Foraminifers

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This account of Foraminiferida is based solely on material from the small rock samples (50 g) used for analysis of the Chitinozoa. When making such analyses I routinely make notes on abundance and sometimes diversity of all other acid-resistant fossils in a sample. Notes on foraminifers are presented here since otherwise an account of these fossils would be lacking in this publication. However, it should be appreciated that 50 g samples are too small for an elaborate study of Silurian foraminifers, and that only tests consisting partly or entirely of organic material are preserved in the sample residues since the samples were processed with hydrochloric, nitric and hydrofluoric acid. This also means that mineral grains originally cemented to and incorporated in the foraminiferal tests were dissolved by the acids. For a summary account such as this, this is no severe objection, but in an elaborate biological and ecological study thin sections should also be scrutinized, together with samples processed specifically for agglutinated material.

Despite the fact that foraminifers are very abundant in the Gotland strata, these fossils have not yet been fully monographed. As far as I am aware, Chapman was the first to report a foraminifer from the Silurian of Gotland (1895:324). The early publications on Gotland material by Chapman (1901) and Smith (1915) are badly in need of revision. Some foraminifers were reported also by Rothpletz (1913). Eisenack (1932, 1954, 1959, 1966a, b, 1967) described several foraminifers from Gotland in a series of useful publications which form the main basis of our knowledge of these fossils on the island.

Only two of the five suborders of Foraminiferida (*sensu* Loeblich and Tappan 1964) are indisputably represented on Gotland, viz. Allogromiina and Textulariina. Specimens of the former suborder have membranous or pseudochitinous tests without or with very little agglutinated material. The Textulariina contain forms with a test of agglutinated foreign matter held by various cements (Loeblich and Tappan 1964: 164, 184). Both suborders are represented at Vattenfallet.

Annotated faunal list

As this is essentially a preliminary study as a by-product of my work on Chitinozoa, the taxonomy used here is chiefly at the generic level. It is beyond the scope of this contribution to discuss the various different species names

used by American and European micropalaeontologists, based either on specimens having agglutinated material preserved or on specimens of the same species in which the foreign material has been dissolved by acids. The results of the two schools are incompatible and the large number of species (and genus) names is unwarranted. I have used Loeblich and Tappan's classification (1964) but pending further studies of foraminiferal nomenclature, the genus and species names used are those based only on material described from Gotland. The distribution is shown in Fig. 21.

Textulariina

Blastammina sp.; *Pseudoastrorhiza* sp.; Saccaminidae gen. *a*, sp.; Saccaminidae gen. *b*, sp.

Blastammina and *Pseudoastrorhiza* were described by Eisenack (1932) with *Blastammina polymorpha* and *Pseudoastrorhiza silurica*, respectively, as type species. Most *Blastammina* specimens from Vattenfallet can be referred to *B. polymorpha* but it can not be excluded that other species, e.g. of *B. polyedra* type, are represented in the material. For discussion and illustration of these taxa, see Eisenack (1932:261–265, Pl. 11:11–18; 1954:59–61, 68–69, Pl. 2:1–7, 11–12, 14–15, Pl. 5:11; 1966b:384–389, 392, 395–396, Pl. 29:3, 5–10, Pl. 30:2, 4–6, and Pl. 32:1, 8; 1967:259–261, Fig. 5–6, Pl. 27:5),

Pseudoastrorhiza is represented by scattered specimens probably belonging to only one species.

The Sacamminidae are represented by two other species groups, here referred to as Genus *a* and *b*, respectively. Specimens with a test structure similar to that of *Blastammina striata* (see Eisenack 1966b, Pl. 30:3; 1967, Pl. 27:6–7) are referred to Genus *a*, since the structure of the organic test wall is entirely different from that of the type species of *Blastammina*. Genus *b* embraces specimens with a test structure similar to that of *Blastammina fenestrata* (Eisenack 1954:61, Pl. 2:8–10; 1967:261, Pl. 27:1–3) which differs so much from that of the type species of *Blastammina* and from Genus *a* that a separate generic designation seems warranted.

