

Silurian Chitinozoa from Gotland

Sven Laufeld



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Silurian Chitinozoa from Gotland

SVEN LAUFELD



Project
ECOSTRATIGRAPHY

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Silurian chitinozoans from 475 localities in the Late Llandoveryan through Ludlovian of Gotland, Sweden, are discussed. Sixty-four species are described. One genus, *Gotlandochitina*, and thirty-two species are described as new. The micromorphology of the ornamentation, appendices, prosome, operculum, and vesicle wall is discussed. The abundance and diversity of the chitinozoans of Gotland have been calculated and are discussed in connection with a palaeo-ecologic interpretation. A method for calculating the productivity in oceans of earlier times is briefly sketched. The systematic position of the chitinozoans is discussed, and it is concluded that they were eggs of polychaetes and gastropods. The local range zones of the chitinozoans in the Silurian of Gotland are established, and some consequences in the correlation are indicated.

S. Laufeld, Department of Historical Geology and Palaeontology, Sölvegatan 13, S-223 62 Lund, Sweden, 1974 03 20.

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Introduction

The chitinozoans are a group of organic-walled microfossils which occur in marine sedimentary rocks of early Ordovician to early Carboniferous age. The chemical resistance of the urn-, tube- or flask-shaped chitinozoan vesicles is of such a kind that they can be extracted from the rocks and concentrated for microscopic study by dissolution of the rocks in inorganic acids. The chitinozoans were discovered by the German scientist A. Eisenack in 1929, and this pioneer is still one of the most active students of the group. It seems quite remarkable that Eisenack remained almost the sole student of Chitinozoa for almost two decades. In the 1950's papers from several other scientists came into sight, but it was not until about 1960 that an "explosion" of papers on the group occurred. Nevertheless, the number of publications dealing with chitinozoa has not reached 300.

Several papers on the group are concerned with descriptions of morphology and, with some notable exceptions, most papers deal with poorly dated material, e.g., from glacial erratics or exploration drillings. A major disadvantage towards an understanding of the stratigraphical importance of the chitinozoans has been the poor illustrations in connection with descriptions of new taxa. Several papers are concerned with material stated as flattened, but in many others the reader remains doubtful as to whether the material is preserved in full relief or deformed to any greater or lesser extent. The systematics of chitinozoans is based mainly on the over-all shape of the vesicle and its ornamentation. Hence, it is of vital importance to know if the specimens described and figured are deformed or not.

The present study of the Silurian chitinozoans of Gotland was initiated for several reasons. Firstly, the Gotlandian series of strata consists of a great number of lithologies characteristic of an epicontinental sea with reef formation. The sequence of rocks comprises about two thirds of the Silurian Period and the occurrence of well-preserved chitinozoans had been established in pioneer studies by Eisenack (1962b, 1964a) and Taugourdeau & Jekhowsky (1964). Gotland held good promise for obtaining an abundance of chitinozoans preserved in full-relief and was therefore well-suited for a study by a scanning electron microscope. The possibility of establishing a chitinozoan biozonation of the Silurian of Gotland, an area with the qualifications of an international stratotype, seemed attractive.

Secondly, the variety of facies in a reef-controlled sedimentary regime in connection with very low dip of the strata should make it possible to answer some

palaeoecological questions. The dependence or non-dependence between chitinozoans and lithofacies has been a matter of dispute for several years.

Thirdly, Gotland was chosen because of the fascination of the island and its geology in itself, and because of the fact that the work could be carried out in a team of spirited colleagues and friends aiming at new ecostratigraphic syntheses of the Silurian of the island.

It deserves mentioning that very little subsurface material is dealt with in this paper. Initially, the chitinozoan successions of the Rosendal and När boring cores were planned to be included in this study. The major reason for not including this material here is that the amount of my subsurface data is equal to that dealt with herein. The subsurface data contain very little new information contributing to understanding of the morphology and systematics of the chitinozoans because of the poorer state of preservation. The palaeoecological conclusions herein are only further supported by the core material, but nothing new can be learned in that respect. The greatest merit of the subsurface data lies in the further refinement of the chitinozoan biozonation. The data will be published when the study of the graptolite succession of the cores has been finished, because the latter will provide the key for the chitinozoan parazonation.

The present study was performed at the Department of Historical Geology and Palaeontology, University of Lund. I am most obliged to Professor Gerhard Regnéll, Director, for all facilities put at my disposal and for financial support, especially in connection with the printing of this paper. Dr. J. Ernhold Hede has shown a constant interest in my studies, and I am especially grateful to him for reading the stratigraphical review of the Silurian of Gotland. It is also a great pleasure to thank Drs. Jan Bergström and Lennart Jeppsson for stimulating discussions. Mrs. Ann-Sofi Jeppsson has typed a major part and Mrs. Ingrid Lineke the remaining part of my manuscript in a masterful way. Mrs. Siri Bergström made the drawings and Mr. Sven Stridsberg did a lot of the photographic work and helped me preparing the final figures. Mr. Brian Holland and Dr. John Peel have corrected my manuscript from a linguistic view. The stereoscan photographs were obtained thanks to the kind cooperation of Mr. P. G. Arbstedt, Mr. Per Lindskog and Miss Monica Olsson of the Höganäs AB, and Miss Birgitta Sandström and Mr. Folke Larsson of the Department of Zoology, Lund. Ms. Trissan Hansson and Mr. Björn Sundquist have kindly assisted in the proof-reading.

One person is left to thank, Professor Anders Martinsson of Uppsala. Ever since my studies of Chitinozoa became a part of the Baltic-Scanian Silurian Project he has shown a never-failing interest and support in this work. He guided me to several critical exposures and sections in Gotland and his generosity has continued in many inspiring discussions and advice all through the years. His kind support has lasted even to the printing of the last sentence of this paper.

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Methods

Collecting.—One of the main intentions of this investigation was to obtain more detailed knowledge of the palaeoecology of chitinozoans. Therefore, the collecting of samples was not restricted to specific lithologies, even though some lithologies, e.g., biohermal limestones and coarse reef detritus, have low potentials for yielding these fossils (Laufeld 1967: 281–282; Jenkins 1970a: 11; Obut 1973: 74; cf. Eisenack 1964a: 337–338). Samples were collected in all types of lithologies all over the island. The only bias in this respect is that some areas are inaccessible for sampling, because of a thick soil cover.

Very little is known about the time needed for the disintegration of organic-walled microfossils once the rocks have been exposed to weathering. But, as we know that an oxidizing environment sooner or later will disintegrate these fossils, all samples have been collected from the most unweathered rock material available. In some instances it has been possible to test the effect of weathering in rocks that were excavated by man many years ago. The chitinozoans in argillaceous limestones (e.g. in the Upper Visby and Mulde Beds) show no trace of disintegration after 50–75 years of weathering of these rocks. Many exposures and sections in Gotland, however, have been exposed to weathering during geological time intervals and, therefore, as fresh rock material as possible has been processed throughout this investigation.

All samples collected (0.5–2 kg each) represent a vertical thickness of 5 cm, unless another thickness is stated in the description of localities and samples.

It has been my intention to collect samples in such a way that it should be possible to relocate the exact sampling spot or level in each locality. Whenever possible the sampled bed has been related to a reference level in the section. In several localities, especially those exhibiting one or several metres of strata, the beds sampled were marked with a coloured dot by an aerosol bottle of enamel paint. Before leaving the locality the section was photographed. Hence, it has been possible to revisit many localities and sample intervals not collected earlier.

Treatment of samples.—Some 300 g of each sample were crushed to hazelnut-size. The crushing was performed on a specially tempered steel plate with a heavy (1.5 kg) hammer. If the slabs are placed inside a wide steel ring with 3–5 cm high walls lying on the plate, the splashing of chips can be kept at a minimum. All utensils were cleaned by a brush before the crushing of a new sample. The crushing of the samples to hazelnut-size speeds up the dissolution of the samples substantially. Comparative experiments

have demonstrated that about one to five per cent of the chitinozoans are fragmented if the samples are crushed to hazelnut-size. The above-mentioned procedure is therefore recommended for all routine analysis, unless very small and unique samples are at hand (cf. Eisenack 1964a: 313).

As a standard, 50 g of the crushed sample were treated by acids. If no or very few chitinozoans were obtained in a 50 g sample, multiples of 50 g were processed. If no or very few chitinozoans were obtained from 1 kg of rock no further efforts were made. (In the beginning of this investigation one sample weighing 10 kg from the Sundre Beds at Västerbackar and one sample weighing 15 kg from the Hemse Beds at Kuppen 2 were dissolved without obtaining a single chitinozoan specimen.)

The 50 g samples were processed in 500 cc polyethylene beakers according to the following procedure.

(1) Dissolution in hydrochloric acid.

To avoid too strong a reaction with an excess of foam water was poured into the beaker until just covering the chips. Small amounts of acid of 5 % concentration were added repeatedly until the reaction almost ceased. A little concentrated acid was then added and the sample left until the reaction was finished (2 hours—3 days). The liquid was then diluted in order not to etch the sieve to be used. If 50 g samples and 500 cc beakers are used the filling up of the beaker with water is always enough to avoid spoiling the sieve.

(2) Sifting and rinsing.

The sample was sifted through a nylon sieve (45 μ m) in gently running water.

The sieves are made in our laboratory in the following way. A piece measuring 80×300 mm is cut from a 1 mm thick celluloid sheet. The short sides are held together by tape and then cemented by repeated addition of acetone inside the seam. The seam may be strengthened further by placing a thin strip of celluloid along it. A piece of nylon straining-cloth (made under the name Nylal by Schweiz. Seidengazefabrik A.G., Thal, St. Gallen, Switzerland) is then cut to fit the celluloid “tube” with 5–10 mm of nylon cloth extending around the edge of it. A thin string of cement of cellulose acetate type is put along the edge of the tube and the nylon cloth is centred over it. The nylon cloth is pressed to the cement and left to dry. The sieve is then completed by gluing the projecting part of the nylon cloth to the sides of the tube fixed with a rubber band while drying.

The residue was then poured back into the plastic beaker.

(3) Etching in hydrofluoric acid.

Concentrated acid was used. If the samples were rich in mica and/or quartz the dissolution was speeded up by gently agitating the beaker now and then during the first hour of reaction. Agitation of the beaker also prevents the formation of a hard crust in the upper part of the residue. The samples were left for 1–3 days and were then diluted with water.

(4) Sifting and rinsing.

(5) Etching in nitric acid.
Concentrated acid was used and the samples were left for 2 hours—2 days, the time depending on the amount of pyrite in the sample.

(6) Sifting and rinsing.

(7) Storage of residue in water in low plastic beakers.
In order not to introduce systematical errors into the investigation all samples were treated according to the above-mentioned procedure, even though steps 1—2 were sufficient for the extraction of chitinozoans from, e.g., biohermal limestones.

The most effective way of routine dissolution of samples from a platform carbonate area such as Gotland has proved to be an acid treatment of about 20 samples at a time. In, e.g., step 1 the reaction has ceased in the first beaker when the first acid is poured into the 20th, wherefore no time is wasted in the laboratory.

When laboratory treatment of samples started each sample was registered in a special form which then followed the sample also through the procedure of microscopy. The head of such a form is seen in Fig. 1. That part of the form which is above the first thick line is completed in the laboratory. Most headings are self-explanatory. It should be noted, however, that if silicified or pyritized fossils were noticed in the sieve after the treatment with hydrochloric acid this was marked by a cross in the box “Silicif.” and “Pyrit.”, respectively. The standard weight of a sample was marked by a cross in the box “50 g”. The letter B stands for boiling. In this investigation, however, all samples dissolved without boiling.

Light microscopy and counts.—All sample residues coming from the laboratory in low plastic beakers (20×70 mm, 60 ml, circular and transparent, made by Cerbo AB, Box 4007, S-461 04 Trollhättan, Sweden) were studied under a stereoscopic microscope (Zeiss Stereo II) at a magnification of 40× in the following manner. The transparent plastic beakers were placed on a white plastic disc of the same diameter as the beaker. The disc had been marked by indian ink with lines radiating from its centre and with a circle at half of the radius. Inside the circle there are 26 sectors and outside 52. The sample was then searched through under the microscope, sector after sector. Each specimen was referred to a species or assigned a working name. To the right of the microscope a bank of 10 manually operated counters (made by English Numbering Machines Ltd., Queensway, Enfield, Essex, England) was used. In front of each counter a low plastic box (20×9 mm, circular and transparent, made by Harlid & Stern, Möbelgatan 6, S-431 33 Mölndal, Sweden) had been placed. Each chitinozoan taxon had its own counter and small plastic box. During the microscopy and counting work well preserved specimens were picked up with a finely drawn glass pipette (consisting of the pipette, a joint

Sample No.	Locality										Silicif.	Pyrit.	50 g			
Beaker No.	Stratigraphy										HCl	HF	HCl B			
											HNO ₃	HNO ₃ B	HF B			
Microscopy	/ 19			Nil			Small		Medium		Great					
Kerogene	1	2	3	Tasm.	1	2	3	Melanoskl.					1	2	3	
Mica, light	1	2	3	Hyst.	1	2	3	Chitinozoa: Preservation								
Mica, dark	1	2	3	Trilet.	1	2	3									
Quartz	1	2	3	Foram.	1	2	3	Total number							Frequency	
Pyrite	1	2	3	Camp.	1	2	3									
				Scol.	1	2	3									
				Sicul.	1	2	3									
				Euryp.	1	2	3									
Species															Numb.	Slide
1.																
2.																
3.																
4.																

