forward swing) and along ventral margin, except for most of its posterior part; it is broad, especially the posterior end which forms a rounded and very pronounced protrusion, the edge of which is sometimes bent slightly outwards; the carina is otherwise bent very slightly inwards.

Valves 3-lobate:

L I throughout its length attached to the substratum, broadest at the ventral end, rising in dorsal direction, dorsal end fairly acute (not reaching to dorsal margin), outer side flat and slanting backwards; area in front of the lobe steeply sloping (thus a distinct angle is created between the backward sloping outer side and the forward sloping prelobate area).

S I practically straight, short, rather deep and broad (in transverse section V-shaped).

L II practically straight or curved very gently backwards, narrow (dorsocentral section often slightly swollen, swelling = the presulcate node of monosulcate genera), in transverse section rounded, dorsal end lowering and tapering into a very acute extremity, extending to the dorsal area.

S II deep and broad, curved backwards or slightly geniculate just behind the swelling of *L II* where it is often deepest (central muscle spot).

L III practically completely fused with *L IV*, thus forming a very broad lobe, for the greater part flattened (only the ventral part somewhat arched); surface rather steeply sloping to posterior part of ventral margin.

S III absent, or traceable as a very short and generally indistinct fissure at the transition between centroventral and ventral areas.

L IV fused with *L III* (see above *L III*).

Surface smooth (except a narrow zone along the ventral margin which is reticulate), or somewhat rugose (which may be due to unfavourable preservation); occasionally one may discern an extremely indistinct reticulation of the outer side of the ventral carina.

Occurrence. Lower Ordovician: middle and upper part of stratum *G* (about 1.5 m—just below *G/R II*) at Gulleråsen, Leskusänget, and Born-Dådran, in Dalecarlia, Sweden.

Type *b* (presumably adult specimens; stratum *R II*).
Pl. VIII, Fig. 14.

Type. The only specimen observed is shown in Pl. VIII, Fig. 14 (P. I. U. No. ar. os. 778).

Locality of type. Leskusänget, in Dalecarlia, Sweden.

Stratum of type. Lower Ordovician: lower part of stratum *R II* (about 0.7 m above *G/R II*).

Material. One valve (posterodorsal corner somewhat damaged).

Dimensions.

No.	L	H	G	D M	F M	H/L	G/L	D M/L	F M/D M	∧ ant	∧ post	Remark
ar. os. 778	1.16	0.71	0.49	1.04	2.25	0.61	0.42	0.90	2.16	120	110	V

Description. The present type is identical with type *a*, except that it is lower and that the outer side of ventral carina is distinctly reticulate posterior to *S II*.

Occurrence. Lower Ordovician: lower part of stratum *R II* (about 0.7 m above *G/R II*) at Leskusänget, in Dalecarlia, Sweden.

Type *C* (presumably a late larval stage; stratum *G*).
Pl. VIII, Fig. 15.

Type. The only specimen observed is shown in Pl. VIII, Fig. 15 (P. I. U. No. ar. os. 605).

Locality of type. Leskusänget, in Dalecarlia, Sweden.

Stratum of type. Lower Ordovician: upper part of stratum *G* (about 1.5 m below *G*/*R II*).

Material. One valve (posterodorsal corner somewhat damaged).

Dimensions.

No.	L	H	G	D M	F M	H/L	G/L	D M/L	F M/D M	∧ ant	∧ post	Remark
ar. os. 605	0.84	0.58	0.40	0.80	1.63	0.69	0.48	0.95	2.04	115	110	V

Description. This type is identical with type *a*, except as regards the appearance of *L I*. In the present type, *L I* is broadest in the dorsocentral part, and the ventral end is gently tapering (in type *a*, *L I* is broadest in the ventral part). Further, *L I* is gently and regularly arched in transverse section, whereas in type *a* its outer surface is slanting backwards, forming, along its anterior margin, a distinct angle with the steeply sloping prelobate area.

Occurrence. Lower Ordovician: middle part of stratum *G* (about 1.5 m below *G*/*R II*) at Leskusänget, in Dalecarlia, Sweden.

Discussion. The specimens referred to *G. robusta* are few but of characteristic appearance. They are principally identical as regards the lobation; furthermore, the posterior end of the ventral carina is broadened and rounded in the same distinctive way.

The types *a* and *b* are interesting, since they occur in different strata (*a* in stratum *G*, and *b* in stratum *R II*). It appears that the later type (*b*) has changed in certain respects in relation to the preceding type *a*: it is considerably lower, and the reticulum of the outer side of the ventral carina is very distinct (in *a* it is absent, or very indistinct).

The reason for the differences is difficult to discover. In discussing the possible reasons it is necessary to consider that type *a* lived in a basin with fairly little communication with the ocean (cf. p. 108), whereas type *b* occurred in the Siljan District after the communication with the ocean had been reopened. It is conceivable that the *b* specimen was transferred to the Siljan District from the oceanic stock. One might imagine that the oceanic stock and that of the Siljan District, which were thus separated from each other during a long period and presumably lived in different ecological surroundings, developed differently.

It is also conceivable that the *R II* specimen is a descendent of the *G* stock of the Siljan District which changed appearance as the ecological conditions were changed.

Considering type *C*, this one is suggested as a late larval stage. If such an interpretation is correct, *L I* has changed its appearance during the latest moulting(s): the ventral end has become broader, and in transverse section the anterior lobe is no longer rounded but the outer surface is flattened and slanting distinctly backwards, this surface forming an angle with the steeply sloping prelobate area. However, type *C* has the characteristic ventral carina of *Glossopsis robusta*, and it is of smaller size than the specimens of the *a* sequence which may indicate that it is a larval stage of type *a*.

Survey of the dimensions of *Glossopsis*.

The following tabular survey shows that the *Glossopsis* species observed are not very large in size. Furthermore, it appears that the dorsal margin is relatively long, the free margin slightly variable (in *G. robusta* type *a* it is proportionally longer than in the other species), and the anterodorsal angle slightly more obtuse than the posterodorsal.

As regards the height, this is fairly normal in most cases, but a few species are proportionally higher than is usually the case in the present genus (*G. alata*, *G. mutilata*, *G. robusta a* and *C*).

	Number	L	H	G	D M	F M	$\frac{H}{L}$	$\frac{G}{L}$	$\frac{DM}{L}$	$\frac{FM}{DM}$	∧ ant	∧ post
G. lingua	15	1.04	0.65	0.46	0.89	1.98	0.63	0.45	0.86	2.23	130	115
G. acuta	15	0.97	0.59	0.45	0.83	1.83	0.61	0.46	0.86	2.20	130	115
G. tenuilimbata	27	0.72	0.43	0.36	0.64	1.33	0.59	0.49	0.89	2.04	125	110
G. alata	2	0.73	0.51	0.39	0.66	1.40	0.71	0.54	0.91	2.12	120	110
G. clavata	27	0.73	0.46	0.37	0.67	1.37	0.63	0.51	0.92	2.04	115	110
G. nodosa	2	0.88	0.54	0.47	0.80	1.66	0.62	0.53	0.91	2.08	125	110
G. depressolimbata	4	0.75	0.48	0.32	0.71	1.44	0.64	0.43	0.93	2.05	115	110
G. indistincta	2	0.67	0.42	0.38	0.62	1.22	0.63	0.56	0.93	1.99	115	115
G. mutilata	1	0.96	0.66	0.47	0.90	1.86	0.69	0.49	0.94	2.07	120	110
G. robusta a	4	1.09	0.82	0.53	0.93	2.34	0.75	0.49	0.86	2.52	125	110
G. robusta b	1	1.16	0.71	0.49	1.04	2.25	0.61	0.42	0.90	2.16	120	110
G. robusta C	1	0.84	0.58	0.40	0.80	1.63	0.69	0.48	0.95	2.04	115	110
						Mean	0.65	0.47	0.91	2.13	120	110

Considering the gibbosity, there are some fairly thick species (*G. alata*, *G. clavata*, *G. nodosa*, *G. indistincta*), but there are also occasional thick specimens among those which have a lower mean gibbosity, e. g. *G. robusta*.

Genus *Ogmoopsis* n. gen.

Derivation of name. *Ogmoopsis* alludes to the distinct velate ridge running in the area between carinal edge and free margin.

Genotype. *Ogmoopsis nodulifera* n. sp.

Occurrence. Ordovician (Lower Ordovician).

Diagnosis. Distinctly 4-lobate ostracods; length about (0.5)—0.7—1.1 mm; presumably equivalved; sulci generally broad; lobes mutually of rather equal breadth, *L I* claviform, *L II* provided with a distinct external node; ventral carina extends along most of ventral margin; in the area between carinal edge and free margin a distinct velate ridge runs from anterodorsal to posterodorsal corner; surface smooth, or partly reticulate or striate.

Discussion and remarks. The relation of *Ogmoopsis* to *Tetradella* and *Glossopsis* is discussed on p. 294. From this discussion it appears that it takes an intermediate position between these genera, but shows closer affinities to *Glossopsis*.

Two species referred to *Ogmoopsis* occur in the present material. Species referable to this genus may not have been observed in earlier investigations, except possibly *Tetradella calkeri* BONNEMA (cf. p. 338).

Ogmoopsis nodulifera n. sp.

Pl. VIII, Figs. 19 and 20.

Derivation of name. *nodulifera* alludes to the distinct node of *L II*.

Holotype. The type shown in Pl. VIII, Fig. 19 is holotype (P. I. U. No. ar. os. 618).

Locality of holotype. Silverberg II, in Dalecarlia, Sweden.

Stratum of holotype. Lower Ordovician: upper part of stratum *G* (about 0.1 m below *G*/*R II*).

Material. 116 valves and internal moulds from 5 localities.

Diagnosis. *Ogmoopsis* of moderate size; lobes somewhat slender: *L I* elongate and claviform, throughout its length attached to the substratum, dorsal end acuminate and lowering, extending practically to the dorsal margin, ventral end tapering, continuing in a ridge along the edge of the ventral carina, outer side flattened and slanting forwards; *L II* provided with a fairly large node; ventral carina extends along ventral margin, except its most posterior part, edge ridged and somewhat acute; the velate ridge in the area between the carinal edge and free margin (this area broad) runs about half-way between the edge and the margin; surface smooth (in internal moulds the lobes may have minute and scattered tubercles).

Dimensions.

No.	L	H	G	D M	F M	H/L	G/L	D M/L	F M/D M	∧ ant	∧ post	Remark
ar. os. 626	1.13	0.70	0.65	0.95	2.23	0.62	0.58	0.84	2.35	130	105	V
ar. os. 618	*1.13*	*0.71*	*0.58*	*0.97*	*2.20*	*0.63*	*0.51*	*0.86*	*2.27*	*120*	*110*	V
ar. os. 630	1.02	0.69	0.51	0.90	2.05	0.68	0.50	0.88	2.27	120	110	V
ar. os. 615	1.01	0.58	0.54	0.87	1.86	0.57	0.54	0.86	2.14	120	110	V
ar. os. 627	0.97	0.58	0.47	0.86	1.82	0.60	0.49	0.89	2.12	120	110	M
ar. os. 631	0.96	0.61	0.47	0.76	1.77	0.64	0.49	0.89	2.33	120	105	V
ar. os. 790	0.88	0.52	0.47	0.78	1.60	0.59	0.53	0.89	2.05	120	110	M
ar. os. 625	0.81	0.48	0.44	0.74	1.51	0.54	0.54	0.91	2.04	120	110	V
ar. os. 633	0.78	0.48	0.42	0.69	1.48	0.62	0.54	0.89	2.14	120	105	M
ar. os. 623	0.73	0.42	0.40	0.65	1.33	0.58	0.55	0.89	2.05	115	110	M
ar. os. 634	0.72	0.45	0.37	0.63	1.38	0.63	0.51	0.88	2.19	120	105	M
ar. os. 802	0.69	0.40	0.37	0.62	1.25	0.58	0.54	0.90	2.02	120	110	M
ar. os. 629	0.66	0.40	0.35	0.59	1.28	0.61	0.53	0.89	2.17	120	105	M
ar. os. 619	0.66	0.40	0.35	0.62	1.26	0.61	0.53	0.94	2.03	120	105	M
ar. os. 632	0.64	0.40	0.35	0.59	1.21	0.63	0.55	0.92	2.05	120	110	M
ar. os. 624	0.50	0.29	0.28	0.47	0.92	0.58	0.56	0.94	1.96	115	105	M
Mean	0.83	0.71 0.51 0.29	0.65 0.44 0.28	0.97 0.73 0.47	2.23 1.57 0.92	0.68 0.61 0.54	0.58 0.53 0.49	0.94 0.89 0.84	2.35 2.14 1.96	120	110	

Affinities. The only additional *Ogmoopsis* species known (*O. paenequisulcata* n. sp.) is different mainly in the following respects: *L I* is shorter and its outline more rounded, *L II* has a minute external node (in the present species the node is fairly large and characteristic), ventral carina bent distinctly inwards (in the present species the edge is often directed outwards), area between carinal edge and free margin fairly narrow and concave (in the present species broad and in the section between the ridge and free margin straight); the velate ridge runs very near to the carinal edge (in the present species it runs about midway between the edge and the margin).

Description. Carapace of moderate size; whether or not is is equivalved was not determinable, since only separate valves were observed.

Dorsal margin straight and long; anterior margin regularly and considerably rounded, posterior one somewhat more broadly rounded; ventral margin moderately convex.

Anterodorsal angle somewhat more obtuse than the posterodorsal.

Sulcate region fairly flattened; area between carinal edge and free margin broad, a distinct velate ridge, edge directed outwards, runs in this area from anterodorsal to posterodorsal corner, section between this ridge and free margin straight, that between the ridge and the carinal edge slightly concave; anteroventral part of the ridge forms a forward swing.

Ventral carina extends along ventral margin, except the section posterior to *L IV*; it is ridged along the edge, anterior part of the ridge continues in the tapering ventral end of *L I*, posterior part forms a slightly outwardly directed and rounded (wing-like) protrusion which is attached to the posteroventral part of *L IV*.

Valves 4-lobate:

L I rather narrow, elongate, and claviform, throughout its length attached to the substratum; its anterior margin often more broadly rounded than its posterior; dorsal end acute and sloping (extending practically to the dorsal margin); ventral end tapering and continuing in the ridge along the carinal edge; outer surface rounded or flattened and slanting forwards (flatness and slope most pronounced in adult specimens); area in front of the lobe steeply sloping.

S I in the central section narrow and shallow but dorsally and ventrally deeper and broader; its dorsal half straight or curved gently backwards, its ventral half curved slightly forwards.

L II fairly narrow, but provided with a rather large dorsocentral-central node (= presulcate node of monosulcate genera), the node somewhat dorsoventrally elongate; dorsal end sloping and tapering, extending to the dorsal area; the lobe in transverse section rounded or (in adult specimens) somewhat flattened; at the node it is more or less distinctly geniculate backwards.

S II broad and deep, broadest in the dorsal half, usually deepest just posterior to the node of *L II*; in the central section gently geniculate or curved backwards, posterior margin more curved than anterior one.

L III fairly broad and high, broadest and highest (and additionally slightly swollen) in the ventral half; extending to dorsal margin; in the central section curved or gently geniculate backwards, both dorsal and ventral ends somewhat tapering.

S III fairly narrow (widened in the dorsal section) and moderately deep (central section often shallow); curved backwards in the centroventral section; the sulcus dorsal to this point practically straight and directed nearly perpendicular to the dorsal margin, ventral to it the sulcus is directed much forwards.

L IV flattened (the centroventral and ventral sections, where the protruding posterior part of ventral carina is attached, are higher than the rest of the lobe); fairly broad in the central section, diminishing in breadth towards dorsal and ventral ends; dorsal end extending to dorsal margin; dorsal half of the lobe sometimes indistinctly limited backwards; area posterior to *L IV* gently sloping, its dorsal and dorsocentral sections sometimes shallowly grooved just behind the lobe (groove longer and more distinct in internal moulds).

Surface smooth; lobes of internal moulds often have minute and scattered tubercles.

Occurrence. Lower Ordovician: upper part of stratum *G* and lower part of stratum *R II* (from about 1.0 m below *G/R II* to about 1.0 m above this boundary) at Silverberg II, Gulleråsen, Born-Dådran, Leskusänget, and Rävanäs, in Dalecarlia, Sweden.

Ogmoopsis paenequisulcata n. sp.

Pl. VIII, Fig. 18.

Derivation of name. *paenequisulcata* alludes to the fact that the sulci are fairly equal.

Holotype. The type shown in Pl. VIII, Fig. 18 is holotype (P. I. U. No. ar. os. 616).

Locality of holotype. Röjeråsvägen, in Dalecarlia, Sweden.

Stratum of holotype. Lower Ordovician: lower part of stratum *G* (about 0.1 m above *R I/G*).

Material. One valve (slightly damaged).

Dimensions.

No.	L	H	G	DM	FM	$\frac{H}{L}$	$\frac{G}{L}$	$\frac{DM}{L}$	$\frac{FM}{DM}$	∧ ant	∧ post	Remark
ar. os. 616	0.74	0.47	0.42	0.66	1.39	0.64	0.57	0.89	2.10	125	105	V

Diagnosis. *Ogmoopsis* of fairly small size; sulci deep and broad, *S II* and *S III* about equally broad; lobes somewhat slender; *L I* shortly claviform, throughout its length attached to the substratum, extending to dorsal margin, ventral end only slightly tapering; *L II* very narrow (except its most ventral part) and provided with a minute dorsocentral node; ventral carina bent inwards, extending along ventral margin, except the section behind *L IV*, continuing posteriorly (via a gentle curve) in the posterior margin of *L IV*; area between carinal edge and free margin fairly narrow and distinctly concave; the distinct velate ridge which occurs in this area runs just along the carinal edge; surface smooth, except *L IV* which is widely but tenuously reticulate, the outer side of ventral carina, and the area between the carinal edge and free margin which are minutely striate conforming to the margin.

Affinities. The main differences from the other known species of *Ogmoopsis* (*O. nodulifera* n. sp.) are given on p. 325.

Description. Carapace of fairly small size; whether or not it is equivalved could not be ascertained, since only one separate valve was observed.

Dorsal margin straight and long; anterior margin broadly convex, posterior one more curved in the dorsal part than in the ventral which is nearly straight; ventral margin moderately convex.

Anterodorsal angle more obtuse than the posterodorsal.

Sulcate region slightly arched, except the outer side of ventral carina which is distinctly arched; area between carinal edge and free margin concave and rather narrow; the distinct velate ridge running in this area from anterodorsal to posterodorsal corner is closely joined to the carinal edge.

Ventral carina extends along ventral margin, except the section posterior to *L IV*; it is protruding over the ventral margin and bent inwards, its anterior end forming a slight forward swing, its posterior end forming a gentle curve terminating in the posterior margin of *L IV*.

Valves 4-lobate:

L I shortly claviform, throughout its length attached to the substratum, outline nearly ovate, ventral end slightly tapering, dorsal end extending to dorsal margin; area just in front of the lobe distinctly grooved.

S I short, fairly broad and deep; curved backwards.

L II practically straight (anterior margin slightly curved backwards), rather short (extending to dorsal-dorsocentral area), and very narrow, except its ventral part which is distinctly broadening towards the ventral end; dorsocentral section slightly swollen, forming a small and somewhat dorsoventrally elongated node; dorsal end of the lobe lowering and tapering.

S II long, deep, broad, and practically straight.

L III practically straight, long (extending almost to dorsal margin), high, and fairly broad; dorsal end slightly acuminate, outer side somewhat flattened, forming angles with the steeply sloping anterior and posterior walls of the lobe.

S III long, broad (narrowing in the ventral section), and deep; posterior margin less steeply sloping than anterior; anterior margin curved slightly backwards, posterior curved distinctly backwards in the centroventral and ventral sections.

L IV rather broad and flattened, except the ventral section which is narrower and somewhat more arched; dorsal end obtuse, extending to dorsal margin; the lobe practically straight, except the ventral part which is curved backwards; area behind the lobe grooved, deeper and narrower at the ventral end, shallow and broad (somewhat indistinct) at the dorsal end.

Surface smooth, except *L IV* which is widely but extremely tenuously reticulate, and the outer side of the ventral carina and the area between the carinal edge and free margin which are very finely striate conforming to the margin.

Occurrence. Lower Ordovician: lower part of stratum *G* (about 0.1 m above *R I/G*) at Röjeråsvägen, in Dalecarlia, Sweden.

Survey of the dimensions of *Ogmoopsis*.

The dimensions and dimensional proportions of *O. paenequisulcata* are not representative, since they are referable to one specimen only. However, it seems as if the dimensional data of this species are rather congruent with those of *O. nodulifera*.

The data of *Ogmoopsis* are very similar to those of *Glossopsis*, with the exception of the thickness of the carapace which is greater in *Ogmoopsis*.

	Number	L	H	G	D M	F M	H/L	G/L	D M/L	F M/D M	∧ ant	∧ post
O. nodulifera	16	0.83	0.51	0.44	0.75	1.57	0.61	0.53	0.89	2.14	120	110
O. paenequisulcata	1	0.74	0.47	0.42	0.66	1.39	0.64	0.57	0.89	2.10	125	105
						Mean	0.63	0.55	0.89	2.12	125	110

Genus *Ceratopsis* Ulrich 1894.

Genotype. *Beyrichia chambersi* Miller 1874.

Occurrence. Ordovician, Gotlandian (lowermost).

Diagnosis. 4- or 3-lobate ostracods; length about (0.5)—1.1—3.0 mm; equivalved; *L I* provided with a process directed dorsally and outwardly, which may be acute or obtuse (top sometimes flattened and widened); ventral carina fairly short and narrow, and protruding over corresponding part of free margin; sometimes an additional velate ridge may be found (conforming to the margin) in the area between the carina and free margin (a few American species seem only to have a velate ridge, but the information is unsatisfactory); surface smooth.

Discussion and remarks. For reasons given in this paper (cf. p. 295), it may be necessary to split the genus *Ceratopsis* Ulrich. Non-spiniferous species are proposed to be removed, forming two new genera: *Glossopsis* and *Ogmoopsis*.

The appearance in *Ceratopsis* emend. of the structures in the free marginal region, which are important characters, are to some extent unsatisfactorily known, owing to imperfect descriptions and figures. For instance, *C. intermedia* Ulrich is described only as regards the appearance of the spine of *L I*, and the species is not figured at all.

In the generic diagnosis by ULRICH is stated: "free edges of carapace as in *Ctenobolbina*, being thick, and having 'false borders'."

It is not clear in this case what is meant by "false borders." Judging by the figures, it seems as if in *C. chambersi* (MILLER) (the genotype) and possibly in *C. oculifera* (HALL) the "false border" is a velate ridge. In *C. robusta* (ULRICH) it may be a ridge running between the ventral carina and the free margin, thus a ridge corresponding to that which is distinctive for the genus *Ogmoopsis* (velate ridge). *C. duftonensis* REED[1] also has such a ridge which, however, is shorter (REED 1910, Pl. XVII, Fig. 9). Whether these species have a ventral carina is not quite clear from the drawings. A carina seems to occur, but it is not so much protruded that the free margin is concealed.

The present species have a distinct ventral carina, much protruding over ventral margin; no velate ridge runs in the area between the carinal edge and free margin. The Estonian *C. cornuta* (KRAUSE) may possibly be of somewhat similar appearance (cf. BONNEMA 1909, Pl. VI). The appearance in these respects of the Bohemian *C. hastata* (BARRANDE) is not clearly obtainable from descriptions and figures (cf. SCHMIDT 1941).

In summing up what is now said about the appearance of the structures of the free marginal region, one may first say that real velate *Ceratopsis* species do not seem to occur (the genus is thus distinctly different from *Tetradella* which has a broad real velum). Concerning the structures of the free marginal zone, the *Ceratopsis* species may be divided into 3 groups.

1. Species provided with a velate ridge (e. g. *C. chambersi* and *C. oculifera*).
2. Species with a narrow ventral carina (not concealing free margin) and a ridge running in the area between the carinal edge and free margin (e. g. *C. robusta* and *C. duftonensis*).
3. Species with a broad ventral carina, concealing corresponding part of free margin (the present species).

Concerning the number of the lobes, most of the species are 4-lobate. *C. hastata* is by SCHMIDT (1941, p. 47) pointed out as 3-lobate, thus being distinguished from the other previously known *Ceratopsis* species. It may be added that the present new species are 3-lobate (a ventral trace of *S III* discernible).

New species belonging to *Ceratopsis* emend. do not seem to have been discerned after BASSLER's and KELLETT's "Index" appeared in 1934. Two species (*C. rostrata* [KRAUSE] and *C. schmidti* BONNEMA) may be excluded from their list. The rest are represented in the following way (one American species — *C. quadrifida* [JONES] — is somewhat uncertain, but left):

[1] SCHMIDT (1941, p. 46) suggests that *C. duftonensis* is conspecific with *C. schmidti* BONNEMA. (This may not be conspecific with *C. obliquejugata* SCHMIDT, cf. p. 296 f.) However, SCHMIDT's suggestion may not be tenable, since *L I* of *C. duftonensis* is spiniform but that of *C. schmidti* claviform, and the lobes of the former are, moreover, much narrower (the difference as regards *L II* is especially obvious). Furthermore, the posterior end of ventral carina is not protruded and wing-like as in *C. schmidti.* Additionally, the carina is not concealing the corresponding part of the free margin which is the case in *C. schmidti.*

	Europe	N. America	
Gotlandian (lowermost)		1	1
Ordovician (middle)	3	4	7
	3	5	8

The 3 European species originate from Estonia, Bohemia and England resd. In this paper 2 Lower Ordovician *Ceratopsis* species are described.

Ceratopsis grandispinosa n. sp.

Pl. VIII, Figs. 21, 22 and Pl. IX, Fig. 1.

To this species are referred 3 types, which were all found only in one locality and in a fairly restricted horizon. Presumably, two of them are sexual dimorphisms of one species, called *A* (types α and β), whereas the third, called *B*, is considered a subspecies.

The types, unfortunately represented by a small number of individuals which, additionally, are all partly damaged, are described separately.

Derivation of name. *grandispinosa* alludes to the large dorsal spine of *L I*.

Holotype. The type shown in Pl. VIII, Fig. 21 is holotype (P. I. U. No. ar. os. 620).

Locality of holotype. Stenberg, in Dalecarlia, Sweden.

Stratum of holotype. Lower Ordovician: lower part of stratum *G* (about 0.8 m above *R I/G*).

Diagnosis. *Ceratopsis* of moderate size; 3-lobate (ventral section of *S III* sometimes traceable); *L I* provided with a prominent spine, which is somewhat ovate in transverse section and directed about 45° dorsally-outwards, *L II* short and curved distinctly backwards, nodiferous; ventral carina protruding over corresponding part of free margin, in type α straight and short (extending along mainly anterior half of ventral margin), in type β and type *B* bent inwards and long (extending along anterior margin, except its dorsal part, forming a forward swing, and along ventral margin, except most of its posterior half); area between carinal edge and free margin in type α only slightly concave but in type β and type *B* very concave; surface smooth or slightly rugose, except outer side of the spine, outer side of ventral carina (especially its anterior part), and the area between the carinal edge and free margin, which are reticulate (in type *B* the outer side of ventral carina is minutely striate, conforming to the margin, and ventral part of *L III* + *L IV* is minutely punctate).

Affinities. *Ceratopsis* sp. *C* (sine nomine) is reminiscent of the present species, especially of the types β and *B* as regards the appearance of the ventral carina. It is different mainly concerning the appearance of the spine which is directed more perpendicularly to the surface than in the present species, further, in that *L II* externally is nodiferous, which is not true of the present species, and as regards the appearance of the ventral carina which is smooth and posteriorly more protruded. The species may furthermore be reminiscent of certain specimens of *Glossopsis acuta* n. sp. viz. those in which *L I* is especially steeply rising in dorsal direction. These specimens are distinguishable from *C. grandispinosa* in that *L I* is attached to the substratum throughout its length (in the present species the spine is free), moreover, in that it has a long and distinct *S III* (*S III* in the present species practically completely absent), and in that the surface is reticulate to a greater extent.

A

Type α (suggested as male).
Pl. VIII, Fig. 21.

Type. This type includes the holotype (P. I. U. No. ar. os. 620).
Locality and stratum of type. Cf. p. 331.
Material. 2 valves (partly damaged) from 1 locality.

Dimensions.

No.	L	H	G	D M	F M	$\frac{H}{L}$	$\frac{G}{L}$	$\frac{DM}{L}$	$\frac{FM}{DM}$	∧ ant	∧ post	Re-mark
ar. os. 620	1.12	0.65	0.54	1.02	2.04	0.58	0.48	0.91	2.00	130	110	V

Description. Carapace of moderate size; whether or not it is equivalved was not determinable, since only separate valves were observed.

Dorsal margin straight and long; anterior margin considerably curved, posterior one seems to be more curved in dorsal than ventral half (this margin partly damaged); ventral margin moderately convex.

Anterodorsal angle may be somewhat more obtuse than the posterodorsal (posterodorsal angle damaged).

Sulcate region fairly flattened, the spine of *L I* rising high above it; area between carinal edge and free margin broad and gently concave.

Ventral carina short (extending mainly along anterior part of ventral margin), protruding considerably over corresponding part of ventral margin, edge acute.

Valves 3-lobate:

L I provided with a large spine, standing about 45° dorsally-outwards, in transverse section dorsoventrally slightly ovate; ventral part of the lobe forms a short, low, and narrow, but fairly distinct ridge, curved gently forwards.

S I shallow but fairly broad, extending to dorsal-dorsocentral area, curved distinctly and regularly backwards.

L II short (extending to dorsocentral area), narrow, in transverse section rounded, curved backwards in conformity to *S I*.

S II broad and deep (ventral end slightly narrowing and diminishing in depth), but fairly short (extending to dorsocentral area); curved backwards, especially ventral half.

L III fused with *L IV* to a very broad lobe (ventral end of *S III* remaining as a short and narrow fissure); dorsal half of the lobe flattened; area just in front of the fissure (corresponding to ventral part of *L III*) gently arched; surface gently sloping to dorsal margin and dorsal half of posterior one, but steeply sloping to ventral half of posterior margin.

Surface smooth or faintly rugose, except the following areas which are reticulate: area between the carinal edge and free margin, outer side of ventral carina, ventral part of *S II* and *S III*; reticulum especially distinct just ventral to *S II*.

Occurrence. Lower Ordovician: lower part of stratum *G* (about 0.8 m above *R I/G*) at Stenberg, in Dalecarlia, Sweden.

Type β (suggested as female).

Pl. VIII, Fig. 22.

Type. A characteristic type is shown in Pl. VIII, Fig. 22 (P. I. U. No. ar. os. 623).

Locality of type. Stenberg, in Dalecarlia, Sweden.

Stratum of type. Lower Ordovician: lower part of stratum *G* (about 0.8 m above *R I/G*).

Material. 5 valves (partly damaged) from 1 locality.

Dimensions.

No.	L	H	G	D M	F M	$\frac{H}{L}$	$\frac{G}{L}$	$\frac{DM}{L}$	$\frac{FM}{DM}$	$\wedge$ ant	$\wedge$ post	Remark
ar. os. 623	*1.12*	*0.67*	*0.61*	*0.95*	*2.09*	*0.60*	*0.54*	*0.85*	*2.20*	*130*	*105*	V
ar. os. 622	0.95	0.61	—	0.86	1.86	0.64	—	0.91	2.16	125	105	V
Mean	1.04	0.64	0.61	0.91	1.98	0.62	0.54	0.88	2.18	130	105	

Description. The present type is similar to type α except in the following respects:

L I not ridged in the ventral part;

L II generally broader, especially in the ventral part;

S III less distinctly developed;

ventral carina longer, extending along anterior margin (except the dorsal part), forming a pronounced forward swing;

area between carinal edge and free margin more concave;

reticulation often less distinct.

Since in the two α specimens observed, the spine was broken just at the base, it may be added that the spine of type β, which was well preserved in 2 specimens, is slightly reticulate on the outer side.

Occurrence. Lower Ordovician: lower part of stratum *G* (about 0.6—0.8 m above *R I/G*) at Stenberg, in Dalecarlia, Sweden.

subspecies *B* (sine nomine).

Pl. IX, Fig. 1.

Type. The only specimen observed (P. I. U. No. ar. os. 621) is shown in Pl. IX, Fig. 1.

Locality of type. Stenberg, in Dalecarlia, Sweden.

Stratum of type. Lower Ordovician: lower part of stratum *G* (about 1.2 m above *R I/G*).

Material. One valve (partly damaged).

Dimensions.

No.	L	H	G	D M	F M	$\frac{H}{L}$	$\frac{G}{L}$	$\frac{DM}{L}$	$\frac{FM}{DM}$	∧ ant	∧ post	Re-mark
ar. os. 621	1.08	0.65	0.56	1.00	2.04	0.60	0.52	0.93	2.04	130	(105)	V

Description. This type is very similar to the main species (especially type β), but is different in the following respects:

L II directed more obliquely;

outer side of ventral carina striate conforming to the margin instead of being reticulate;

ventral half of *L III* + *L IV* more arched, and minutely punctate.

Occurrence. Lower Ordovician: lower part of stratum *G* (about 1.2 m above *R I/G*) at Stenberg, in Dalecarlia, Sweden.

Discussion. As appears from the above descriptions, there are several differences between the 3 types discerned. They might even be considered different species or subspecies. Unfortunately, the material is too scarce and the state of preservation not quite satisfactory to elucidate this question completely. However, I think that the types are referable to one species; as mentioned, two of them (α and β) may constitute males and females resp., the third (*B*) may be a subspecies.