Allogromiina

Archaeochitinia (Lagynacea, Allogromiidae) is represented by one species only, viz. the type species *A. gotlandica* Eisenack, 1954 (see Eisenack 1954:54–55, 68, 70, Pl. 1:9–10; 1966b:390, Pl. 32:10; 1967:269–270).

Archaeochitosa (Allogromiidae) was described by Eisenack in 1959, the type species being *A. lobosa*. The genus is represented by specimens similar to *A. clausa* Eisenack, 1959 and *A. lobosa* Eisenack, 1959, but a species designation cannot be made until a detailed study of the variation of the vesicle shape in relation to substrate has been made on all Baltic *Archaeochitosa* species and until their nomenclature has been revised. For descriptions and photographs

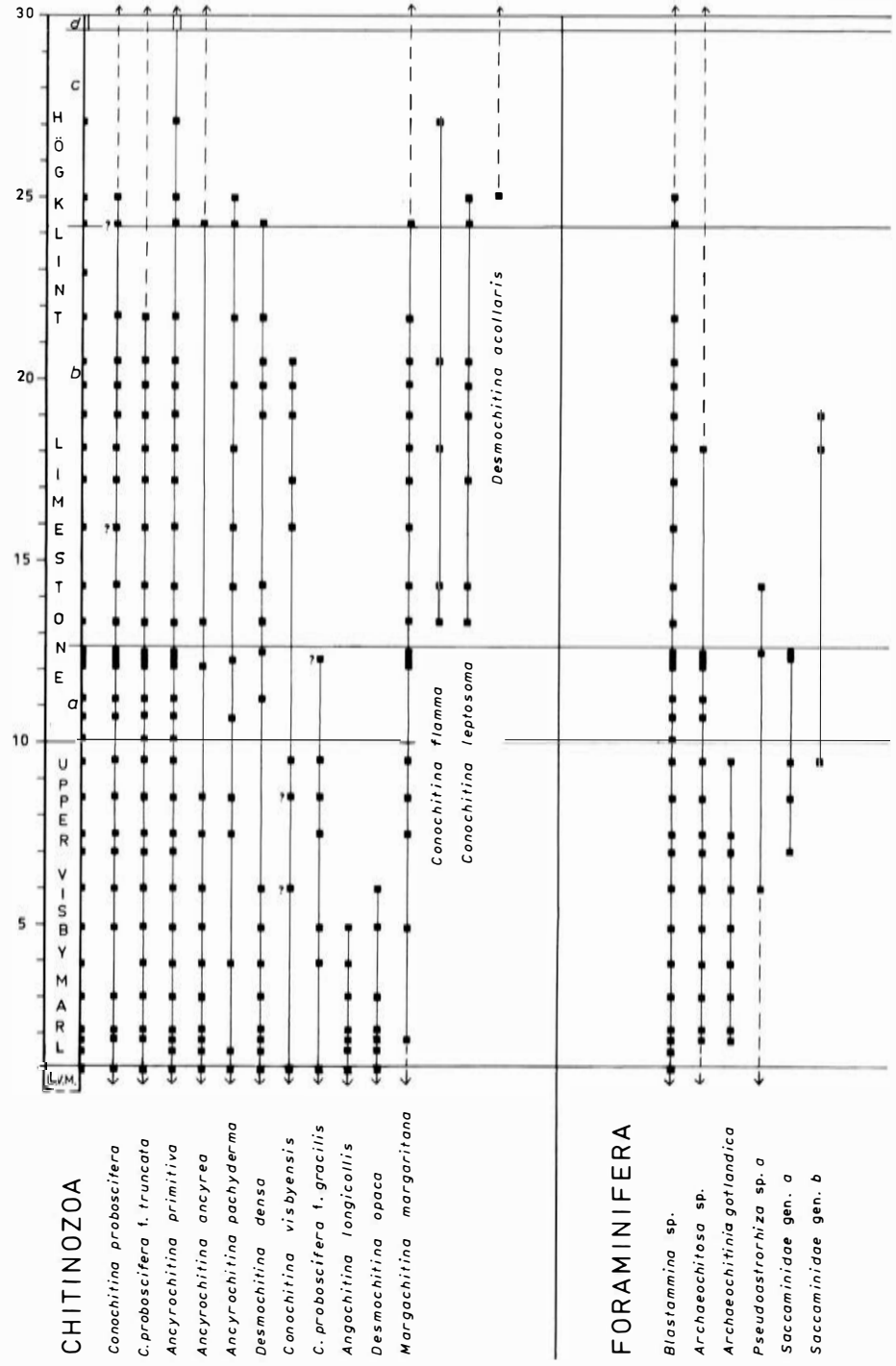
30
25
20
15
10
5
d
c
b
a
HÖGKLINT
LIMESTONE
UPPER VISBY MARL
LVM
CHITINOZOA
Conochitina proboscifera
C. proboscifera f. truncata
Ancyrochitina primitiva
Ancyrochitina ancyrea
Ancyrochitina pachyderma
Desmochitina densa
Conochitina visbyensis
C. proboscifera f. gracilis
Angochitina longicollis
Desmochitina opaca
Margachitina margaritana
Conochitina flamma
Conochitina leptosoma
Desmochitina acollaris
FORAMINIFERA
Blastammina sp.
Archaeochitosa sp.
Archaeochitinia gotlandica
Pseudoastrorhiza sp. a
Saccaminidae gen. a
Saccaminidae gen. b