Fig. 1. Part of the form used for the laboratory and primary microscopy work. Instructions for use are dealt with in the text.

Abbreviations: *Tasm.* = tasmanitids, includes all smooth, more or less spheroidal spores not having trilete marks. *Hyst.* = hystrichospheres, includes all kinds of spores having some kind of spinose ornamentation. Thus, these designations are of waste-basket type. *Trilet.* means trilete spores (commonly occurring in tetrads). *Foram.* includes the foraminifers. *Camp.* = campanularid hydrozoans. *Scol.* = scolecodonts. *Sicul.* = graptolite siculae of all stages; rhabdosome fragments were marked in the extra space. *Euryp.* includes fragments of eurypterid cuticula. *Melanoskl.* = melanosclerites.

of rubber tube and a glass tube with a mouthpiece of rubber, and kept in the mouth all through the microscopical investigation) and put in their respective plastic boxes. The boxes were then glued to ordinary microscopic slides with a cement of acetate type, preferably one that whitens (in Sweden Cliffilm) some time after its drying, thus giving good contrast to the chitinozoans.

During the microscope work the area between the thicker lines in the above-mentioned form (Fig. 1) was filled in. After the box with the date of microscopy are four boxes referring to the relative size of the sample residue as a whole. “Small” means that up to a third of the bottom of the plastic box is covered, “Medium” between one and two thirds and “Great” that more than two thirds are covered. A subjective estimate of the kerogenaceous and mineralogenic residues, if any, is marked in the left column. The presence of mineralogenic components in the residue is often only an indication of too short acid treatment, but this information has proved useful when more sample material is to be processed. If other organic-walled microfossils (and eurypterid fragments) were present in the sample their abundance was estimated and marked in the right column by encircling one of the figures. If 1 is encircled there were only rare specimens, 2 means fairly common to common and 3 abundant specimens of the group of fossils in question. It should be stressed that the estimates are fairly subjective and that the figures for one group of fossils can not be compared with those of another. An abund-

ance of scolecodonts means say 25 specimens, but an abundance of hystrichospheres means at least several hundred specimens. These estimates were included in the form in order to get at least some idea about the co-occurrence or mutually exclusive occurrence of chitinozoans and the other organic-walled microfossils. The estimates were included also with the intention that they might be used as a guide for future work on the groups they represent.

During and after the microscopy of a sample the remaining part of the form was filled in. In the sample space after the list of chitinozoan species comments and drawings were made. The last steps were to comment on the state of preservation, to fill in the total number of specimens and express the frequency as number of specimens per gram of rock. The latter figure was taken from a ready-reckoner computed in the beginning of this investigation.

When counting the chitinozoans during microscopy all specimens in the sample were counted unless the number exceeded 500. If the number exceeded that figure, counting was continued until a specific percentage of the bottom surface of the plastic box had been counted. As the surface area between the sectors had been computed earlier, the total number of specimens could be calculated from the known percentage.

After counting was stopped, scrutiny of the sample continued sector after sector in order to pick up well-preserved specimens and in search for chitinozoans occurring in low frequencies.

The chitinozoans picked out and put in the small plastic box mounted on the microscopic slide were preserved in distilled water. In the beginning of this study glycerine (or glycerine with some formalin added to prevent the growth of fungi) was used. It may be mentioned parenthetically that the growth of fungi acted as a natural bleaching agent for the chitinozoans. But, when it was realized that chitinozoans stored in glycerine needed washing in distilled water before successful investigation under a stereoscan electron microscope (SEM), the glycerine was replaced by distilled water.

The most perfect specimens in some of these slides were later picked out for a SEM study. Many others were picked out for study under an ordinary light microscope, but at higher magnification than that of the stereoscopic microscope. For the latter purpose a Nikon microscope (LUR-Ke) with all accessories was used.

Permanent slides were made with the use of Caedax (Merck; $n = 1.56$) or De Pe X (Gurr; $n = 1.524$) as mounting media.

All measurements were made using an eyepiece micrometer and with an accuracy of $\pm 2.5 \mu\text{m}$, except for measurements of small details which were made on the prints of photographs taken on the SEM. In my opinion there is very little reason for making time-consuming measurements of great accuracy in gross characters of chitinozoans because of the following points.

(1) Even in extremely well-preserved populations

most specimens show some kind of flattening or distortion of the measurable characters.

(2) Sorting out of only perfectly preserved specimens for measurements means introduction of non-randomness, since specimens of different sizes show different responses to stress.

(3) Measured gross characters, e.g., length and width of fairly well-preserved specimens show a marked range of variation within one and the same population.

(4) It is a well-known fact that the size of spores and pollen grains in Quaternary strata is changed by the laboratory treatment. The change of size is different for different acids or bases used, and is also depending on the duration of treatment. It seems probable that the change of size during processing of older microfossils, e.g., chitinozoans, is less, but until comparative experiments have been made in this respect there is no reason for making measurements of extreme accuracy.

Stereoscan microscopy and photography.—Some of the most well-preserved chitinozoans were studied under a JEOL JSM-U 3 or a Cambridge Mark IIa Stereoscan Electron Microscope (SEM). The preparations were made in the following way. Thin, circular metal discs (ϕ 12 mm) were cemented to the specimen stubs using silver paint as cement. The advantage of using these metal discs is that they can be easily removed from the specimen stub. Different SEM manufacturers make dissimilar specimen stubs that do not fit into other SEMs. However, as the small discs are easily cemented to all kinds of specimen stubs, these preparations can be studied in all SEMs. Furthermore, the discs cost a tenth to a hundredth of the price of specimen stubs. Some chitinozoans have been put directly on the specimen stubs and others have been put on small, circular cover glasses glued to the specimen stubs, however.

The chitinozoans were then taken from the distilled water of the slides and put on the metal disc by a finely drawn glass pipette. It soon became apparent that the small amount of saliva entering the pipette and mixing with the drop of water containing the chitinozoan specimens was one of the most effective glues tested. When a suitable number (10–20) of chitinozoans had been placed on the disc the excess of water was pipetted away. During the latter procedure the specimens were oriented in a proper way with a preparation needle. A little water was left under each specimen and the specimen stub was then left to drying in at least half an hour.

The specimen holders were placed in a conventional vacuum apparatus and coated with native gold or an alloy of gold and palladium in the proportion of 60 : 40. It was found important to use two or three times as much gold as in standard work, since chitinozoans become electrically charged very easily, at least when working at high kilovolts.

Photographs were taken on the JEOL JSM-U 3 at a scanning speed of 100 s/frame using 1000 lines. A

panchromatic roll film with a speed of 100 ASA/21 DIN (Agfapan 100 Professional) was used. Photographs were taken on the Cambridge Mark IIa at a scanning speed of 40 s/frame using 1950 lines. The film used in this connection was a 24 × 36 mm Ilford Pan F with a speed of 50 ASA/18 DIN. All photographs used in this paper were taken at 10 kV. After the SEM work with a particular specimen stub the metal disc was freed from the stub and labelled with a self-adhesive current number. The discs were fixed in a transparent plastic box by double-adhesive tape, thus permitting easy identification of the discs through the bottom of the plastic box.

The original material is deposited in the type collections of the Department of Historical Geology and Palaeontology, University of Lund.

Outline of the stratigraphy of Gotland

The Silurian of Gotland consists of a succession of mainly limestones and calcareous shales of a thickness of about 500 m. The sedimentation took place in a fairly shallow shelf area on top of a thin (75–125 m) Ordovician succession of sedimentary rocks which is underlain by a Cambrian and very thin Precambrian series of sedimentary strata of a total thickness of about 150–225 m. These Cambro-Silurian rocks rest on the Precambrian crystalline basement, the surface of which strikes roughly northeast–southwest and dips 0.15–0.3°, roughly towards the southeast. The preserved part of the Silurian strata is less than 200 m in northwest Gotland and about 500 m where most complete, viz., in the southeastern part of the southernmost peninsula (in the Faludden–Hamra area). Due to the strike and dip conditions the oldest Silurian rocks are exposed at the northwest coast of Gotland. Successively younger strata crop out towards the southeast as more or less parallel bands striking roughly northeast–southwest.

The sedimentation in the Gotland area in Silurian times took place in a shallow epicontinental sea which transgressed and regressed parts of the Baltic Precambrian Shield which was exposed to the west, north and northeast. As Gotland was located not very far from the Silurian equator (Creer 1973: 62–69; Fig. 7) and the depth of water never exceeded 175–200 m (Gray, Laufeld & Boucot 1974 in press) in a sea that was becoming shallower, reef growth started in latest Llandoveryan times when the sea was about 50–100 m deep (Hadding 1941: 66–67). As the sea in this area was probably never deeper during the remaining part of the Silurian Period, hermatypic organisms thrived on most parts of the shelf where the depth of water was between 2 and 50 metres (Hadding 1941: 74–75; Manten 1971: 467). The northwestern part of this Gotland shelf was becoming shallower by detritus from the bioherms and by terrigenous sediments. This led to a migration of the coast-parallel zone of bioherms towards the southeast. Eustatic changes of the sea-level and possibly also other factors complicated this

pattern of sedimentation to a great extent. Substantial difficulties arise when attempts are made at a correlation of strata consisting of biohermal and bedded limestones with those of shales and mudstones deposited in deeper water. The floras and faunas of these lithologies are often entirely different from each other.

Ever since Linnaeus' visit to Gotland in 1741 the great abundance and beautiful preservation of fossils in the island have attracted scientists and laymen alike. For lack of space it is not possible to review here even the major contributions of Swedish and foreign geologists and palaeontologists towards an understanding of the Silurian of Gotland. Regnéll (1949) has made an interesting study of the history of research before 1800 and Hadding (1941: 79–94) has briefly reviewed some of the major contributions between 1845 and 1930 to which reference is made. Further, Hede (1921: 7–25) and Manten (1971: 32–44) have reviewed different interpretations of the geology and stratigraphy of Gotland.

The chronostratigraphy and correlation will be discussed in a following chapter. However, it is necessary to describe the topostratigraphy (*sensu* Jaanusson 1960: 216–219) of Gotland as a background for the descriptions and occurrence of the chitinozoans.

Murchison (1846: 18–32; 36–46; Pl. 1: 11) was the first to establish correctly the general stratigraphy of the island. Syntheses of the stratigraphy and survey maps were published in 1910 separately by van Hoepen, Hedström, and Munthe.

The main source for all modern work, however, are the geological map sheets (1 : 50 000) and the descriptions to them. This monumental contribution by J. E. Hede, which makes Gotland one of the geologically best described areas in the world, contains such an enormous amount of information that it can not be appreciated at full until the reader has spent several field seasons in Gotland. Hede subdivided the Silurian of Gotland into 13 topostratigraphical units (for a summary in English, see Hede 1958; 1960: 44–52). Most of these major units have been divided further in the descriptions to the map sheets. These units and subunits represent bodies of rock. Hence, they are the most useful frame-work we have for pigeon-holing samples of fossils, despite the fact that the fine relationships between several of the small units remain obscure and will remain so until a lot of cores have been drilled all over the island. Therefore I can find no excuse for amalgamating Hede's topostratigraphical units. Our efforts towards an understanding of, e.g., the palaeoecological relationships between different groups of organisms will be severely hampered if the fossils discussed not can be tied into a physical body of rocks.

In this study Hede's topostratigraphy has been used. The 13 major units have well-known formal names, but as most of the smaller local units are unnamed, a description of all units referred to in this paper will be given below. When unnamed the local units will be designated by *a*, *b*, *c*, etc. It would have been better to have formal names on them, but this is not the

proper place for introducing new stratigraphical terms. The descriptions below are based on Hede's papers. The areal extent of the major units is shown in Fig. 2.

Lower Visby Marl.—The lowermost exposed stratigraphic unit in the Silurian of Gotland has a minimum thickness of 9 m. The Lower Visby Marl has not been defined as to underlying strata and its upper boundary can not be delimited from the overlying Upper Visby Marl by any abrupt change in lithology. There is a difference in lithology if the two units are taken as a whole, but the change is gradual and the boundary between the two has been defined by differences in the macrofauna. Recently, it has been indicated that a difference exists between the two units also as far as beyrichiid ostracodes are concerned, even though the change apparently does not take place at exactly the same level as that of the macrofauna (Martinsson 1962a: 46; 1967: 358). Therefore, it is evident that the boundary between the Lower Visby Marl and the Upper Visby Marl is of a kind always to be expected where sedimentation is continuous and not interrupted by any events that change the biotope to any major extent. As a stratigraphic subdivision is most useful in all geological work on these strata, there is no reason for deviating from Hede's (1921: 27—33) subdivision of the Visby marls. It deserves mentioning that this subdivision has already been used, though with other names, by Lindström (1888a: 150—151) and Hedström (1910: 1464—1466). In my opinion the Lower and Upper Visby Marl should be looked upon as the uppermost two members of the Visby Formation which is delimited by the red *Arachnophyllum* Marl below. Hede (1974 pers.comm.) is inclined to treat the two as separate formations.