The presumption that α and β are sexual dimorphisms is partly based on the circumstance that specimens of these different types are of about equal size, which may exclude the possibility of their being different moult stages. Furthermore, the assumption is supported by the fact that the types occur in a very restricted horizon of one locality, and, of course, on certain morphological features. The prominent spine may be very similar in both types, and the lobes and sulci are furthermore of practically identical appearance (*L II* in type β somewhat broader, and *S III* more difficult to trace). They are slightly different as regards the distinctness of the reticulation, but this is of minor importance. The only important difference has reference to the ventral carina, which in type α is shorter and narrower than in type β.

It is impossible to know the sexes of α and β. The appearance of the ventral carina of type β is certainly not caused by its being a brood space. Type β may be imagined female, nevertheless, but on account of its being more abundant than type α (in recent ostracods females, as a rule, are more abundant than males).

Type *B*, represented by one partly damaged valve, occurs in a higher horizon than the types α and β.

It is closely related to type β, but easily distinguishable from this one (cf. p. 334). As anticipated, I do not consider the differences so important that the type should be classed as a certain species, but only as a subspecies.

Ceratopsis sp. *C* (sine nomine).

Pl. IX, Figs. 2 and 4.

The material of the present type is not sufficient to allow a complete description of the species.

The type is described *sine nomine* as completely as possible.

Type. The best preserved type is shown in Pl. IX, Fig. 2 (P. I. U. No. ar. os. 635).

Locality of type. Silverberg II, in Dalecarlia, Sweden.

Stratum of type. Lower Ordovician: lower part of stratum *R II* (just above *G/R II*).

Material. One valve (partly damaged) and 6 internal moulds from 3 localities.

Diagnosis. *Ceratopsis* of moderate size; 3-lobate; spine of *L I* in transverse section round or somewhat dorsoventrally ovate and rising fairly perpendicularly to the surface; *L II* noduliferous; ventral carina broad and long, bent slightly inwards, anterior end forming a forward swing, posterior end somewhat protruding, its outline regular and very curved; area between carinal edge and free margin very concave; surface smooth (an extremely fine striation occurs along the edge of ventral carina).

Affinities. The main differences from the other *Ceratopsis* species described in this paper (*C. grandispinosa* n. sp.) are mentioned on p. 332.

Dimensions.

No.	L	H	G	D M	F M	H / L	G / L	D M / L	F M / D M	∧ ant	∧ post	Remark
ar. os. 635	*1.17*	*0.77*	*0.56*	*1.13*	*2.14*	*0.66*	*0.48*	*0.96*	*1.89*	*115*	*110*	V
ar. os. 608	0.84	0.51	0.44	0.77	1.49	0.61	0.52	0.92	1.94	120	110	M
ar. os. 609	0.81	0.57	0.42	0.73	1.55	0.70	0.52	0.90	2.12	125	110	M
Mean	0.94	0.77 0.62 0.51	0.56 0.47 0.42	1.13 0.88 0.73	2.14 1.73 1.49	0.70 0.66 0.61	0.52 0.51 0.48	0.96 0.93 0.90	2.12 1.98 1.89	120	110	

The species may be somewhat reminiscent of *Glossopsis robusta* n. sp. as regards general shape, especially the appearance of the ventral carina. Differences in this respect are mentioned on p. 319. The most striking difference, of course, is referable to the appearance of *L I* which in the present species is spiniferous whereas that of the *Glossopsis* species is claviform and throughout its length attached to the substratum.

Description. Carapace of moderate size; whether or not it is equivalved could not be determined, since only one separate valve was observed.

Dorsal margin straight and long; anterior margin considerably curved, posterior seems to be more curved in the dorsal half than in the ventral; ventral margin moderately convex.

Anterodorsal angle more obtuse than the posterodorsal.

Sulcate region flattened; area between carinal edge and free margin very concave.

Ventral carina broad and long, extending along ventral half of anterior margin and along the whole ventral margin; gently curved inwards; anterior part forms a forward swing, posterior end somewhat protruding, its outline regular and very curved.

Valves 3-lobate:

L I short and provided with a large spine, round in transverse section or slightly dorsoventrally ovate, rising almost perpendicularly.

S I fairly short, shallow, and narrow; curved somewhat backwards.

L II narrow and extending to the dorsal area, provided with a dorsoventrally somewhat elongate node situated in the dorsocentral-central area; slightly geniculate backwards just at the node.

S II very broad and fairly deep, curved slightly backwards.

L III fused with *L IV* to a very broad lobe, dorsal half broader, ventral half only slightly narrowing (*S III* may be discerned as a short ventral fissure; in internal moulds it is not discernible at all); dorsal half of *L III* + *L IV* gently sloping, ventral half more steeply sloping; the area corresponding to ventral part of *L III* somewhat arched.

Surface smooth (an extremely fine striation along the edge of ventral margin may be discernible); surface of internal moulds smooth but provided with a few scattered and minute tubercles.

Occurrence. Lower Ordovician: upper part of stratum *G* and lower part of stratum *R II* (from about 0.3 m below *G/R II* to about 0.3 m above this boundary) at Silverberg II, Leskusänget, and Born-Dådran, in Dalecarlia, Sweden.

Survey of the dimensions of *Ceratopsis*.

The following data are not representative partly on account of the small number of specimens and partly on account of their imperfect preservation. However, so much may appear that the dimensional data are not very different from those of *Glossopsis* n. gen. and *Ogmoopsis* n. gen. (p. 323 and 329).

	Number	L	H	G	DM	FM	$\frac{H}{L}$	$\frac{G}{L}$	$\frac{DM}{L}$	$\frac{FM}{DM}$	∧ ant	∧ post
C. grandispinosa α	1	1.12	0.65	0.54	1.02	2.04	0.58	0.48	0.91	2.00	130	110
C. grandispinosa β	2	1.04	0.64	0.61	0.91	1.98	0.62	0.54	0.88	2.18	130	105
C. grandispinosa B	1	1.08	0.65	0.56	1.00	2.04	0.60	0.52	0.93	2.04	130	(105)
C. sp. *C* (sine nomine)	3	0.94	0.62	0.47	0.88	1.73	0.66	0.51	0.93	1.98	120	110
						Mean	0.62	0.51	0.91	2.05	130	110

Group *B* (*Tetradella* group).

This group is different from group *A* of the subfamily Tetradellinae (the *Ceratopsis* group) in that, as far as is known, it is broadly velate; the *A* group species have been observed to have a ventral carina, or they may have a velate ridge, or both a ventral carina and a velate ridge.

Earlier descriptions and drawings of *Tetradella* species are often incomplete as regards the appearance of the velate structure, partly owing to the fact that the fragile velum has been more or less destroyed. Experience has shown that the velum is often disturbed (vela also have been observed as detached from the carapace). On that account, a definite idea of the general appearance of the velate structure is often difficult to obtain. However, in most species the velum is broad, judging by descriptions and drawings. In other species, generally reproduced by primitive drawings, the velum has not been delineated or has been indicated only as a velate ridge which may be due to the reason just mentioned. As a matter of fact, not having seen specimens of these species, I do not know the real appearance of their velate structures, but presumably they form broad vela. I observed only one picture which shows almost unmistakably that the species concerned (*Tetradella calkeri* BONNEMA 1909, Pl. III, Fig. 22) has so narrow a velum that it has the character of a velate ridge, but the generic position of this species is debatable: I think it is possibly referable to *Ogmoopsis* n. gen.

To the *Tetradella* group may be referred, exclusive of *Tetradella*, in the first place *Tallinnella* ÖPIK. This genus is very closely related to *Tetradella*. It is said by ÖPIK (1937, p. 24) to be different from *Tetradella* since the females should have a so-called brood-pouch, "formed by the enlargement of the marginal border in the posterior (in reality anterior) part of the valves". *Tetradella grewingki* (BOCK) also has such a pouch but situated mainly posteriorly (cf. ÖPIK 1935, Pl. II, Fig. 1 b).

Among earlier described species, ÖPIK referred *Tetradella* (*Beyrichia*) *marchica* (KRAUSE), besides the variety *angustata*, to *Tallinnella*, without definitely knowing whether the "females" have an anterior so-called brood-pouch. He only says that it "is closely related to *Tallinnella dimorpha*", i.e. the genotype (1937, p. 24). In fact, they are similar, but the greatest similarity known has reference to the appearance of the velum, which is broad and provided with a broad groove running just inside its border which latter is sharply raised into a fairly broad and high ridge.

SCHMIDT (1941, p. 38) is of the opinion that a taxonomic separation on account of the appearance of the velum is not possible, and he proposes *Tallinnella* to be rejected or considered only as a subgenus. My opinion is that the appearance of velum is very distinctive and that it, together with other characters (*L II* very short, *L III* and *L IV* somewhat bulbous in the dorsal part), is good evidence for the retention of the genus. The genus may include the species referred to it by ÖPIK (cf. above); however, the variety *lata* of *Tetradella marchica* may not belong to *Tallinnella*. *Tetradella grewingki* was by SCHMIDT questioned to be equally entitled as *Tetradella marchica* to be referable to *Tallinnella* on account of the appearance of the velum, but this may scarcely be tenable, since the velum is importantly different from that of *Tallinnella* in lacking the sharply raised border (the lobes are also different).

The genus *Kiesowia* ULRICH and BASSLER may be referable to the *Tetradella* group. Descriptions and figures are not satisfactorily elucidating for the appearance of the velate structure, however. Certain species are evidently broadly velate; velum of *Kiesowia radians* (KRAUSE) is magnificently developed. As regards the species which in drawings or photographs are reproduced as non-velate or as provided only with a narrow velate ridge one may in the text find the information that the species concerned is "very rare and badly preserved" (ÖPIK 1937, p. 32). Generally in earlier papers nothing is said about the state of preservation.

Rigidella ÖPIK is a genus which is stated to "consist of species with a beyrichoid trilobate valve without a spine on the anterior (= anterior?) lobe and with well developed crests especially on the border of the anterior (= posterior) lobe" (ÖPIK 1937, p. 53). ÖPIK referred to this genus 6 (possibly 7) species, earlier classed as *Steusloffia, Tetradella* (*Beyrichia*) or *Strepula*. The genotype (1935, p. 11) was described as a *Steusloffia* "distinguished from the other species of *Steusloffia* by the very well developed *Beyrichia*-like trilobation, and the position of the crests."

The genotype, originally described as *Steusloffia mitis*, is dissimilar to *Steusloffia* mainly in being distinctly 4-lobate, which is evidently discernible in ÖPIK's elucidating photograph (1935, Pl. II, Fig. 5). It is different also as regards a second character, viz. in that the anterior of the backward running crests belongs to *L IV* instead of to *L III*; in *Steusloffia* this crest (*C III*) runs just behind *S II* and may thus belong to the anterior part of the broad postsulcate lobe (which presumably is created by fusion of *L III* and *L IV*), i. e. *L III*. Thirdly, the type is different from *Steusloffia* in lacking a forwardly directed branch of the crests. (The sharp ridge of the distinctly developed *L I* may not be confused with such a crest.)

Undoubtedly the type is very interesting and it will possibly take a central position in further taxonomic discussions, but, for the present, I am inclined to class it as a *Tetradella*, or as belonging to a subgenus of *Tetradella* (*Rigidella*).

Another species referred to *Rigidella* is that which is represented by the specimen figured by KRAUSE 1889, Pl. II, Fig. 8, and by him called *Beyrichia erratica*. It is distinctly 4-lobate. Furthermore, the posterior crest of *L IV* may not be homologous to that of *Rigidella mitis*: it seems to be the dorsal part of the velum. I think this species is certainly referable to *Tetradella*.

A third species classed among *Rigidella* is *Beyrichia erratica acuta* KRAUSE which has certain similarities to "a true *Steusloffia*", as originally pointed out by ÖPIK (1935, p. 11); it seems to be monosulcate and provided with ridges running mainly as those in *Steusloffia* (in their detailed arrangement not perfectly identical, however).

Strepula lineata granulosa STEUSLOFF and *Strepula lineata separata* STEUSLOFF are normal *Steusloffia* species, as far as I can see.

Strepula beyrichoides JONES and HOLL, which by ÖPIK is also referred to *Rigidella*, is so primitively figured and insufficiently described that it is scarcely recognizable as a *Rigidella*. By BASSLER and KELLETT (1934) it is classed as a *Steusloffia*, but whether this is correct may be questionable.

Strepula lineata KRAUSE, finally, is by ÖPIK probably considered a *Rigidella*. The reason for that is difficult to understand. The pictured specimen is a monosulcate type provided with ridges arranged as in *Steusloffia* (the hindmost ridge may be disturbed in its anterior part) Most likely the species is a *Steusloffia*.

From this discussion it may appear that *Rigidella* is scarcely maintainable in the extension proposed by ÖPIK: as far as I see, most of the species referred to it by ÖPIK are *Steusloffia*. The two remaining species (one of them the genotype), which are mutually somewhat equal, though most presumably not conspecific (by SCHMIDT 1941, p. 40 suggested conspecific), are different from the majority just mentioned in being 4-lobate and as regards the arrangement of the crests. The crests of *L IV* (as arranged in *Rigidella mitis*) may be a specific character more than a generic one. As anticipated, I am inclined to consider the two species mentioned as being referable to *Tetradella*; *Tetradella mitis* may be classed in a monotypic subgenus (*Rigidella*). It is astonishing that SCHMIDT (1941, p. 39—40) without discussion seems to accept the proposals by ÖPIK as regards *Rigidella*.

On the relations to the *Tetradella* group of certain other genera such as the following erected by ÖPIK (*Pseudostrepula*, *Polyceratella, Rakverella* and *Ctenonotella*), I have not yet a decided opinion, not having studied any specimen referred to them.

Genus ***Tetradella*** ULRICH 1890; emend. ULRICH 1894.

Genotype. *Beyrichia quadrilirata* HALL and WHITFIELD 1875.

Occurrence. Ordovician, Gotlandian (lowermost).

Diagnosis. To the revised diagnosis by ULRICH (1894) may be added that the velate structure, as far as is known, generally forms a broad velum.

Discussion and remarks. The *Tetradella* section characterized by *T. quadrilirata* HALL and WHITFIELD (*L I* and *L III* more or less completely divided) has been observed only in America. The European species are referable to the *T. subquadrans* group, which is far more numerous.

Among the species referred to *Tetradella*, several are taxonomically uncertain. Reports on the vertical distribution in some cases are certainly also not reliable.

One Devonian species referred to *Tetradella* (*T. cicatricosa* WARTHIN) is by SCHMIDT (1941, p. 42) suggested to be a *Dizygopleura*. *T. calkeri* (BONNEMA) may be referable to *Ogmoopsis* n. gen. *T. marchica* (KRAUSE) has been transferred to *Tallinnella*. *Rigidella mitis* ÖPIK, on the other hand, may be a *Tetradella* (cf. above).

The uncertainty as regards the vertical distribution is attached to some old reports and to species found in drifts. The genotype is thus reported from the Middle Ordovician (Black River Formation), but originally it was observed in a Lower Gotlandian formation (the Waynesville Formation, i. e. Richmond); the specimens of these different formations are not likely to be conspecific.

Kay (1934, p. 339) intended to show that the Middle Ordovician specimens are specifically different from the Richmond ones; those former were called *T. ellipsilira*. *T. lunatifera* is likewise reported from the same very different horizons. Also in this case, Kay (1934, p. 339) is of the opinion that specific differences occur; the Middle Ordovician type was called *T. ulrichi*. *T. complicata* (Salter), which is reported from many localities, is most likely erroneously given too wide a vertical distribution (Llandeilian and Caradoc). One has certainly believed to have recognized the species from more localities than is correct.

An old report on the recognition of a Portuguese species in Sweden, *T. bussacensis* (Jones), is also fairly unreliable.

Concerning the North German *Geschiebe* ostracods, many are not possible to localize stratigraphically.

The following survey may give an idea of the distribution of *Tetradella*, though it is impaired with uncertainty as regards the taxonomy of some species; concerning the stratigraphy, the stratum of the holotype is reported in case of different horizons being mentioned. (Revised data from Bassler and Kellett 1934, Öpik 1935 and 1937, and Schmidt 1941.)

	Europe	N. America	
Gotlandian (lowermost)	1[1]	3	4
Ordovician, Middle	12	3	15
Ordovician, Lower	6		6
	19	6	25

Remarkably enough, many Lower Ordovician species are reported. They originate from England, Estonia, Ingermanland, and Norway:

T. complicata (Salter) was found in English Llandeilian, thus in a horizon above the so-called *Expansus* Limestone of Sweden (also reported from Caradoc; cf. above).

T. grewingki (Bock) seems to be the only *Tetradella* species known which has been found in strata corresponding to the *Expansus* Limestone, viz. from Norway (Öpik 1940, p. 139) and from Ingermanland (Öpik 1935, p. 9); Öpik's uncertainty as regards its stratal position in Ingermanland may not be necessary, since, in fact, the strata in question most certainly belong to the *Expansus* Zone, according to the Estonian geologist V. Jaanusson (verbal communication).

[1] Wenlock, England; generic position considered uncertain. Among the *Geschiebe* ostracods which may not be more closely datable, 5 are by Bassler and Kellett enumerated as Ordovician and 1 as Gotlandian.

Two species which may be referable to *Tetradella* (both described by ÖPIK) originate from the Estonian zone B II γ, which is lower than the *Expansus* Limestone: *T.* (*Rigidella*) *mitis* and *T. primaria.*

The internal mould described by BRÖGGER as *Beyrichia nana* (1882, p. 55) is *Tetradella grewingki.* It is no doubt erroneously reported from a very low horizon: the Norwegian *Ceratopyge* Limestone (in reality, almost certainly *Expansus* Slate; verbal communication by Dr G. HENNINGSMOEN). From the Swedish *Ceratopyge* Zone is reported by MOBERG and SEGERBERG (1906, p. 76) one species called *Beyrichia nanella* which is said to be somewhat reminiscent of *Tetradella nana*; its identity is not revealed, however.

Finally, one additional species seems to occur in the Lower Ordovician, i. e. that which is represented by the specimen figured by KRAUSE 1889, Pl. II, Fig. 6, i. e. *T. erratica granulosa* (KRAUSE 1891). It was observed in a glauconitic drift boulder.

The present investigation has brought forth 2 new Lower Ordovician *Tetradella* species.

Tetradella grewinki (BOCK).

Pl. IX, Figs. 3, 5—9, and 11.

Beyrichia grewingki BOCK (BOCK 1867, p. 592, and 1869).
Beyrichia erratica var. KRAUSE 1889 (Pl. II, Fig. 6).
Tetradella grewingki (BOCK) (ÖPIK 1935, p. 9, and 1940, p. 139).
Beyrichia erratica var. *granulosa* KRAUSE 1891.

The main part of my specimens referred to the present species are represented by internal moulds. Only a few valves are preserved. Their state of preservation is somewhat different. One or two may be said to be fairly well preserved, but the rest are more or less effaced. The collection also includes some excellent impressions of the carapace.

In fact, the different states of preservation are elucidating for the taxonomy of this species, in showing that the distinctness of the denticulation of the lobes (which is an important character) is, to a certain extent, owing to the degree of weathering and wear of the lobes (cf. p. 344).

The material also shows real specific variations, which partly are also discernible in internal moulds, especially as regards the appearance of *L II* and *L III.*

Lectotype. The type figured by ÖPIK 1935, Pl. II, Figs. 1 a and 1 b is by him designated lectotype.

Locality of lectotype. Obuchowo, Wolchow, in Ingermanland.

Stratum of lectotype. Lower Ordovician: *Expansus* Zone (according to verbal communication by Mr V. JAANUSSON, cf. p. 341).

Present material. 5 valves, 155 internal moulds (several with remains

Dimensions.

No.	L	H	D M	F M	Vel.	$\frac{H}{L}$	$\frac{DM}{L}$	$\frac{Vel.}{L}$	$\frac{FM}{DM}$	∧ ant	∧ post	Remark
ar. os. 641	1.21	0.76	1.07	2.30	0.30	0.63	0.89	0.25	2.15	115	105	V
ar. os. 643	1.21	0.65	1.04	2.14	0.28	0.54	0.86	0.23	2.06	125	110	M
ar. os. 652	1.21	0.64	1.09	2.13	—	0.53	0.90	—	1.79	125	110	M
ar. os. 656	1.14	0.70	0.97	2.21	0.30	0.61	0.85	0.26	2.28	120	110	I
ar. os. 650	1.12	0.62	0.99	2.02	—	0.55	0.88	—	2.04	125	110	M
ar. os. 649	1.10	0.67	1.00	2.12	0.26	0.61	0.91	0.24	2.12	120	110	M
ar. os. 655	1.09	0.68	1.00	2.04	0.23	0.62	0.92	0.21	1.98	120	110	M
ar. os. 654	1.07	0.66	0.95	2.07	0.30	0.62	0.89	0.28	2.18	120	105	I
ar. os. 646	1.07	0.66	0.81	2.09	0.26	0.62	0.89	0.24	2.58	125	120	I
ar. os. 640	1.07	0.66	0.95	2.00	0.25	0.62	0.89	0.23	2.10	120	105	V
ar. os. 638	1.07	0.70	0.96	2.18	0.28	0.65	0.90	0.26	2.27	115	105	V
ar. os. 642	1.06	0.69	0.91	2.16	0.27	0.65	0.86	0.25	2.37	120	110	V
ar. os. 644	1.05	0.65	0.94	1.96	0.30	0.62	0.89	0.29	2.09	120	110	M (v)
ar. os. 645	1.05	0.57	0.94	1.86	0.24	0.54	0.89	0.23	1.98	115	110	M
ar. os. 658	0.97	0.57	0.84	1.81	0.17	0.59	0.87	0.18	2.15	125	105	M
ar. os. 647	0.95	0.59	0.82	1.83	0.17	0.62	0.86	0.18	2.29	120	110	M
ar. os. 648	0.94	0.55	0.78	1.77	—	0.58	0.83	—	2.27	120	115	M
ar. os. 639[1]	0.91	0.65	0.74	1.91	0.24	0.71	0.81	0.26	2.58	120	115	V
ar. os. 657	0.67	0.41	0.60	1.35	0.12	0.61	0.88	0.18	2.25	110	100	M
ar. os. 653	0.57	0.33	0.53	0.93	0.08	0.58	0.93	0.14	1.75	110	105	M
Mean	1.03	0.76 0.62 0.33	1.09 0.90 0.53	2.30 1.94 0.93	0.30 0.24 0.08	0.71 0.61 0.53	0.93 0.88 0.81	0.29 0.23 0.14	2.58 2.16 1.75	120	110	
Lecto-type[2]	1.10	0.70	1.00	2.20	0.25	0.64	0.91	0.23	2.20	120	110	V
[3]	0.85	0.55	0.75	1.60	0.25	0.65	0.88	0.29	2.14	115	110	V

[1] Specimen longitudinally depressed.
[2] ÖPIK 1935, Pl. II, Fig. 1 a.
[3] Norwegian species (ÖPIK 1940, Pl. II, Fig. 13).

In specimen No. ar. os. 651 it was possible to measure the ratio $\frac{G}{L}$; it was found to be 0.84 (in this case the highest lobe is included).

of velum), and a few impressions, from 6 localities. The reason why so few valves have been preserved is that the granulate carapace surface adheres to the rock; the smooth surface of the internal mould, on the other hand, easily loosens from the inner side of the carapace.

Dimensions, cf. p. 343. The inner border of velum not always distinctly discernible externally. The inner margin of the grooved part of velum is considered to be the inner part of velum.

Diagnosis. BOCK's original diagnosis, which is quoted by ÖPIK (1935, p. 9), may be completed in a few respects:

L II short, in internal moulds somewhat swollen in the dorsal end.

L III the highest lobe; in well preserved specimens very sharp-edged.

All the lobes on both sides minutely denticulate; denticulation occurs somewhat below the very edge of the ridges; hence, the denticulation appears most distinct in somewhat effaced specimens (well preserved specimens may appear non-denticulate); denticulation generally best developed in *L III*, in other lobes often indistinct, or even not discernible.

Outer part of velum radiately wrinkled and finely striate conforming to the margin; inner (grooved) part scatteredly granulate.

Carapace densely granulate, granulation most distinct in the extralobate region; lobes and sulci more minutely granulate (granulae often disturbed, so that this region may appear smooth or slightly rugose); the extension of the granulation best observable in impressions being left after the carapace has been dissolved by weathering.

Maximum length (inclusive of velum) 1.6 mm.

Affinities. SCHMIDT's suggestion that *T. grewingki* might be a *Tallinnella* may not be tenable (cf. p. 338).

ÖPIK says that *Beyrichia erratica granulosa* KRAUSE is doubtless identical with *T. grewingki* (1935, p. 10—11). Whether this is correct may be decided first after *T. grewingki* and KRAUSE's type have been carefully revised. But the identity seems to be very probable.

KRAUSE's type is so dissimilar from the specimens figured by ÖPIK (which specimens may be weathered) and from weathered specimens among the present ones that they might be taken for different species. However, in the present material the differences, as regards the appearance of the lobes, between well preserved specimens and weathered ones are so great that they might be considered non-conspecific, unless intermediate types had not been observed.

The lobes of KRAUSE's type appear non-denticulate; in this respect they are identical with well preserved specimens of *T. grewingki* which have not been whitened with NH_4Cl.

So distinct a granulation of sulci and nodes as is figured by KRAUSE may not occur in most specimens of *T. grewingki*, but I observed that such a granulation really occurs, viz. in impressions of carapaces left after the carapaces have been dissolved by weathering (Pl. IX, Fig. 8).

The outer part of velum of KRAUSE's type is wrinkled; this structure is not visible in ÖPIK's figures, nor is it mentioned in his text, but this is a characteristic feature of *T. grewingki*.

The velum of KRAUSE's specimen is narrower than in *T. grewingki*, and its inner section does not seem to be broadly grooved (U-shaped) but V-shaped. On the other hand, the area between this angle and *L I*, *L IV*, and the ridge connecting these lobes is broader than in *T. grewingki*. I think that these differences are due to a slight inaccuracy in the drawing.

The spines, which in KRAUSE's figure are drawn as giving the impression of replacing the anterior and posterior sections of velum, may correspond to the spiniform structures as seen in the inside of a specimen reproduced by ÖPIK (1935, Pl. I, Fig. 1 b).

Thus there are many features which favour the idea that *Beyrichia erratica granulosa* KRAUSE is conspecific with *Tetradella grewingki* (BOCK).

Description (referable to the present specimens).

Carapace of fairly large size; whether or not it is equivalved was not ascertained, since only separate valves were observed.

Dorsal margin straight and long; anterior margin somewhat more curved than the posterior; ventral margin inconsiderably convex.

Anterodorsal angle somewhat more obtuse than the posterodorsal.

Sulcate region flattened, lobes rising steeply over it; area between velum and free margin concave.

Velum broad, inner part forming a broad and fairly shallow groove (inner border externally not always distinctly discernible), outer part plane (anteriorly somewhat convex) and fragile; along the very edge an extremely narrow and slightly raised rim may be visible; outer part of velum radially wrinkled and minutely striate, conforming to the margin; inner (grooved) part slightly granulate.

Valves 4-lobate:

L I very narrow, rather low but long, extending to dorsal margin; dorsal half straight, ventral curved gently backwards, directly continuing in the ridge connecting *L I* with *L IV*.

S I fairly broad and deep, ventral end tapering.

L II practically straight, narrow, rather high but fairly short, extending to dorsocentral area.

S II broad and deep, dorsocentral-central area additionally slightly but distinctly depressed (= central muscle spot); ventral end somewhat narrowing and shallowing.

L III in the dorsal half straight, ventral half curved distinctly backwards; very high and sharp-ridged, base relatively broad, lobe in transverse section reversed V-formed, dorsal end acute; lobe long, extending to dorsal margin (dorsal section successively dropping towards dorsal margin).

S III broad but fairly shallow, ventral end tapering.

L IV narrow and low but long, extending to dorsal margin; dorsal half practically straight, ventral curved considerably backwards, continuing in the ridge connecting *L I* and *L IV*.

Concerning the lobes, the character has to be mentioned that nearly all of them are provided with minute rounded denticles on both sides. The important fact should be noted that these denticles are situated somewhat below the very edge. For this reason they are best discernible in somewhat effaced specimens; in perfectly preserved specimens they are sometimes easily overlooked. The denticles are generally best developed in *L III*; they do not occur in internal moulds.

Surface granulate; area between the velate groove and *L I*, *L IV*, and the connecting ventral ridge densely granulate, density diminishing towards the velum (surface of velum, cf. above); lobes and sulci more minutely granulate, granulation often indistinct.

In internal moulds, *L I* and *L IV* are indicated as very low and indistinct ridges, mostly scarcely discernible. Dorsal end of *L II* slightly swollen (= presulcate node of monosulcate genera). The height of *L III* somewhat variable. The depression of *S II* distinct (= central muscle spot); in *S I* one mandibular muscle attachment in the ventral part and one antennal in the dorsal part are visible. Surface of internal moulds smooth.

Occurrence. Lower Ordovician.

INGERMANLAND: *Expansus* Zone (cf. above: stratum of lectotype); the species not observed in Estonia, acc. to ÖPIK 1935, p. 10.

NORWAY: *Expansus* Slate (ÖPIK 1940, p. 139).

NORTH GERMAN GESCHIEBE: (*Beyrichia erratica granulosa* KRAUSE): the specimen pictured by KRAUSE 1889, Pl. II, Fig. 6, originates from a grey glauconitic drift boulder (KRAUSE 1889, p. 19).

SWEDEN: upper part of stratum *R I* and lower part of stratum *G* (from about 0.2 m below *R I/G* to about 1.4 m above this boundary) at Stenberg, Leskusänget, Granmor, Rävanäs, Röjeråsvägen, and Gulleråsen, in Dalecarlia, Sweden.

Tetradella lanceolata n. sp.

Pl. IX, Figs. 10, 13, 17, and 20.

Derivation of name. *lanceolata* alludes to the lanceolate outline of *L II*.

Holotype. The type shown in Pl. IX, Fig. 10 is holotype (P. I. U. No. ar. os. 660).

Locality of holotype. Stenberg, in Dalecarlia, Sweden.

Stratum of holotype. Lower Ordovician: lower part of stratum *G* (about 0.6 m above *R I/G*).

Material. 10 valves from 3 localities.

Dimensions.

No.	L	H	D M	F M	Vel.	H/L	D M/L	Vel./L	F M/D M	∧ ant	∧ post	Re-mark
ar. os. 661	0.97	0.58	0.80	1.79	—	0.60	0.83	—	2.24	120	115	V
ar. os. 662	0.91	0.56	0.76	1.70	0.15	0.62	0.84	0.17	2.24	130	110	V
ar. os. 663	0.91	0.58	0.72	1.81	0.16	0.64	0.79	0.17	2.52	130	115	V
ar. os. 660	*0.86*	*0.51*	*0.69*	*1.63*	*0.11*	*0.59*	*0.80*	*0.13*	*2.36*	*125*	*115*	V
ar. os. 665	0.83	0.51	0.63	1.60	—	0.61	0.76	—	2.54	125	115	V
ar. os. 682	0.81	0.48	0.67	1.49	0.09	0.59	0.83	0.11	2.22	125	115	V
ar. os. 673	0.71	0.42	0.59	1.23	—	0.59	0.83	—	2.08	125	110	V
Mean	0.86	0.58 0.52 0.42	0.80 0.69 0.59	1.81 1.61 1.49	0.16 0.13 0.09	0.64 0.61 0.59	0.84 0.81 0.79	0.17 0.15 0.11	2.52 2.31 2.22	125	115	

Diagnosis. *Tetradella* of fairly small size; 4-lobate, all lobes sharply ridged, *L I* and *L IV* very narrow, connected by a narrow and sharp ridge, in old specimens also joined by a narrow and sharp crest running along dorsal margin, outline of *L II* lanceolate; velum moderately broad; surface (except mainly velum, *S II*, and *S III*) tenuously but very distinctly reticulate (velum minutely striate conforming to the margin, *S II* smooth, *S III* very indistinctly reticulate).

Affinities. The species is somewhat reminiscent of *Tetradella teres* n. sp. which appears in about the same horizon and which is reticulate like the present species. They are different, the lobes of the present species being sharply ridged but those of *T. teres* being rounded; in adult specimens of *T. teres* the lobes are more acute than in younger stages but not sharp-edged as in *T. lanceolata*; furthermore, *L I* and *L IV* of *T. teres* are not connected by a ventral ridge like in *T. lanceolata*.

Description. Carapace of fairly small size; whether or not it is equivalved was not determinable, since only separate valves were observed.

Dorsal margin straight and long; anterior and posterior margins regularly and about equally rounded (the anterior may be slightly more convex); ventral margin moderately convex.

Anterodorsal angle nearly equal to the posterodorsal, or inconsiderably more obtuse.

Velum moderately broad, in all its breadth extremely finely striate, conforming to the margin.

Valves 4-lobate:

L I narrow, sharp-edged and long, extending to dorsal margin; dorsal half practically straight, ventral curved forward, continuing directly in the ridge connecting *L I* with *L IV*.

S I fairly narrow and shallow; practically straight.

L II lanceolate in outline, broadest in the dorsocentral-central section, where it is also highest; the tapering and lowering dorsal end extending to dorsal area (not exactly extending to dorsal margin); the tapering ventral end rather long; the lobe straight, except the very ventral end which is curved backwards in joining the ridge connecting *L I* and *L IV*; the ridge of the lobe is sharp, especially that of the narrow ventral part.