Fig. 21.

see Eisenack (1959:90–94, Pl. 9:1–11; 1966:389–391, 395, Pls. 30:8–10, 31:2–5, 32:2–3, 7; 1967:270.

Abundance

Foraminifers occur in all samples studied except for the uppermost four (Fig. 21). The absence of specimens from the middle–upper part of Högklint *c* and from Högklint *d* is possibly the result of the small sample size. It seems probable, however, that local palaeoecological conditions were unfavourable to foraminifers during the time corresponding to this interval, since their frequency appears to decrease upwards through the Högklint Beds. This conclusion is also supported by the fact that *Blastammina* specimens (which occur in all other samples of the section and thus display a fairly strong independence of facies) are the only foraminifers found in the upper part of Högklint *b* and lower part of Högklint *c*.

The most important conclusion to be drawn is that foraminifers played a fairly important role in the Silurian ecosystems of Gotland (the same is true of most Silurian carbonate sequences throughout the world).

Stratigraphical remarks

The stratigraphical range of *Archaeochitosa* is Ordovician–Jurassic and that of *Blastammina* and *Pseudoastrorhiza* late Ordovician–Silurian. (In the "*Treatise*" Loeblich and Tappan give too short ranges for the last two genera.) Thus, as would be expected, taxa at the generic level are of no stratigraphical use in this study.

The type stratum of *Archaeochitinia gotlandica* is within the Upper Visby Marl (Eisenack 1954:54), and according to Eisenack the species has been found definitely only in the Upper Visby Marl (Eisenack 1954:55), with a possible occurrence also in the Lower Visby Marl (Eisenack 1966b:390). *A. gotlandica* disappears close to the uppermost sample of the Upper Visby Marl at Vattenfallet. The absence of the species from the Högklint Limestone in this section corroborates Eisenack's results. It is not improbable that *A. gotlandica* will prove to be a good index fossil for Upper Llandovery, even though its degree of independence of lithofacies remains to be tested.

Other Gotland foraminifers, e.g. *Blastammina* species, seem to have fairly restricted stratigraphical significance. However, they will be of great use in palaeoecological interpretations, since several specimens show impressions of their substrate. Some, for example, lived attached to skeletal fragments of bryozoans, conodont elements and scolecodonts lying on the sea-bed.

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