The Lower Visby Marl consists of bedded, blue-grey, soft marlstone with irregular nodules and thin lenses of grey, dense or fine-grained, argillaceous limestone embedded. For palaeontological criteria on the distinction between the Lower and Upper Visby Marl reference is made to Hedström (1910: 1463—1468), Hede (1921: 27—30; 1925b: 13—14; 1940: 12—15) and Martinsson (1967: 358).

Upper Visby Marl.—According to Hede (1921: 30—31; 1925b: 14—15; 1940: 13—18; 1960: 51—52) the Upper Visby Marl is composed of between 9 and 16 m of stratified, blue-grey, soft marlstone with embedded irregular nodules, thin lenses and thin beds of grey, fine-grained argillaceous limestone. The limestone beds usually increase in thickness upwards in the unit, whereas the marlstones become progressively thinner (Hede 1940: 14). The Upper Visby Marl is further distinguished from the Lower Visby Marl by the occurrence of bioherms, especially in the upper part of the unit (Hede 1921: 31). The biohermal limestone is light grey to light greenish grey and in general highly argillaceous.

Höglint Group.—The Höglint Group consists of a complex of sediments of highly varying development

and with an approximate thickness of 35 m. In the central part of its area of occurrence, the Höglint group can be subdivided into four units. The lowermost of these, here called *a*, is dominated by three facies types, viz. biohermal limestone and laterally equivalent, light grey, often slightly pink crinoid limestone, and, at a greater distance from the bioherms, thin-bedded, grey, argillaceous limestone intercalated with thin layers of bluish grey marlstone. Unit *a* is about 15 m thick.

Unit *b*, which is 14—15 m in thickness, consists of bedded, light grey to greyish white, often conglomeratic limestone, and of thin-bedded, light brown, argillaceous limestone intercalated with thin layers of grey to brown marlstone. Towards the northeast unit *b* has been subdivided by Hede (1933: 18—36, beds *a*—*c*).

The third unit (*c*) is composed of 4—5 m of bedded, light grey to brownish grey, hard limestone, at places rich in stromatopora.

The uppermost unit (*d*), the "*Pterygotus* and *Palaeophonius nunciatus* Beds", is only half a metre thick and developed only in the Visby area. Unit *d* consists of grey to almost black, in part reddish marlstone and grey, reddish or speckled, bituminous limestone. In north Gotland, where unit *d* is lacking, the hiatus is marked by a thin level of silicification of the underlying stratum (Laufeld & Jeppsson, in press).

The above-mentioned three units can be distinguished in several areas. However, towards the southwest, where very few bioherms occur, it is not possible to make this subdivision. In that area the Höglint Group consists of a monotonous sequence of argillaceous limestone intercalated with marlstone. In this paper, this sequence will be referred to as the "southwestern facies". At some places within the main area it is not possible to make a four-unit subdivision of the Höglint Group, since huge bioherms form the major part of the entire sequence (Hede 1921: 33—35; 1925: 15; 1927a: 16—20; 1933: 16—30; 1936: 12—18; 1940: 18—31; 1958: 146—148; 1960: 50—51).

Tofta Limestone.—This formation is about 8 m thick and consists of light grey to brownish grey, more or less argillaceous limestone very rich in *Spongiostroma*. The Tofta Limestone thins out towards the northeast and disappears about 5 km west of the southern end of Kappelshamn Bay. The strata probably thin out also towards the southwest (Hede 1960: 50). According to Hedström (1910: 1413; Fig. 4) and Hede (1921: 36) there is a slight discordance between the Höglint and Tofta Beds and a similar one between the Tofta and Slite Beds (Hede 1960: 50). In several places the base of the Tofta Limestone is developed as a conglomerate, less than 0.3 m thick (Hedström 1910: 1473; Hede 1921: 36; 1940: 31—32).

Slite Group.—From the lithological point of view the Slite Group is the most heterogeneous and complicated in the Silurian of Gotland. The maximum thickness is estimated at about 100 m. The Slite Group is composed of two main facies types. In the northwestern

GOTLAND

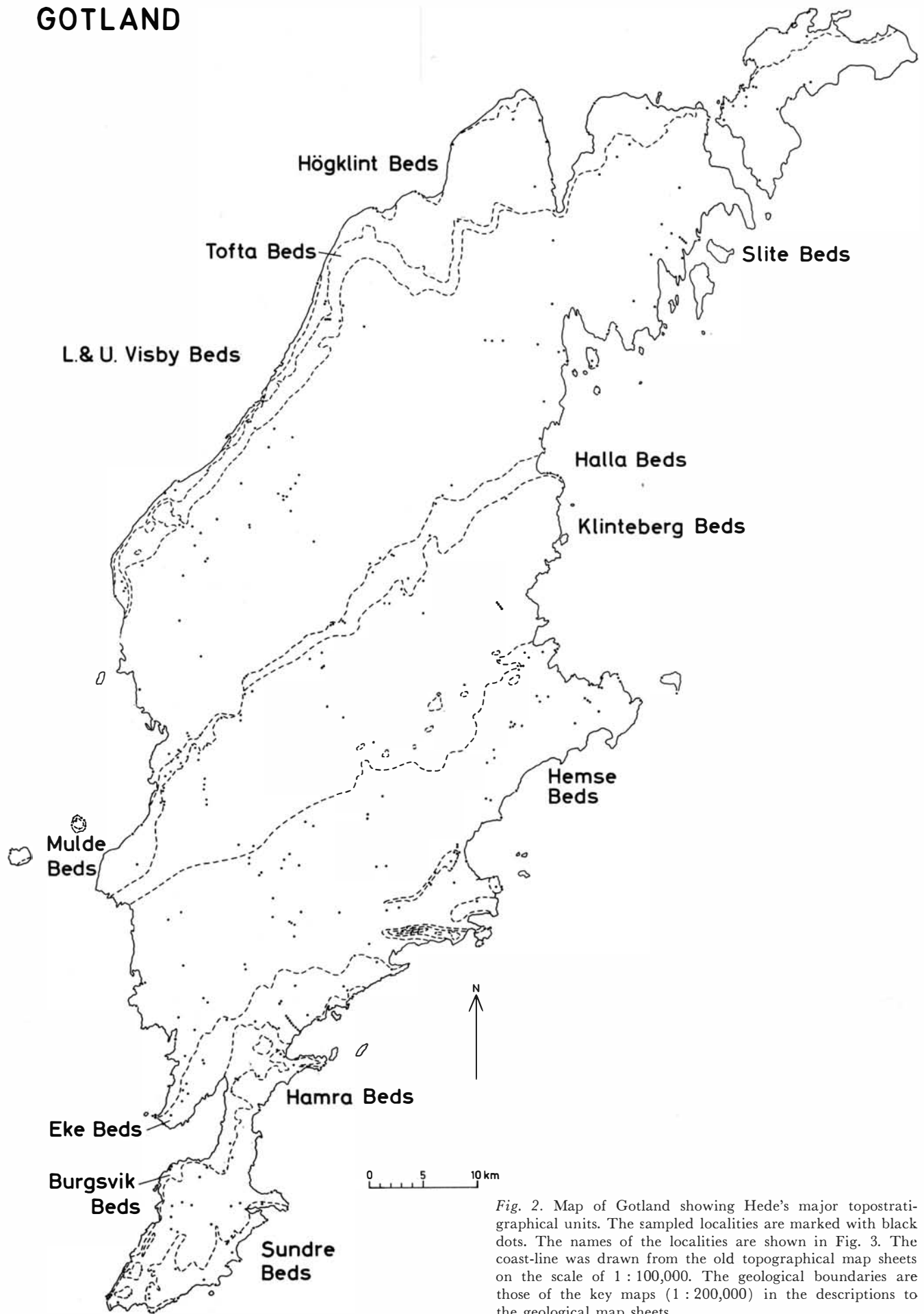


Fig. 2. Map of Gotland showing Hede's major topostratigraphical units. The sampled localities are marked with black dots. The names of the localities are shown in Fig. 3. The coast-line was drawn from the old topographical map sheets on the scale of 1 : 100,000. The geological boundaries are those of the key maps (1 : 200,000) in the descriptions to the geological map sheets.

part of its area the group is composed of stratified limestones with bioherms enclosed and in the southern and southwestern parts mainly of marlstone and argillaceous limestone. The transition between these two facies types is gradual, especially in the southwest. Hede (1960: 49–50) has subdivided the limestone succession in the northwestern to northeastern area into the following seven stratigraphic units (most of them referred to as members by Hede).

The oldest unit (*a*) consists mainly of bedded, grey limestone (mainly crinoid limestone and bryozoan limestone). In the southwest, in the geological map sheet Klintehamn (Hede 1927a) and in the southwesternmost part of the Visby map sheet (Hede 1940), the unit is about 3.5 m thick and contains also small bioherms. It then thins out towards the northeast and disappears about 6 km northeast of Visby. Northeast of this hiatus unit *a* reappears at the southern end of Kappelshamn Bay and is then represented in the northeasternmost part of the Kappelshamn map sheet, where it is 1.5 m thick. It thins out again further towards the northeast and is probably marked by a hiatus in the Fårö map sheet.

Unit *b* consists of bedded, grey or bluish grey to light yellowish brown or brown, sometimes slightly bituminous, argillaceous limestone. The unit is about 3 m thick in the southwest, but thins out towards the northeast, disappearing about 6 km northeast of Visby. There is a hiatus at this level in northern Gotland.

The Katrinelund Limestone (unit *c*) consists of bedded, grey to yellowish or brownish grey limestone, sometimes intercalated with very thin layers of dark grey or bluish grey marlstone. Unit *c* forms a continuous cover over unit *b* in the southwest and, towards the northeast over the Tofta Limestone from a place about 6 km northeast of Visby. About 5 km west of the southern end of Kappelshamn Bay the Tofta Limestone disappears and in the northeastern part of the Kappelshamn map sheet unit *c* rests on unit *a* of the Slite Group. In the island of Fårö unit *c* is underlain by strata belonging to the Höglint Group. Unit *c* is about 8 m thick in the Visby area but thins towards the northeast. In the Fårö island it is 3–4 m in thickness.

Unit *d* is composed of thin-bedded, grey or bluish grey to light brownish grey, almost dense, argillaceous limestone. It is about 2 m thick in the Lummelunda area but thins towards the southwest, where it disappears about 10 km southwest of Visby, and towards the northeast. Unit *d* is not represented northeast of Kappelshamn Bay in the Kappelshamn map sheet but reappears in the Fårö island.

It is succeeded by the Kalbjerga Limestone (*e*) which consists of grey, in some places red, dense or fine-grained limestone in very thin to thick beds, often intercalated with laminae of greenish or bluish marlstone. The unit increases in thickness towards the southwest from about 3.5 m in northeastern Fårö to about 5 m in southwestern Fårö and 10 m in the Kappelshamn map sheet. Its thickness decreases towards the southwest in the Lummelunda and Visby

map sheet and is about 3.5 m thick east of Visby and 2 m about 10 km southwest of the city.

The “*Conchidium tenuistriatum* Beds” (*f*, 2 m) are a distinct topostratigraphic unit which consists of thinly to mediumly bedded, grey to brownish grey, fine-grained, in places highly argillaceous limestone. The limestone is in places intercalated with laminae or very thin layers of bluish or greenish marlstone. In the Klintehamn map sheet this unit is developed in its most argillaceous variety. The marl content and thickness of unit *f* decrease in the Visby map sheet and, east and northeast of Visby, there is a hiatus in this part of the sequence. Unit *f* reappears in southwestern Fårö (ca. 2 m thick) but thins out in the eastern part of that island.

The uppermost part of the limestone succession (unit *g*, maximum thickness about 30 m) is composed mainly of stratified limestones of varying character. This unit is probably best characterized as a formation composed of several members one of which is the Ryssnäs Limestone. For a detailed description of the other subunits reference is made to Hede (e.g. 1960: 50). At various levels of unit *g* smaller or larger bioherms are of common occurrence.