S II broad and deep, breadth increasing in dorsal direction, depth greatest in the dorsocentral-central section (central muscle spot); slightly curved backwards.

L III broad, high, sharp-ridged, and long, extending practically to dorsal margin, dorsal end lowering and acute; curved backwards, ventral half more curved than dorsal.

S III fairly broad and deep, curved backwards.

L IV fairly broad, rather high, sharp-ridged, and long (extending to dorsal margin), dorsal end acute; widely curved backwards.

Area between the inner margin of velum and the ridge formed by *L I*, *L IV*, and the connecting ventral ridge fairly broad and rather steeply sloping.

Surface, except velum (cf. above), *S II*, and *S III*, tenuously but distinctly reticulate; *S II* smooth, and *S III* indistinctly reticulate (practically smooth).

Occurrence. Lower Ordovician: lower part of stratum *G* (about 0.4—0.6 m above *R I/G*) at Stenberg, Leskusänget, and Gulleråsen, in Dalecarlia, Sweden.

Tetradella teres n. sp.

Pl. IX, Figs. 12, 14—16, 18, and 19.

Derivation of name. *teres* alludes to the rounded appearance of the carapace.

Holotype. The type shown in Pl. IX, Fig. 15 is holotype (P. I. U. No. ar. os. 686).

Locality of holotype. Stenberg, in Dalecarlia, Sweden.

Stratum of holotype. Lower Ordovician: lower part of stratum *G* (about 0.6 m above *R I/G*).

Material. 124 valves and internal moulds from 3 localities.

Diagnosis. *Tetradella* of fairly small size; 4-lobate, lobes flattened or gently rounded in transverse section, *L II* distinctively bulbous; velum rather narrow; surface distinctly reticulate, except velum which is minutely striate conforming to the margin.

Dimensions.

No.	L	H	G	D M	F M	Vel.	H/L	G/L	D M/L	F M/D M	Vel./L	∧ ant	∧ post	Remark
ar. os. 689	1.08	0.58	0.44	0.88	2.02	—	0.54	0.41	0.81	2.29	—	130	120	M
ar. os. 691	1.05	0.60	—	0.88	1.86	0.12	0.57	—	0.84	2.11	0.11	125	110	M (v)
ar. os. 651	1.05	0.58	0.42	0.83	1.96	—	0.55	0.40	0.79	2.36	—	135	120	M
ar. os. 680	0.99	0.58	—	0.79	1.86	0.11	0.59	—	0.80	2.35	0.11	130	115	M
ar. os. 688	0.93	0.52	0.42	0.78	1.63	—	0.56	0.44	0.84	2.09	—	130	110	M (v)
ar. os. 686	*0.91*	*0.53*	*0.42*	*0.70*	*1.63*	—	*0.58*	*0.46*	*0.77*	*2.32*	—	*135*	*115*	V
ar. os. 684	0.84	0.53	—	0.65	1.63	0.10	0.63	—	0.77	2.50	0.12	125	115	M
ar. os. 674	0.83	0.49	0.35	0.70	1.51	—	0.59	0.42	0.84	2.16	—	130	110	M
ar. os. 694	0.81	0.51	—	0.65	1.60	0.08	0.63	—	0.80	2.46	0.10	125	115	V
ar. os. 690	0.81	0.47	—	0.65	1.49	0.11	0.58	—	0.80	2.29	0.14	125	120	M
ar. os. 692	0.80	0.48	—	0.70	1.42	0.10	0.60	—	0.87	2.03	0.13	125	110	M (v)
ar. os. 676	0.79	0.49	—	0.65	1.49	0.12	0.62	—	0.82	2.29	0.15	135	115	M (v)
ar. os. 672	0.78	0.52	—	0.67	1.53	0.09	0.65	—	0.87	2.28	0.12	120	110	M
ar. os. 670	0.76	0.48	0.45	0.63	1.56	—	0.63	0.46	0.83	2.47	—	125	115	M (v)
ar. os. 666	0.74	0.48	—	0.63	1.39	0.11	0.60	—	0.85	2.21	0.15	120	110	V
ar. os. 682	0.73	0.44	—	0.63	1.36	0.08	0.59	—	0.86	2.16	0.11	120	110	M
ar. os. 687	0.67	0.42	—	0.58	1.23	0.10	0.63	—	0.87	2.12	0.15	120	110	V
ar. os. 683	0.67	0.44	—	0.56	1.35	0.08	0.66	—	0.83	2.41	0.12	125	115	V
ar. os. 669	0.65	0.38	—	0.58	1.16	—	0.59	—	0.89	2.00	—	125	110	V
ar. os. 668	0.63	0.41	—	0.54	1.21	0.07	0.65	—	0.86	2.24	0.11	125	115	V
ar. os. 671	0.60	0.40	—	0.52	1.16	0.08	0.67	—	0.87	2.23	0.13	120	110	M (v)
ar. os. 693	0.59	0.36	—	0.52	1.14	—	0.61	—	0.88	2.19	—	125	110	V
ar. os. 681	0.58	0.35	—	0.51	1.05	—	0.60	—	0.88	2.06	—	120	110	M
ar. os. 685	0.56	0.38	—	0.47	1.14	0.07	0.68	—	0.84	2.43	0.12	125	105	V
ar. os. 677	0.54	0.34	—	0.47	0.95	0.03	0.63	—	0.87	2.02	0.06	115	105	V
ar. os. 678	0.54	0.35	—	0.48	1.05	0.03	0.65	—	0.89	2.19	0.06	110	110	V
ar. os. 679	0.54	0.33	—	0.49	1.02	0.05	0.61	—	0.91	2.08	0.09	125	105	V
ar. os. 667	0.51	0.35	—	0.44	1.02	—	0.69	—	0.86	2.32	0.04	115	105	M
ar. os. 675	0.51	0.35	—	0.44	0.95	0.03	0.69	—	0.86	2.16	—	110	110	M
ar. os. 695	0.44	0.28	—	0.38	0.81	—	0.63	—	0.86	2.19	—	125	110	M
Mean	0.73	0.60 0.45 0.28	0.45 0.39 0.28	0.88 0.61 0.38	2.02 1.37 0.81	0.12 0.08 0.03	0.69 0.62 0.54	0.46 0.43 0.40	0.91 0.84 0.76	2.54 2.24 2.00	0.15 0.11 0.04	120	110	

Affinities. This species is not a typical *Tetradella*, since a distinct longitudinal ventral ridge connecting *L I* and *L IV* is not usually developed; an incomplete and indistinct ridge may be discernible in adult specimens, but in young stages there is no ridge. Distinctive for the species is the fact that *L II* and *L III* are ventrally connected by a fairly distinct U-shaped ridge. In this respect and as regards the appearance of the lobes for the rest (especially in larval stages) the species is otherwise somewhat reminiscent of *Dizygopleura* ULRICH and BASSLER.

On account of the reticulation, the species is reminiscent of *Tetradella lanceolata* n. sp.; differentiating features mentioned on p. 347.

Internal moulds of adult specimens are rather similar to those of *Tetradella grewingki*. The moulds are different mainly as regards the lobes. The most distinctive feature is the fact that *L II* of the present species is more bulbous than that of *T. grewingki*. Furthermore, *L III* is lower and less sharp-edged, and *L I* and *L IV* are provided with low and narrow but fairly distinct ridges, which is not the case in *T. grewingki*.

Description. Carapace fairly small, whether or not it is equivalved is not known, since only separate valves were observed.

Dorsal margin straight and long; anterior margin somewhat more convex than the posterior; ventral margin moderately convex.

Anterodorsal angle somewhat more obtuse than the posterodorsal.

Sulcate region moderately arched (young stages appear more regularly arched since the lobes are lower, and sulci are proportionally shallower and narrower than in adult specimens and in late stages); area between velum and free margin rather narrow and straight or slightly concave; posterior section straight and very gently sloping; a low ridge runs near the free margin.

Velum moderately broad or rather narrow, plane, and directed outwards; minutely striate conforming to the margin.

Valves 4-lobate:

L I low and broad; its posterior margin somewhat edged (in adult specimens slightly ridged), lobe curved gently forwards; surface slightly arched and regularly sloping forwards from the posterior margin of the lobe.

S I narrow, shallow, and fairly short, extending from central-centroventral to dorsal area; curved forwards; in young larval stages the sulcus may be indistinct.

L II elongate and bulbous, practically straight, dorsal end rounded and extending to dorsal area, ventral end tapering and continuing in a narrow and low ridge seen to run round the ventral end of *S II*; in certain adult specimens a low and indistinct dorsoventral ridge along its highest part may be developed.

S II broad, deep (deepest in the central area = central muscle spot) and fairly short, extending from centroventral to dorsal area, ventral end distinctly limited by the low ridge connecting *L II* and *L III*; curved, or (in adult specimens) in the central area slightly geniculate backwards.

L III broad (for the most part equally broad in all its extension) and flattened (in late larval stages nearly flat, anterior and posterior margins sharply angled; in adult specimens more arched, anterior and posterior margins rounded, sometimes in adult specimens a low ridge runs along the posterior margin); the lobe is fairly long, extending from centroventral to dorsal area (dorsal end rounded); the lobe curved backwards; joined with *L II* by a low U-shaped ridge running just ventral to *S II*.

S III in adult specimens fairly broad and deep (in larval stages narrower and shallower; in very young stages scarcely discernible or not developed), rather long, extending from centroventral to dorsal area (in larval stages shorter), curved backwards, ventral end tapering.

L IV broad and flattened (slightly more arched in adult specimens than in larvae), gently sloping from its anterior margin (which is rather distinctly angled) to the velum.

Area between the lobes and the inner margin of velum rather broad and fairly gently sloping.

Surface, except mainly the bulbous part of *L II*, sulci and velum, distinctly reticulate (bulbous part of *L II* and the sulci smooth; velum cf. above).

All stages of internal moulds characterized by the fact that *L II* is bulbous; in internal moulds of adult specimens, *L I* and *L IV* are marked by low ridges, one running along the posterior margin of *L I* and another along anterior margin of *L IV*; in moulds of young stages, *S I* and *S III* are indistinct or not developed at all; surface of internal moulds smooth.

Notes on the larval development. The present species is represented by a sequence illustrating fairly well the changes in appearance of the carapace during a great part of the larval development.

L II is distinctly bulbous in all stages which is a characteristic feature of *T. teres*. *S I* and *S III* are not discernible at all in very young stages (such stages might erroneously be taken for young *Ctenentoma* or *Euprimitia*); in somewhat later stages, *S I* and *S III* are developed in the dorsal part, and in late larval stages and adults they are fairly long, extending ventrally to the central and centroventral areas.

Distinguishing for the larval development of the species is further that in young and moderately young stages the valves appear more regularly arched (cf. p. 350); on the other hand, during the latest stages the separate lobes have been more rounded in transverse section.

The dorsal margin is proportionally longer than in late larval stages and adult specimens, and the anterodorsal angle seems to grow slightly more obtuse during the larval development. Velum seems to be proportionally narrower in very young stages than in later ones.

Occurrence. Lower Ordovician: lower part of stratum *G* (about 0.6—0.8 m above *R I/G*) at Stenberg, Leskusänget, and Granmor, in Dalecarlia, Sweden.

Survey of the dimensions of *Tetradella*.

The following mean dimensional data may be rather representative, since fairly many specimens were measured.

It appears that *T. grewingki* is larger than the two other species, furthermore, that its dorsal margin is proportionally longer, and the velum proportionally broader.

Proportional height and proportional length of free margin are, on the average, remarkably coincident in the three species.

	Number	L	H	G	D M	F M	Vel.	H/L	G/L	D M/L	F M/D M	Vel./L	∧ ant	∧ post
T. grewingki	20	1.03	0.62	—	0.90	1.94	0.24	0.61	—	0.88	2.20	0.23	120	110
T. lanceolata	7	0.86	0.52	—	0.69	1.61	0.13	0.61	—	0.81	2.31	0.15	125	115
T. teres	30	0.73	0.45	0.39	0.61	1.37	0.08	0.62	0.43	0.84	2.24	0.11	120	110
							Mean	0.61	0.43	0.84	2.25	0.16	120	110

Group *C* (*Steusloffia* group).

To this group I refer, for the present, only the genus *Steusloffia*, which shows affinities to the *Tetradella* group. Very likely, the genera *Piretella* ÖPIK, *Hesperidella* ÖPIK, and possibly *Pseudostrepula* ÖPIK are also referable to the present group. The group may thus correspond to the family Piretellidae ÖPIK.

Genus *Steusloffia* ULRICH and BASSLER 1908.

Genotype. *Beyrichia costata* LINNARSSON 1869 (cf. THORSLUND 1940, p. 176).

Occurrence. Ordovician, Gotlandian.

Diagnosis. Monosulcate ostracods; length about (0.5)—1.0—2.6 mm; sulcus (*S II*) generally broad and deep; often a fairly shallow and narrow furrow occurs just in front of the presulcate node (this furrow certainly corresponding to *S I*); presulcate node generally large and prominent; one node also may occur in the anterodorsal corner and another just posterior to the ventral end of the sulcus; narrow crests run over the surface; one (*C I*) in front of the furrow which may correspond to *S I*, sometimes a second (*C II*) dorsoventrally traversing the presulcate node, a third (*C III*) generally just posterior to *S II*, and a fourth (*C IV*) somewhat behind *C III*; the crests are joined in the area just ventral to the sulcus (in young stages the crests are indistinct or not developed; in adult specimens there is usually also a ridge running along the dorsal margin, connecting dorsal ends of the crest); velum seems generally to occur, being, as a rule, fairly broad; surface granulate, or (as seems to have been observed in one case) smooth.

Discussion and remarks. The taxonomic position of *Steusloffia* has been discussed (cf. SCHMIDT 1941, p. 51) and it was pointed out by SCHMIDT that it is difficult to make a decision in this question. He proposed to class the genus in a group of Drepanellidae, which he considered related to Hollinidae. I propose to class *Steusloffia* in Hollinidae, more closely in Tetradellinae.

There are many affinities between the *Steusloffia* group and the other groups of Tetradellinae. It is true that *Steusloffia* is monosulcate (*S II*), but *S I* is most often clearly traceable. Correspondence to *S III* does not seem to occur, but this may be parallel to the phenomenon which appears in the *Ceratopsis* group of Tetradellinae, viz. that in several species, *S III* is poorly developed or not developed at all. The arrangement of the crests points to an original quadrilobation. This is demonstrated by ÖPIK's clear reproduction of, among others, *Steusloffia rigida* ÖPIK (1937, Pl. IV, Fig. 1): one crest (*C I*) runs just in front of the furrow which may correspond to *S I* (this crest certainly indicates *L I*), another (*C II*) traverses in dorsoventral direction the presulcate node (=*L II*), the third crest, *C III* (running just posterior to *S II*), may indicate *L III*, and the hindmost (*C IV*) may correspond to *L IV*.

The velate structure of *Steusloffia* has not been studied very much: several side view pictures were published earlier but only two ventral side pictures seem to have been reproduced, viz. of *Steusloffia lineata* var. *separata* STEUSLOFF (STEUSLOFF 1894, Pl. LVIII, Fig. 23) and of *Steusloffia rigida* ÖPIK (ÖPIK 1937, Pl. XII, Fig. 9).

From the side views of many species it appears that the valves are surrounded by a broad velum (cf. pictures in ÖPIK 1937). I made the corresponding observation in adult specimens of the present material; in young stages the velum is narrower and may appropriately be termed a velate ridge.

SCHMIDT states in the diagnosis of Drepanellidae that a real velum is not developed in this family, to which he referred *Steusloffia*. In the diagnosis of the subfamily Bassleratiinae, where he ranged *Steusloffia*, SCHMIDT says that on the *Umbiegungskante,* there runs a thin crest. However, this crest is not situated on the *Umbiegungskante*: in my opinion, the *Umbiegungskante* corresponds to the flexure which is discernible dorsal to and parallel to the longitudinal ventral crest. This flexure is more distinct in young stages than in later ones (cf. Pl. X, Figs. 1 b and 6). In fact, the crest is situated in a position corresponding to the velum of *Tetradella,* and there may be no reason to consider it anything but a real velum.

From the above discussion on the arrangement of the crests, and the appearance of the velate structure and the ventral area it appears that *Steusloffia* may be referred to Tetradellinae.

Concerning the crests, it has been observed that they are differently developed within the same species. This may be due to different states of preservation, as mentioned by THORSLUND (1940, p. 178), but also to the fact that the crests were increasing in size and distinctness during the ontogenesis (cf. THORSLUND 1940, p. 177). This also appears from the present material; in very young stages there are even no crests at all (Pl. X, Figs. 1 and 6). In old specimens the crests have grown high and their dorsal ends have generally been joined by a crest running along the dorsal margin. Crests of the latter kind do not occur in *Steusloffia* alone, however. They may also be observed in *Tetradella*, for instance in *T. lanceolata* n. sp. (Pl. IX, Fig. 13), and in two *Tetradella* specimens figured by KRAUSE (1889, Pl. II, Figs. 7 and 8); such extra deposits of calcium carbonate likewise occur in old specimens of molluscs and brachiopods. ÖPIK's statement that the crests have no corresponding markings in internal moulds is in most cases correct, but low ridges may sometimes be discerned (Pl. X, Fig. 5).

Steusloffia was referred by ÖPIK to the family Piretellidae ÖPIK which, except for *Steusloffia* and *Strepula* JONES and HOLL, includes 4 genera erected by him (1937, p. 47). Among them is *Rigidella*, which may not have the wide range proposed by ÖPIK: most of the species referred to it may be *Steusloffia,* and *Rigidella* itself may be a monotypic subgenus of *Tetradella* (cf. p. 339 f.).

After ÖPIK's now mentioned revision (1937), only 5 of the *Steusloffia* species enumerated by BASSLER and KELLETT (1934) should belong to *Steusloffia*. But, as stated, I think that the majority of the species classed as *Rigidella* in fact belong to *Steusloffia.* ÖPIK himself added 3 new *Steusloffia* species.

The following survey may give an idea of the distribution of *Steusloffia* (revised data from BASSLER and KELLETT 1934, ÖPIK 1937 and THORSLUND 1940):

	Europe
Gotlandian	1
Ordovician	11
	12

It is noteworthy that *Steusloffia* does not seem to occur in America.

The identity of the Gotlandian species (*Strepula beyrichoides* JONES and HOLL from the Wenlock, England) is uncertain (cf. p. 339). The statement by BASSLER and KELLETT that another species, *S. simplex* (KRAUSE), should be

Gotlandian is wrong. Thus, the occurrence of *Steusloffia* in Gotlandian is very uncertain.

Only 4 of the Ordovician species originate from bed-rocks, viz. those described by ÖPIK 1937 (Estonia) and the genotype (THORSLUND 1940, p. 178: Sweden); they are all Middle Ordovician. The remaining Ordovician species were found in North German drifts. Not unlikely, some of them are Lower Ordovician.

In the present paper two Lower Ordovician *Steusloffia* species are presented.

Steusloffia polynodulifera n. sp.

Pl. X, Figs. 1—7.

This species is different from the other species represented in the stratal sequence investigated, viz. as regards the vertical distribution. The other species occur in one, as a rule, restricted horizon, but this one was found in two different horizons (cf. discussion below).

Derivation of name. *polynodulifera* alludes to the fact that the surface is crowded with minute nodules.

Holotype. The type shown in Pl. X, Fig. 2 is holotype (P. I. U. No. ar. os. 699).

Locality of holotype. Gulleråsen, in Dalecarlia, Sweden.

Stratum of holotype. Lower Ordovician: lower part of stratum *G* (about 0.5 m above *R I/G*).

Material. 1 carapace, and 97 valves and internal moulds from 8 localities (9 from lower part of stratum *G*; 89 from upper part of stratum *G* and lower part of stratum *R II*).

Diagnosis. *Steusloffia* of moderate or fairly large size; sulcus deep and long; presulcate node large, in transverse section rounded and dorsoventrally elongate; surface crests joined dorsally, dorsal ends of *C I* and *C II* in adult specimens declining backwards (that of *C III* continuing in the velum); (crests in young stages poorly or not developed, in adult specimens high but thin and fragile); velum fragile and broad, directed outwards; area between velum and free margin rather broad; surface crowded with small nodules.

Affinities. The species may be closely related to *Steusloffia lineata* (KRAUSE) var. *granulosa* STEUSLOFF (STEUSLOFF 1894, Pl. LVIII, Fig. 22), but they may not be conspecific. Since the description of STEUSLOFF's species is very incomplete, and the drawing appears to be fairly schematic, one feels somewhat uncertain as regards its real appearance.

Judging from STEUSLOFF's drawing, his species is much more sparsely granulate, but in the text the surface is said to be densely granulate. According to the text, the species may thus be fairly similar to the present one as regards the surface. However, they seem to be distinctly different concerning the appearance of velum which in STEUSLOFF's species is said to

Dimensions.

No.	L	H	G	D M	F M	$\frac{H}{L}$	$\frac{G}{L}$	$\frac{DM}{L}$	$\frac{FM}{DM}$	∧ ant	∧ post	Re-mark
ar. os. 718	1.34	0.84	0.82	1.12	2.56	0.63	0.61	0.84	2.37	125	115	V
ar. os. 704	1.23	0.77	0.81	0.95	2.39	0.63	0.66	0.77	2.51	130	115	V
ar. os. 700	1.20	0.77	0.77	1.00	2.35	0.64	0.64	0.83	2.35	125	110	V
ar. os. 699	*1.11*	*0.73*	*0.81*	*0.94*	*2.12*	*0.66*	*0.73*	*0.85*	*2.25*	*125*	*115*	V
ar. os. 703	1.03	0.67	—	0.88	2.04	0.65	—	0.85	2.32	125	110	M(v)
ar. os. 716	1.02	0.64	0.60	0.88	2.04	0.63	0.59	0.86	2.31	125	110	M
ar. os. 702	1.01	0.67	0.63	0.84	2.04	0.66	0.62	0.83	2.43	125	115	V
ar. os. 709	0.99	0.65	0.67	0.81	1.98	0.67	0.66	0.82	2.44	125	115	V
ar. os. 701	0.97	0.65	0.63	0.78	1.86	0.67	0.65	0.80	2.38	125	115	V
ar. os. 710	0.85	0.50	0.52	0.73	1.58	0.59	0.61	0.86	2.16	125	115	M
ar. os. 706	0.84	0.51	0.42	0.72	1.58	0.61	0.55	0.86	2.20	120	110	M
ar. os. 705	0.80	0.53	0.56	0.64	1.63	0.66	0.70	0.80	2.55	120	115	V
ar. os. 714	0.79	0.47	0.47	0.65	1.51	0.60	0.60	0.82	2.32	130	115	M
ar. os. 707	0.73	0.44	0.46	0.63	1.39	0.60	0.63	0.86	2.20	120	115	V
ar. os. 717	0.70	0.42	0.44	0.63	1.23	0.60	0.63	0.90	1.95	115	105	V
ar. os. 711	0.69	0.44	0.44	0.61	1.37	0.64	0.64	0.88	2.24	115	110	C
ar. os. 715	0.62	0.41	0.42	0.54	1.19	0.66	0.67	0.87	2.20	115	110	M
ar. os. 708	0.52	0.34	0.33	0.47	1.02	0.65	0.63	0.90	2.17	115	105	M
ar. os. 712	0.44	0.30	0.24	0.40	0.81	0.68	0.55	0.91	2.02	110	110	M
Mean	0.89	0.84 0.57 0.30	0.82 0.56 0.24	1.12 0.75 0.40	2.56 1.72 0.81	0.68 0.64 0.59	0.73 0.62 0.55	0.91 0.85 0.77	2.55 2.28 1.95	120	110	

be provided with radial ridges continuing outside the edge of the velum as fine spines; such structures were not observed in any of the present specimens. Moreover, the presulcate node of STEUSLOFF's species seems to be smaller, and judging by the drawing, the appearance of the dorsal ends of the crests are different from those of my specimens (whether the drawing correctly reproduces their appearance may be questionable, however). At any rate, the characteristic appearance of the velum is a feature differentiating *Steusloffia lineata* var. *granulosa* from the present species.

Description. Carapace of moderate or fairly large size, practically equivalved.

Dorsal margin straight and long; anterior and posterior margins about equally rounded, or the anterior slightly more curved; ventral margin moderately or fairly little convex.

Anterodorsal angle slightly more obtuse than the posterodorsal.

Sulcate region considerably gibbous, the postsulcate region (especially its anteroventral part) more than the presulcate: area between velum and free margin rather broad, outer part practically straight, inner part slightly concave; a narrow and rather low but distinct ridge (directed outwards) runs just along the free margin (the ridge best developed in the right valve).

Velum in adult specimens and late larval stages fairly broad, but thin and fragile, therefore, often broken; anterior end sometimes not exactly extending to the anterodorsal corner, median part of posterior section often low, posterodorsal end continuing in the backwardly directed dorsal extension of *CIII*; velum directed outwards. In young stages velum is poorly developed, occurring only as a low ridge.

Sulcus (*SII*) deep (a small but fairly distinct depression just behind the middle of the presulcate node = central muscle spot) and broad (broader in the dorsal half, in some large specimens the ventral half is as broad as the dorsal); it extends ventrally to centroventral area, and is curved backwards.

Just in front of the presulcate node is a narrow and shallow furrow (slightly curved forwards) which certainly corresponds to *SI*. Traces of *SIII* could not be observed.

Presulcate node large, extending over dorsocentral and central areas, in transverse section rounded, outline dorsoventrally ovate; in a few specimens one may discern traces of a very low and indistinct ridge traversing in dorsoventral direction.

Another node occurs in the ventral part of the area between *CIII* and *CIV*; it is small and externally often not very distinct so it may be overlooked, but in internal moulds it is generally prominent (situated on the highest point of the mould).

A third, small and low node situated in the anterodorsal corner was observed in one specimen from the lower part of stratum *G* (the holotype).

Surface crests are thin and fragile, meeting just posterior to the ventral end of sulcus; they are developed in the following way:

CI forms a wide curve directed forwards, running just in front of the furrow corresponding to *SI*; its dorsal end declines backwards following the dorsal margin (in some cases it extends to the dorsal end of *CIII*).

CII sometimes traceable as an indistinct ridge traversing the presulcate node in dorsoventral direction.

C III runs just along the edge of the posterior margin of *S II* forming a slight backward curve; dorsal end declined backwards (sometimes continuing in the velum).

C IV forms a wide backward curve enclosing the postsulcate node; generally it extends to dorsocentral area (not observed to reach the backward declined dorsal end of *C III*).

In young stages the crests are poorly developed, or not developed at all.

In internal moulds there are, as a rule, no ridges corresponding to the surface crests; in a few cases such ridges were observed, however.

Surface for the greater part crowded with small but very distinct nodules situated like knots in a reticulum (sulcus smooth, except in dorsal and ventral ends, which, like the presulcate node, are minutely and indistinctly granulate); area between velum and free margin in the ventral section minutely striate conforming to the margin, or smooth (anterior sections sparsely and finely granulate).

Notes on the larval development. Very young stages are dissimilar from later stages and adult specimens in lacking surface crests; their identity is certain, however, since a fairly long sequence of ontogenetic stages was observed.

From this sequence it appears that the crests (as well as the velum) grew higher during the ontogenetic development, and that the backwardly directed dorsal extensions of *C I* and *C III* appeared in late larval stages and in adult specimens. Furthermore, the dorsal margin seems to be proportionally longer, and the anterodorsal angle somewhat less obtuse in very young stages than in later ones.

The surface nodulation is very similar in all stages examined, and the small postsulcate node was observed even in the youngest stages.

Occurrence. Lower Ordovician: lower part of stratum *G* (from just above *R I/G* to about 1.1 m above this boundary); upper part of stratum *G* and ower part of stratum *R II* (from about 1.5 m below *G/R II* to about 1.0 m above this boundary; one single specimen about 1.5 m below *G/R II*) at Gulleråsen, Stenberg, Leskusänget, Rävanäs, Silverberg II, Born-Dådran, Röjeråsvägen, and Silverberg (sample 1), in Dalecarlia, Sweden.

Discussion. The vertical distribution of this species is different from those of the other ostracodal species observed during this investigation, which occur in a generally restricted horizon. The majority of the present species occur in the lowermost part of stratum *R II*, one single and obviously occasional specimen was found about 1.5 m below *G/R II*, but in the lower part of stratum *G* a real population (though few in number) has been embedded.

The specimens from the lower part of stratum *G* have the characteristic surface nodulation of *S. polynodulifera* and the same arrangement of the crests, so the specific identity may be fairly certain, as far as I can see. Only one slight difference was observed: in one specimen from the lower horizon (the holotype) there is a small node in the anterodorsal corner, but such a node was not observed in the specimens from the higher horizon. Whether this node is characteristic of all specimens of the low horizon was not determinable, since this part of the carapace was damaged in the other specimens. The permanence of the presulcate node has been questioned by THORSLUND (1940, p. 178); in the present case, this character may not be of specific value.

The vertical distribution of this species may be explained in the following way:

The species probably required such ecological conditions as those prevailing on an ocean coast. A fairly isolated basin may not have been favourable.

Presumably, the species lived in the ocean outside the Siljan District during the *G* and *R II* stages (not unlikely also during at least the final part of *R I*). In the Siljan District it could live mainly during the periods when the communication with the ocean was open. As the communication at the time of the development of *R I/G* was choked, the ecological conditions grew unfavourable, and the population of the Siljan District relatively soon became extinct. The occasionally occurring specimen about 1.5 m below *G/R II* may have been transferred into the Siljan District, but may soon have succumbed in the unfavourable surroundings. But as soon as the communication with the ocean had been permanently re-established (*G/R II*), the species invaded the Siljan District from the ocean in great numbers, where, as anticipated, it may have lived during at least the whole *G* stage.

Steusloffia* sp. *A (sine nomine).

Pl. X, Fig. 10.

This species is represented by only one valve, which additionally is somewhat damaged. On that account I prefer to describe it *sine nomine*, in spite of the fact that the parts preserved apparently show so characteristic features that the type might be described by name. The specimen is interesting from a taxonomic point of view in having the characteristic features of *Steusloffia*, except surface crests (cf. below: affinities).

Type. The only specimen known is shown in Pl. X, Fig. 10 (P. I. U. No. ar. os. 719).

Locality of type. Born-Dådran, in Dalecarlia, Sweden.

Stratum of type. Lower Ordovician: lower part of stratum *R II* (about 0.5 m above *G/R II*).

Material. One somewhat damaged valve.

Diagnosis. *Steusloffia* of non-typical appearance in lacking surface crests; node of anterodorsal corner fairly distinct; velum rather broad; surface crowded with tubercles of mutually somewhat irregular size.

Affinities. Though lacking surface crests, the type, at least provisionally,

Dimensions.

No.	L	H	D M	F M	Vel.	H/L	D M/L	Vel./L	F M/D M	∧ ant	∧ post	Re-mark
ar. os. 719	0.95	0.63	0.90	1.74	0.12	0.66	0.95	0.13	1.93	115	105	V

may be considered a *Steusloffia*, since it is otherwise identical with this genus (appearance of sulcus, presence of a certainly large presulcate node and of a node in the anterodorsal corner, presence of a velum, and granulations on the surface). Further investigations will perhaps show that the type should properly be removed from *Steusloffia* and classed in a new genus or subgenus. The distinguishing feature is in such a case the presence or non-presence of surface crests. (There are really non-crested specimens among *Steusloffia*, but these specimens are young larval stages; the present specimen is adult, or a late larval stage.)

Description. Carapace of somewhat small size; whether or not it is equivalved could not be ascertained, since only one separate valve was observed.

Dorsal margin straight and apparently long (posterior part damaged); anterior margin seems to be slightly more curved than the posterior; ventral margin moderately convex.

Anterodorsal angle may be a little more obtuse than the posterodorsal (posterodorsal corner damaged).

Sulcate region, on the whole, slightly arched, area just behind ventral part of sulcus, and dorsal area somewhat swollen (area between velum and free margin not observed).

Velum broad (at least ventral section), and plane.

Sulcus (*S II*) extending from dorsocentral to centroventral area; it is deep (in the central part is a distinct depression = central muscle spot), broad (dorsal part broadest, ventral half tapering), and gently curved backwards.

Presulcate node presumably large (damaged).

A small and low but distinct node in the anterodorsal corner.

Surface (except dorsal area, anterodorsal node, central section of sulcus, and ventral part of velum) crowded with minute tubercles intermingled with somewhat larger ones, especially in the postsulcate region, ends of sulcus additionally very finely wrinkled; the non-tuberculate areas smooth.

Occurrence. Lower Ordovician: lower part of stratum *R II* (about 0.5 m above *G/R II*) at Born-Dådan, Dalecarlia, Sweden.

Survey of the dimensions of *Steusloffia*.

The mean dimensional data grouped in the following table are scarcely comparable, since *Steusloffia* sp. *A* is represented by only one specimen. It appears, as if the dorsal margin of this species should be very long.

	Number	L	H	G	D M	F M	Vel.	$\frac{H}{L}$	$\frac{G}{L}$	$\frac{DM}{L}$	$\frac{Vel.}{L}$	$\frac{FM}{DM}$	$\wedge$ ant	$\wedge$ post
Steusloffia polynodulifera	19	0.89	0.57	0.56	0.75	1.72	—	0.64	0.62	0.85	—	2.28	120	110
Steusloffia A (sine nomine)	1	0.95	0.63	—	0.90	1.74	0.12	0.66	—	0.95	0.13	1.93	115	105
							Mean	0.65	0.62	0.90	0.13	2.10	120	110

Family *Drepanellidae* SCHMIDT 1941.