To the south and southeast of the limestone succession described above the Slite Group is mainly composed of irregular nodules, small thin lenses, and thin, more or less continuous beds of light grey or grey, dense or fine-grained, argillaceous limestone embedded in blue-grey marlstone. The latter series of strata, the Slite Marl, has been subdivided stratigraphically only in its upper part. The topmost part of the Slite Marl in southwestern Gotland is represented by grey or brownish grey, slightly dolomitic, calcareous sandstone (siltstone) and arenaceous limestone (Hede 1927a: 31; 1960: 50). The latter beds, the Slite Siltstone, have a maximum thickness of 5 m but thin towards the northeast and towards the southwest, where the thickness is 0.3 m in Lilla Karlsö west of the main island (Hede 1927a: 32; 1927b: 50). In southwestern Gotland the Slite Siltstone is underlain by the “*Pentamerus gotlandicus* Beds” (Hede 1927a: 29–30; 1927b: 40–41, 46–47). In Stora and Lilla Karlsö these beds have an exposed thickness of about 10 m. In Stora Karlsö this sequence is underlain by the Lerberget Marl. The *Pentamerus gotlandicus* Beds are developed also in the northeast, where the Slite Siltstone is lacking (Hede 1928: 32–33; 1929: 15). In the northeast (the Vallstena–Tjeldersholm area) Hede distinguished a thin unit, the “*Atrypa reticularis* Beds”, between the *Pentamerus gotlandicus* Beds and the *Halla Group* (Hede 1928: 36–37, 40).

Mulde Marl.—This lithologically homogeneous formation consists of thickly laminated to thinly bedded, grey to bluish grey, dense or fine-grained, argillaceous and slightly dolomitic limestone alternating with thin layers of light blue-grey, soft marlstone. The Mulde Marl has a maximum thickness of about 25 m. The width of the outcrop narrows towards the northeast and the Mulde Marl disappears about 5 km northeast

of Klinte church (Hede 1927a: 36—37). In that area the marl is underlain by less than a metre of Halla beds.

Halla Group.—The Slite Group is overlain disconformably by a thin series of strata deposited in shallow water. These strata, the Halla Group (Hede 1927a: 32), have a thickness of about 15 m in the northeast where three lithostratigraphic units have been distinguished (Hede 1928: 45). The lowermost unit, the Bara Oolite (*a*), is 3.5—4 m in thickness and consists of almost white, oolitic limestone enclosing small bioherms. It is overlain by, and in part equivalent to, a brownish, bituminous and argillaceous limestone enclosing bioherms (unit *b*). The uppermost part of the Halla Group in the northeast is composed of grey, argillaceous limestone intercalated with thin beds or laminae of marlstone. This unit (*c*) is probably about 5 m thick and is terminated above by a discontinuity surface (Hede 1928: 45—55; 1960: 49). This three-fold subdivision of the Halla Group is easily discerned in the Hörsne—Gothemshammar area in the Slite map sheet (Hede 1928). Towards the southwest, however, the Halla beds decrease in thickness (probably ca. 10 m north of Viklau church, 5 m at Väte church and 2 m west-northwest of Hejde church) and the lithologies exposed are similar only to those of unit *b* in the northeast. Further towards the southwest, in the Klinte area, it is not possible to refer the thin (0.5—0.2 m) Halla beds to any specific unit. West of the main island the Halla Group is represented in the southeasternmost part of Stora Karlsö (Hede 1927b: 41—42). It consists of very light grey, often porous, splintery biohermal limestone and laterally equivalent, light grey, bedded limestone of about 15 m thickness. Halla beds of the same facies and thickness are also represented in the lower and some higher parts of the steep cliffs of Lilla Karlsö (Hede 1927b: 47—48).

Klinteberg Group.—Recently Hede (1958: 174—175) subdivided the Klinteberg Group into six stratigraphical units, some of them composed of more than one gross lithology. The lowermost unit (here called *a*) is ca. 15 m thick and consists of three more or less synchronous subunits most of them of member rank, viz., argillaceous limestone intercalated with marlstone, crinoidal limestone, and limestone intercalated with marlstone. Unit *a* is in places extremely rich in *Conchidium biloculare* (Hisinger). The next overlying unit (*b*) is ca. 3 m thick and consists of dense or fine-grained, hard limestone extremely rich in calcareous algae. The following unit (*c*), which is about 4 m thick, contains yellowish limestone fairly rich in calcareous algae. Unit *d* is 10 m thick, composed of bluish gray, argillaceous limestone and contains abundant *Ilionia prisca* (Hisinger). The next, *e*, is thin (2 m) and composed of two types of rock which are in part equivalent, viz., light brown, argillaceous limestone rich in calcareous algae and crinoidal limestone. The uppermost unit (*f*, 30 m) of the Klinteberg Group consists of almost white or light grey limestone.

The above-mentioned subdivision (Hede 1960: 48—49; cf. Hede 1921: 51—54; 1925b: 21—23) was based on the bed-rock of the Katthammarsvik map sheet and, with the help of the description to this map (Hede 1929: 17—25), it is possible to outline the areal extent of all these stratigraphical units within the map sheet. In the Slite map sheet (Hede 1928) it seems probable that units *a* and *e* are lacking and that unit *f* is represented by a very thin sequence of strata in a very small area only. The areal extent of the units *b*—*c*—*d* can be plotted from Hede's description (Hede 1928: 55—61). The Katthammarsvik and Slite map sheets cover the northeastern facies types of the Klinteberg Group for which Hede's (1960: 48—49) stratigraphical scheme was constructed. But towards the southwest it is not possible to apply the above-mentioned subdivision due to the facies changes. As pointed out by Hede (1921: 52; 1925b: 22; 1960: 48—49) biohermal limestones constitute a substantial part of the southwestern parts of the Klinteberg Group and the amount of terrigenous, fine-clastic material increases strongly in the extreme southwest (in the Eksta area). Within the Klintehamn map sheet (Hede 1927a) it is still possible to recognize roughly some of the middle units of the northeastern area of facies, at least in the eastern part of the map sheet. It is, however, not possible to apply that subdivision to the lower and upper parts of the Klinteberg Group of the Klintehamn map sheet. In the Hemse map sheet (Hede 1927b) it is not possible to apply the northeastern units with any kind of certainty. In this study the localities and samples from the southwestern area (the Klintehamn and Hemse map sheets) of the Klinteberg Group have therefore been referred to the lower, middle or upper part of these beds. The southernmost part of the Klinteberg Group (of the main island) in the Hemse map sheet is developed as a more marly facies type, referred to as *Klinteberg Marl* in this paper.

Hemse Group.—The Hemse Group shows an even more complicated pattern of facies types than the Klinteberg Group. In the northeast the Hemse Group is composed of a sequence of limestones. They were subdivided into five stratigraphic units by Hede (1929: 25—54; 1958: 142—144; 1960: 47—48).

The basal unit (*a*, some few metres in thickness) consists of thinly bedded, grey, fine-grained limestone with bioherms enclosed. The unit is very rich in stromatoporoids and crinoids. In places the stratified component abounds in "*Megalomus*" *gotlandicus* Lindström. This unit is followed by thinly bedded, light grey to brownish or bluish light grey, argillaceous limestone interbedded with thin layers of blue-gray, soft marlstone (*b*, maximum thickness 1.5 m). Unit *c* has a maximum thickness of about 15 m and consists of thin-bedded, grey or brown, dense or fine-grained, more or less argillaceous limestone. The overlying unit (*d*, maximum thickness approximately 25 m) is composed of thinly to very thickly bedded, light grey or almost white to light brownish grey, some-

times reddish or light greenish grey limestones, mainly crinoid limestones and stromatoporoid biostromes. In some districts bioherms are of common occurrence. The topmost unit, ca. 6 m in thickness, which has a formal name, the Millklint Limestone (Hede 1929: 50, 1960: 48), consists of thin-bedded, light brownish grey or yellowish grey, in places pale reddish or nearly white, fine-grained limestone.

Hede founded this stratigraphy on the rocks outcropping within the Katthammarsvik map sheet. The areal extent of the different units in that map area was also established by Hede (1929: 25—54) in his description to the map. In the northeastern part of the Hemse map sheet (Hede 1927b) and the northern part of the Ronehamn map sheet (Hede 1925) the Hemse Group is developed as biohermal limestones and bedded equivalents of detrital limestone. It seems probable that only unit *d* outcrops within these map sheets. To the south of a line running roughly from the Linde area through Stånga to Ljugarn, the above-mentioned Hemse beds of limestone facies are replaced by a marlstone facies, the *Hemse Marl*, which is at least partly synchronous with the limestones to the northwest. The Hemse Marl is a fairly uniform formation and no lithologic subdivision was made by Hede. However, he has pointed out (Hede 1960: 48) that in the east the Hemse Marl consists of irregular nodules and thin lenses of argillaceous limestone intercalated with thin bands of marlstone, whereas in the west the marlstone dominates with argillaceous limestone occurring only as nodules or lenses. Hede (1927b: 24) distinguished between an older and a younger part of the Hemse Marl, basing his conclusion on palaeontological evidence. The boundary between these two parts was established (Hede 1927b: 24) as running from Kvinnegårde in the parish of Havdhem through St. Vasstäde in Hablingbo, and through Mullvalds in Hemse, to about 1.5 km southeast of Stånga church (the names refer to the geological map sheet). Martinsson (1962: 53—54) pointed out that the beyrichiid faunas are dissimilar on the two sides of this boundary and that the genus *Craspedobolbina* disappears at the boundary. Laufeld (1974b) has pointed out that this boundary zone is parallel with the local direction of the coast-line in Hemse time and that no facies changes could be held responsible for the faunal difference, because of the extremely gentle slope of the Hemse shelf in this area. In the present paper Hemse Marl, northwestern or southeastern part will be used for distinguishing these heterocronous parts. The very top of the Hemse Marl consists of argillaceous, dolomitic limestone generally extremely rich in *Dayia navicula* (Sowerby). The total thickness of the Hemse group is estimated at about 100 m (Hede 1925b: 25).

Eke Group.—The Eke Group consists mainly of bluish grey, more or less argillaceous limestone alternating with very thin beds of blue-grey, somewhat silty and micaceous marlstone abundant in calcareous algae. In the Burgsvik boring the thickness of the group is 13.9 m (Hede 1910a: 10, Pl. 1). The Eke beds have been

drilled through also in the easternmost part of Grötlingsboud, where the same lithology was encountered with a thickness of 14.75 m (Skoglund 1973, pers. comm.). Towards the northeast the content of calcium carbonate increases (Munthe 1910: 1410) but the thickness decreases to about 10 m (Hede 1925a: 29). In the northeasternmost part of its area (Lausbackar and some other outliers northeast of the main outcrop area) the Eke Group is composed of stratified, bluish grey to light brown-grey limestone (mainly crinoid limestone), bluish grey to brownish grey marlstone, and of generally highly argillaceous, biohermal limestone, the *Rhizophyllum* Limestone (Munthe 1902: 267 or 49; 1910: 1430; Hede 1925a: 43—46; 1960: 47).

Burgsvik Group (Burgsvik Sandstone and Oolite).—The Burgsvik Group (Hede 1974, pers. comm.) consists mainly of thinly to very thickly bedded, light grey, fine-grained and slightly calcareous, argillaceous sandstone in places intercalated with very thinly bedded, bluish grey claystone. This sandstone is in places overlain by thinly bedded, light grey to bluish grey, oolitic limestone or, in most places, by a succession of beds of sandstone alternating with beds of oolitic limestone. Locally the latter beds of oolitic limestone are very rich in sand and may be conglomeratic (Hede 1960: 47). In southernmost Gotland the Burgsvik beds have been drilled through at Burgsvik. According to Hede (1919a, Pl. 1) the thickness is 47 m. Studies by Munthe (1910: 1410—1413; 1921: 30—40), Hede (1921: 70—74), Hadding (1920: 185—188), Agterberg (1958: 254—256), and Mantén (1966; 1971: 393—405) have demonstrated that the lithological development of the uppermost part of the Burgsvik beds in southernmost Gotland shows a strong and complicated lateral variation which makes a detailed correlation difficult even between closely located exposures. This is even more true as far as the exposures of the Burgsvik Group in the far northeast are concerned. Within the Ronehamn map sheet there are outliers of the Burgsvik Group at Burgen and Närsholm far in the northeast. According to Munthe (1910: 1428—1429) and Hede (1925a: 29—33) the Burgsvik Group of that area consists of a basal, calcareous sandstone (1—2 m) to be correlated with the lower part of the Burgsvik Group in the southwest. The overlying part consists of calcareous oolite and arenaceous limestone, in part conglomeratic, followed by and partly equivalent to biohermal limestone and surrounding crinoidal limestone. The total thickness of the Burgsvik Group in these outliers is estimated at 7—8 m. According to Munthe (1910: 1428) and Hede (1925a: 30; 1960: 47) this upper part is to be correlated with the lower as well as the upper part of the Burgsvik Group in the southwest.

Hamra Group.—In similarity with the Burgsvik Group, the Hamra Group is of different lithological composition in its main outcrop area as compared to that of the outliers at Burgen and Närsholm in the northeast. In the southwest the total thickness is about

40 m (Munthe 1921: 33, 43), whereas it is less than 10 m in the outliers. However, the original thickness in the northeast is reduced to unknown extent by the post-Silurian erosion.

In the main area, in the southwest, the lowermost part of the Hamra Group consists of a thin unit (*a*, 0.2–1.5 m) of argillaceous, mostly indistinctly stratified, algal limestone, according to Munthe (1910: 1413; 1921: 44–45) and Hede (1925b: 28). This is overlain by (*b*) argillaceous limestone intercalated with marlstone. The upper and main part (*c*) of the Hamra Group is composed of three different facies types. Far in the southwest, unit *c* consists of biohermal limestone and its lateral, bedded limestone equivalents, mainly crinoid limestone. Towards the northeast, in the main outcrop area, these two rock types are replaced by argillaceous limestone intercalated with marlstone and somewhat bituminous limestone, not infrequently replaced by stromatoporoid limestone.

In the outliers in the northeast the Hamra Group is represented by a biohermal limestone which probably is equivalent to units *a* and *b* in the southwest. The biohermal Hamra limestone is light grey or greenish grey to brownish grey and sometimes pale reddish (Hede 1921: 78–81; 1925b: 30; 1960: 47; Munthe 1921: 58–68).

Sundre Limestone.—The preserved part of the uppermost unit in the Silurian of Gotland is only about 10 m thick. It consists of thinly to very thickly bedded, grey or pink limestone (mainly crinoid limestone). This bedded limestone is equivalent to and sometimes covered by light greenish grey or reddish brown biohermal limestone (Hede 1921: 78–81; 1925b: 30; 1960: 47; Munthe 1921: 68).

Localities, samples and chitinozoans

About 475 geological localities were sampled for chitinozoans. For various reasons, one being not to burden this survey, the detailed descriptions of all localities dealt with have been published in a separate volume (Laufeld 1974a). Hence, only the descriptions of samples, their stratigraphic position and the chitinozoans recorded in each sample will be described here. The samples are described under the alphabetically ordered locality names. The latter are those recorded in the above-mentioned paper, *Reference localities for palaeontology and geology in the Silurian of Gotland*, to which reference is made.

The name and number of a locality is followed by its stratigraphic position. The neutral term “Beds” has been used for designating Hede’s major stratigraphical units in these descriptions, primarily for having a consistent term throughout. The current concept of the stratigraphical rank of the different Beds has been reviewed in the preceding chapter.

In the sample number, which follows the stratigraphical designation, e.g. G 71–46, G stands for Gotland, 71 for the year of collection, and 46 for the number in the field diary. The sample numbers are

used here for the sake of brevity. However, many other geologists and palaeontologists working in Gotland use the same type of sample designation and confusion may arise if reference in the future is made only to a sample number, and several students have the same number.

The sample number is followed by a short, standardized and rough lithological description of the sample. The names of the chitinozoan species recorded in each sample is preceded by the number of specimens of chitinozoans per gram of rock.

Each locality is represented by a black dot in Fig. 2. The names of the localities investigated are recorded in Fig. 3.

AJMUNDE 1, *Klinteberg Beds*, Klinteberg Marl, top: G 71–46 light greenish grey, calcareous mudstone, 0.5 m below ground level. Chitinozoa: 4.7 specimens per g. *Ancyrochitina primitiva*, *Angochitina elongata*, *Conochitina latifrons*.

ALBY 2, *Slite Beds*, Slite Marl: G 66–337 light greenish and brownish grey, fine-grained, argillaceous limestone, 10–15 cm below the reference level. Chitinozoa: 4.5 specimens per g. *Ancyrochitina ancyrea*, *A. primitiva*, *Conochitina tuba*, *Desmochitina acollaris*, *Margachitina margaritana*.

ALBY 4, *Slite Beds*, Slite Marl: G 66–336 light grey, fine-grained, slightly argillaceous limestone very rich in fossils (coquina), 20 cm below top of the section at the reference point. Chitinozoa: 6 specimens per g. *Ancyrochitina primitiva*, *Conochitina tuba*, *Gotlandochitina martinsoni*, *Margachitina margaritana*.

ALBY 5, *Slite Beds*, Slite Marl: G 66–333 brownish grey, fine-grained, slightly argillaceous limestone rich in fossils, from top of the section, 125 m northwest of the reference point. Chitinozoa: 2 specimens per g. *Ancyrochitina ancyrea*, *A. primitiva*, *Conochitina tuba*, *Gotlandochitina martinsoni*, *Margachitina margaritana*. G 66–334 same lithology, from top of the section, 50 m northwest of the reference point. Chitinozoa: 4.9 specimens per g. *Ancyrochitina primitiva*, *A. gutnica*, *Conochitina tuba*, *Gotlandochitina martinsoni*, *G. valbyttiensis*. G 66–335 grey, almost dense, argillaceous limestone, from top of the section at the reference point. Chitinozoa: 4.6 specimens per g. *Ancyrochitina primitiva*, *A. gutnica*, *Conochitina tuba*, *Gotlandochitina martinsoni*, *G. valbyttiensis*.

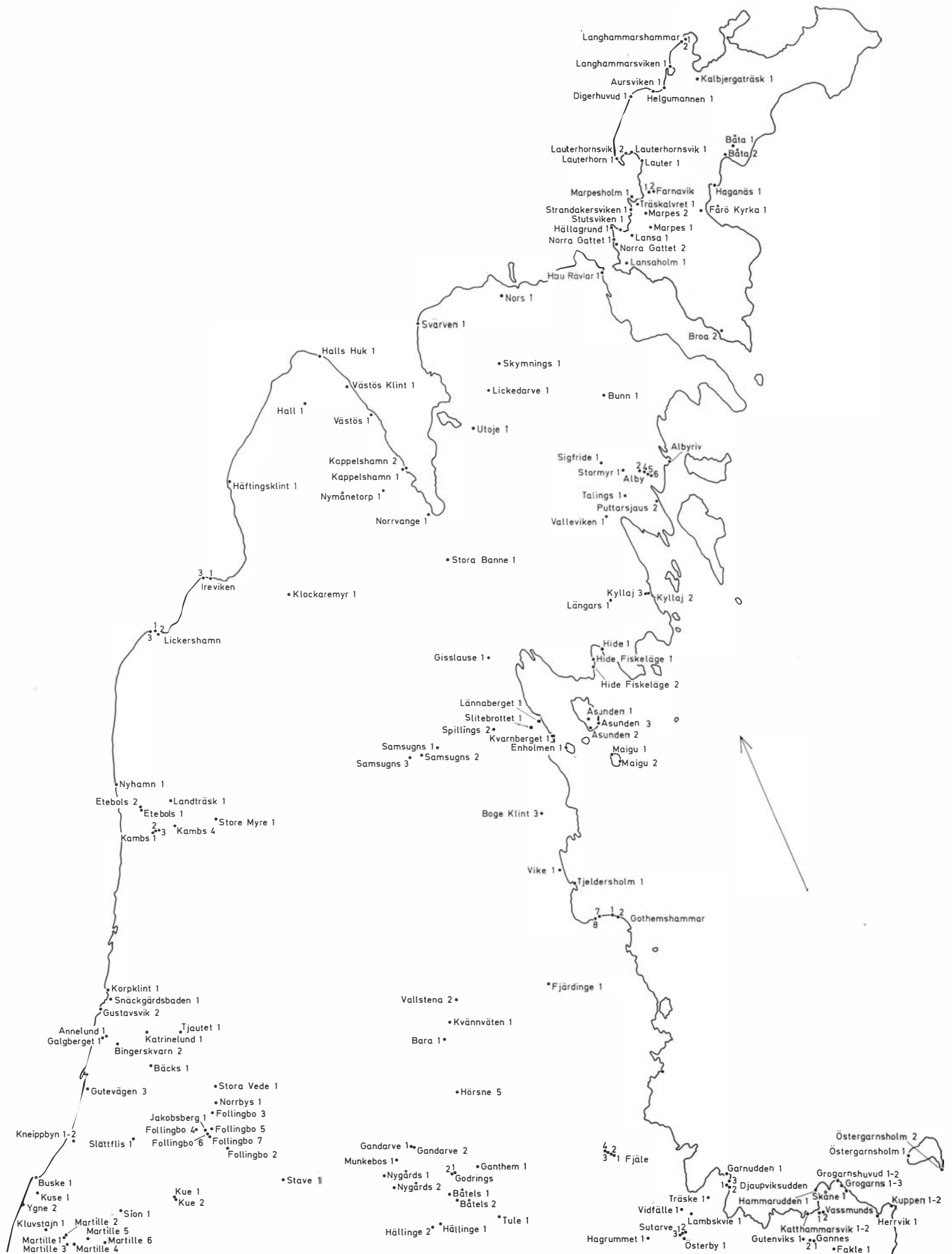
ALBY 6, *Slite Beds*, Slite Marl: G 66–332 brownish grey and grey, fine-grained, slightly argillaceous limestone with discontinuity surfaces, from excavated material (very thin section) at the reference point. Chitinozoa: 2.1 specimens per g. *Ancyrochitina gutnica*, *A. primitiva*, *Conochitina tuba*, *Gotlandochitina martinsoni*, *G. valbyttiensis*, *Margachitina margaritana*.

ALBYRIV 1, *Slite Beds*, Slite Marl: G 69–166 light grey and greenish grey, almost dense, argillaceous limestone, 10–15 cm below ground level. Chitinozoa: 13.1 specimens per g. *Ancyrochitina gutnica*, *A. primitiva*, *Conochitina tuba*, *Gotlandochitina valbyttiensis*.

ALSTÄDE 1, *Klinteberg Beds*, middle-upper part: G 66–156 light brownish grey, coarse-grained crinoid limestone rich in stromatoporoids, 50–100 cm below top of the section at the telephone pole. Chitinozoa: None.

ALTAJME 1, *Klinteberg Beds*, upper part: G 69–83 light greyish and greenish brown, almost dense limestone, 0–20 cm below top of the section. Chitinozoa: None.

AMLINGS 1, *Hemse Beds*, Hemse Marl, northwestern part: G 66–170 light greenish grey, dense, argillaceous limestone and dark grey, fine-grained limestone, from bottom of the ditch, about 50 m north of the reference point. Chitinozoa: 2.8 specimens per g. *Ancyrochitina* cf. *diabolus*, *Angochitina crassispina*, *A. elongata*, *Conochitina* aff. *elegans*, *C. latifrons*, *Linochitina convexa*.





ANDERSE 1, *Burgsvik Beds*, upper part: G 69—33 yellowish brown, slightly silty, coarse-oolitic limestone, 10—20 cm below top of the section and probably less than 1 m below the Burgsvik—Hamra boundary. Chitinozoa: None.

ÄNGVARD 1, *Hamra Beds*, unit b: G 71—6 light brown, fine-grained, slightly silty limestone, 0.75 m below ground level. Chitinozoa: 0.7 specimen per g. *Ancyrochitina* cf. *diabolus*, *A. pedavis*, *Conochitina intermedia*, *Sphaerochitina sphaerocephala*.

ÄNGVARD 2, *Hamra Beds*, unit b: G 71—7 greyish brown, fine-grained, slightly silty limestone, 0—10 cm below top of the section. Chitinozoa: 8.4 specimens per g. *Ancyrochitina* cf. *diabolus*, *Conochitina intermedia*, *Eisenackitina lagenomorpha*, *Sphaerochitina sphaerocephala*.

ANLUNDAR 1, *Sundre Beds*, lower-middle part: G 69—12 light greenish grey, almost dense limestone very rich in stromatopores and crinoids, 20—40 cm below ground level. Chitinozoa: None.

ANNELUND 1, *Höglint Beds*, upper part: G 66—404 brownish grey, coarse-grained limestone rich in stromatopores, 5 m below the Höglint—Tofta boundary. Chitinozoa: None.

Tofta Beds: G 66—405 light pinkish and yellowish grey, dense limestone, 100—110 cm above the Höglint—Tofta boundary. Chitinozoa: None.

ANSARVE 2, *Höglint Beds*, southwestern facies, upper part: G 72—98 greenish and brownish grey, almost dense, argillaceous limestone, 1.25 m under the road surface. Chitinozoa: 40.1 specimens per g. *Ancyrochitina pachyderma*, *A. primitiva*, *Conochitina flamma*, *C. leptosoma*, *C. proboscifera*, *C. proboscifera* f. *truncata*, *Margachitina margaritana*.

ANSARVE 3, *Höglint Beds*, southwestern facies, upper part: G 66—141 brownish grey, almost dense, argillaceous limestone, from the upper part of the ditch. Chitinozoa: 30.1 specimens per g. *Ancyrochitina ancyrea*, *A. ansarvicensis*, *A. primitiva*, *Conochitina leptosoma*, *Desmochitina acollaris*, *D. opaca*, *Gotlandochitina corniculata*.

ASARVE 1, *Hemse Beds*, Hemse Marl, southeastern part: G 69—172 greenish and brownish grey, fine-grained, argillaceous limestone very rich in fossils, 1.5 m below ground level. Chitinozoa: 7.1 specimens per g. *Ancyrochitina primitiva*, *Angochitina ceratophora*, *A. echinata*, *Conochitina lauensis*.