Diagnosis. SCHMIDT 1941, p. 49.

Discussion and remarks. This family has been given different ranges by SWARTZ, who erected the family (1936), and by SCHMIDT, who revised it (1941).

SCHMIDT parted the genera which, according to him, are referable to Drepanellidae into two groups:

A. Genera seemingly related to Hollinidae.

B. Genera generally referred to Primitiidae.

My experience of several genera referred to Drepanellidae is not sufficient to allow a closer judgement concerning their taxonomic position, except for *Steusloffia* which SCHMIDT, with reservation, referred to the *A* group; I refer this genus to the subfamily Tetradellinae (family Hollinidae). For the present, I follow SCHMIDT for the rest.

The present material includes a few incompletely preserved specimens which are possibly referable to the *B* group (two valves considered to belong to *Ulrichia* JONES and one to a closely related genus, not unlikely *Pseudulrichia* SCHMIDT).

Genus *Ulrichia* JONES 1890.

Genotype. *Ulrichia conradi* JONES 1890.

Occurrence. Ordovician—Devonian.

Diagnosis. SCHMIDT 1941, p. 52.

Remark. According to SCHMIDT's revised list of species belonging to *Ulrichia* (1941, p. 54), this genus is represented in the following way (4 species considered by SCHMIDT to be generically uncertain):

	Europe	N. America	
Devonian		7	7
Gotlandian	2	1[1]	3
Ordovician	4		4
	6	8	14

[1] Also reported from the Upper Ordovician.

Three Ordovician species are Middle Ordovician (two in England and one in Bohemia). *U.? perforata ?* BARRANDE from Bohemia is Lower Ordovician.

Ulrichia ? sp.

Pl. X, Fig. 11.

Type. The best preserved specimen is shown in Pl. X, Fig. 11 (P. I. U. No. ar. os. 720).

Locality of type. Stenberg, in Dalecarlia, Sweden.

Stratum of type. Lower Ordovician: lower part of stratum *G* (about 0.8 m above *R I/G*).

Material. 2 badly preserved valves.

Affinities. The specimens may be referred to *Ulrichia* on account of the appearance of the swellings. The fact that these swellings are ovate excludes the possibility of the specimens belonging to *Pseudulrichia*.

Since, however, the surface is smooth (non-typical for *Ulrichia*), and no *Umbiegungskante* (typical for *Ulrichia*) was observed, the reference to *Ulrichia* is very uncertain.

Description. Only the area bearing two swellings preserved.

Swellings low and ovate; situated fairly close to each other and apparently at some distance from the dorsal margin.

Surface appears smooth.

Occurrence. Cf. above (locality and stratum of type).

Genus *Pseudulrichia* SCHMIDT 1941.

Genotype. *Leperditia bivertex* ULRICH 1879.

Occurrence. Ordovician—Gotlandian.

Diagnosis. SCHMIDT 1941, p. 59.

Remark. SCHMIDT referred 4 species to *Pseudulrichia*. One is Gotlandian (Bohemia), the others are Ordovician: two from the Middle Ordovician of England; another from the Middle Ordovician of America also reported from Bohemia.

Pseudulrichia ? sp.

Pl. X, Fig. 12.

Type. The only specimen known is shown in Pl. X, Fig. 12 (P. I. U. No. ar. os. 721).

Locality of type. Leskusänget, in Dalecarlia, Sweden.

Stratum of type. Lower Ordovician: lower part of stratum *G* (about 1.0 m above *R I/G*).

Material. One valve, encrusted with limonite and slightly damaged.

Affinities. The specimen may be referable to *Pseudulrichia* on account of the presence of two rounded swellings situated dorsally and parted by a slight depression; furthermore on account of the absence of *Umbiegungskante* and of the fact that the surface is smooth. However, the swellings may be situated more close to the dorsal margin than is generally the case in *Pseudulrichia*.

Description. Specimen small (L = 0.54 mm).

Dorsal margin appears straight (not clearly visible); anterior and posterior margins rather regularly rounded; ventral margin slightly convex.

Valves gently arched.

Two low and rounded swellings slightly protruding over dorsal margin (this protrusion may have been accentuated on account of the limonite encrusting); swellings parted by a slight dorsoventral depression. A third small swelling occurs just ventral to one of the two swellings mentioned.

Surface smooth.

Occurrence. Cf. above (locality and stratum of type).

Family *Kloedenellidae* (ULRICH and BASSLER 1908).

Occurrence. Ordovician ?, Gotlandian—Carboniferous.

Diagnosis. ULRICH and BASSLER 1923, p. 312 (cf. SCHMIDT 1941, p. 71).

Genus *Kloedenella* ULRICH and BASSLER 1908.

Genotype. *Kloedenia pennsylvanica* JONES 1889.

Occurrence. Ordovician ?, Gotlandian—Carboniferous.

Diagnosis. ULRICH and BASSLER 1923, p. 313.

Discussion and remarks. In the present material there was found one specimen which may provisionally be considered a *Kloedenella*. At least, as far as I can see, it shows the greatest similarities to this genus. Further finds will not unlikely show that a new genus must be erected for this type and its allies.

The type is principally identical with *Kloedenella* as regards the sulci: one situated in the anterodorsal corner, and the other behind this one. (According to my discussion of the orientation of the carapace [p. 118 f.], the sulcate end is the anterior and not the posterior, as said by ULRICH and BASSLER.) Also as regards gibbosity of the valves and their outline, the present specimen is similar to *Kloedenella*.

Concerning the details of the lobes, the posterior ("the median lobe") is more shallow and indistinct than is generally the case in *Kloedenella*. Furthermore, it is situated more posteriorly (only just before the midlength).

The present type, occurring considerably earlier than any *Kloedenella* species known, will perhaps appear to belong to a group of species important for the elucidation of the phylogeny of *Kloedenella*.

According to BASSLER and KELLETT (1934), *Kloedenella* is represented as follows (the taxonomy of the species appears certain):

	Europe	N. America	
Devonian		4	4
Carboniferous	1		1
Gotlandian		12	12
	1	16	17

Additionally, one Asiatic species not more closely dated than as Lower Paleozoic has been reported (*K. birmanica* REED).

Kloedenella ? dorsodepressula n. sp.

Pl. X, Fig. 8.

The present type is represented by only one valve (slightly damaged), and it is generically somewhat uncertain, but I describe it by name, since it has a very characteristic appearance.

Derivation of name. *dorsodepressula* alludes to the depressed dorsal area.

Holotype. The type shown in Pl. X, Fig. 8 is holotype (P. I. U. No. ar. os. 723).

Locality of holotype. Rävanäs, in Dalecarlia, Sweden.

Stratum of holotype. Lower Ordovician: middle part of stratum *G* (about 1.7 m above *R I/G*).

Material. One valve (slightly damaged).

Dimensions.

No.	L	H	G	D M	F M	$\frac{H}{L}$	$\frac{G}{L}$	$\frac{DM}{L}$	$\frac{FM}{DM}$	∧ ant	∧ post	Remark
ar. os. 723	0.97	0.52	0.30	0.86	1.63	0.54	0.31	0.89	1.89	130	120	V

Diagnosis. Ostracod of fairly small size, provisionally referred to *Kloedenella*; dorsal area depressed; two sulci proceed from this area: one anterior (short but rather deep) and another median (very short and shallow), on each side surrounded by a slight, rounded swelling; the narrow area in front of anterior sulcus considerably swollen; surface, except dorsal area, minutely verrucose.

Affinities. The taxonomy of this species has been discussed on p. 363. It was indicated that it is partly a non-typical *Kloedenella*; perhaps it will appear to belong to a new genus closely related to *Kloedenella*.

On account of the depressed dorsal area and the appearance and position of the posterior sulcus the species is easily distinguishable from all known species of *Kloedenella*.

Description. Carapace of fairly small size; whether or not it is equivalved could not be determined, since only one separate valve was observed.

Dorsal margin straight and long; anterior margin slightly more curved than the posterior; ventral margin nearly straight.

Anterodorsal angle slightly more obtuse than the posterodorsal.

Dorsal area distinctly depressed, except the very anterior and posterior ends; anterior part of the depressed area broader than the posterior; the rest of the valve gently arched.

Two sulci, one anterior and one median, proceed from the depressed dorsal area.

Anterior sulcus proceeds from the most anterior end of the depressed dorsal area, and practically conforms to the dorsal part of anterior margin of the valve; it is rather short but fairly deep and distinct; area in front of this sulcus slightly swollen, broadest dorsally, dorsal end rounded.

Median sulcus is directed dorsoventrally and situated inconsiderably in front of the midlength; it is indistinct (very short and shallow, but fairly broad); surrounded on each side by a very low node.

Surface, except the depressed dorsal area, minutely verrucose; the depressed area smooth.

Occurrence. Lower Ordovician: middle part of stratum *G* (about 1.7 m above *RI/G*) at Rävanäs, in Dalecarlia, Sweden.

Family *Cypridae* SARS 1923.

Diagnosis. SARS 1923, p. 45.

Subfamily *Bairdiinae* SARS 1923.

Diagnosis. SARS 1923, p. 62.

Genus *Bythocypris* BRADY 1880.

Genotype. *Bythocypris reniformis* BRADY 1880 (recent).

Occurrence. Ordovician—Recent.

Diagnosis. BRADY 1880, p. 45.

Discussion and remarks. Obviously, it is impossible to decide definitely whether those fossil specimens which have been referred to *Bythocypris* are in reality congeneric with the recent genus *Bythocypris*. The latter is to a very great extent distinguished by the appearance of the extremities and other parts of the body, whereas the fossil specimens are only represented by carapaces and valves.

The fossil carapaces are very similar to the recent ones, and such as has been hitherto used, I describe the species of the type concerned as belonging to *Bythocypris*, well knowing that the congenerity is not proved.

The generic characters of *Bythocypris* are rather easily recognizable, at least as regards entire carapaces. The specific characters, on the contrary, may appear vague and uncertain, since the carapace, as a rule, is unsculptured. The Paleozoic genus *Cytherellina* JONES and HOLL, which was proposed by BASSLER and KELLETT to be rejected and ranged in *Bythocypris*, is an exception in this respect, viz. in its surface being minutely striate. Sometimes, however, other distinguishing characters occur, such as for instance in *B. monocarinata* n. sp.; in this species only one of the valves is provided with a ventral carina.

As a matter of fact, there are other characters of great taxonomic importance, though they are not very prominent. Such characters are the length of the hinge line, the shape of the dorsal area, and the appearance of the ventral overlap.

The dorsal area may be swollen either in one or both valves. The umbones thus formed are generally protruding over hinge line. The two umbones of one species are often differently protruded and of dissimilar shape; the differences, as a rule, are fairly minute.

Concerning the ventral overlap, the umbonate valve of monoumbonate species generally seems to be overlapped, and this also occurs to the valve with larger umbo in inaequiumbonate species.

In the present material, which (after exclusion of *B. monocarinata* n. sp.) mainly consists of specimens that are very similar to each other, such small differences as now mentioned are discernible. Owing to minute dissimilarities concerning the dorsal area, combined with differences in the length of hinge line and the appearance of the ventral overlap, the specimens can be divided into 6 different groups, which are here classed as species. Intermediate types were not observed. These species form a vertical sequence where only a few are perfectly or partly contemporary (cf. Pl. XXIII). A short taxonomic survey of the species is given below.

B. nonumbonata n. sp.: Nonumbonate; hinge line long; ventral margin convex; one long type of carapace and one short discerned.

B. elongata n. sp.: Nonumbonate; hinge line short; ventral margin slightly concave.

B. monoumbonata n. sp.: Monoumbonate, umbo rather long and not ridged, outward side arched, hinge side flattened; dorsal part of nonumbonate valve gently arched; umbonate valve overlapped ventrally.

B. obliquedorsata n. sp.: Monoumbonate, umbo long and ridged, outward side arched, hinge side flat (flatter than in *B. monoumbonata*); dorsal area of nonumbonate valve flat (steeply sloping); hinge line short and narrow; umbonate valve overlapped ventrally.

B. curvata n. sp.: Monoumbonate, umbo short and low, not ridged; ventral margin slightly concave; umbonate valve overlapped ventrally (slight overlap).

B. ellipsiformis n. sp.: Both valves umbonate, umbones short and slightly swollen, somewhat different.

From this survey it appears that it is impossible to recognize species only on the basis of the appearance of separate valves. There is reason to assume that in the present material is one more *Bythocypris* species than those represented by carapaces, but since it occurs only as separate valves its identity cannot be proved and, hence, it is described as *Bythocypris* sp. *A*.

Bythocypris is represented in all the localities examined here. It appears in fairly small numbers, but occurs rather permanently in the whole stratal sequence investigated. The genus has been reported earlier from a great many Paleozoic localities. BASSLER and KELLETT (1934) enumerate no less than 95 Paleozoic species. There is reason to believe that many of them are generically uncertain: BASSLER and KELLETT consider 15 out of the 95 species generically doubtful. The identity of many of the remaining species is also certainly dubious, for instance those reported both from the Island of Gotland and Australia (several species). To give an idea of the distribution of the Paleozoic species referred to *Bythocypris* I made the following tabular survey (BASSLER and KELLETT).

	Europe	N. America	
Permian	1	3	4
Carboniferous	9	16	25
Devonian	10	10	20
Gotlandian	29	6	35
Ordovician	8	3	11
	57	38	95

The three Ordovician species from America are Middle Ordovician (two of them considered generically uncertain).

Four of the Ordovician species from Europe originate from Middle Ordovician of Estonia, viz. those referred by BONNEMA to *Cytherellina*. The remaining four species are reported by KUMMEROW from North German drifts. Their age is not more precisely determined: three of them are said to have been found in "a sort of algal limestone of about the same age as the Lyckholm stratum", i. e. Upper Ordovician (KUMMEROW 1924, p. 436).

In the present paper 8 Lower Ordovician *Bythocypris* species are described. It may be noted that in the tables DM = hinge line.

Bythocypris monocarinata n. sp.

Pl. X, Figs. 13 and 14.

The two carapaces which represent this species are somewhat different, mainly as regards the appearance of the carina. However, they are similar as regards so many characters that they may be conspecific. I think that the differences are due to the circumstance that the types represent different ontogenetic stages.

Derivation of name. *monocarinata* alludes to the fact that one valve of the carapace has a ventral carina.

Holotype. The type shown in Pl. X, Fig. 14 is holotype (P. I. U. No. ar. os. 725).

Locality of holotype. Granmor, in Dalecarlia, Sweden.

Stratum of holotype. Lower Ordovician: upper part of stratum *G* (about 0.4 m below *G/R II*).

Material. Two carapaces from two localities.

Dimensions.

No.	L	H	G	D M	F M	$\frac{H}{L}$	$\frac{G}{L}$	$\frac{DM}{L}$	$\frac{FM}{DM}$	Remarks
ar. os. 725	*1.19*	*0.79*	*0.70*	*0.72*	*2.32*	*0.66*	*0.61*	*0.61*	*3.22*	C
ar. os. 726	0.93	0.58	0.57	0.60	1.81	0.62	0.61	0.64	3.01	C
Mean	1.06	0.69	0.64	0.66	2.07	0.64	0.61	0.63	3.12	

Diagnosis. *Bythocypris* of moderate size; valves distinctly unequal: left valve gibbous, right one provided with a ventral carina; both valves umboniferous; umbones short, ridged, and somewhat protruding over middle part of hinge line; surface indistinctly and irregularly striate.

Affinities. The species is characterized by the pronounced inequality of the valves and, therefore, distinguishable from other species known.

Description. Carapace of moderate size; inequivalved: the left valve is the larger, overlapping the right along the ventral margin.

Hinge line straight and fairly long, concealed, except at the ends, by the umbones; anterior margin somewhat more broadly rounded than posterior; ventral margin moderately convex.

Left valve rather gibbous, especially the ventral half which is protruding over ventral margin.

Right valve provided with a short ventral carina of somewhat different appearance: angle in specimen No. ar. os. 725 (the holotype) slightly obtuse (in No. ar. os. 726 somewhat acute), the very edge faintly but rather distinctly pinched (in No. 726 not pinched); area between carinal edge and free margin practically plane (in No. 726 somewhat concave); outward side of carinal edge of right valve invariably flattened.

Both valves umboniferous: umbones short and slightly ridged, that of the left valve somewhat broader than that of the right one.

An indistinct smooth spot discernible in the central area just in front of the midlength (presumably central muscle spot) and another in the anterior part of centroventral area (presumably an antennal muscle attachment).

Surface indistinctly and somewhat irregularly striate, except mainly the ventral area which is smooth.

Occurrence. Lower Ordovician: upper part of stratum *G* (about 0.4—1.0 m below *G/R II*) at Granmor and Silverberg II, in Dalecarlia, Sweden.

Bythocypris nonumbonata n. sp.

Pl. XI, Figs. 3 and 4.

To this species are referred two types: one relatively long and low and another relatively short and high. It may be debatable whether they are conspecific, but until more material is found, they are considered as belonging to one species (cf. discussion below).

The two types, called *a* and *b*, are described separately.

Derivation of name. *nonumbonata* alludes to the absence of umbones.

Holotype. The type shown in Pl. XI, Fig. 3 is holotype (P. I. U. No. ar. os. 728).

Locality of holotype. Rävanäs, in Dalecarlia, Sweden.

Stratum of holotype. Lower Ordovician: lower part of stratum *G* (about 0.6 m above *R I/G*).

Diagnosis. *Bythocypris* of fairly small size; one relatively long and low type, and another relatively short and high; hinge line fairly short; valves nonumbonate; ventral overlap rather short but distinct; surface appears very slightly rugose.

Affinities. The species may resemble one or other specimen of *B. monoumbonata* n. sp. provided with a low umbo. However, *B. monoumbonata* never lacks an umbo and is hence distinguishable from the present species.

The nonumbonate *B. elongata* is different mainly in being proportionally longer and in its ventral side being concave. Furthermore, there is in this species a minute extra convexity of the dorsal margin just in front of the hinge line.

Type *a* (long type).

Pl. XI, Fig. 3.

Type. This type includes the holotype (P. I. U. No. ar. os. 728).

Locality and stratum of type. Cf. above.

Material. 3 carapaces and presumably 1 valve from 3 localities.

Dimensions.

No.	L	H	G	D M	F M	H / L	G / L	D M / L	F M / D M	Remark
ar. os. 735	0.74	0.37	0.37	0.48	1.37	0.50	0.50	0.65	**2.85**	C
ar. os. 729	0.74	0.37	0.36	0.49	1.28	0.50	0.49	0.66	2.61	V
ar. os. 728	*0.72*	*0.38*	*0.35*	*0.45*	*1.28*	*0.53*	*0.49*	*0.63*	*2.84*	C
ar. os. 733	0.72	0.36	0.37	0.48	1.32	0.50	0.51	0.67	2.75	C
Mean	0.73	0.38 0.57 0.36	0.37 0.36 0.35	0.49 0.48 0.45	1.37 1.31 1.28	0.53 0.51 0.50	0.51 0.50 0.49	0.67 0.65 0.63	2.85 2.76 2.61	

Description. Carapace rather small and elongate; inequivalved: left valve the larger, slightly but distinctly overlapping the right along the ventral margin.

Hinge line fairly short (visible in side view in all its extension, no umbones); anterior margin regularly and considerably convex, posterior gently curved in the dorsal half but much in the ventral; ventral margin considerably convex.

Valves nonumbonate.

An indistinct small depression discernible in the central area just in front of the midlength (presumably central muscle spot).

Surface very slightly rugose.

Occurrence. Lower Ordovician: upper part of stratum *RI* and lower part of stratum *G* (from about 0.2 m below *RI/G* to about 1.7 m above *RI/G*) at Rävanäs, Granmor, and Silverberg (sample 2), in Dalecarlia, Sweden.

Type *b* (short type).

Pl. XI, Fig. 4.

Type. A characteristic specimen is shown in Pl. XI, Fig. 4 (P. I. U. No. ar. os. 727).

Locality of type. Gulleråsen, in Dalecarlia, Sweden.

Stratum of type. Lower Ordovician: lower part of stratum *G* (about 0.7 m above *RI/G*).

Material. 2 carapaces from one locality.

Description. This type is similar to type *a*, except mainly in being proportionally shorter and higher; but, they are dissimilar in some minor respects: hinge line is proportionally somewhat shorter, and dorsal part of anterior margin is somewhat less convex than in type *a*.

Occurrence. Lower Ordovician: lower part of stratum *G* (about 0.7 m above *RI/G*) at Gulleråsen, in Dalecarlia, Sweden.

Dimensions.

No.	L	H	G	D M	F M	H/L	G/L	D M/L	F M/D M	Re-mark
ar. os. 741	1.08	0.65	0.63	0.63	2.21	0.60	0.58	0.58	3.51	C
ar. os. 727	*0.65*	*0.41*	*0.37*	*0.38*	*1.39*	*0.63*	*0.57*	*0.58*	*3.66*	C
Mean	0.87	0.53	0.50	0.51	1.80	0.62	0.58	0.58	3.58	

Discussion. The types described above are similar as regards the important character that both are nonumbonate. The dimensional dissimilarities and the differences concerning outline are conceivably due to specific or subspecific differences or to variability within the specific range. It is scarcely possible to decide which of the alternative is correct, but I think that the types may be considered conspecific.

The types are so different that the difference is scarcely due to individual variation, nor may they represent different moult stages since they do not form a continuous sequence. They are possibly sexual dimorphisms. If so, it is impossible to know which type is male and which is female. On the other hand, the possibility of one type being subspecies in relation to the other may also not be excluded.

However, the scattered material does not allow any judgement in these questions.

Bythocypris monoumbonata n. sp.

Pl. XI, Figs. 5 and 6.

Two types of this species are discernible: one relatively long and low, and another relatively short and high; the types are also slightly different as regards the umbo.

The types, called *a* and *b*, are described separately.

Derivation of name. *monoumbonata* alludes to the fact that only one of the valves is umbonate.

Holotype. The type shown in Pl. XI, Fig. 5 is holotype (P. I. U. No. ar. os. 730).

Locality of holotype. Leskusänget, in Dalecarlia, Sweden.

Stratum of holotype. Lower Ordovician: upper part of stratum *G* (about 0.9 m below *G*/*R II*; 2.6 m above *R I*/*G*).

Diagnosis. *Bythocypris* of moderate or fairly large size: one relatively long and low, and another relatively short and high type; hinge line fairly short; one valve umbonate, umbo rather short and broad, outer side more arched than hinge side; dorsal area of nonumbonate valve flattened; ventral overlap distinct; surface very minutely rugose.

Affinities. The species is reminiscent of *B. obliquedorsata* n. sp. in being monoumbonate. They are different mainly in the following respects: umbo of *B. obliquedorsata* more acutely ridged, hinge side of umbo more flattened, dorsal area of its nonumbonate valve flattened and more steeply sloping; moreover, the hinge line is narrower.

The *a* type of the present species is reminiscent of the *a* type of *B. non-umbonata*, since the umbo of this type is not very prominent. However, they are distinguishable in that the present type is really umbonate.

Type *a* (long type).

Pl. XI, Fig. 6.

Type. The only specimen found is figured in Pl. XI, Fig. 6 (P. I. U. No. ar. os. 731).

Locality of type. Stenberg, in Dalecarlia, Sweden.

Stratum of type. Lower Ordovician: lower part of stratum *G* (about 1.2 m above *R I/G*).

Material. One carapace (umbo partly slightly defective).

Dimensions.

No.	L	H	G	D M	F M	$\frac{H}{L}$	$\frac{G}{L}$	$\frac{DM}{L}$	$\frac{FM}{DM}$	Remark
ar. os. 731	1.00	0.52	0.51	0.60	1.90	0.52	0.51	0.60	3.16	C

Description. This type is very similar to type *b*, but is different mainly in being proportionally longer and lower; furthermore, the umbo appears somewhat lower.

Occurrence. Cf. above (locality and stratum of type).

Type *b* (short type).

Pl. XI, Fig. 5.

Type. This type includes the holotype (P. I. U. No. ar. os. 730).

Locality and stratum of type. Cf. p. 371.

Material. 4 carapaces from 2 localities.

Description. Carapace of moderate or fairly large size; inequivalved: left valve the larger, overlapping broadly the right one along ventral margin.

Hinge line straight and fairly long; anterior margin gently curved in the dorsal part (median part sometimes slightly acuminate); posterior margin regularly and fairly broadly rounded; ventral margin very slightly convex.

Right valve umboniferous: umbo fairly short and in the middle part rather broad, ridge rounded, outer side somewhat arched, hinge side rather flattened.

Dimensions.

No.	L	H	G	D M	F M	H/L	G/L	D M/L	F M/D M	Re-mark
ar. os. 730	*1.32*	*0.79*	*0.66*	*0.78*	*2.65*	*0.60*	*0.50*	*0.59*	*3.40*	C
ar. os. 732	1.19	0.75	0.58	0.72	2.44	0.63	0.49	0.61	3.39	C
ar. os. 734	0.78	0.49	0.42	0.45	1.49	0.63	0.54	0.58	3.30	C
Mean	1.09	0.79 0.68 0.49	0.66 0.55 0.42	0.78 0.65 0.45	2.65 2.19 1.49	0.63 0.62 0.60	0.54 0.51 0.49	0.61 0.59 0.58	3.40 3.36 3.30	

Left valve nonumbonate; dorsal area rather flattened.

An indistinct, small spot occurs in the central area just in front of the midlength (presumably central muscle spot).

Surface very minutely rugose (practically smooth).

Occurrence. Lower Ordovician: middle and upper part of stratum *G* (about 1.4—2.6 m above *R I/G*) at Leskusänget and Silverberg (sample 4), in Dalecarlia, Sweden.

Discussion. The two types now described are so similar that they are most certainly conspecific. The taxonomic importance of the difference concerning the proportions of length and height is difficult to decide: it may scarcely be due to individual variation (difference too large), but sooner to the fact that the types are sexual dimorphisms or that one is of subspecific range.

Bythocypris ellipsiformis n. sp.

Pl. XI, Figs. 7 and 8.

This species might be divided into two groups, according to different gibbosity. This difference, however, may be due only to the fact that the groups represent different moult stages. Since the groups are otherwise very similar, they are not described separately.

Derivation of name. *ellipsiformis* alludes to the fact that the carapace is almost ellipsoidal.

Holotype. The type shown in Pl. XI, Fig. 8 is holotype (P. I. U. No. ar. os. 736).

Locality of type. Leskusänget, in Dalecarlia, Sweden.

Stratum of type. Lower Ordovician: lower part of stratum *G* (about 1.4 m above *R I/G*).

Material. 6 carapaces and possibly 40 valves (identity somewhat uncertain) from 2 localities.

Diagnosis. *Bythocypris* of moderate size; carapace considerably gibbous; outline almost ellipsoidal; valves distinctly unequal: left valve more gibbous

Dimensions.

No.	L	H	G	D M	F M	H/L	G/L	D M/L	F M/D M	Remark
ar. os. 739	1.15	0.69	0.65	0.57	2.37	0.60	0.57	0.50	4.15	C
ar. os. 736	*1.09*	*0.65*	*0.64*	*0.58*	*2.16*	*0.60*	*0.59*	*0.53*	*3.72*	C
ar. os. 737	1.07	0.63	0.55	0.56	2.09	0.59	0.51	0.52	3.73	C
ar. os. 738	1.03	0.58	0.53	0.50	2.12	0.56	0.52	0.49	4.23	C
ar. os. 740[1]	0.63	0.37	0.31	0.35	1.26	0.59	0.49	0.54	3.60	C
Mean	0.99	0.69 0.58 0.37	0.65 0.54 0.31	0.58 0.51 0.35	2.37 2.00 1.26	0.60 0.59 0.56	0.59 0.54 0.49	0.54 0.52 0.49	4.23 3.89 3.60	

[1] Identity somewhat uncertain.

than the right; hinge line short, for the greater part concealed by the umbones; umbones rather short, fairly broad, and rounded (that of the left valve somewhat higher and broader); surface smooth.

Affinities. The species is distinguished by the fact that the carapace is considerably gibbous, that the valves are distinctly unequal, and that the ventral overlap is broad. It is scarcely confusable with any of the specimens now described. In general shape it is very reminiscent of the Middle Ordovician *Bythocypris* (*Cytherellina*) *jonesii* (BONNEMA); this species is striate, however (the present smooth).

Description. Carapace of moderate size; inequivalved: left valve distinctly larger and more gibbous, broadly overlapping the right one along ventral margin and slightly along anterior and posterior margins.

Hinge line short and straight, in side view for the greater part concealed by the umbones; anterior margin in the dorsal half more gently curved than in the ventral; posterior margin more regularly rounded than the anterior; ventral margin moderately or fairly slightly convex.

Both valves umbonate: umbones rather short, fairly broad, and rounded; that of the left valve somewhat higher and broader.

Surface smooth.

Occurrence. Lower Ordovician: lower part of stratum *G* (about 0.7—1.9 m above *R I*/*G*) at Leskusänget and Gulleråsen, in Dalecarlia, Sweden.

Bythocypris elongata n. sp.

Pl. X, Fig. 16.

Derivation of name. *elongata* alludes to the elongate carapace.

Holotype. The type shown in Pl. X, Fig. 16 is holotype (P. I. U. No. ar. os. 765).

Locality of holotype. Silverberg II, in Dalecarlia, Sweden.

Stratum of holotype. Lower Ordovician: upper part of stratum *G* (about 1.0 m below *G/R II*).

Material. 3 carapaces from 2 localities.

Dimensions.

No.	L	H	G	D M	F M	H/L	G/L	D M/L	F M/D M	Remark
ar. os. 742	0.87	0.42	0.41	0.41	1.70	0.48	0.47	0.47	4.15	C
ar. os. 765	*0.75*	*0.36*	*0.33*	*0.35*	*1.51*	*0.48*	*0.44*	*0.47*	*4.30*	C
ar. os. 743[1]	0.60	0.30	0.28	—	—	0.50	0.47	—	—	C
Mean	0.74	0.42 0.36 0.30	0.41 0.34 0.28	0.38	1.61	0.50 0.49 0.48	0.47 0.46 0.44	0.47	4.23	

[1] Identity somewhat uncertain.

Diagnosis. *Bythocypris* of fairly small size; carapace elongate; anterior margin rounded, posterior one slightly acuminate, dorsal margin regularly convex, ventral slightly but distinctly concave; valves nonumbonate; ventral overlap slight and short; surface smooth.

Affinities. The species is very reminiscent of *B. nonumbonata* n. sp. in that both species are nonumbonate, and also somewhat as regards outline. They are different mainly in that the ventral margin of the present species is slightly concave but that of *B. nonumbonata* slightly convex.

Furthermore, the species is reminiscent of *B. curvata* n. sp. as regards outline, especially in that the ventral margin is slightly concave in both species. They are different mainly in that *B. curvata* is monoumbonate (umbo small, however) but the present species nonumbonate. Furthermore, dorsal margin is somewhat differently curved (a slight extra convexity in *B. curvata* just in front of hinge line).

Description. Carapace elongate and of rather small size; inequivalved; left valve somewhat larger, slightly overlapping right valve along middle part of ventral margin.

Hinge line rather short; anterior and posterior sections of dorsal margin gently convex (anterior one slightly more convex than the posterior); anterior margin regularly rounded; posterior margin somewhat acute in the ventral half; ventral margin slightly concave.

Valves nonumbonate.

A very shallow and indistinct depression may be discerned in the central area somewhat in front of the midlength (presumably central muscle spot).

Surface smooth.

Occurrence. Lower Ordovician: upper part of stratum *G* (about 1.0 m below *G/R II*) at Silverberg II and Silverberg (sample 5), in Dalecarlia, Sweden.

Bythocypris obliquedorsata n. sp.

Pl. XI, Figs. 1 and 2.

Derivation of name. *obliquedorsata* alludes to the fact that the carapace is oblique dorsally because the flat and steeply sloping dorsal area of the nonumbonate valve forms the direct continuation of the flat hinge side of the umbo.

Holotype. The type shown in Pl. XI, Fig. 1 is holotype (P. I. U. No. ar. os. 745).

Locality of holotype. Rävanäs, in Dalecarlia, Sweden.

Stratum of holotype. Lower Ordovician: upper part of stratum *G* (about 0.1 m below *G/R II*).

Material. 4 carapaces from 2 localities.

Dimensions.

No.	L	H	G	D M	F M	$\frac{H}{L}$	$\frac{G}{L}$	$\frac{D M}{L}$	$\frac{F M}{D M}$	Re-mark
ar. os. 746	0.74	0.41	0.34	0.35	1.39	0.55	0.46	0.47	3.97	C
ar. os. 745	*0.70*	*0.55*	*0.33*	*0.35*	*1.39*	*0.50*	*0.47*	*0.50*	*3.97*	C
ar. os. 744	0.69	0.38	0.28	0.32	1.39	0.55	0.41	0.46	4.34	C
ar. os. 747	0.52	0.29	0.26	0.26	1.12	0.56	0.50	0.50	4.31	C
Mean	0.66	0.41 0.36 0.29	0.34 0.30 0.26	0.35 0.32 0.26	1.39 1.32 1.12	0.56 0.54 0.50	0.50 0.46 0.41	0.50 0.48 0.46	4.34 4.14 3.97	

Diagnosis. *Bythocypris* of fairly small size; monoumbonate: umbo fairly long, edge slightly acute, outer side arched, hinge side flattened; dorsal area of nonumbonate valve (left valve) flat and steeply sloping; hinge line short and narrow; ventral overlap rather slight; surface smooth.