ASKRYGGEN 1, *Slite Beds*, Slite Marl, *Pentamerus gotlandicus* Beds, top: G 69—178 greenish and brownish grey, fine-grained, argillaceous and slightly silty limestone, from base of the section. Chitinozoa: 0.6 specimen per g. *Ancyrochitina gutnica*, *Conochitina tuba*, *Desmochitina acollaris*, *Linochitina cingulata*, *L. odiosa*. G 71—55 dark grey, slightly silty, calcareous mudstone, 40—50 cm above base of the section. Chitinozoa: 984 (sic) specimens per g. *Ancyrochitina gutnica*, *Conochitina tuba*, *Linochitina cingulata*, *Margachitina margaritana*.

ASKRYGGEN 2, *Slite Beds*, Slite Siltstone, top: G 69—175 bluish grey, slightly calcareous, argillaceous, laminated siltstone, 0—10 cm above base of the section (on the beach). Chitinozoa: 6.7 specimens per g. *Ancyrochitina gutnica*, *Linochitina cingulata*. G 69—177 whitish grey and light greenish grey, fine-grained, silty limestone very rich in bryozoans (coquina), 10—15 cm above base of the section. Chitinozoa: less than 0.1 specimen per g. *Ancyrochitina gutnica*, *Conochitina tuba*. G 69—176 light grey, slightly calcareous, very hard and splintery siltstone, 15—25 cm above base of the section. Chitinozoa: less than 0.1 specimen per g. *Conochitina* sp.

ASUNDEN 1, *Slite Beds*, unit g: G 69—157 light brownish grey, medium-grained limestone, 125—150 cm below base of the section. Chitinozoa: None.

ASUNDEN 2, *Slite Beds*, unit g: G 69—158 light brownish grey, medium-grained limestone, 0.5 m above base of the section (in the "cave"). Chitinozoa: None.

ASUNDEN 3, *Slite Beds*, unit g: G 69—159 brownish and greenish grey, fine-grained, slightly silty, argillaceous limestone, at sea level. Chitinozoa: 3.7 specimens per g. *Ancyrochitina primitiva*, *Conochitina* aff. *proboscifera*, *C. tuba*,

Gotlandochitina martinssoni, *Margachitina margaritana*.

AURSVIKEN 1, *Höglint Beds*, lower-middle part: G 69—119 light brownish grey, almost dense, slightly argillaceous limestone, 20—30 cm below ground level. Chitinozoa: 4.1 specimens per g. *Ancyrochitina ancyrea*, *A. primitiva*, *Conochitina leptosoma*, *C. cf. leptosoma*, *C. mamilla*, *Desmochitina acollaris*, *D. densa*, *D. opaca*, *Margachitina margaritana*.

AUTSARVE 1, *Hemse Beds*, Hemse Marl, northwestern part: G 71—49 greenish brown, medium-grained, slightly silty limestone and light brownish and greenish grey, calcareous siltstone, 0.5 m below ground level. Chitinozoa: 4.3 specimens per g. *Ancyrochitina desmea*, *Conochitina latifrons*, *Sphaerochitina impia*.

BÄCKS 1, *Slite Beds*, unit d: G 72—105 light greyish brown, fine-grained, silty and argillaceous limestone, 10 cm below ground level. Chitinozoa: None.

BANDLUNDE 1, *Eke Beds*, lower part: G 72—129 light brown, fine-grained, slightly silty and argillaceous algal limestone, 0.5 m below ground level and approximately 0.5 m above the Hemse—Eke boundary. Chitinozoa: 6.6 specimens per g. *Ancyrochitina* sp., *Eisenackitina philipi*, *Linochitina erratica*, *Sphaerochitina acanthifera*.

BANKVÄT 1, *Hamra Beds*, unit b: The following samples were collected in ascending order from north towards the south-southeast. They represent a stratigraphic sequence of between 100 and 150 cm. G 71—130 light greenish grey, almost dense, argillaceous limestone in irregular nodules. Chitinozoa: 39 specimens per g. *Eisenackitina lagenomorpha*, *Sphaerochitina* cf. *acanthifera*, *S. sphaerocephala*. G 71—29 light bluish grey, fine-grained, thin-bedded, argillaceous limestone very rich in crinoids (coquina). Chitinozoa: 5.1 specimens per g. *Eisenackitina lagenomorpha*, *Sphaerochitina* cf. *acanthifera*, *S. sphaerocephala*. G 71—28 brownish grey, fine-grained argillaceous limestone very rich in brachiopods (coquina). Chitinozoa: 27.2 specimens per g. *Eisenackitina intermedia*, *E. cf. lagenomorpha*, *Sphaerochitina* cf. *acanthifera*, *Sphaerochitina sphaerocephala*. G 71—27 grey, almost dense, argillaceous, nodular limestone very rich in crinoids (coquina). Chitinozoa: 54.4 specimens per g. *Eisenackitina lagenomorpha*, *Sphaerochitina* cf. *acanthifera*, *S. sphaerocephala*. G 71—26 grey, fine-grained, argillaceous algal limestone. Chitinozoa: 15.6 specimens per g. *Eisenackitina lagenomorpha*, *Sphaerochitina* cf. *acanthifera*, *S. sphaerocephala*. G 71—25 brownish grey, fine-grained, argillaceous limestone very rich in bryozoans (coquina). Chitinozoa: 12.6 specimens per g. *Ancyrochitina* sp., *Sphaerochitina* cf. *acanthifera*, *S. sphaerocephala*.

BARA 1, *Halla Beds*, Bara Oolite: G 66—35 light grey, fine-grained limestone with scattered ooids, 100—110 cm below base of the small bioherm in the northern wall. Chitinozoa: None. G 66—36 whitish grey, oolitic limestone, 85—95 cm below base of the bioherm. Chitinozoa: None. G 66—37 light brownish grey, fine-grained limestone with scattered ooids, 0—15 cm below base of the bioherm. Chitinozoa: None.

BARKARVEÅRD 1, *Hamra Beds*, unit c: G 71—15 brownish grey, fine-grained, slightly silty limestone, 0—10 cm below ground level on the shore (from the uppermost bed exposed). Chitinozoa: 0.6 specimen per g. *Ancyrochitina pedavis*, *Eisenackitina* cf. *lagenomorpha*, *Gotlandochitina villosa*, *Pterochitina perivelata*.

BARSHAGEUDD 1, *Hamra Beds*, unit c: G 66—115 dark brownish grey, fine-grained, slightly argillaceous limestone, 1 m below ground level. Chitinozoa: 4 specimens per g. *Ancyrochitina* cf. *diabolus*, *A. pedavis*, *Eisenackitina lagenomorpha*, *E. oviformis*, *Linochitina hedei*.

BARSHAGEUDD 2, *Hamra Beds*, unit c: G 69—15 grey, medium-grained, argillaceous limestone very rich in fossils, from a loose boulder. Chitinozoa: 32.1 specimens per g. *Ancyrochitina* cf. *diabolus*, *A. pedavis*, *Eisenackitina lagenomorpha*, *E. oviformis*, *Gotlandochitina villosa*, *Linochitina hedei*, *Pterochitina perivelata*, *Sphaerochitina sphaerocephala*.

BARSHAGEUDD 3, *Hamra Beds*, unit c: G 69—16

brownish grey, fine-grained, slightly silty, argillaceous limestone rich in fossils, from a loose boulder. Chitinozoa: 152 specimens per g. *Ancyrochitina* cf. *diabolus*, *A. pedavis*, *A. sp.*, *Conochitina intermedia*, *Eisenackitina lagenomorpha*, *Linochitina hedei*, *Pterochitina perivelata*.

BARSHAGEUDD 4, *Hamra Beds*, unit c: G 69—17 brownish grey, medium-grained limestone and grey, calcareous mudstone, from a loose boulder. Chitinozoa: 7.2 specimens per g. *Ancyrochitina pedavis*, *Conochitina intermedia*, *Eisenackitina lagenomorpha*, *Gotlandochitina villosa*, *Linochitina hedei*, *Sphaerochitina* cf. *acanthifera*, *S. sphaerocephala*.

BÅTA 1, *Slite Beds*, *Conchidium tenuistriatum* Beds, lower part: G 66—340 light grey, medium-grained limestone rich in *Rhipidium tenuistriatum*, 0.5 m below ground level. Chitinozoa: less than 0.1 specimen per g. *Conochitina tuba*.

BÅTA 2, *Slite Beds*, *Conchidium tenuistriatum* Beds, top, or slightly younger: light greenish grey, almost dense, slightly argillaceous limestone. Chitinozoa: 0.2 specimen per g. *Conochitina tuba*, *Gotlandochitina martinsoni*.

BÅTELS 1, *Klinteberg Beds*, unit c: G 71—84 light brownish grey, fine-grained limestone, from the uppermost part of the section. Chitinozoa: 7.6 specimens per g. *Conochitina* aff. *elegans*, *C. pachycephala*, *C. cf. tuba*, *Sphaerochitina concava*.

BÅTELS 2, *Klinteberg Beds*, unit b: G 71—85 brownish and greenish grey, medium-grained limestone, 10—40 cm below ground level. Chitinozoa: None.

BINGERSKVARN 2, *Tofta Beds*: G 66—73 light brownish grey, fine-grained, slightly argillaceous algal limestone, 10—20 cm below top of the section. Chitinozoa: None.

BJÄRGES 1, *Mulde Beds*, upper part: G 71—37 brownish grey, fine-grained, argillaceous limestone, 0.5 m below ground level. Chitinozoa: 9.6 specimens per g. *Ancyrochitina gutnica*, *A. primitiva*, *Conochitina* aff. *elegans*, *C. pachycephala*, *Desmochitina muldiensis*, *Linochitina cingulata*.

BLÅHÄLL 1, *Mulde Beds*, lower part: G 66—130 brownish grey, dense, argillaceous limestone, from base of the section immediately north of the iron ladder. Chitinozoa: 304.5 specimens per g. *Ancyrochitina gutnica*, *Conochitina* aff. *elegans*, *C. pachycephala*, *C. tuba*. G 66—131 greenish grey, dense, argillaceous limestone, 120 cm above base of the section. Chitinozoa: 81.4 specimens per g. *Ancyrochitina gutnica*, *Conochitina* aff. *elegans*, *C. pachycephala*, *C. aff. proboscifera*, *C. tuba*, *C. sp.* G 66—132 grey, almost dense, argillaceous limestone, 220 cm above base of the section. Chitinozoa: 20.1 specimens per g. *Ancyrochitina gutnica*, *Conochitina* aff. *elegans*, *C. pachycephala*, *C. aff. proboscifera*, *Desmochitina muldiensis*, *Linochitina sp.*

BODARNA 1, *Halla Beds*, G 69—180 light greenish and brownish grey, almost dense, slightly argillaceous limestone rich in crinoids and stromatoporoids, from the exposure just outside the section. Chitinozoa: 0.3 specimen per g. *Ancyrochitina* cf. *gutnica*, *A. primitiva*, *Linochitina cingulata*.

BODUDD 1, *Hemse Beds*, Hemse Marl, uppermost part: G 72—140 brownish grey, fine-grained, silty limestone and grey, calcareous, argillaceous siltstone very rich in *Dayia navicula* (coquina), 0—15 cm below the ground on the shore. Chitinozoa: 146 specimens per g. *Ancyrochitina* cf. *diabolus*, *Angochitina ceratophora*, *A. crassispina*, *A. echinata*, *Conochitina lauensis*, *Eisenackitina philipi*, *Linochitina erratica*.

BODUDD 2, *Eke Beds*, lowermost part: G 72—139 greenish grey, fine-grained, silty algal limestone, from the lowermost 10 cm of the section. Chitinozoa: 5 specimens per g. *Angochitina ceratophora*, *A. echinata*, *Desmochitina squamosa*, *Eisenackitina philipi*.

BOFRIDE 1, *Klinteberg Beds*, upper part: G 66—157 light yellowish brown, fine-grained limestone, 1.25 m below the reference level at the reference point. Chitinozoa: 0.5 specimen per g. *Ancyrochitina primitiva*, *Gotlandochitina tabernaculifera*. G 66—158 light brownish grey, fine-grained limestone, 1.25 m above the reference level at the reference point. Chitinozoa: 0.4 specimen per g. *Ancyrochitina primitiva*, *Conochitina sp.* G 66—159 light brownish grey, coarse-grained limestone rich in grey stromatoporoids, 2.25 m above

the reference level at the reference point. Chitinozoa: None. G 66—160 light greenish grey, dense limestone rich in stromatoporoids, 2.5 m above the reference level at the reference point. Chitinozoa: None. G 66—161 brownish grey, coarse-grained crinoid limestone, 3.25 m above the reference level at the reference point. Chitinozoa: None. G 66—162 light brownish grey, coarse-grained crinoid limestone rich in stromatoporoids, 0—50 cm below top of the section, about 35 m southeast of the reference point. Chitinozoa: None.