Affinities. The species is reminiscent of *B. monoumbonata* n. sp. in being monoumbonate; differences between these species mentioned on p. 372.

Description. Carapace of fairly small size; inequivalved: left valve larger, slightly overlapping the right one along ventral margin.

Hinge line short and very narrow; anterior and posterior sections of dorsal margin fairly steeply sloping (the posterior somewhat more than the anterior); anterior and posterior margins very convex; ventral margin very slightly convex.

Right valve umbonate: umbo fairly long, edge slightly acute; outer side arched, hinge side flattened.

Left valve nonumbonate, dorsal area flat and steeply sloping, thus forming a direct continuation of the flat hinge side of umbo.

An indistinct and small depression discernible in the central area just in front of the midlength and just below the midheight (certainly central muscle spot).

Surface smooth (carapace thin).

Occurrence. Lower Ordovician: upper part of stratum *G* (about 0.4—0.1 m below *G*/*R II*) at Rävanäs and Granmor, in Dalecarlia, Sweden.

Bythocypris curvata n. sp.

Pl. X, Figs. 15 and 17.

Derivation of name. *curvata* alludes to the fact that the dorsal margin is convex and the ventral concave.

Holotype. The type shown in Pl. X, Fig. 15 is holotype (P. I. U. No. ar. os. 748).

Locality of holotype. Leskusänget, in Dalecarlia, Sweden.

Stratum of holotype. Lower Ordovician: lower part of stratum *R II* (about 0.7 m above *G*/*R II*).

Material. 9 carapaces and 18 valves from 5 localities.

Diagnosis. *Bythocypris* of fairly small size; monoumbonate: umbo (right valve) rather long and very low, edge rounded; hinge line short; dorsal margin convex, a minute extra convexity just in front of hinge line; dorsal section of posterior margin more steeply sloping than corresponding part of anterior margin; ventral overlap distinct; surface smooth.

Affinities. The species is very reminiscent of *B. elongata* n. sp.; differences mentioned on p. 375. It is also somewhat similar to *B. obliquedorsata* n. sp.; differences cf. p. 366 f. Furthermore it resembles *Bythocypris* sp. *A*, but differs from this one in that the anterior and posterior ends are less acute.

Description. Carapace of fairly small size; inequivalved: left valve larger, distinctly overlapping the right one along ventral margin; a slight overlap also discernible along anterior and posterior margins as well as along anterior and posterior sections of dorsal margin.

Hinge line short, dorsal margin gently convex, a minute extra convexity just in front of hinge line; anterior margin regularly and considerably convex (dorsal part forming a gentle slope); posterior margin slightly acuminate (dorsal part fairly steeply sloping); ventral margin slightly concave (that of left valve practically straight).

Right valve umbonate: umbo somewhat longer than hinge line, very low, and thus it may sometimes easily be overlooked, edge rounded.

Left valve nonumbonate; gibbosity about equal to that of right valve.

Dimensions.

No.	L	H	G	D M	F M	H/L	G/L	D M/L	F M/D M	Remark
ar. os. 755	0.78	0.37	0.42	—	—	0.47	0.54	—	—	V
ar. os. 748	*0.74*	*0.37*	*0.33*	*0.33*	*1.53*	*0.50*	*0.45*	*0.45*	*4.64*	C
ar. os. 753	0.74	0.34	0.33	0.33	1.44	0.46	0.44	0.45	4.36	V
ar. os. 754	0.72	0.38	0.33	0.31	1.47	0.53	0.46	0.43	4.73	C
ar. os. 757	0.71	0.37	0.33	—	—	0.52	0.47	—	—	V
ar. os. 752	0.69	0.31	0.30	—	—	0.45	0.43	—	—	V
ar. os. 758	0.66	0.35	0.30	—	—	0.53	0.46	—	—	V
ar. os. 749	0.60	0.31	0.29	0.26	1.28	0.52	0.48	0.43	4.91	C
ar. os. 751	0.60	0.30	0.28	0.27	1.18	0.50	0.47	0.45	4.37	C
ar. os. 750	0.58	0.30	0.27	0.24	1.16	0.52	0.47	0.41	4.83	C
ar. os. 759	0.50	0.27	0.23	—	—	0.54	0.46	—	—	V
ar. os. 756	0.44	0.21	0.20	—	—	0.48	0.45	—	—	V
Mean	0.65	0.38 0.32 0.21	0.42 0.30 0.20	0.33 0.29 0.24	1.53 1.34 1.16	0.54 0.50 0.46	0.54 0.47 0.43	0.45 0.44 0.41	4.91 4.64 4.36	

Central muscle spot best discernible in internal moulds; it is large and rounded, and situated in the central area somewhat in front of the midlength and just below the midheight.

Surface smooth.

Occurrence. Lower Ordovician: upper part of stratum *G* and lower part of stratum *R II* (from about 0.6 m below *G/R II* to about 0.8 m above this boundary) at Leskusänget, Röjeråsvägen, Rävanäs, Silverberg II, and Born-Dådran, in Dalecarlia, Sweden.

Bythocypris sp. ***A*** (sine nomine).

Pl. XI, Fig. 9.

In one horizon at Born-Dådran there occur *Bythocypris* specimens which may belong to a new species, or to a subspecies, possibly of *B. curvata* n. sp. Since only separate valves were observed, their identity is not yet ascertainable, and thus they are described *sine nomine.*

Type. A characteristic specimen is shown in Pl. XI, Fig. 9 (P. I. U. No. ar. os. 767).

Locality of type. Born-Dådran, Dalecarlia, Sweden.

Stratum of type. Lower Ordovician: lower part of stratum *R II* (about 0.8 m above *G/R II*).

Material. 5 valves and 4 internal moulds from one locality.

Dimensions.

No.	L	H	G	H/L	G/L	Remark
ar. os. 762	0.79	0.37	0.42	0.47	0.53	V
ar. os. 760	0.72	0.37	0.40	0.51	0.55	V
ar. os. 767	*0.67*	*0.35*	*0.36*	*0.52*	*0.54*	V
ar. os. 761	0.67	0.37	0.34	0.55	0.51	V
ar. os. 763	0.53	0.26	0.28	0.49	0.53	V
Mean	0.67	0.37 0.34 0.26	0.42 0.36 0.28	0.55 0.51 0.47	0.55 0.53 0.51	

Affinities. On account of the fact that only separate valves have been found, it is difficult to estimate the affinities of the specimens here grouped as *Bythocypris* sp. *A*. However, the valves are reminiscent of *Bythocypris curvata* n. sp.; differences mentioned on p. 377.

Description. Carapace of fairly small size; since only separate valves were found, the overlap was not observed.

Hinge line seems to be short; dorsal margin considerably convex, a slight extra convexity just in front of hinge line, section in front of this one more steeply sloping than posterior section of dorsal margin; anterior margin regular and very convex; posterior margin slightly acuminate in the ventral half (dorsal half fairly steeply sloping); ventral margin practically straight.

Valves monoumbonate: umbo (right valve) appears short, edge rounded.

Central muscle spot observed in internal moulds; it is fairly large and rounded, situated in central area somewhat in front of the midlength and just below the midheight.

Surface smooth.

Occurrence. Cf. above (locality and stratum of type).

Survey of the dimensions of *Bythocypris*.

Since the species are represented by so few specimens, the following mean data may be only little representative. However, the mostly minute differences as regards morphological characters upon which the taxonomy here proposed is based seem to be corresponded by one or more dimensional dissimilarities.

Concerning the two species within which two types have been discerned, the dimensional proportions are in one species rather the same as regards three characters but different as regards the fourth (*B. monoumbonata*: the height); in the second species (*B. nonumbonata*), the dimensional proportions seem to be rather dissimilar as regards all the characters considered. It might be questioned whether the types (at least in *B. nonumbonata*) are different species. But until more material is found, the types may be grouped as proposed here.

It appears further that the 4 species occurring in the upper part of the stratal sequence investigated (exclusive of the unique *B. monocarinata*) are dimensionally fairly similar to each other and different from the species appearing below (the 4 lowermost species of the table contra the remaining ones, except *B. monocarinata*). The most striking dimensional difference is referable to the length of the hinge line which is mostly shorter in the upper group.

The dimensional differences between the two groups are corresponded by morphological dissimilarities. In the upper group, the dorsal margin is more arched than in the lower, and the ventral margin is mostly concave (in the lower group it is convex); furthermore the posterior end is generally more acute.

	Number	L	H	G	DM	FM	H/L	G/L	DM/L	FM/DM
B. monocarinata	2	1.06	0.69	0.64	0.66	2.07	0.64	0.61	0.63	3.12
B. nonumbonata a	4	0.73	0.57	0.36	0.48	1.31	0.51	0.50	0.65	2.76
B. nonumbonata b	2	0.87	0.53	0.50	0.51	1.80	0.62	0.58	0.58	3.58
B. monoumbonata a	1	1.00	0.52	0.51	0.60	1.90	0.52	0.51	0.60	3.16
B. monoumbonata b	3	1.09	0.68	0.55	0.65	2.19	0.62	0.51	0.59	3.36
B. ellipsiformis	5	0.99	0.58	0.54	0.51	2.00	0.59	0.54	0.52	3.89
B. elongata	3	0.74	0.36	0.34	0.38	1.61	0.49	0.46	0.47	4.23
B. obliquedorsata	4	0.66	0.36	0.30	0.32	1.32	0.54	0.46	0.48	4.14
B. curvata	12	0.65	0.32	0.30	0.29	1.34	0.50	0.47	0.44	4.46
B. sp. *A* (sine nomine)	5	0.67	0.34	0.36	—	—	0.51	0.53	—	—
						Mean	0.55	0.52	0.55	3.65

The development of the ostracodal fauna of the strata investigated.

The vertical distribution of the ostracods is reproduced quantitatively in Plates XIX—XXIV.

The frequency data are referable to the numbers of specimens observed in 10 samples weighing together 100 g (cf. p. 116 f.). The taxonomical units are plotted in the same profile where the distance between *R I/G* and *G/R II* corresponds to the maximal distance observed (4 m). The position of each taxonomic unit is marked, starting from one of these lines. Since the thickness of stratum *G* in all localities but one is less than 4 m, the impression of the low frequency in the middle and upper part of stratum *G* is somewhat accentuated.

Frequencies less than 1 are marked by an uniform sign.

The mutual total frequency distribution among the genera and the species respectively is graphically reproduced in Pl. XXVI.

Pl. XXV demonstrates the total frequency of ostracods in the reference mass. The diagram also shows the number of specimens observed, the number of samples investigated, the calculated frequency per 10 samples, and the correction factor for the weight.

The total frequency per 10 samples/100 g was obtained by calculating the number per 10 samples and referring this number to a weight of 100 g.

This diagram shows that the frequency is fairly low in the uppermost part of stratum *R I*. The frequency has increased just above *R I/G*, but a remarkable decrease just a little higher up appears at 3 localities: Leskusänget, Gulleråsen, and Granmor. Whether this decrease is general for the whole district is not known, but it is conceivable.

The intervals between the samples in this part of the stratal sequence are smaller in the localities mentioned than in others. The horizon concerned may have happened not to have been represented in the thinner sequences of samples from the other localities.

The following very high frequency, somewhat below the highest frequency of ooids, is observed in all localities but one, i. e. Rävanäs. The intervals between the samples are great in this locality, and the consideration may not be excluded that the richest ostracod-bearing stratum was not represented among the samples.

The frequency rapidly decreases in the oolitic zone mentioned, and in the greater part of the remaining section of stratum *G* it is very low. The reason for the practical extinction in the oolite of large ostracodal groups may be the heavy precipitation of hydrous iron oxide at that time. The respiratory tissues were coated by the colloidal hydrous oxide and thus put out of function so that the animals succumbed. The heavy precipitation of hydrous iron oxide may partly have been a consequence of the fact that the ostracods were so numerous (cf. discussion below).

In the uppermost part of stratum *G* ostracods appear in a somewhat larger number, but just above *G*/*R II* the frequency has become considerably greater; locally it has increased enormously, as demonstated in Leskusänget. However, the frequency was soon diminished again. This appears more distinctly from the diagrams showing the total frequency of ostracods in all the localities (Pl. XXIII and XXIV). These diagrams also show the previous fluctuations just mentioned: a fairly abundant population occurring just after the development of *R I*/*G* was followed by a diminished frequency, which, however, was succeeded by the masses of ostracods which were annihilated at the heavy fall of hydrous iron oxide. After this event the ostracods were sparse, but towards the definitive reopening of the communication between the Siljan District and the ocean (cf. p. 108 f.) an increasing number of ostracods appeared. This migration was maximal just after the communication had been re-established, but, as mentioned, the frequency soon diminished again.

From the survey of the vertical distribution of the species (Pl. XXIII) it appears that they are grouped in two vertically separated groups connected by a few species occurring in small numbers. The one group causes the high ostracodal frequency in the lower part of stratum *G*; the majority of these species are also represented in the uppermost part of stratum *R I*. The second group forms the numerous assemblage of the lower part of stratum *R II*, the forerunners of which appear in the upper part of stratum *G*. Only one species is represented in both groups.

Favourable conditions for ostracods must have prevailed in the Siljan District during the first part of the *G* stage: all the species observed in the uppermost part of stratum *R I* have increased considerably in number, and new species have appeared; several of the species are very abundant.

This group of species may have been favoured by a sea type of *G* stage character; i. e. a basin having restricted communication with the ocean which presumably could afford a good supply of nutritious substances of both zoogene and phytogene origin and which could also afford a good supply of oxygen. This latter must have been a very important condition. At first sight, it may seem remarkable that such a condition could be realized in surroundings like this, where the water must have been stagnant to a rather great extent. As stated in a previous chapter, a certain degree of stagnation is assumed to be one important condition for the genesis of limonitic precipitates of the present type. The supply of oxygen from the air via the water was, of course, hindered by the stagnation, and the animals (in spite of the fact that, as observed in recent ostracods, they can live at a low oxygen pressure) would finally have been choked. But there existed sources of oxygen in the water, viz. in the great masses of algae which at that time lived in the Siljan District. Perforating and enveloping algae were abundant, and there is reason to believe that non-perforating types were also numerous. As is well known, plants produce oxygen during the process of carbon dioxide assimilation. In this case, they most probably received the greater part of the carbon dioxide from the animals, not least from the ostracods. Thus, there presumably existed a certain amount of symbiosis. This principle is developed to a high degree of perfection in corals which have incorporated the algae in their bodies; this is certainly of the greatest importance for the luxuriance of the coral reefs.

The presumable reason for the fairly sudden and practically complete extinction of this comprehensive ostracod fauna was pointed out above: the respiratory tissues were coated with colloidal hydrous iron oxide. As discussed on p. 109, this must have been precipitated as a consequence of the lowering of the carbon dioxide pressure, which caused the rather highly soluble but unstable iron bicarbonate (dissolved in great quantities in the water) to be transformed into hydrous iron oxide, the solubility product of which is very low at the pH which may be presumed for these surroundings (about pH 8). The lowering of the carbon dioxide pressure was caused by the photosynthesis of the algae, and also by reaction between CO_2, H_2O, O_2, Fe, and S (Fe and S, inter alia, being released during the decomposition of dead organisms). The oxygen required for the genesis of hydrous iron oxide according to the method now mentioned was produced by the algae. It may be assumed that an initial precipitation of hydrous iron oxide caused by the photosynthesis covered the respiratory tissues of ostracods, which were thereby choked; Fe- and S-ions, released during the decomposition of the dead bodies, in turn also caused precipitation of $Fe_2O_3 . n\,H_2O$ which killed even more animals. Thus a cumulative process was set going, which finally practically exterminated the whole fauna. Only a few species, represented in fairly small numbers, were found above the zone of the greatest precipitation of $Fe_2O_3 . n\,H_2O$. A few of them, moreover, seem to have been redeposited from this zone.

The reason why the ostracods were so few during most of the period after this heavy precipitation of limonite is difficult to understand. But the following facts and circumstances may be taken into consideration.

Nowadays, ostracods (like molluscs) are dispersed to a certain extent by other animals, especially fishes and aquatic birds. The dispersal to many isolated lakes and ponds during the Quaternary must be explicable by transference by birds. Possibilities of dispersal by fishes and birds did not exist during the Lower Ordovician, however.

Ostracods at that time must have been dispersed not only by their own locomotion but mainly as larvae by movements in the water: currents and waves (both superficial and submarine waves). After the abundant ostracodal fauna living during the first half of the *G* stage had succumbed for the most part, the Siljan District had to be populated with a new fauna from the ocean. However, the communication with the ocean was restricted, and there is reason to believe that currents from the ocean did not, as a rule, continue into the Siljan District; as anticipated, the water of the Siljan District must have been stagnant to a high degree, and current activity seems to have been insignificant. A few new species appeared during the later half of the *G* stage, nevertheless. Some of them may have been evolved in the district, but I think that most of them were brought there by oceanic water that broke in occasionally. This may have been realized by superficial water streaming in, but it is also likely that the larvae were brought there by submarine waves. Such waves are developed at the discontinuity between strata of different density. Since such a stratification was quite reasonable for the Siljan District, submarine waves formed outside the Siljan District may, after having reached that area, have continued there, dispersing larvae from the ocean.

The species which may have been transferred into the Siljan District during that time appeared first as single specimens during the later part of the *G* stage, but arrived towards *G/R II* in increasing numbers, and were very abundant just after the development of *G/R II*. This development means that the conditions for dispersal had grown better, which is certainly connected with the transgression that finally raised the isolation of the Siljan District (*G/R II*).

The oceanic species transferred, at least those appearing earliest, do not seem to have met suitable ecological conditions in the Siljan District. Several reasons indicate that the salinity was low during this time (cf. part IV of the present series; chamositic substances), and this was certainly an important reason why oceanic species could not exist there. They may have lived for a time, but they most certainly did not propagate. It may even be questioned whether the oceanic species did propagate before the Siljan District could permanently afford the same ecological conditions as the ocean, i. e. after the development of *G/R II*.

We shall now consider a few species which appeared after the extinction of the lower *G* stage fauna, but which themselves soon definitely disappeared (cf. p. 387). Since they do not occur among the species which invaded the Siljan District in large masses after the re-establishment of the communication with the ocean, one may question whether they were oceanic inhabitants. This consideration may not be excluded. But, if they could live and probably also propagate in the Siljan District (judging by the fact that they formed small populations) they must have been ecologically indifferent to a fairly large extent. Furthermore, they may also have been scarce in the ocean.

If not, they might have appeared during the migration just after the development of *G/R II*. Other considerations may also be made. One is that the species concerned likewise lived in the ocean, but had become extinct at the time of the *G/R II* migration. Another is that they may not have occurred in the ocean but were endemic in the Siljan District, and that they became extinct there when the ecological conditions towards *G/R II* grew unfavourable for the endemic fauna.

Thus, there is a good deal of uncertainty about this group. It is hoped that further investigations of corresponding strata in other districts will elucidate this question.

Returning again to the *G/R II* migration, one may ask why the ostracodal frequency soon decreased again. A complete answer cannot be given but some suggestions may be made.

It is conceivable that the supply of suitable nutritious substances became scanty (especially phytogene ones), which may be a consequence of increased depth of water (the algae vanished). Other reasons may also be taken into consideration. It is a wellknown fact that among recent animals an enormous invasion of a species is often followed by a very distinct decrease in frequency. An example of this is the invasion around 1930 of the Swedish Lake Mälaren by *Dreissensia polymorpha* (the wandering mussel). The mussel appeared in very large quantities, but a few years later the frequency had decreased considerably. A corresponding example is the invasion of Southern Swedish lakes by the hydrophyte *Elodea canadensis*. One may suggest that such enormous rises of frequency should be due to the organisms' release of their parasites, and that the following decrease was due to the circumstance that they were soon attacked by parasites of the area invaded, against which they had little resistance. Whether this suggestion is correct is not proved, as far as I know. Of course, the decrease in frequency is less distinct if the newly colonized region is invariably connected with the original region, so that new specimens are continually furnished until stabilized conditions have been developed. This may have happened in the present case. It will be of interest to see, in a following investigation, how the fauna developed upwards in *R II*.

In the above discussion on the vertical distribution of the ostracods in the stratal sequence investigated, great weight has been attached to the importance of ecological conditions for the faunal development. Against this may be objected that other important factors must be considered. Such a factor is time, since speciation is to a certain extent a function of time. One might question whether the vertical distribution of the ostracods as appearing in the Siljan District in reality corresponds to the lifetime of the species concerned. This question may be answered when the ostracods of corresponding strata in other districts have been investigated together with the hydrology during the development of these strata. A brief examination of some samples from the Island of Öland has shown that a few of the Dalecarlian ostracods may have somewhat different vertical distributions in Öland, but this may possibly be explicable if the different palecological conditions between these districts are taken into consideration. I hope to get an opportunity to carry out such an investigation.

On the stratigraphic significance of the ostracodal fauna investigated.

From the preceding chapter, one might have received the impression that ostracods are more suited as ecological than as stratigraphic indicators. Their stratigraphic value might be restricted by their being ecologically sensitive.

However, ostracods, as a rule, have a wide horizontal distribution, and under such circumstances they may be of great stratigraphic importance. As a matter of fact, stratigraphy has to be based on analyses of whole necrocoenoses, with due consideration to the chemistry, granulometry, and petrology of the stratal sequences. Ostracods will presumably be of particular value, not only on account of their wide horizontal distribution but also on account of their ecological sensitivity. When their ecological nature is known, they will be elucidative of paleohydrology and consequently also of changes of level; and these branches of geology are most intimately combined with stratigraphy.

For the time being, the Lower Ordovician ostracods of Scandinavia and Estonia are very little known. For this reason the present investigation is of restricted stratigraphic importance until the ostracodal faunæ of other districts have been examined. However, some of the most abundant species in the Siljan District and their vertical distribution will be briefly mentioned (cf. Pl. XXIII).

Group of lower part of stratum *G*. The most abundant among the species observed belong to this group.

The most frequent species is *Conchoides minuta* n. sp. which may be fairly easily recognized in spite of its being non-sulcate and smooth (the fact that the posterodorsal area is swollen is a typical feature of this species).

Other characteristic and fairly numerous *Conchoides* species of this group are *C. meganotifera* n. sp., *C. ventroincisurata* n. sp., and *C. micropunctata* n. sp. Though represented by only two specimens, *C. socialis* (Brögger) is of interest in being one of the 3 present species which were known earlier (from Norway).

Four abundant and rather easily distinguishable *Glossopsis* species are characteristic of the group: *G. tenuilimbata* n. sp., *G. acuta* n. sp., *G. clavata* n. sp., and *G. lingua* n. sp.

Primitiella is represented by the numerous but somewhat variable *P. brevisulcata* n. sp. and by the less abundant but distinctly patterned *P. expressoreticulata* n. sp. and *P. anterodepressa* n. sp.

Both the carinate *Aulacopsis* species (which are rather numerous) belong here (*A. monofissurata* n. sp. and *A. bifissurata* n. sp.).

All the three *Tetradella* species observed appear in the lower *G* group. Among them, *T. grewingki* (BOCK) is of great interest, since it is abundant in the Siljan District and was earlier reported both from Ingermanland and Norway. The two remaining species (both reticulate) are less frequent but easily recognizable (*T. teres* n. sp., and *T. lanceolata* n. sp.).

Attention may also be directed to *Ceratopsis grandispinosa* n. sp., though it is not abundant and represented only in one locality; but it has a distinct appearance.

Ctenentoma is represented by *C. macroreticulata* n. sp., which belongs to the *Ctenentoma* group that is provided with a velate ridge. The species has a characteristic appearance but was observed practically only in one locality.

Bythocypris species are often difficult to determine, but *B. ellipsiformis* (which occurs in the lower *G*) is fairly easily recognizable on account of the two rather broad umbones.

Of the genera now mentioned, *Tetradella* and the carinate section of *Aulacopsis* were not observed above this horizon. The *Glossopsis* species, as a rule, are of somewhat different appearance in relation to those of the upper groups (*S III* being much better developed).

Group of interstage species. These species are few in number. Some are slightly more abundant than others; they are also fairly easily recognizable, viz.:

Conchoides levis n. sp. (disappears just at *G/R II*)
Glossopsis robusta n. sp.
Ectoprimitia tenuireticulata n. sp.

Group around *G/R II*. This group is characterized by the fact that some earlier represented genera have partly changed their appearance, and also by the fact that genera not represented in the lower and interstage groups have appeared.

As just mentioned, the *Glossopsis* species of the upper group are distinguished by the feature that *S III* is incomplete or not developed (in the lower group only *G. mutilata* n. sp. has an incomplete *S III*). Carinate *Ctenentoma* species appear in this group. *Conchoides* is represented by a circumstriate type, differing distinctly in this respect from those of the lower *G* group.

The following genera are not represented in the lower groups: *Macronotella*, *Pinnatulites* n. gen., *Ceratocypris*, *Euprimites* n. gen., *Eurychilina*, and *Laccochilina* n. gen. *Ogmoopsis* n. gen. occurs mainly in the upper group (only one species represented by one specimen was found in the lower *G* group). The main part of *Euprimitia* belongs to the upper group. Also the main part of *Steusloffia* occurs there.

Steusloffia is unique in being represented, as far as I may judge, by the same species in the lower *G* group and in the upper group. In the discussion on p. 358 it was suggested that the species had lived in the ocean during the whole *G* stage. In the Siljan District it had remained in small numbers until the large ostracodal extinction in connection with the maximal precipitation of hydrous iron oxide in the *Expansus* period. After the communication with the ocean had been reestablished (*G/R II*), it returned to the Siljan District. Meanwhile, the species may have changed slightly in appearance: a small anterodorsal node had disappeared.

Some of the most typical species of the upper group may be mentioned (arranged in order according to frequency):

Ogmoopsis nodulifera n. sp.
Pinnatulites procera (KUMMEROW)
Laccochilina dorsoplicata n. sp.
Glossopsis depressolimbata n. sp.
Ctenentoma plana n. sp.
Ceratocypris longispina n. sp.
Conchoides circumstriata n. sp.
Eurychilina dorsotuberculata n. sp.
Macronotella fabuliformis n. sp.
Primitiella dibulbosa n. sp.

*

Attention has been directed above to more abundant and fairly easily distinguishable species. Species which are frequent but difficult to determine, such as those belonging to *Aparchites* and *Bythocypris*, are only occasionally mentioned, since they may be of more restricted stratigraphic importance on account of their mostly minute differences.

However, there is also reason to observe those species which are rare in the Siljan District, since they may be more abundant in other regions. An example of this is *Laccochilina centrotuberculata* n. sp. which appears in small numbers in the present material, but which seems to be a common species in the Upper *Asaphus* Limestone of the Island of Öland.

Addendum.

After this paper went to press, a note by WARTHIN appeared, entitled "Ostracode genotypes designated by S. A. MILLER" (Journ. Pal. Vol. 22. No. 5. 1948).

In this note it is stated that the genus *Eurychilina* should be a synonym of *Primitia*, since MILLER (in 1889) designated *P. strangulata* (SALTER), which is an Eurychilinid, as the type of *Primitia*. "Miller's designation antedates any other known to the writer." However, I prefer to wait for further studies by Mr WARTHIN in subsequent designations of genotypes; the present result of his studies is perhaps not definite.

In the same journal, SWARTZ and ORIEL discussed orientation terminology. They use the so-called plenate terminology proposed by SWARTZ in a previous paper (1945) "as a vehicle for objective discussion of orientation problems". However, this terminology is not suggested for common use in systematic descriptions. "'Anterior' and 'posterior', and 'right valve' and 'left valve' are far more desirable terms wherever common agreement can be attained."

I think that common agreement is attainable (cf. the chapter Orientation of the carapace, p. 118 f.).

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Explanation of plates.

Magnification 30 × unless otherwise indicated.

Numbers of specimens referable to the Collection of the Institute of Paleontology of Uppsala.

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c. Dorsal view of left valve.

Plate VII.

Fig. 1. *Ctenentoma plana* n. sp. Type *a*. Holotype. No. ar. os. 442. Röjeråsvägen 9 . . 276
Side view of left valve.

Fig. 2. *Ctenentoma plana* n. sp. Type *a*. No. ar. os. 445. Leskusänget 25 276
Anterior view of carapace, showing ventral carina.

Fig. 3. *Ctenentoma plana* n. sp. Type *b*. No. ar. os. 443. Röjeråsvägen 9 278
a. Side view of left valve.
b. Anterior view of left valve.

Fig. 4. *Ctenentoma plana* n. sp. Type *b*. No. ar. os. 438. Born-Dådran 6 278
Internal mould of right valve, side view.

Fig. 5. *Ctenentoma plana* n. sp. Type *b*. No. ar. os. 444. Leskusänget 25 278
Side view of right valve.

Fig. 6. *Ctenentoma plana* n. sp. Type *b*. No. ar. os. 441. Born-Dådran 5 278
Side view of right valve.

Fig. 7. *Ctenentoma canaliculata* n. sp. Holotype. No. ar. os. 435. Rävanäs 6 273
a. Side view of right valve.
b. Posterior view of right valve.
c. Anterior view of right valve.
d. Dorsal view of right valve.
e. Ventral view of right valve.

Fig. 8. *Ctenentoma* sp. No. ar. os. 795. Born-Dådran 2.
Internal mould of left valve, side view, showing muscle scars.

Fig. 9. *Aulacopsis monofissurata* n. sp. Type *a*. Holotype. No. ar. os. 457. Stenberg 5. 284
Side view of right valve.

Fig. 10. *Aulacopsis monofissurata* n. sp. Type *a*. No. ar. os. 464. Stenberg 4 284
Side view of left valve.

Fig. 11. *Aulacopsis monofissurata* n. sp. Type *b*. No. ar. os. 470. Stenberg 5 286
a. Side view of left valve.
b. Anterior view of left valve.
c. Dorsal view of left valve.

Fig. 12. *Aulacopsis nodosa* n. sp. Holotype. No. ar. os. 474. Rävanäs 4 281
a. Side view of left valve.
b. Dorsal view of left valve.
c. Anterior view of left valve.

Fig. 13. *Aulacopsis bifissurata* n. sp. No. ar. os. 796. Leskusänget 9 287
Side view of right valve.

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Fig. 14. *Aulacopsis bifissurata* n. sp. No. ar. os. 801. Leskusänget 9.............. 287
Ventral view.

Fig. 15. *Aulacopsis bifissurata* n. sp. Type *a*. Holotype. No. ar. os. 821. Stenberg 5.. 288
Ventral view of carapace.

Fig. 16. *Aulacopsis bifissurata* n. sp. Type *a*. No. ar. os. 487. Leskusänget 9....... 288
Side view of right valve.

Fig. 17. *Aulacopsis bifissurata* n. sp. Type *b*. No. ar. os. 485. Stenberg 4......... 290
a. Side view of right valve.
b. Anterior view of right valve.

Fig. 18. *Aulacopsis bifissurata* n. sp. Type *c*. No. ar. os. 489. Gulleråsen 5........ 291
a. Side view of right valve.
b. Anterior view of right valve.

Fig. 19. *Aulacopsis bifissurata* n. sp. Type *d*. No. ar. os. 480. Stenberg 2.......... 291
Side view of right valve.

Fig. 20. *Aulacopsis bifissurata* n. sp. Type *d*. No. ar. os. 483. Stenberg 5........... 291
a. Side view of right valve.
b. Dorsal view of right valve.
c. Anterior view of right valve.

Fig. 21. *Glossopsis tenuilimbata* n. sp. Holotype. No. ar. os. 497. Stenberg 5........ 303
a. Side view of carapace, right valve.
b. Dorsal view of carapace.
c. Ventral view of carapace.
d. Anterior view of carapace.

Fig. 22. *Glossopsis tenuilimbata* n. sp. juv. No. ar. os. 498. Stenberg 5............. 303
Side view of left valve.

Fig. 23. *Glossopsis acuta* n. sp. No. ar. os. 531. Stenberg 5........................ 300
a. Side view of left valve.
b. Dorsal view of left valve.

Fig. 24. *Glossopsis acuta* n. sp. Holotype. No. ar. os. 542. Stenberg 5............. 300
Side view of left valve.

Fig. 25. *Glossopsis acuta* n. sp. No. ar. os. 538. Rävanäs 4....................... 300
Side view of left valve.

Fig. 26. *Glossopsis alata* n. sp. Holotype. No. ar. os. 584. Silverberg II: 1......... 306
Side view of right valve.

Fig. 27. *Glossopsis alata* n. sp. No. ar. os. 583. Granmor 6....................... 306
Side view of right valve.

Plate VIII.

Fig. 1. *Glossopsis clavata* n. sp. No. ar. os. 572. Stenberg 2...................... 308
Side view of right valve.

Fig. 2. *Glossopsis clavata* n. sp. Holotype. No. ar. os. 560. Rävanäs 2............ 308
Side view of left valve.

Fig. 3. *Glossopsis clavata* n. sp. juv. No. ar. os. 561. Stenberg 2................ 308
Side view of left valve.

Fig. 4. *Glossopsis clavata* n. sp. No. ar. os. 547. Granmor 2...................... 308
Anterior view of right valve.

Fig. 5. *Glossopsis clavata* n. sp. juv. No. ar. os. 562. Rävanäs 1.................. 308
Side view of left valve.

Fig. 6. *Glossopsis clavata* n. sp. No. ar. os. 573. Leskusänget 2................... 308
Side view of left valve.

Fig. 7. *Glossopsis lingua* n. sp. Holotype. No. ar. os. 525. Rävanäs 1............ 298
a. Side view of left valve.
b. Dorsal view of left valve.

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Fig. 8. *Glossopsis lingua* n. sp. No. ar. os. 556. Leskusänget 3 298
Side view of left valve.

Fig. 9. *Glossopsis lingua* n. sp. No. ar. os. 533. Granmor 2 298
Side view of right valve.

Fig. 10. *Glossopsis indistincta* n. sp. Holotype. No. ar. os. 614. Leskusänget 25 315
a. Side view of right valve.
b. Anterior view of right valve.

Fig. 11. *Glossopsis mutilata* n. sp. Holotype. No. ar. os. 597. Stenberg 7 317
Side view of left valve.

Fig. 12. *Glossopsis robusta* n. sp. Type *a*. Holotype. No. ar. os. 585. Gulleråsen 15 ... 320
a. Side view of left valve.
b. Dorsal view of left valve.

Fig. 13. *Glossopsis robusta* n. sp. Type *a*. No. ar. os. 598. Gulleråsen 8 320
Anterior view of left valve.

Fig. 14. *Glossopsis robusta* n. sp. Type *b*. No. ar. os. 778. Leskusänget 22 321
Side view of right valve.

Fig. 15. *Glossopsis robusta* n. sp. Type *C*. No. ar. os. 605. Leskusänget 17 321
Side view of right valve.

Fig. 16. *Glossopsis depressolimbata* n. sp. Holotype. No. ar. os. 611. Leskusänget 24 . 313
Side view of right valve.

Fig. 17. *Glossopsis nodosa* n. sp. Holotype. No. ar. os. 596. Born-Dådran 5 311
Side view of right valve.

Fig. 18. *Ogmoopsis paenequisulcata* n. sp. Holotype. No. ar. os. 616. Röjeråsvägen 2. 327
a. Side view of left valve.
b. Anterior view of left valve.
c. Ventral view of left valve.
d. Dorsal view of left valve.

Fig. 19. *Ogmoopsis nodulifera* n. sp. Holotype. No. ar. os. 618. Silverberg II: 7 324
a. Side view of right valve.
b. Dorsal view of right valve.
c. Anterior view of right valve.

Fig. 20. *Ogmoopsis nodulifera* n. sp. No. ar. os. 626. Gulleråsen 17 324
a. Side view of left valve.
b. Ventral view of left valve.
c. Anterior view of left valve.

Fig. 21. *Ceratopsis grandispinosa* n. sp. *A*. Type α. Holotype. No. ar. os. 620. Stenberg 5 332
a. Side view of left valve.
b. Anterior view of left valve.
c. Dorsal view of left valve.

Fig. 22. *Ceratopsis grandispinosa* n. sp. *A*. Type *β*. No. ar. os. 623. Stenberg 5 333
Side view of left valve.

Plate IX.

Fig. 1. *Ceratopsis grandispinosa* n. sp. subspecies *B*. No. ar. os. 621. Stenberg 7 334
Side view of left valve, partly damaged.

Fig. 2. *Ceratopsis* sp. *C*. No. ar. os. 635. Silverberg II: 9 335
Side view of right valve, partly damaged.

Fig. 3. *Tetradella grewingki* (Bock). No. ar. os. 638. Stenberg 6 342
Side view of right valve.
(Sedimentary rock remaining on both sides of the lobes to prevent the granulation of the lobes from damage at the preparation.)

Fig. 4. *Ceratopsis* sp. *C*. No. ar. os. 609. Leskusänget 24 335
Internal mould of left valve, side view.

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Fig. 5. *Tetradella grewingki* (Bock). No. ar. os. 645. Stenberg 5 342
Internal mould of right valve, side view, showing muscle scars. Velum partly preserved.

Fig. 6. *Tetradella grewingki* (Bock). No. ar. os. 642. Stenberg 5. Specimen slightly worn 342
a. Side view of right valve.
b. Ventral view of right valve.

Fig. 7. *Tetradella grewingki* (Bock). No. ar. os. 640. Stenberg 5 342
a. Side view of right valve.
b. Ventral view of right valve.

Fig. 8. *Tetradella grewingki* (Bock). No. ar. os. 776. Stenberg 5 342
External mould of left valve, side view.

Fig. 9. *Tetradella grewingki* (Bock). No. ar. os. 644. Stenberg 5 342
Side view of right valve, partly damaged.

Fig. 10. *Tetradella lanceolata* n. sp. Holotype. No. ar. os. 660. Stenberg 4 346
a. Side view of left valve.
b. Ventral view of left valve.

Fig. 11. *Tetradella grewingki* (Bock). No. ar. os. 643. Stenberg 5 346
Internal mould of left valve, side view, and part of velum.

Fig. 12. *Tetradella teres* n. sp. No. ar. os. 684. Leskusänget 8 348
Internal mould of left valve, side view; velum and part of valve left.

Fig. 13. *Tetradella lanceolata* n. sp. No. ar. os. 661. Gulleråsen 5 346
Side view of right valve (old specimen).

Fig. 14. *Tetradella teres* n. sp. juv. No. ar. os. 677. Leskusänget 8 348
Side view of left valve.

Fig. 15. *Tetradella teres* n. sp. Holotype. No. ar. os. 686. Stenberg 4 348
Side view of right valve.

Fig. 16. *Tetradella teres* n. sp. juv. No. ar. os. 681. Stenberg 4 348
Side view of right valve.

Fig. 17. *Tetradella lanceolata* n. sp. No. ar. os. 665. Leskusänget 7 346
Side view of left valve.

Fig. 18. *Tetradella teres* n. sp. No. ar. os. 668. Stenberg 4 348
a. Side view of right valve.
b. Ventral view of right valve.

Fig. 19. *Tetradella teres* n. sp. No. ar. os. 675. Leskusänget 7 348
Internal mould of right valve, side view.

Fig. 20. *Tetradella lanceolata* n. sp. No. ar. os. 673. Leskusänget 7 346
Internal mould of left valve, side view.

Plate X.

Fig. 1. *Steusloffia polynodulifera* n. sp. juv. No. ar. os. 711. Silverberg 5 355
a. Side view of carapace, right valve.
b. Ventral view of carapace.
c. Dorsal view of carapace.

Fig. 2. *Steusloffia polynodulifera* n. sp. Holotype. No. ar. os. 699. Gulleråsen 6 . . . 355
a. Side view of left valve.
b. Anterior view of left valve.
c. Ventral view of left valve.

Fig. 3. *Steusloffia polynodulifera* n. sp. No. ar. os. 700. Born-Dådran 8 355
Side view of left valve (old specimen).

Fig. 4. *Steusloffia polynodulifera* n. sp. juv. No. ar. os. 708. Born-Dådran 5 355
Internal mould of left valve, side view, showing muscle scars.

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Fig. 5. *Steusloffia* cf. *polynodulifera* n. sp. No. ar. os. 777. Gulleråsen 17 355
Postsulcate part of internal mould of left valve, side view, showing ridges corresponding to *C III* and *C IV*.

Fig. 6. *Steusloffia polynodulifera* n. sp. juv. No. ar. os. 701. Rävanäs 10 355
Side view of right valve.

Fig. 7. *Steusloffia polynodulifera* n. sp. No. ar. os. 704. Born-Dådran 2 355
Side view of left valve.

Fig. 8. *Kloedenella*? *dorsodepressula* n. sp. No. ar. os. 723. Rävanäs 7 364
Side view of left valve.

Fig. 9. *Steusloffia* sp. No. ar. os. 798. Leskusänget 16.
Internal mould of right valve, side view.

Fig. 10. *Steusloffia* sp. *A*. No. ar. os. 719. Born-Dådran 7 359
Side view of left valve.

Fig. 11. *Ulrichia*? sp. No. ar. os. 720. Stenberg 5 362
Fragment of valve.

Fig. 12. *Pseudulrichia* ? sp. No. ar. os. 721. Leskusänget 10 362
Fragment of valve.

Fig. 13. *Bythocypris monocarinata* n. sp. No. ar. os. 726. Silverberg II: 4 368
a. Side view of carapace, left valve.
b. Side view of carapace, right valve.
c. Ventral view of carapace.
d. Dorsal view of carapace.

Fig. 14. *Bythocypris monocarinata* n. sp. Holotype. No. ar. os. 725. Granmor 9 368
a. Side view of carapace, right valve.
b. Anterior view of carapace.

Fig. 15. *Bythocypris curvata* n. sp. Holotype. No. ar. os. 748. Leskusänget 25 377
a. Side view of carapace, left valve.
b. Posterior view of carapace.
c. Ventral view of carapace.
d. Dorsal view of carapace.

Fig. 16. *Bythocypris elongata* n. sp. Holotype. No. ar. os. 765. Silverberg II: 4 374
a. Side view of carapace, left valve.
b. Anterior view of carapace.
c. Dorsal view of carapace.
d. Ventral view of carapace.

Fig. 17. *Bythocypris curvata* n. sp. No. ar. os. 752. Leskusänget 23 377
Internal mould of right valve.
a. Side view.
b. Posterior view.

Plate XI.

Fig. 1. *Bythocypris obliquedorsata* n. sp. Holotype. No. ar. os. 745. Rävanäs 9 376
a. Side view of carapace, left valve.
b. Ventral view of carapace.
c. Dorsal view of carapace.
d. Posterior view of carapace.

Fig. 2. *Bythocypris obliquedorsata* n. sp. No. ar. os. 744. Granmor 9 376
a. Side view of carapace, left valve.
b. Dorsal view of carapace.
c. Anterior view of carapace.

Fig. 3. *Bythocypris nonumbonata* n. sp. Type *a*. Holotype. No. ar. os. 728. Rävanäs 1 369
a. Side view of carapace, left valve.
b. Posterior view of carapace.
c. Ventral view of carapace.
d. Dorsal view of carapace.

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Fig. 4. *Bythocypris nonumbonata* n. sp. Type *b*. No. ar. os. 727. Gulleråsen 7..... 370
a. Side view of carapace, left valve.
b. Ventral view of carapace.
c. Dorsal view of carapace.
d. Posterior view of carapace.

Fig. 5. *Bythocypris monoumbonata* n. sp. Type *b*. Holotype. No. ar. os. 730. Leskusänget 20 372
a. Side view of carapace, left valve.
b. Anterior view of carapace.
c. Dorsal view of carapace.

Fig. 6. *Bythocypris monoumbonata* n. sp. Type *a*. No. ar. os. 731. Stenberg 7..... 372
a. Side view of carapace, left valve.
b. Posterior view of carapace.
c. Dorsal view of carapace.

Fig. 7. *Bythocypris ellipsiformis* n. sp. No. ar. os. 737. Leskusänget 14........... 373
a. Side view of carapace, left valve.
b. Anterior view of carapace.
c. Dorsal view of carapace.

Fig. 8. *Bythocypris ellipsiformis* n. sp. Holotype. No. ar. os. 736. Leskusänget 14. 373
a. Side view of carapace, left valve.
b. Side view of carapace, right valve.
c. Posterior view of carapace.
d. Ventral view of carapace.
e. Dorsal view of carapace.

Fig. 9. *Bythocypris* sp. *A*. No. ar. os. 767. Born-Dådran 8 378
Side view of right valve.

Plate XII.

Transverse sections through ostracodal carapaces and valves. Slight retouch. Magnification 130 ×, except Figs. 1 and 4 (40 ×).

Fig. 1. *Conchoides micropunctata* n. sp.
Figs. 2—3. *Conchoides ventroincisurata* n. sp.
Fig. 4. *Conchoides circumreticulata* n. sp.
Fig. 5. *Macronotella fabuliformis* n. sp.
Fig. 6. *Pinnatulites procera* (Kummerow)
Fig. 7. *Ceratocypris longispina* n. sp.
Fig. 8. *Primitiella brevisulcata* n. sp. ab. *maculata*.

Note the perforations through the valves for sensory bristles in *Macronotella fabuliformi* and *Pinnatulites procera*.

Plate XIII.

Transverse sections through ostracodal carapaces and valves. Slight retouch. Magnification 130 ×.

Fig. 1. *Aulacopsis monofissurata* n. sp.
Fig. 2. *Aulacopsis bifissurata* n. sp.
Fig. 3. *Glossopsis tenuilimbata* n. sp.
Fig. 4. *Glossopsis lingua* n. sp.
Fig. 5. *Glossopsis clavata* n. sp.
Fig. 6. *Glossopsis robusta* n. sp.
Fig. 7. *Ogmoopsis nodulifera* n. sp.

Plate XIV.

Transverse sections through ostracodal carapaces and valves. Slight retouch. Magnification 130 ×, except Figs. 7 and 8 (65 ×).

Fig. 1. *Tetradella teres* n. sp.
Fig. 2. *Tetradella grewingki* (Bock)
Fig. 3. *Steusloffia polynodulifera* n. sp.
Fig. 4. *Eurychilina* ? sp. juv.
Fig. 5. *Chilobolbina dentifera* (Bonnema)
Fig. 6. *Eurychilina dorsotuberculata* n. sp.
Fig. 7. *Eurychilina dorsotuberculata* n. sp.
Fig. 8. *Bythocypris ellipsiformis* n. sp.
Fig. 9. *Beyrichia kloedeni* McCoy. Note the longitudinally sectioned young larval carapace, which is enclosed in the upper right part of the adult carapace.

Plate XV.

Schematic figures showing transverse sections through ostracodal carapaces, drawn on the basis of thin-sliced specimens as shown in Plates XII—XIV. Magnification 43 ×, except Figs. 1 and 5 (21.5 ×).

Figs. 11 and 15 show ventral carina (*a*) and velate ridge (*b*).

Figs. 16—19 show different types of ventral carina. In Figs. 20—21 two types of vela are demonstrated (in Fig. 20 the ventral hinge device occurs along the ventral margin of the valves, but in Fig. 21 along the velate margin). In Fig. 22 the ventral swellings may represent a type of brood pouches.

Fig. 1. *Conchoides micropunctata* n. sp.
Fig. 2. *Conchoides circumreticulata* n. sp.
Fig. 3. *Conchoides ventroincisurata* n. sp.
Fig. 4. *Conchoides ventroincisurata* n. sp.
Fig. 5. *Bythocypris ellipsiformis* n. sp.
Fig. 6. *Pinnatulites procera* (Kummerow)
Fig. 7. *Macronotella fabuliformis* n. sp.
Fig. 8. *Tetradella teres* n. sp.
Fig. 9. *Ceratocypris longispina* n. sp.
Fig. 10. *Eurychilina dorsotuberculata* n. sp.
Fig. 11. *Aulacopsis monofissurata* n. sp.
Fig. 12. *Eurychilina* ? sp. juv.
Fig. 13. *Tetradella grewingki* (Bock)
Fig. 14. *Aulacopsis bifissurata* n. sp.
Fig. 15. *Ogmoopsis nodulifera* n. sp.
Fig. 16. *Glossopsis tenuilimbata* n. sp.
Fig. 17. *Glossopsis clavata* n. sp.
Fig. 18. *Glossopsis lingua* n. sp.
Fig. 19. *Glossopsis robusta* n. sp.
Fig. 20. *Eurychilina dorsotuberculata* n. sp.
Fig. 21. *Chilobolbina dentifera* (Bonnema)
Fig. 22. *Beyrichia kloedeni* McCoy.

Plate XVI.

Thin slides of rock samples with sections of ostracods. Non-retouched photographs. Magnification 40 ×.

Fig. 1. Longitudinal section of a non-described spiniferous ostracod (Leskusänget 24).

Fig. 2. Longitudinal section of a non-described, partly spiniferous ostracod (Leskusänget 1).

Fig. 3. Longitudinal section of an ostracod (Born-Dådran 5).

Fig. 4. Transverse sections of *Conchoides* sp. (most likely *C. minuta* n. sp.); ostracods partly filled with limonite (Röjeråsvägen 4).

Fig. 5. Transverse section of valve fragment of *Glossopsis* sp. (probably *G. acuta* n. sp.) (Stenberg 13).

Fig. 6. Transverse section of valve fragment of *Tetradella* sp. (certainly *T. grewingki* [Bock]) (Stenberg 4).

Fig. 7. Transverse section of valve fragment of *Steusloffia* (certainly *S. polynodulifera* n. sp.) (Leskusänget 23).

Plate XVII.

Thin slides of rock samples with sections of ostracods. Non-retouched photographs. Magnification 40×, except Fig. 4 (130×).

Fig. 1. To the left is a *Conchoides* carapace, in the centrum a larval *Ceratocypris longispina* valve (Röjeråsvägen 9).

Fig. 2. In the upper right part a *Bythocypris* carapace (Rävanäs 9).

Fig. 3. Valves of *Ceratocypris longispina* n. sp. and *Bythocypris* sp. juv. (Born-Dådran 7).

Fig. 4. Fragment of *Steusloffia polynodulifera* n. sp. (Rävanäs 3).

Figs. 5—6—7. Sections through carapaces (*Conchoides*) filled with limonite; in Fig. 6 valves of different specimens attached to each other. (Fig. 5: Stenberg 6; Fig. 6: Röjeråsvägen 3; Fig. 7: Röjeråsvägen 4.)

Plate XVIII.

Thin slides of rock samples with sections of ostracods. Non-retouched photographs. Magnification 40×.

Fig. 1. In centrum valve of *Glossopsis* sp. (possibly *G. acuta* n. sp.) (Stenberg 4).

Fig. 2. In centrum valve of *Steusloffia* cf. *polynodulifera* n. sp. (Rävanäs 4).

Fig. 3. Ostracodal valves encrusted with limonite; in under left corner contamination of one *Glossopsis* and one *Conchoides* valve (such phenomena fairly common) (Röjeråsvägen 3).

Fig. 4. To the left of the gastropod, larval valve of *Ogmoopsis nodulifera* n. sp. and in the gastropod an even younger stage of the same species (Röjeråsvägen 9).

Fig. 5. Larval ostracodal valve (possibly *Ctenentoma plana* n. sp.) (Leskusänget 24).

Fig. 6. Larval ostracodal valve (possibly *Steusloffia polynodulifera* n. sp.) (Gulleråsen 16).

Plate XIX—XXII.

Vertical distribution of the ostracodal species in the localities investigated.

Plate XXIII.

Vertical distribution of species.

Plate XXIV.

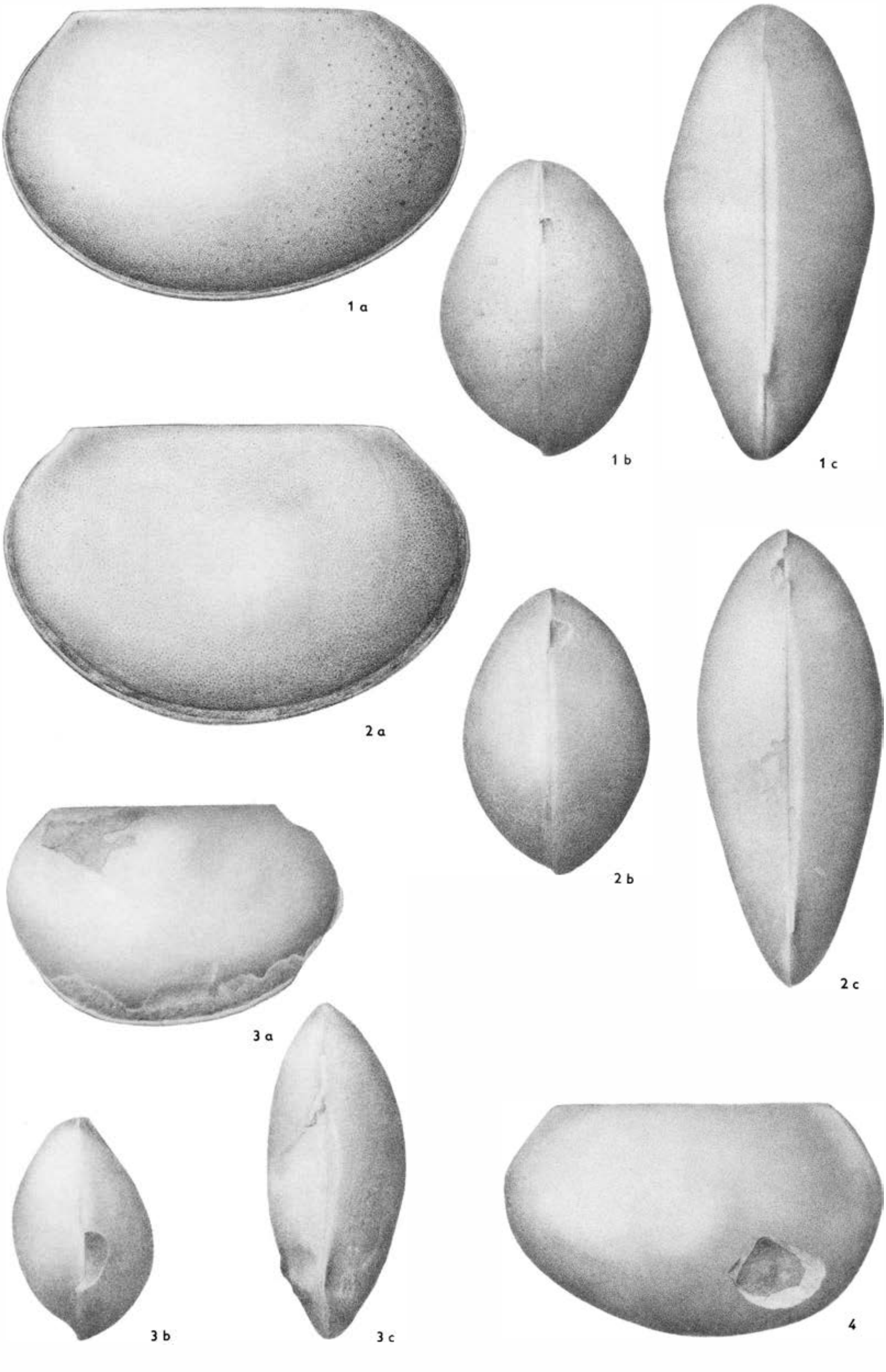
Vertical distribution of genera.

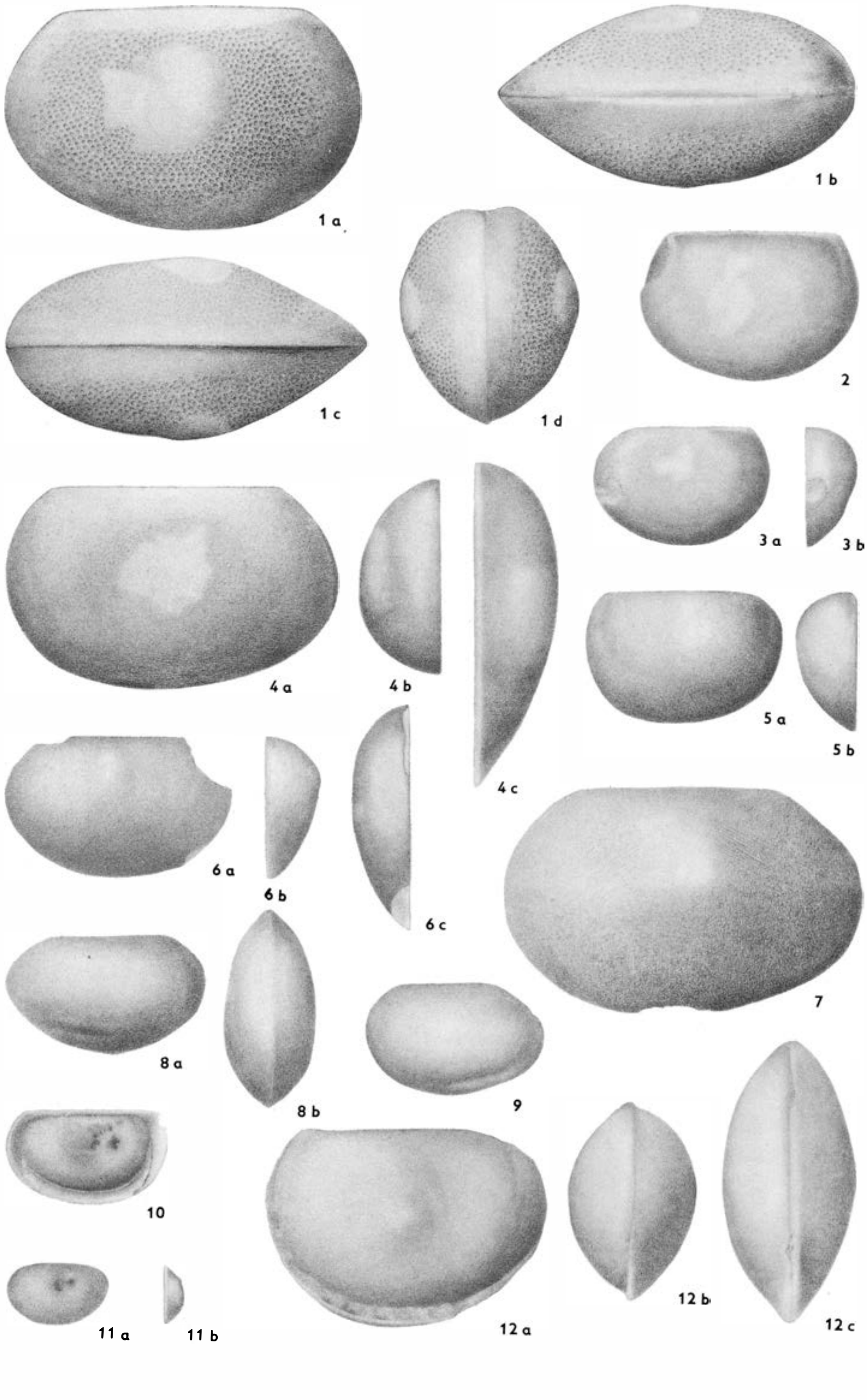
Plate XXV.

Total frequency of the ostracods. Broken longitudinal line indicates greatest frequency of ooids.

Plate XXVI.

Total frequency of species and genera.


1 a
1 b
1 c
2 a
2 b
2 c
3 a
3 b
3 c
4


1 a
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1 d
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3 a
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4 a
4 b
4 c
5 a
5 b
6 a
6 b
6 c
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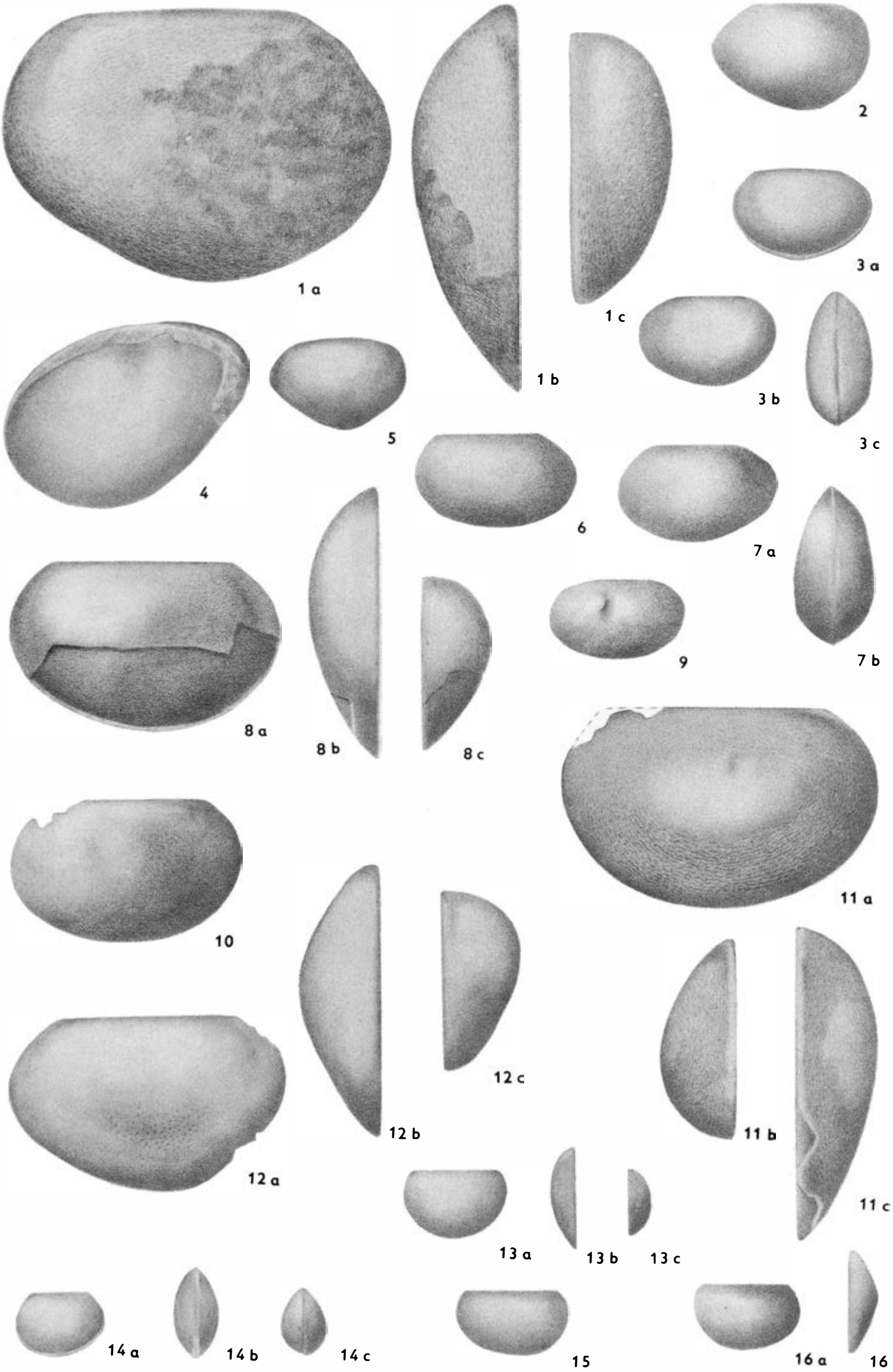
11 b
12 a
12 b
12 c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7 b
8 a
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11 a
11 b
11 c
12 a
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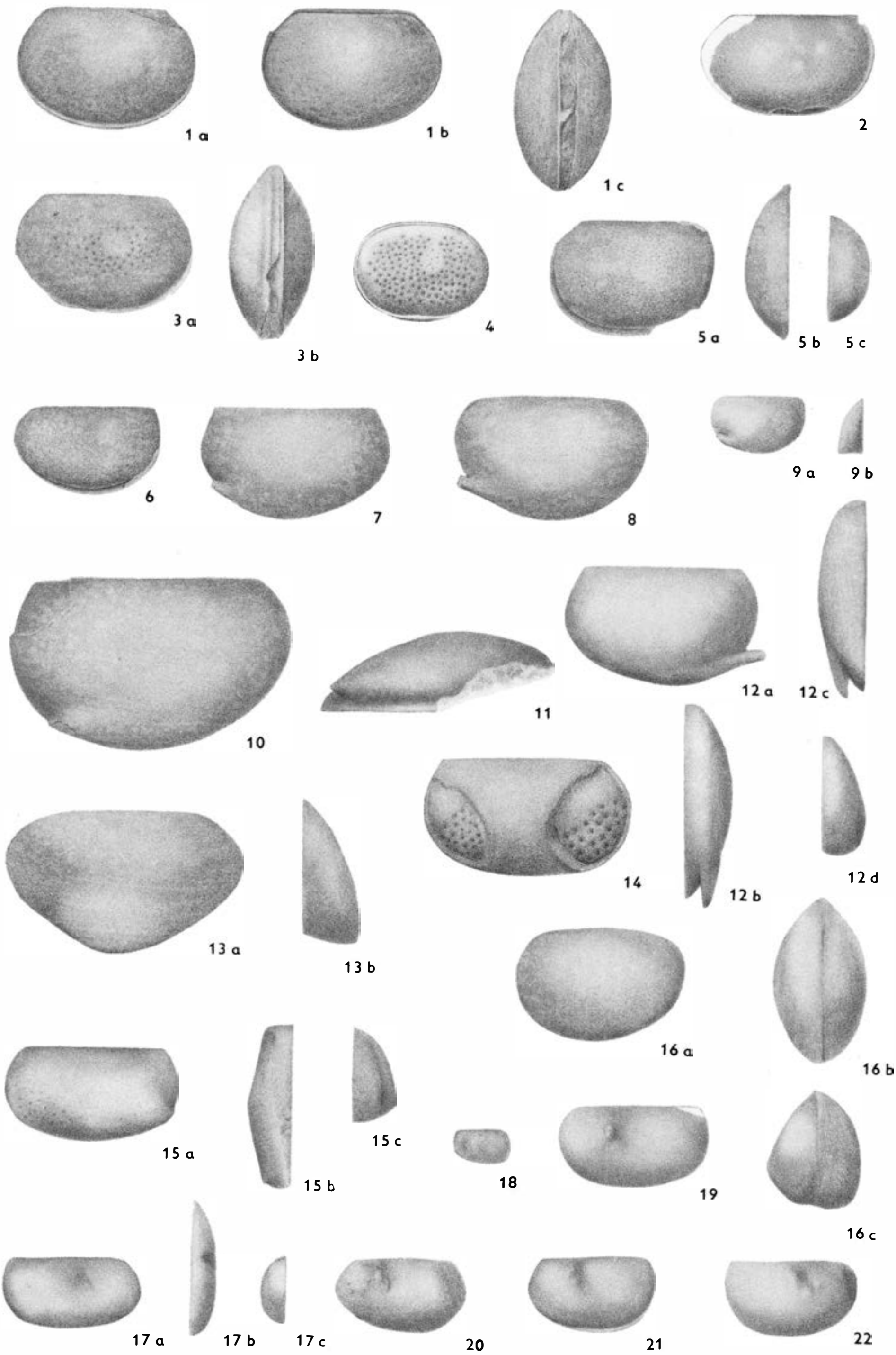
12 c
13 a
13 b
13 c
14 a
14 b
14 c
15
16 a
16 b