BOFRIDE 2, *Klinteberg Beds*, upper part: G 66—163 light greenish grey, dense limestone rich in *Conchidium* and crinoids, 0—75 cm below top of the central part of the section west of the road. Chitinozoa: None.

BOGEKLINT 3, *Slite Beds*, outlier of unit g: G 66—302 light yellowish grey, coarse-grained limestone rich in crinoids, 1 m above the reference level. Chitinozoa: None.

BOTRAJVS 1, *Hamra Beds*, unit c, top: G 72—144 greyish brown, fine-grained, argillaceous and silty limestone rich in stromatoporoids, 0.75 m below ground level. Chitinozoa: 0.2 specimen per g. *Ancyrochitina pedavis*.

BOTTARVE 1, *Hamra Beds*, unit b: G 71—4 light greyish brown, fine-grained, argillaceous limestone rich in fossils, 1 m below ground level. Chitinozoa: 3.1 specimens per g. *Sphaerochitina* cf. *acanthifera*, *S. sphaerocephala*.

BOTTARVE 2, *Hamra Beds*, unit b: G 71—5 brownish grey, fine-grained, argillaceous limestone, 1 m below ground level. Chitinozoa: 8.3 specimens per g. *Ancyrochitina* cf. *diabolus*, *Sphaerochitina* cf. *acanthifera*, *S. sphaerocephala*.

BOTVIDE 1, *Hemse Beds*, Hemse Marl, uppermost part: G 66—248 light brownish grey, thinly laminated, slightly silty, calcareous mudstone, 50—55 cm below the reference level (the Hemse-Eke boundary). Chitinozoa: 2 specimens per g. *Ancyrochitina* cf. *diabolus*, *A. primitiva*, *Angochitina ceratophora*, *A. crassispina*, *A. echinata*, *Conochitina lauensis*, *Desmochitina hemsensis*, *D. squamosa*, *Sphaerochitina sp.* G 66—249 light brownish grey, almost dense, slightly argillaceous limestone, 5—10 cm below the reference level. Chitinozoa: 4.9 specimens per g. *Ancyrochitina* cf. *diabolus*, *Angochitina ceratophora*, *A. crassispina*, *A. elongata*, *Conochitina lauensis*, *Desmochitina hemsensis*, *Linochitina convexa*.

Eke Beds, lowermost part: G 66—250 light brownish grey, fine-grained limestone rich in crinoids and stromatoporoids, 20 cm above the reference level. Chitinozoa: 0.3 specimen per g. *Angochitina elongata*, *Eisenackitina philipi*, *Linochitina convexa*. G 66—247 whitish grey, medium-grained limestone, about 1.75 m above the reference level. Chitinozoa: None.

BOTVIDE 2, *Eke Beds*, upper part: G 66—246 light brownish grey, almost dense limestone, from the upper part of a sea-stack. Chitinozoa: less than 0.1 specimen per g. *Angochitina* cf. *elongata*.

BRINGES 1, *Sundre Beds*, lower part: G 71—17 brownish grey, medium-grained limestone, 0—10 cm below top of the section. Chitinozoa: None.

BRINGSARVE 1, *Hemse Beds*, unit c, lower part: G 66—272 light grey, almost dense limestone rich in stromatoporoids (light brown), from the lowermost 10 cm of the section, about 175 cm under the road surface. Chitinozoa: 0.3 specimen per g. *Angochitina elongata*, *Conochitina latifrons*.

BROA 2, *Slite Beds*, Ryssnäs Limestone: G 66—345 brownish grey, coarse-grained limestone rich in stromatoporoids and crinoids, 160—165 cm below the reference level at the reference point. Chitinozoa: 0.2 specimen per g. *Ancyrochitina primitiva*, *Conochitina tuba*. G 66—346 brownish grey, medium-grained limestone rich in stromatoporoids, 40—50 cm above the reference level. Chitinozoa: 0.2 specimen per g. *Ancyrochitina primitiva*, *Conochitina tuba*. G 66—347 light brownish grey, medium-grained limestone 300—310 cm above the reference level. Chitinozoa: None.

BROTÄSKKRÖKEN 1, *Hemse Beds*, middle-upper part: G 71—50 greyish brown, medium-grained limestone rich in stromatoporoids, 1 m above base of the section at the sharp

bend of the road. Chitinozoa: None.

BUNN 1, *Slite Beds*, unit g: G 66—339 light greenish grey and pink, medium-grained stromatoporoid limestone, from base of the section. Chitinozoa: None.

BURGEN 1, *Burgsvik Beds*, upper part: G 66—48 yellowish grey crinoid limestone, 225—230 cm below top of the section. Chitinozoa: None. G 66—49 light yellowish grey, fine-grained, oolitic limestone, 125—130 cm below the top. Chitinozoa: None. G 66—50 light yellowish grey, almost dense limestone, 20—25 cm below the top. Chitinozoa: None.

BURGEN 2, *Hamra Beds*, lower part: G 72—115 light greenish grey, almost dense, slightly silty limestone rich in bryozoans, 20—30 cm below ground level. Chitinozoa: None.

BURGEN 3, *Eke Beds*, lower part: G 72—116 yellowish brown, fine-grained limestone, from the lowermost 15 cm of the section. Chitinozoa: 2.7 specimens per g. *Angochitina crassispina*, *Eisenackitina lagenomorpha*, *E. philipi*.

BURGEN 4, *Hemse Beds*, Hemse Marl, southeastern part, top: G 72—118 light greenish grey, calcareous and silty mudstone, 0—3 cm below the reference level. Chitinozoa: 21.6 specimens per g. *Ancyrochitina primitiva*, *Angochitina ceratophora*, *A. echinata*, *Conochitina lauensis*, *Desmochitina hemsensis*, *Eisenackitina* cf. *philipi*, *Linochitina erratica*.

Eke Beds, lowermost part: G 72—119 brown, fine-grained, argillaceous and slightly silty limestone, 9—13 cm above the reference level. Chitinozoa: 27.2 specimens per g. *Angochitina echinata*, *A. elongata*, *Desmochitina hemsensis*, *Eisenackitina* cf. *lagenomorpha*, *E. philipi*, *Linochitina convexa*.

BURGEN 5, *Eke Beds*, lower part: G 72—120 brownish grey, coarse-grained limestone, 125 cm above the Hemse—Eke boundary. Chitinozoa: 1.6 specimens per g. *Eisenackitina lagenomorpha*, *Sphaerochitina acanthifera*.

BURGEN 6, *Burgsvik Beds*, upper part: G 72—121 light yellowish grey, fine-grained, slightly silty, fine-oolitic limestone, 0—15 cm below top of the oolite. Chitinozoa: 0.4 specimen per g. *Eisenackitina* cf. *lagenomorpha*, *Sphaerochitina acanthifera*. G 72—122 light greenish brown, fine-grained, slightly silty, pisolitic limestone, 100 cm above top of the oolite and 40 cm below the conglomerate of reworked algae. Chitinozoa: less than 0.1 specimen per g. *Eisenackitina* cf. *lagenomorpha*.

BURGEN 7, *Hamra Beds*, lower part: G 72—123 light greyish green, fine-grained limestone very rich in crinoids, 20—30 cm above the Burgsvik—Hamra boundary. Chitinozoa: None.

BURGSVIK 1, *Hamra Beds*, unit a: G 66—198 light brownish, almost dense, argillaceous limestone rich in calcareous algae, 5—15 cm below top of the section. Chitinozoa: less than 0.1 specimen per g. *Sphaerochitina* cf. *acanthifera*.

BUSKE 1, *Lower Visby Beds*, top: G 66—377 light greenish grey, dense, argillaceous limestone, 0—10 cm above base of the section and 65—75 cm below the boundary between the Lower and Upper Visby Beds as defined by Hede. Chitinozoa: 12.6 specimens per g. *Ancyrochitina ancyrea*, *A. pachyderma*, *A. primitiva*, *Angochitina longicollis*, *Conochitina acuminata*, *C. proboscifera*, *Margachitina margaritana*.

Upper Visby Beds: G 66—378 light greenish grey, dense, argillaceous limestone, 20—25 cm above the reference level (the Lower-Upper Visby boundary). Chitinozoa: 25.4 specimens per g. *Ancyrochitina primitiva*, *Angochitina longicollis*, *Conochitina* cf. *acuminata*, *C. proboscifera*, *C. proboscifera* f. *gracilis*, *C. proboscifera* f. *truncata*, *C. visbyensis*, *Desmochitina densa*, *Margachitina margaritana*. G 66—379 brownish and greenish grey, fine-grained, slightly argillaceous limestone very rich in pyrite, 1.5 m above the reference level. Chitinozoa: 7 specimens per g. *Ancyrochitina primitiva*, *Angochitina longicollis*, *Conochitina proboscifera*, *C. proboscifera* f. *truncata*, *C. visbyensis*, *Desmochitina densa*. G 66—380 brownish grey, medium-grained, slightly argillaceous limestone and greenish grey, calcareous mudstone, 3 m above the reference level. Chitinozoa: 12.5 specimens per g. *Ancyrochitina primitiva*, *Angochitina longicollis*, *Conochitina proboscifera*, *C. proboscifera* f. *truncata*, *Desmochitina densa*, *D. opaca*, *Margachitina margaritana*. G 66—381 brownish grey,

medium-grained, slightly argillaceous limestone rich in vugs filled with calcite, 4.25 m above the reference level. Chitinozoa: 17.6 specimens per g. *Ancyrochitina primitiva*, *Angochitina longicollis*, *Conochitina proboscifera*, *C. proboscifera* f. *truncata*, *Desmochitina densa*. G 66—382 brownish grey, medium-grained, slightly argillaceous limestone, 5.5 m above the reference level. Chitinozoa: 1.3 specimens per g. *Ancyrochitina primitiva*, *Conochitina proboscifera*, *C. proboscifera* f. *truncata*.

DANS 1, *Klinterberg Beds*, lower part: G 69—76 light greyish brown, medium-grained crinoid limestone, 0.5 m below top of the section. Chitinozoa: None.

DÄPPS 1, *Mulde Beds*, upper part: G 66—117 brownish and greenish grey, almost dense, argillaceous limestone, from base of the section. Chitinozoa: 44.8 specimens per g. *Ancyrochitina gutnica*, *A. primitiva*, *Conochitina* aff. *elegans*, *C. pachycephala*, *C. aff. proboscifera*, *C. sp.*, *Desmochitina muldiensis*, *Gotlandochitina cornuta*. G 66—118 light brown, almost dense limestone, 115 cm above base of the section. Chitinozoa: 8.4 specimens per g. *Ancyrochitina primitiva*, *Conochitina* aff. *elegans*, *C. pachycephala*, *Gotlandochitina cornuta*.

DÄPPS 2, *Mulde Beds*, upper part: G 66—123 brownish grey, fine-grained limestone, from base of section at the reference point. Chitinozoa: 0.8 specimen per g. *Ancyrochitina gutnica*, *A. primitiva*, *Conochitina* aff. *elegans*, *C. pachycephala*, *C. tuba*, *Gotlandochitina cornuta*. G 66—121 light grey, almost dense, argillaceous limestone, from base of the section, 25 m southeast of the reference point. Chitinozoa: 15.8 specimens per g. *Ancyrochitina gutnica*, *A. primitiva*, *Conochitina* aff. *elegans*, *C. pachycephala*, *C. aff. proboscifera*, *C. sp.*, *Linochitina cingulata*, *Gotlandochitina cornuta*. G 66—122 light brownish grey, fine-grained, slightly argillaceous limestone, 1.5 m above G 66—121. Chitinozoa: 4.5 specimens per g. *Ancyrochitina primitiva*, *Conochitina* aff. *elegans*, *C. pachycephala*, *C. tuba*, *Gotlandochitina cornuta*. G 66—119 brownish grey, fine-grained, slightly argillaceous limestone, from base of section 75 m southeast of the reference point. Chitinozoa: 15.3 specimens per g. *Ancyrochitina gutnica*, *A. primitiva*, *Conochitina* aff. *elegans*, *C. pachycephala*, *C. tuba*, *Gotlandochitina cornuta*. G 66—120 dark brownish grey, fine-grained, slightly argillaceous limestone and brownish grey, dense, argillaceous limestone, 75 cm above G 66—119. Chitinozoa: 16.5 specimens per g. *Ancyrochitina primitiva*, *Conochitina* aff. *elegans*, *C. pachycephala*, *C. aff. proboscifera*, *Gotlandochitina cornuta*.

DIGERHUVUD 1, *Höglint Beds*, lower-middle part: G 69—118 light greenish grey, almost dense limestone very rich in rugose corals, about 4 m a.s.l. Chitinozoa: None.

DIGRANS 1, *Hamra Beds*, lower part: G 71—11 brownish grey, fine-grained, slightly silty limestone, 40—50 cm below ground level. Chitinozoa: 108.4 specimens per g. *Ancyrochitina pedavis*, *Angochitina* cf. *echinata*, *Conochitina granosa*, *C. intermedia*.