1 a
1 b
1 c
2
3 a
3 b
4
5 a
5 b
5 c
6
7
8
9 a
9 b
10
11
12 a
12 c
12 b
12 d
13 a
13 b
14
15 a
15 b
15 c
16 a
16 b
16 c
17 a
17 b
17 c
18
19
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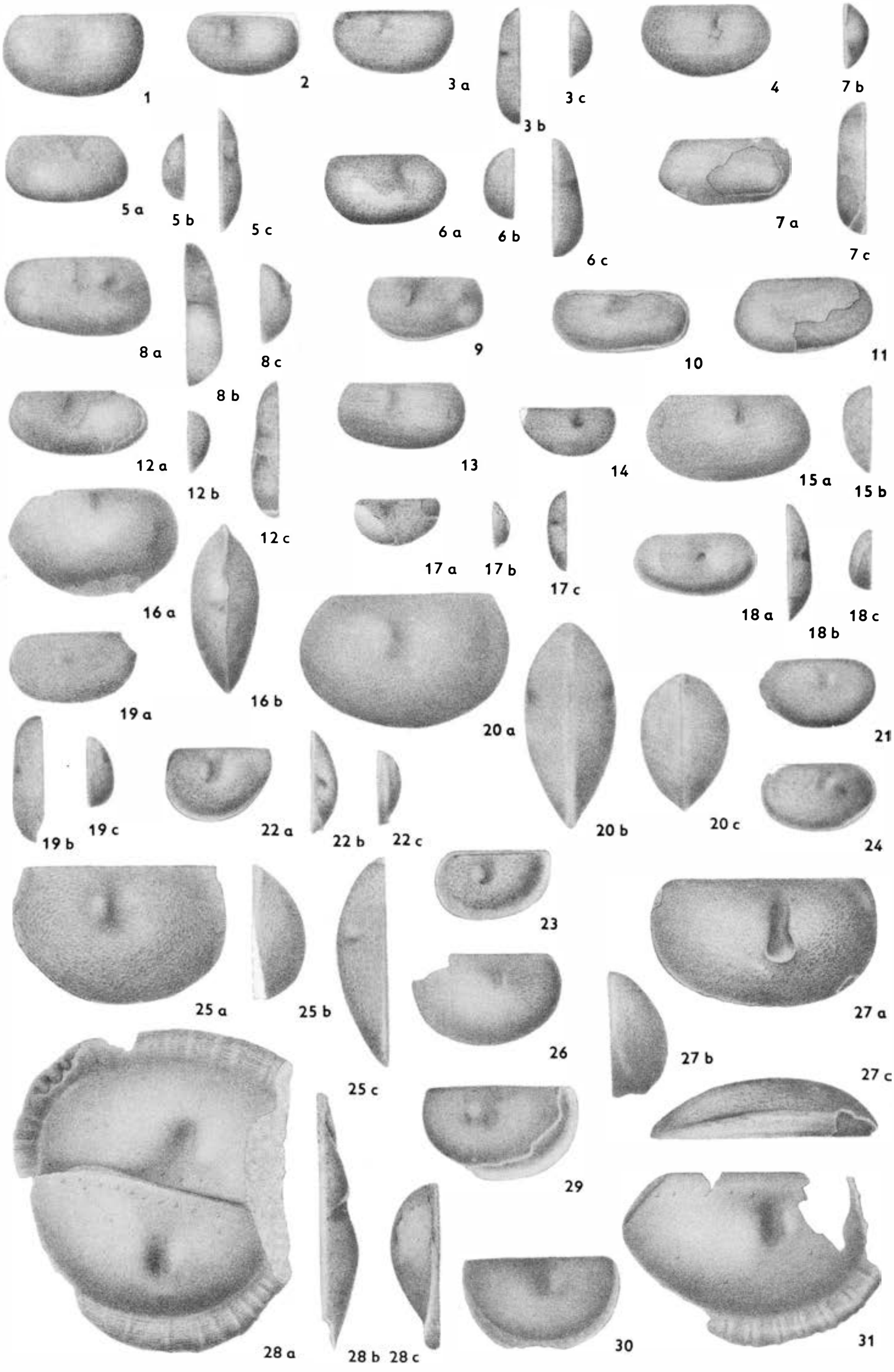
21
22


1
2
3 a
3 b
3 c
4
7 b
5 a
5 b
5 c
6 a
6 b
6 c
7 a
7 c
8 a
8 b
8 c
9
10
11
12 a
12 b
12 c
13
14
15 a
15 b
16 a
16 b
17 a
17 b
17 c
18 a
18 b
18 c
19 a
19 b
19 c
20 a
20 b
20 c
21
22 a
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27 c
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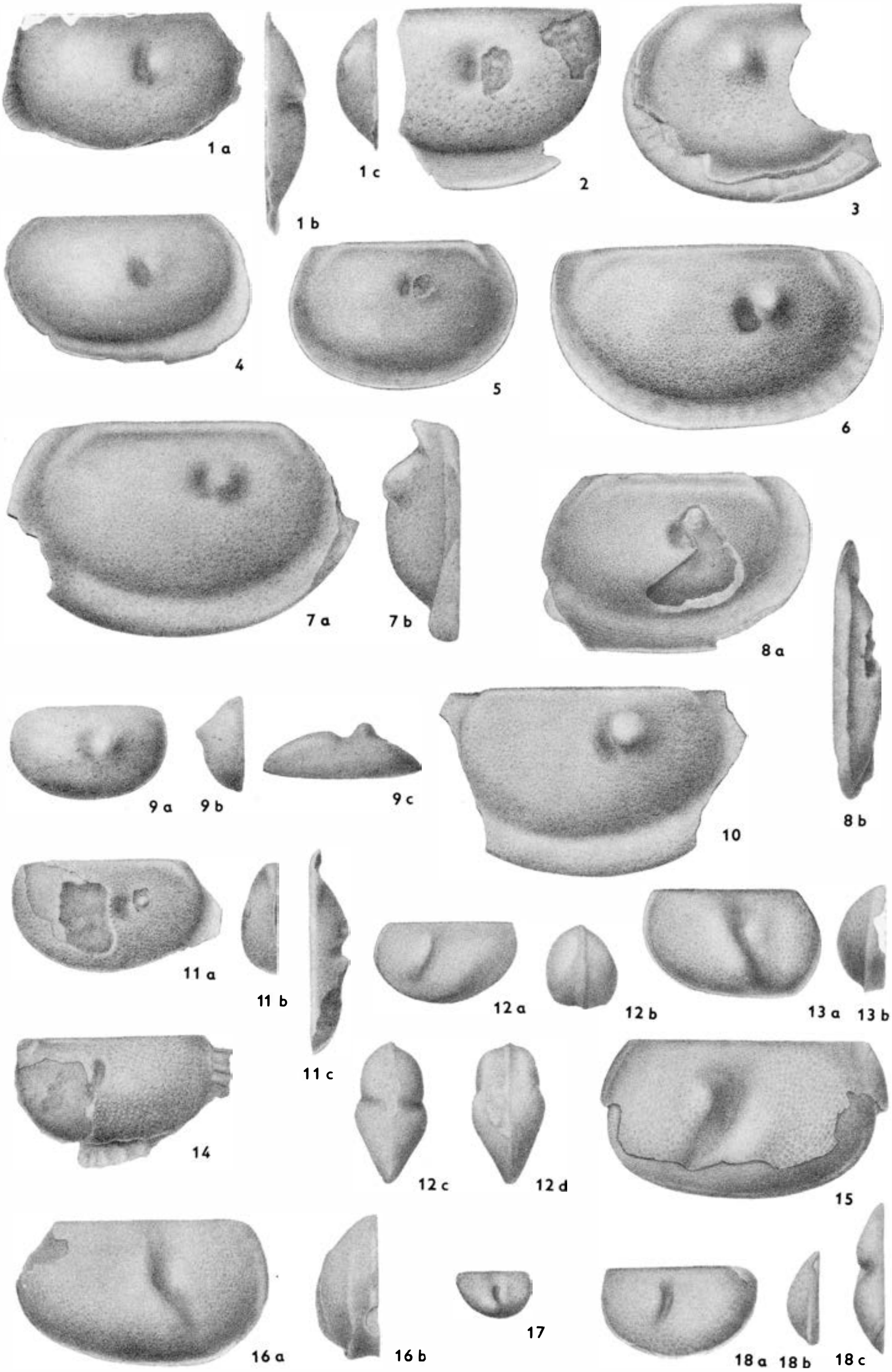
28 b
28 c
29
30
31


1 a
1 b
1 c
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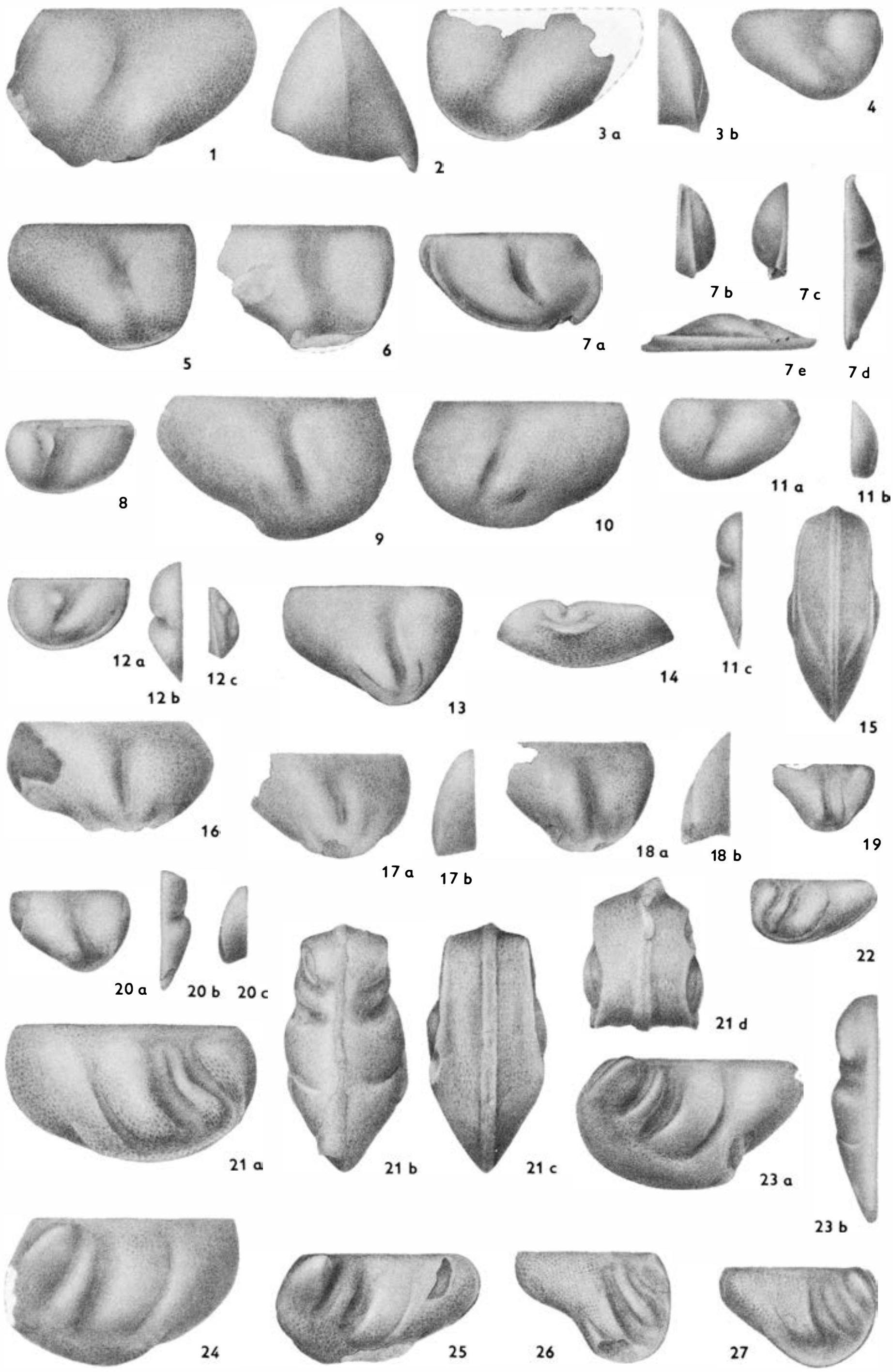
6
7 a
7 b
8 a
8 b
9 a
9 b
9 c
10
11 a
11 b
11 c
12 a
12 b
12 c
12 d
13 a
13 b
14
15
16 a
16 b
17
18 a
18 b
18 c


1
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3 a
3 b
4
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6
7 a
7 b
7 c
7 e
7 d
8
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10
11 a
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12 a
12 b
12 c
13
14
11 c
15
16
17 a
17 b
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21 c
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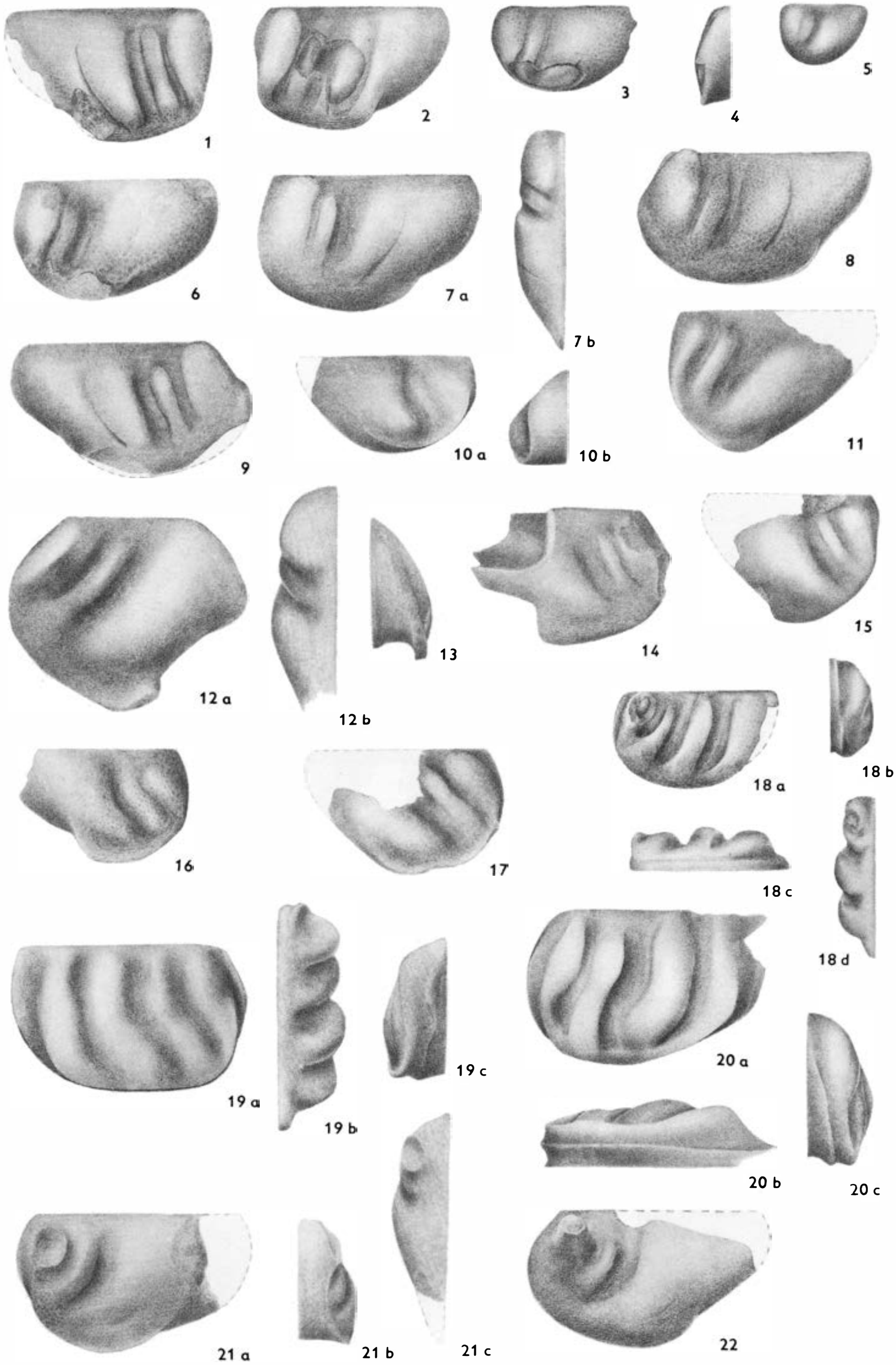
23 b
24
25
26
27


1
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5
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7 a
7 b
8
9
10 a
10 b
11
12 a
12 b
13
14
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20 b
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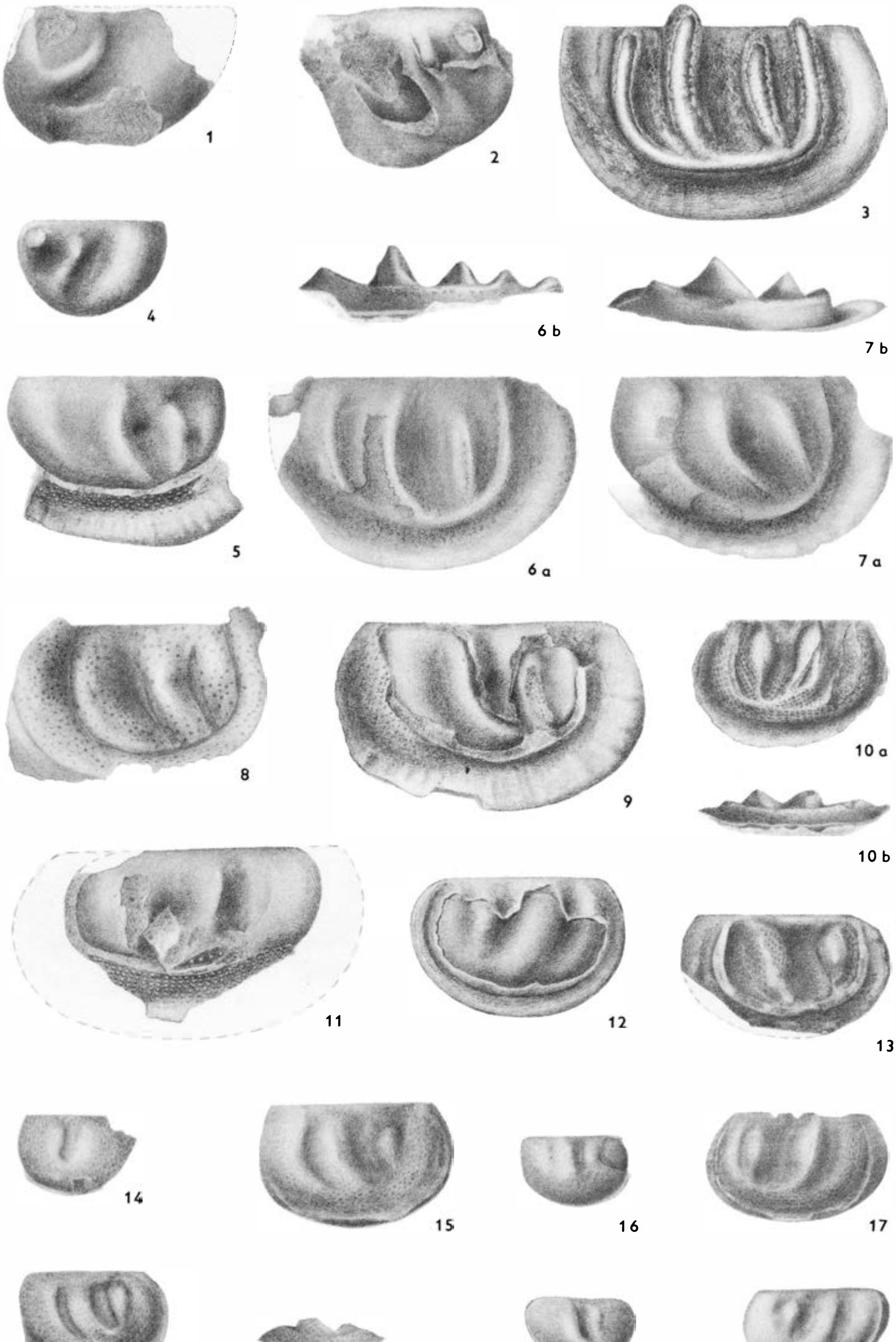
21 a
21 b
21 c
22


1
2
3
4
6 b
7 b
5
6 a
7 a
8
9
10 a
10 b
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12
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14
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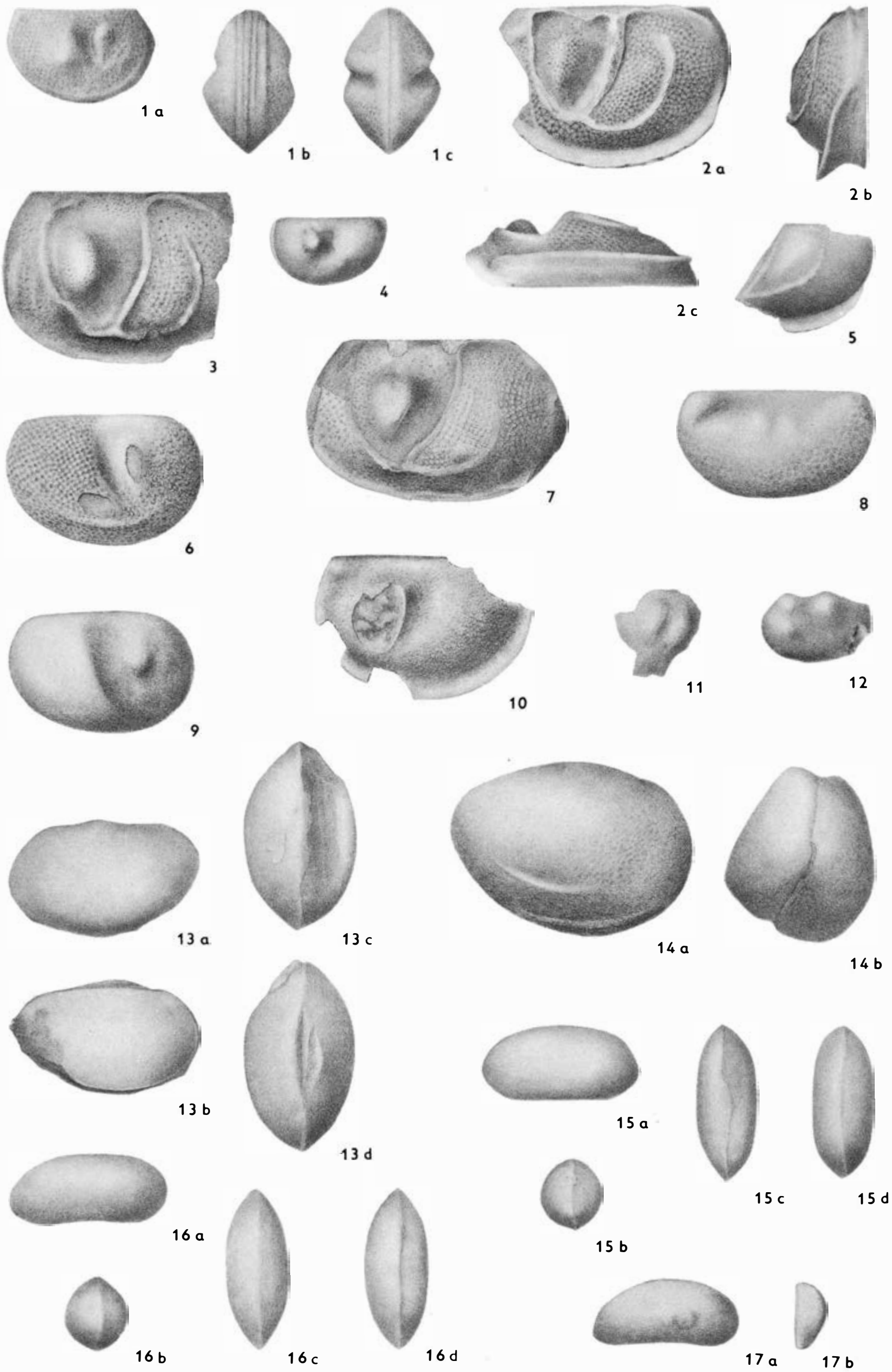
16
17
18 a
18 b
19
20


1 a
1 b
1 c
2 a
2 b
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4
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12
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13 a
13 c
14 a
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13 d
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15 c
15 d
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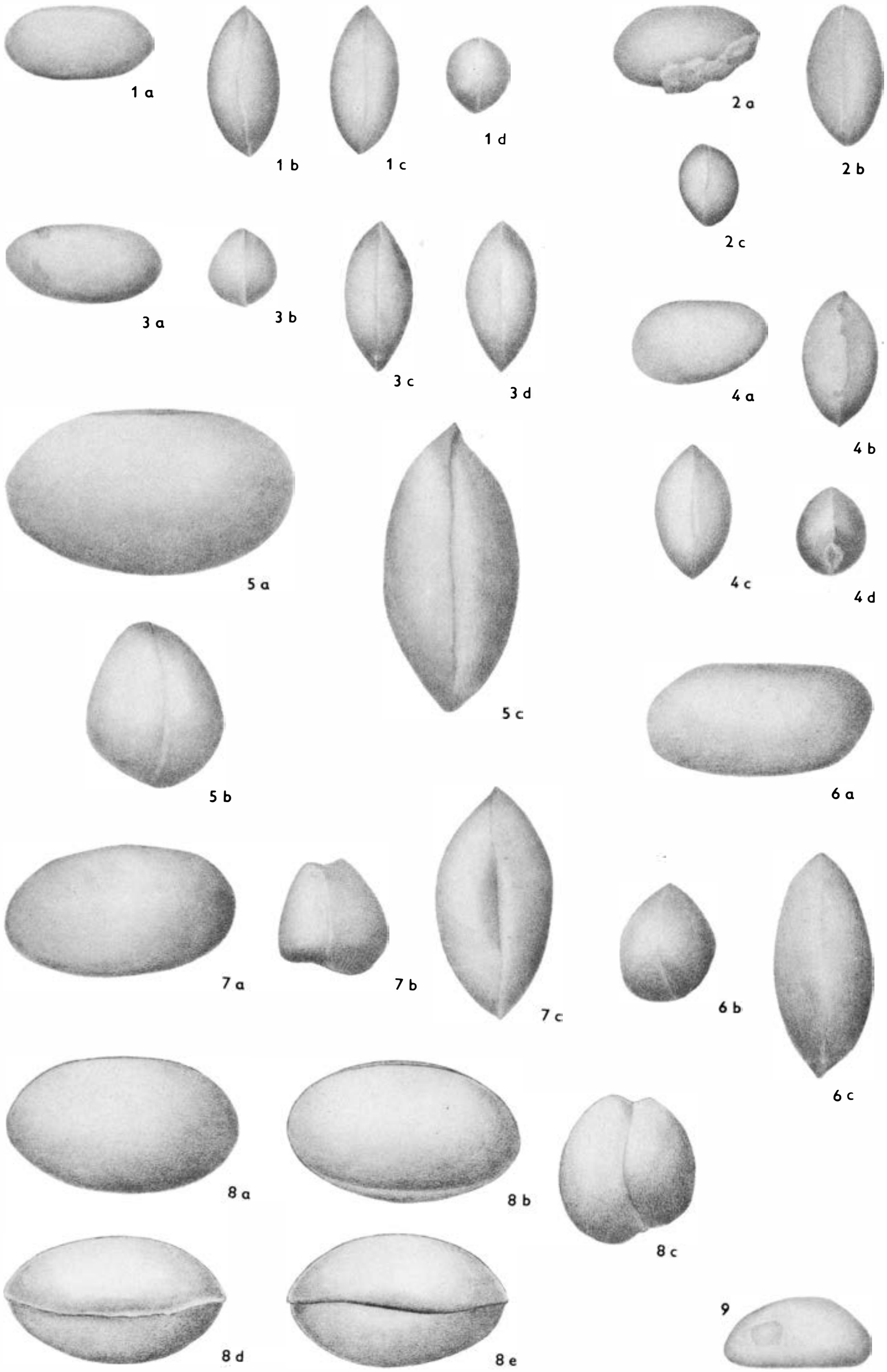
15 b
16 b
16 c
16 d
17 a
17 b


1 a
1 b
1 c
1 d
2 a
2 b
2 c
3 a
3 b
3 c
3 d
4 a
4 b
4 c
4 d
5 a
5 b
5 c
6 a
6 b
6 c
7 a
7 b
7 c
8 a
8 b
8 c
8 d
8 e
9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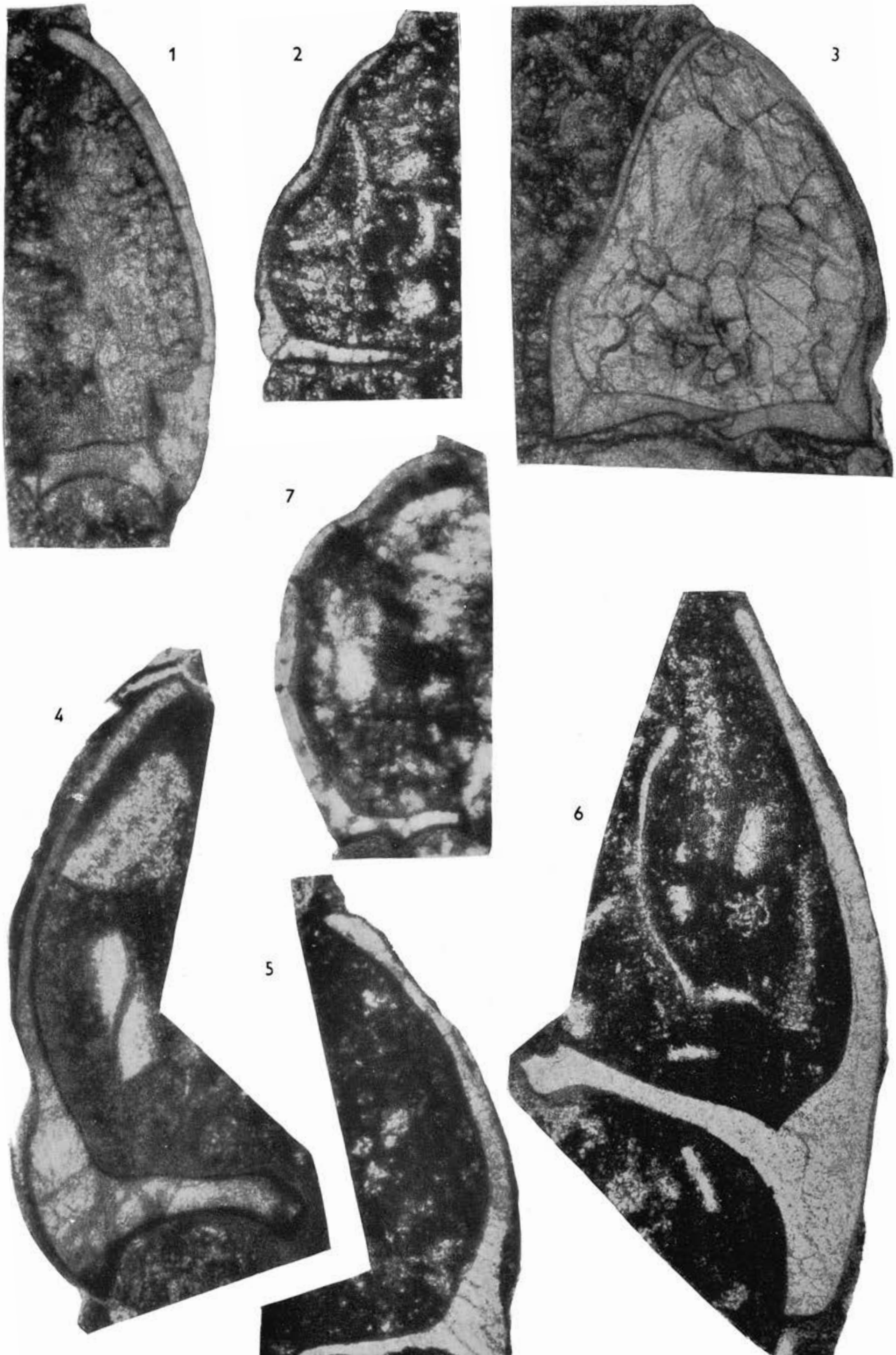
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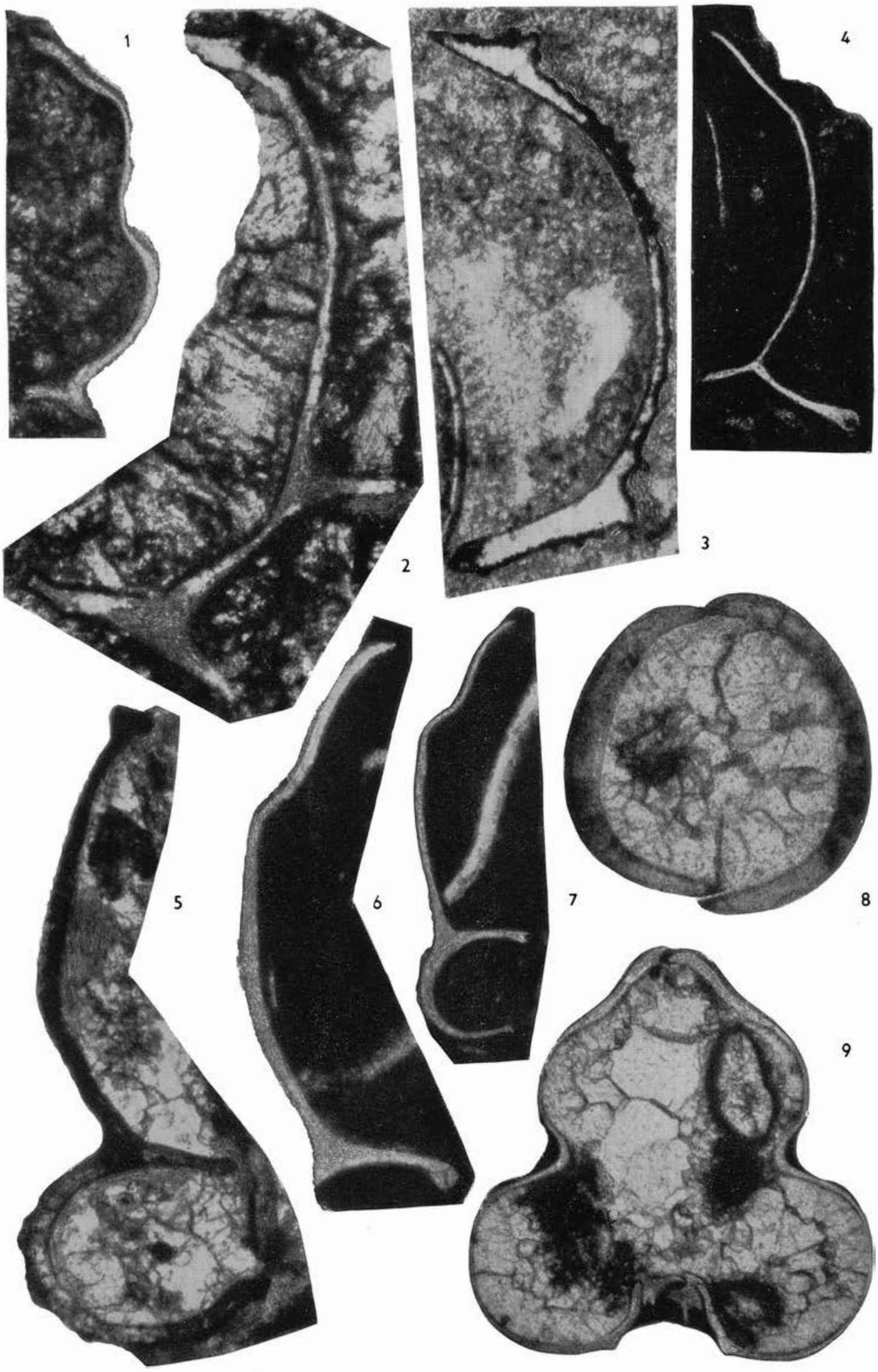
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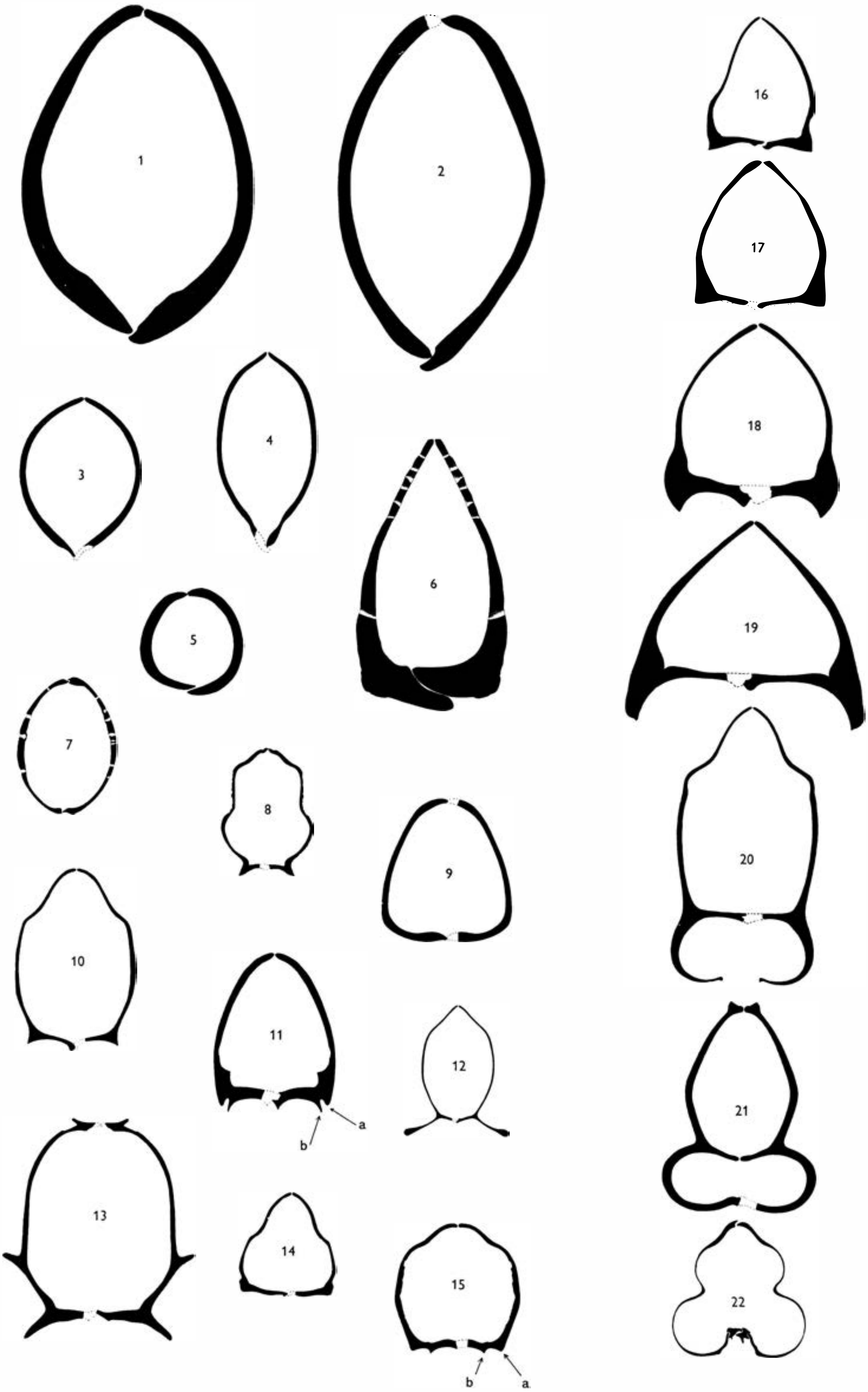
1
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a
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15
a
b
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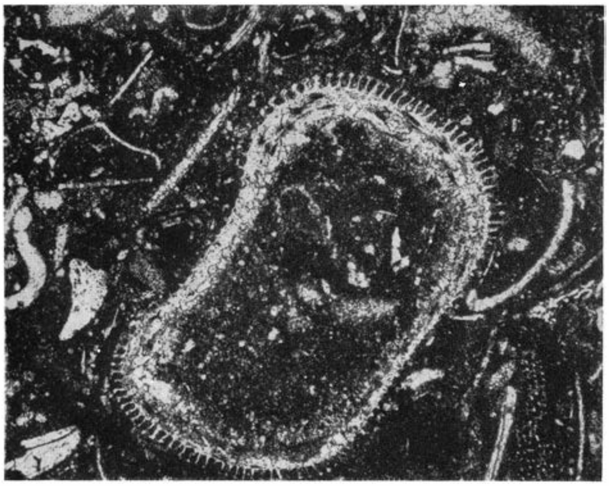
1


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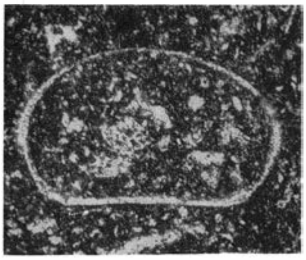

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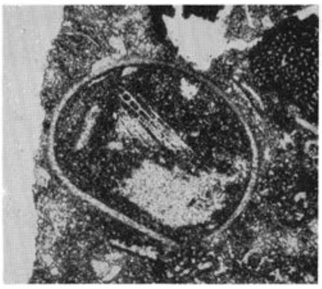

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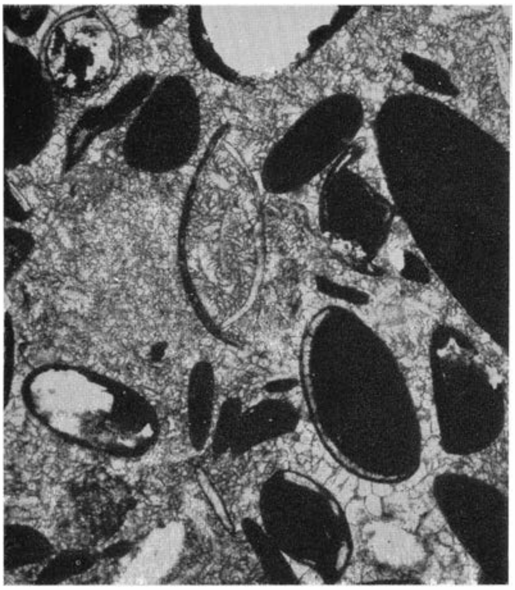

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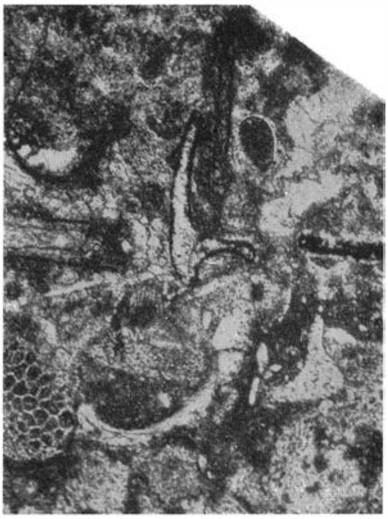

6


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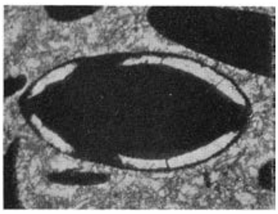

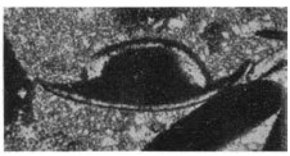

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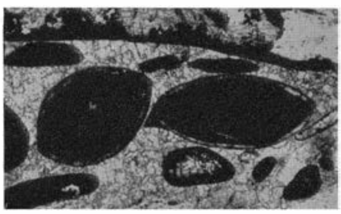

7

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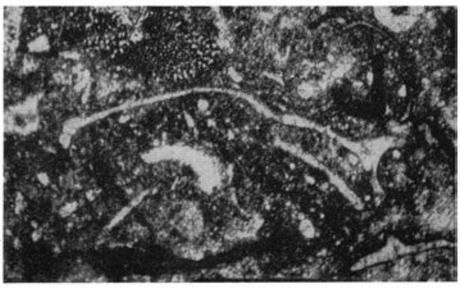
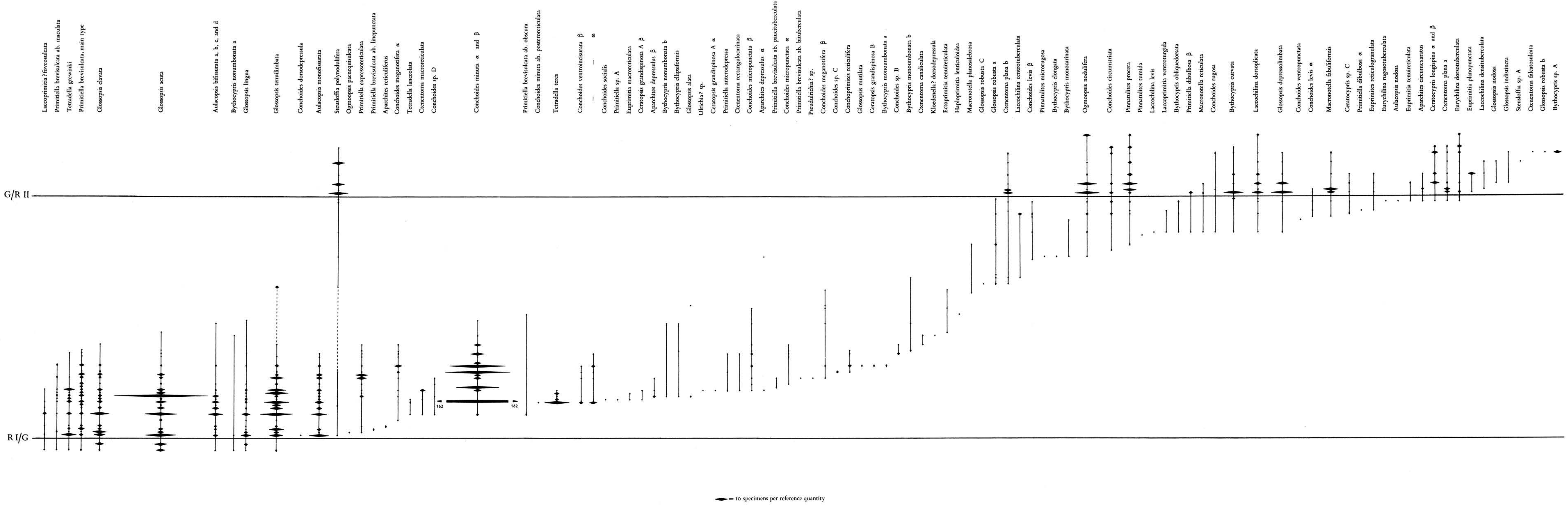


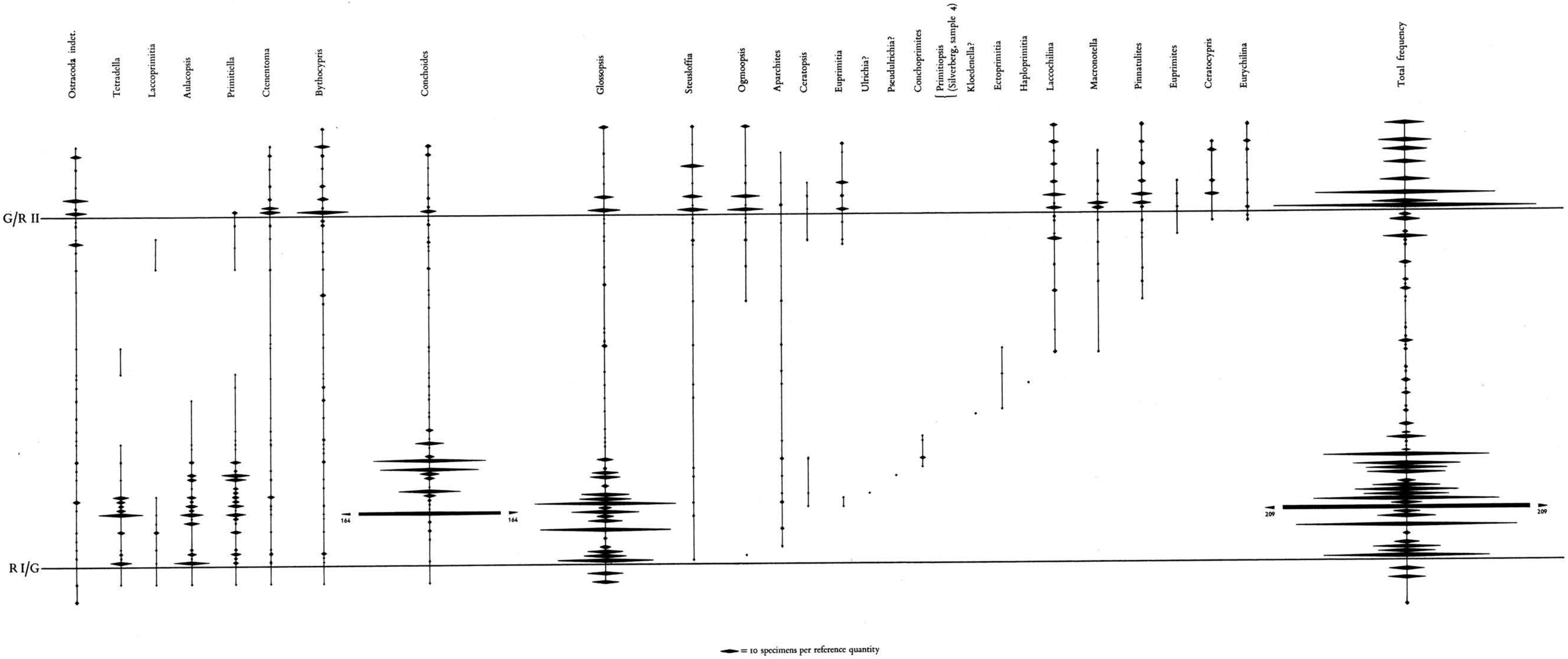

Conchoides
Aparchites
C. dorso-depressula
C. meganotifera
C. sp. D
C. minuta
C. minuta ab. posteroreticulata.
C. ventroincisurata
C. socialis
C. micropunctata
C. sp. C
C. sp. B
C. levis
C. circumstriata
C. rugosa
C. ventro-punctata
C. sp.
A. reticuliferus
A. depressulus
A. circumexaratus
A. sp.
G/R II
R I/G
= 10 specimens per reference quantity

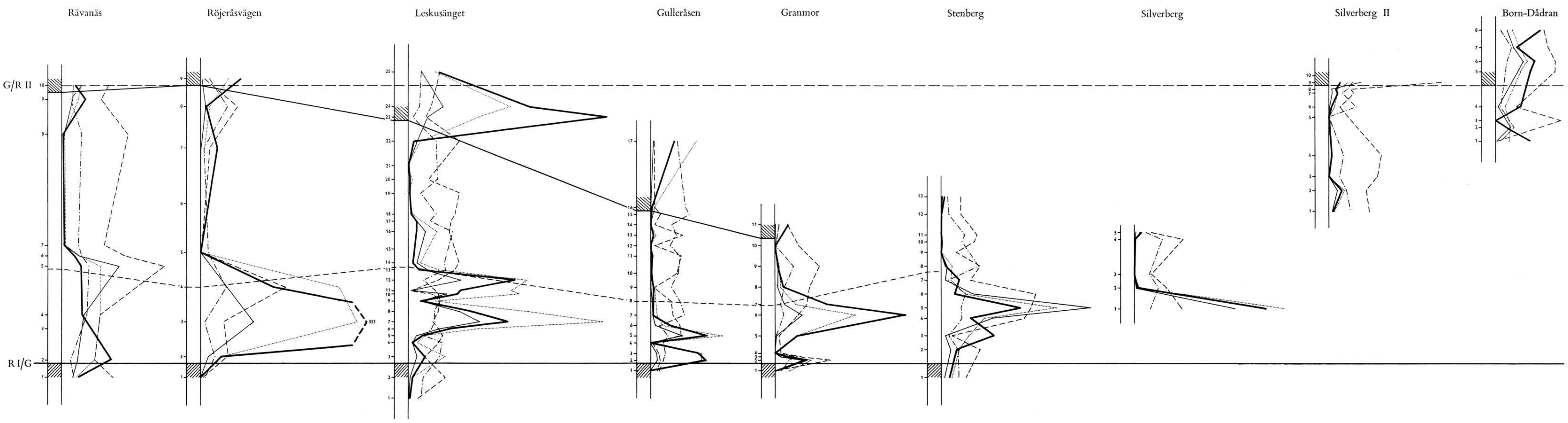

Macronotella
M. planosalebrosa
M. fabuliformis
M. reticulata
M. sp.
Ceratocypris
C. longispina
Pinnatulites
P. microrugosa
P. tumida
P. procera
Primitiella
Main type
ab. maculata
ab. lineapunctata
ab. obscura
ab. paucituberculata
ab. bituberculata
P. expressoreticulata
P. sp. A
P. anterodepressa
P. dibulbosa
P. sp.
Ectoprimitia
E. tenuireticulata
Haploprimitia
H. lenticuloidea
Laccoprimitia
L.? foveosulcata
L. ventroturgida
Conchoprimites
C. reticulifera
Primitiopsis
P. circumreticulatum
Euprimitia
E. macroreticulata
E. tenuireticulata
E. planopunctata
E. sp.
Eurychilina
E. reticulograssulata
E. rugosotuberculata
E. dorsotuberculata
G/R II
R I/G
= 10 specimens per reference quantity


Laccochilina
L. centrotuberculata
L. levis
L. dorsoplicata
L. densituberculata
L. sp.
Ctenentoma
C. macroreticulata
C. rectangulocarinata
C. canaliculata
C. plana
C. falcatosulcata
C. sp.
Aulacopsis
A. bifissurata
A. monofissurata
A. nodosa
Glossopsis
G. tenuilimbata
G. acuta
G. clavata
G. lingua
G. alata
G. mutilata
G. robusta
G. depressolimbata
G. nodosa
G. indistincta
G. sp.
G/R II
R I/G
= 10 specimens per reference quantity


Ogmoopsis
O. paenequisulcata
O. nodulifera
Ceratopsis
C. grandispinosa
C. sp. C
Tetradella
T. grewinki
T. lanceolata
T. teres
T. sp.
Steusloffia
S. polynodulifera
S. sp. A
S. sp.
Ulrichia
U.? sp.
Pseudulrichia
P.? sp.
Kloedenella
K.? dorsodepressula
Bythocypris
B. nonumbonata
B. ellipsiformis
B. monoumbonata
B. elongata
B. monocarinata
B. obliquedorsata
B. curvata
P. sp. A
P. sp.
Ostracoda indet.
G/R II
R I/G
= 10 specimens per reference quantity


Laccoprimitia ? foveosulcata
Primitiella brevisulcata ab. maculata
Tetradella grewinki
Primitiella brevisulcata, main type
Glossopsis clavata
Glossopsis acuta
Aulacopsis bifissurata a, b, c, and d
Bythocypris nonumbonata a
Glossopsis lingua
Glossopsis tenuilimbata
Conchoides dorsodepressula
Aulacopsis monofissurata
Steusloffia polynodulifera
Ogmoopsis paenequisulcata
Primitiella expressoreticulata
Primitiella brevisulcata ab. linepunctata
Aparchites reticuliferus
Conchoides meganotifera α
Tetradella lanceolata
Ctenentoma macroreticulata
Conchoides sp. D
Conchoides minuta α and β
Primitiella brevisulcata ab. obscura
Conchoides minuta ab. posteroreticulata
Tetradella teres
Conchoides ventroincisurata β
— — α
Conchoides socialis
Primitiella sp. A
Euprimitia macroreticulata
Ceratopsis grandispinosa A β
Aparchites depressulus β
Bythocypris nonumbonata b
Bythocypris ellipsiformis
Glossopsis alata
Ulrichia? sp.
Ceratopsis grandispinosa A α
Primitiella anterodepressa
Ctenentoma rectangulocarinata
Conchoides micropunctata β
Aparchites depressulus α
Primitiella brevisulcata ab. paucituberculata
Conchoides micropunctata α
Primitiella brevisulcata ab. bituberculata
Pseudulrichia? sp.
Conchoides meganotifera β
Conchoides sp. C
Conchoprimites reticulifera
Glossopsis mutilata
Ceratopsis grandispinosa B
Bythocypris monoumbonata a
Conchoides sp. B
Bythocypris monoumbonata b
Ctenentoma canaliculata
Kloedenella? dorsodepressula
Ectoprimitia tenuireticulata
Haploprimitia lenticuloidea
Macronotella planoscabrosa
Glossopsis robusta C
Glossopsis robusta a
Ctenentoma plana b
Laccochilina centrotuberculata
Conchoides levis β
Pinnatulites microrugosa
Bythocypris elongata
Bythocypris monocarinata
Ogmoopsis nodulifera
Conchoides circumstriata
Pinnatulites procera
Pinnatulites tumida
Laccochilina levis
Laccoprimitia ventroturgida
Bythocypris obliquedorsata
Primitiella dibulbosa β
Macronotella reticulata
Conchoides rugosa
Bythocypris curvata
Laccochilina dorsoplicata
Glossopsis depressolimbata
Conchoides ventropunctata
Conchoides levis α
Macronotella fabuliformis
Ceratocypris sp. C
Primitiella dibulbosa α
Euprimitia reticulogranulata
Eurychilina rugosotuberculata
Aulacopsis nodosa
Euprimitia tenuireticulata
Aparchites circumexaratus
Ceratocypris longispina α and β
Ctenentoma plana a
Eurychilina dorsotuberculata
Euprimitia planopunctata
Laccochilina densetuberculata
Glossopsis nodosa
Glossopsis indistincta
Steusloffia sp. A
Ctenentoma falcatosulcata
Glossopsis robusta b
Bythocypris sp. A
G/R II
R I/G
162
162
= 10 specimens per reference quantity


Ostracoda indet.
Tetradella
Laccoprimitia
Aulacopsis
Primitiella
Ctenentoma
Bythocypris
Conchoides
Glossopsis
Steusloffia
Ogmoopsis
Aparchites
Ceratopsis
Euprimitia
Ulrichia?
Pseudulrichia?
Conchoprimites
Primitiopsis (Silverberg, sample 4)
Klodenella?
Ectoprimitia
Haploprimitia
Laccochilina
Macronotella
Pinnatulites
Euprimites
Ceratocypris
Eurychilina
Total frequency
G/R II
R I/G
164
164
209
209
= 10 specimens per reference quantity

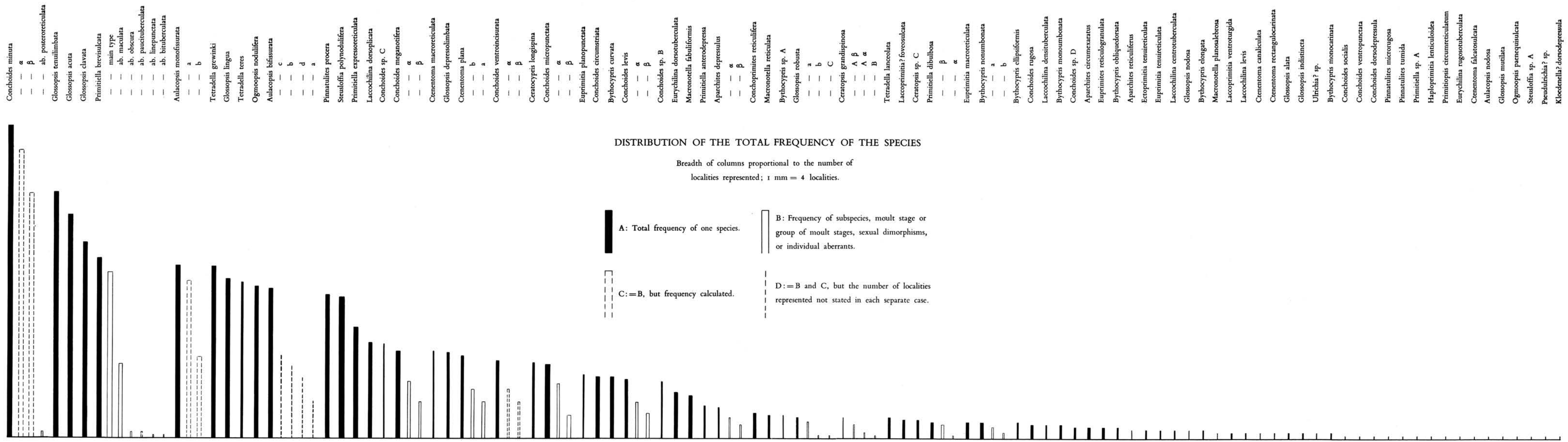


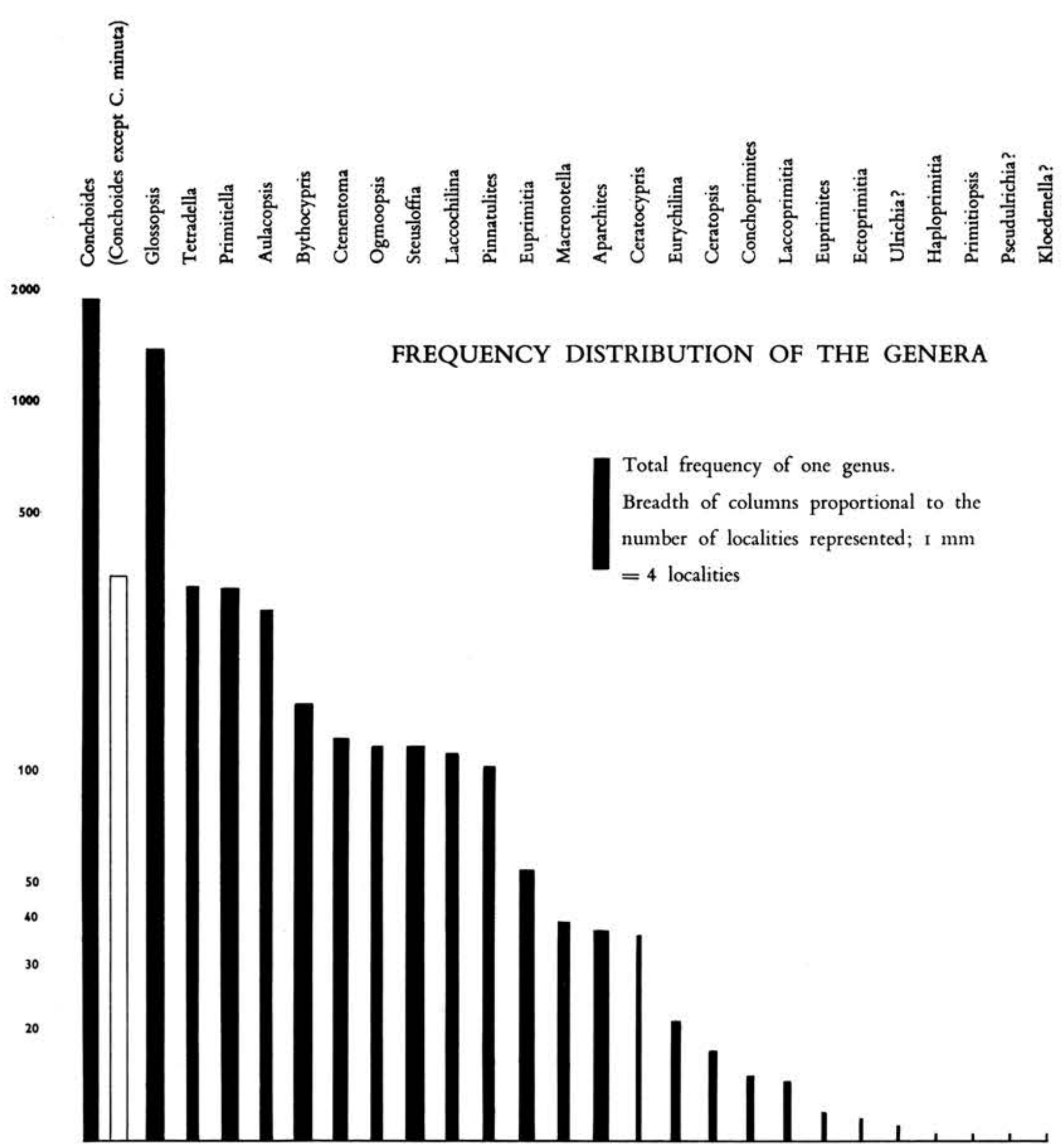
1 Total frequency of Ostracods per 10 samples weighing together 100 g
2 Total frequency of Ostracods per 10 samples
3 Number of samples investigated
4 Number of specimens observed
5 Correction factor for the weight

0 10 20 30 40 50 100
Scale for 1, 2 and 3

0 50 100 150 200 250 500
Scale for 4

0 1 2 3 4 5 10
Scale for 5


DISTRIBUTION OF THE TOTAL FREQUENCY OF THE SPECIES
Breadth of columns proportional to the number of localities represented; 1 mm = 4 localities.
A: Total frequency of one species.
B: Frequency of subspecies, moult stage or group of moult stages, sexual dimorphisms, or individual aberrants.
C: = B, but frequency calculated.
D: = B and C, but the number of localities represented not stated in each separate case.
2000
1000
500
100
50
40
30
20


FREQUENCY DISTRIBUTION OF THE GENERA
Total frequency of one genus. Breadth of columns proportional to the number of localities represented; 1 mm = 4 localities
Conchoides
(Conchoides except C. minuta)
Glossopsis
Tetradella
Primitiella
Aulacopsis
Bythocypris
Ctenentoma
Ogmoopsis
Steusloffia
Laccochilina
Pinnatulites
Euprimitia
Macronotella
Aparchites
Ceratocypris
Eurychilina
Ceratopsis
Conchoprimites
Laccoprimitia
Euprimites
Ectoprimitia
Ulrichia?
Haploprimitia
Primitiopsis
Pseudulrichia?
Kloedenella?
2000
1000
500
100
50
40
30
20