DJAUPVIKSUDDEN 1, *Hemse Beds*, unit b: G 66—300 brownish grey, fine-grained limestone very rich in brachiopods (coquina), 50—60 cm below the boundary between units b and c. Chitinozoa: 2.3 specimens per g. *Conochitina latifrons*. G 66—301 light greenish and brownish grey, fine-grained limestone very rich in fossils (coquina), 25—30 cm below the reference level. Chitinozoa: 3.7 specimens per g. *Gotlandochitina spinipes*, *Sphaerochitina impia*. G 66—299 brownish grey, fine-grained, slightly silty limestone, 15—20 cm below the reference level. Chitinozoa: None. G 66—296 dark grey, fine-grained limestone with small pebbles of calcareous mudstone and discontinuity surfaces, 5—10 cm below the reference level. Chitinozoa: 0.2 specimen per g. *Sphaerochitina impia*.

Hemse Beds, unit c: G 66—295 grey, almost dense, argillaceous limestone with a discontinuity surface, 0—10 cm above the reference level. Chitinozoa: 2.3 specimens per g. *Gotlandochitina spinipes*, *Sphaerochitina impia*. G 66—298 grey, almost dense, slightly argillaceous limestone, 10—20 cm above the reference level. Chitinozoa: less than 0.1 specimen per g.

Sphaerolithina impia. G 66—297 brownish grey, fine-grained limestone, 20—30 cm above the reference level. Chitinozoa: None.

DJAUPVIKSUDDEN 2, *Hemse Beds*, unit c, lower part: G 69—146 grey, fine-grained, argillaceous and silty limestone. Chitinozoa: 1.4 specimens per g. *Ancyrochitina* cf. *desmea*, *Conochitina latifrons*, *Sphaerolithina impia*.

DJAUPVIKSUDDEN 3, *Hemse Beds*, unit c, lower part: G 69—147 brownish grey, fine-grained, silty limestone. Chitinozoa: less than 0.1 specimen per g. *Ancyrochitina* sp.

DJUPVIK 1, *Mulde Beds*, lower part: G 66—124 bluish grey, almost dense, argillaceous limestone, 75 cm below the lowermost of the four (caved) marly beds. Chitinozoa: 14 specimens per g. *Ancyrochitina gutnica*, *A. primitiva*, *Conochitina* aff. *elegans*, *C. pachycephala*, *Gotlandochitina cornuta*, *Linolithina cingulata*. G 66—125 brownish grey, fine-grained, argillaceous limestone, 25 cm above the lowermost, caved marl bed. Chitinozoa: 34.1 specimens per g. *Ancyrochitina gutnica*, *A. primitiva*, *Conochitina* aff. *elegans*, *C. pachycephala*, *C. sp.*, *Desmochitina muldiensis*, *Gotlandochitina cornuta*, *Linolithina cingulata*. G 66—126 light brownish grey, almost dense, argillaceous limestone, 5—10 cm above the second, caved marl bed (which is located about 1 m above the lowermost marl bed). Chitinozoa: 9.8 specimens per g. *Ancyrochitina gutnica*, *A. primitiva*, *Conochitina* aff. *elegans*, *C. pachycephala*, *Desmochitina muldiensis*, *Gotlandochitina cornuta*. G 66—127 light brownish grey, almost dense, argillaceous limestone, between the second and third caved marl beds (15 cm in between them). Chitinozoa: 11.5 specimens per g. *Ancyrochitina gutnica*, *A. primitiva*, *Conochitina* aff. *elegans*, *C. pachycephala*, *C. aff. proboscifera*, *Gotlandochitina cornuta*, *Linolithina cingulata*. G 66—128 light brownish grey, almost dense, argillaceous limestone, 5—10 cm above the fourth caved marl bed (located about 60 cm above the third). Chitinozoa: 11.9 specimens per g. *Ancyrochitina gutnica*, *Conochitina* aff. *elegans*, *C. pachycephala*, *Linolithina cingulata* cf. *odiosa*. G 66—129 yellowish grey, almost dense, argillaceous limestone, 125 cm above the fourth caved marl bed. Chitinozoa: 4.4 specimens per g. *Ancyrochitina gutnica*, *Conochitina* aff. *elegans*, *C. pachycephala*, *Gotlandochitina cornuta*.

DOMERARVE 1, *Burgsvik Beds*, top: G 69—31 grey, micaceous and thinly laminated, calcareous siltstone, 1 m below ground level. Chitinozoa: None.

DRAKARVE 1, *Hemse Beds*, Hemse Marl, uppermost part: G 72—131 greenish grey, calcareous and slightly silty mudstone, 1.5 m below ground level. Chitinozoa: 76.7 specimens per g. *Ancyrochitina* cf. *diabolus*, *A. cf. primitiva*, *Angochitina ceratophora*, *A. echinata*, *Desmochitina hemiensis*, *Eisenackitina* cf. *lagenomorpha*, *Linolithina convexa*.

EKE 1, *Eke Beds*, middle part: G 66—228 brownish grey, almost dense, slightly argillaceous and silty limestone, from base of the section immediately southeast of the bridge. Chitinozoa: 12.3 specimens per g. *Eisenackitina* cf. *lagenomorpha*, *E. philipi*, *Sphaerolithina acanthifera*, *S. cf. acanthifera*.

EKE 3, *Hemse Beds*, Hemse Marl, uppermost part: G 71—38 grey, fine-grained, argillaceous limestone, from dumped rock material. Chitinozoa: *Ancyrochitina ancyrea*, *A. cf. diabolus*, *Angochitina ceratophora*, *A. elongata*, *Conochitina lauensis*, *Desmochitina hemiensis*, *D. squamosa*, *Linolithina convexa*, *L. erratica*.

ENHOLMEN 1, *Slite Beds*, unit g: G 69—154 light greenish grey, almost dense limestone very rich in stromatoporoids, about 5 m a.s.l. Chitinozoa: None.

ETEBOLS 1, *Tofta Beds*, uppermost part: G 69—186 light yellowish and greyish brown, almost dense algal limestone very rich in *Hermannina*, 10—20 cm below ground level. Chitinozoa: None.

ETEBOLS 2, *Slite Beds*, Katrinelund Limestone, base: G 69—187 light grey, fine-grained limestone, 0—10 cm above the Tofta—Slite boundary. Chitinozoa: None.

FÄGELHAMMAR 1, *Hemse Beds*, upper part: G 69—169 light greenish grey, almost dense limestone rich in light

brown stromatoporoids, from the sea-stack on the beach due south of the pillbox. Chitinozoa: None.

FAKLE 1, *Hemse Beds*, unit c: G 66—292 light brownish grey, fine-grained limestone rich in stromatoporoids, 1.5 m above base of the section. Chitinozoa: None.

FALUDDEN 1, *Sundre Beds*, lower part: G 69—1 greenish and brownish grey, fine-grained limestone rich in stromatoporoids, 1 m above the Hamra—Sundre boundary and 5 m north of the reference point. Chitinozoa: 0.1 specimen per g. *Ancyrochitina* cf. *diabolus*, *Angochitina* cf. *echinata*, *Gotlandochitina villosa*, *Linolithina hedei*.

FALUDDEN 2, *Hamra Beds*, unit c, top: G 71—16 brownish grey, fine-grained, silty limestone, 0—10 cm below the Hamra—Sundre boundary. Chitinozoa: 0.7 specimen per g. *Gotlandochitina villosa*, *Pterochitina perivelata*, *Sphaerolithina* cf. *sphaerocephala*.

FARNAVIK 1, *Slite Beds*, Kalbjerga Limestone: G 69—112 light brownish grey, fine-grained limestone, 5—15 cm below ground level. Chitinozoa: None.

FARNAVIK 2, *Slite Beds*, Kalbjerga Limestone: G 69—113 light greenish and brownish grey, almost dense limestone, 5—15 cm below ground level. Chitinozoa: None.

FÄRÖ KYRKA 1, *Slite Beds*, Ryssnäs Limestone. G 66—2 light brownish grey, coarse-grained limestone, 50—55 cm below top of the section. Chitinozoa: None.

FIE 2, *Hemse Beds*, Hemse Marl, southeastern part: G 66—238 light greenish grey, dense, argillaceous limestone, 30—35 cm below ground level. Chitinozoa: 5 specimens per g. *Angochitina ceratophora*, *A. elongata*, *Conochitina lauensis*, *Eisenackitina* cf. *philipi*, *Linolithina convexa*.

FJÄLE 1, *Klinteberg Beds*, unit e: G 72—67 light greyish brown, fine-grained, slightly silty limestone, 10 cm below ground level. Chitinozoa: None.

FJÄLE 2, *Klinteberg Beds*, unit d, top: G 72—68 light greenish grey, fine-grained, silty limestone, 75 cm below ground level. Chitinozoa: 2.1 specimens per g. *Ancyrochitina* cf. *primitiva*, *Conochitina pachycephala*, *Gotlandochitina tabernaculifera*.

FJÄLE 3, *Klinteberg Beds*, unit e: G 72—69 light brownish grey, fine-grained, silty limestone, about 50 cm below ground level. Chitinozoa: None.

FJÄLE 4, *Klinteberg Beds*, unit e: G 72—70 light greyish brown, fine-grained, slightly silty limestone, 10 cm below ground level. Chitinozoa: None.

FJÄRDINGE 1, *Klinteberg Beds*, unit b: G 69—144 light greenish grey, fine-grained, slightly silty algal limestone, from the uppermost part of the section. Chitinozoa: 6.7 specimens per g. *Sphaerolithina concava*, *S. cf. dubia*, *S. lycoperdoides*.

FOLLINGBO 2, *Slite Beds*, Slite Marl, northwesternmost part: G 66—396 brownish grey, fine-grained, argillaceous limestone, about 0.75 m below ground level. Chitinozoa: 3.8 specimens per g. *Ancyrochitina gutnica*, *Gotlandochitina martinsoni*, *Conochitina proboscifera* f. *truncata*, *C. tuba*.

FOLLINGBO 3, *Slite Beds*, Slite Marl, northwesternmost part: G 66—74 brownish grey, fine-grained limestone, 150—160 cm below top of the section north of the road. Chitinozoa: 0.6 specimen per g. *Ancyrochitina gutnica*, *Conochitina tuba*, *Gotlandochitina spinosa*. G 66—75 brownish grey, fine-grained, slightly argillaceous limestone, 0—10 cm below the top. Chitinozoa: 0.1 specimen per g. *Ancyrochitina* sp., *Conochitina tuba*, *C. sp.*

FOLLINGBO 4, *Slite Beds*, unit g: G 72—49 light grey, dense limestone rich in multi-coloured fossils, 0.5 m under the road surface. Chitinozoa: None.

FOLLINGBO 7, *Slite Beds*, Slite Marl, northwesternmost part: G 71—60 grey, calcareous mudstone, 1.25 m under the road surface. Chitinozoa: 7.9 specimens per g. *Ancyrochitina gutnica*, *A. primitiva*, *Conochitina gutta*, *C. tuba*, *Desmochitina acollaris*, *Margachitina margaritana*. G 66—395 (temporary excavation) brownish grey, fine-grained, argillaceous limestone very rich in trilobites (coquina), about 0.5 m under the road surface. Chitinozoa: 1 specimen per g. *Ancyrochitina gutnica*, *A. primitiva*, *Conochitina tuba*, *Gotlandochitina martinsoni*, *G. spinosa*, *Margachitina margaritana*.

G 71—61 light brown, almost dense, slightly argillaceous limestone, 30 cm under the road surface. Chitinozoa: 0.5 specimen per g. *Ancyrochitina primitiva*, *Conochitina tuba*. G 71—59 grey and brownish grey, medium-grained, argillaceous limestone very rich in trilobites (coquina), 20 cm under the road surface. Chitinozoa: 8 specimens per g. *Ancyrochitina gutnica*, *Conochitina gutta*, *C. tuba*, *C. sp.*, *Desmochitina acollaris*, *Gotlandochitina martinssoni*.

FORSE 1, *Klinteberg Beds*, lower part: G 69—75 light greenish grey, almost dense limestone rich in light brown stromatoporoids, 0.5 m below ground level. Chitinozoa: None. G 66—88 light brownish grey, coarse-grained, slightly argillaceous limestone rich in *Conchidium*, 0.3 m below ground level. Chitinozoa: None. G 66—89 same lithology, from excavated material. Chitinozoa: less than 0.1 specimen per g. *Conochitina pachycephala*.

FRIDHEM 2, *Hemse Beds*, unit a: G 71—93 light greenish grey, almost dense limestone and light brownish grey, medium-grained limestone, 0—20 cm below ground level. Chitinozoa: None.

FRÖJEL 1, *Klinteberg Beds*, lowermost part: G 69—67 light greenish brown, fine-grained limestone, about 50 cm above the Mulde—Klinteberg boundary. Chitinozoa: 0.1 specimen per g. *Conochitina pachycephala*.

FRÖJEL 2, *Mulde Beds*, upper part: G 69—68 greyish brown, medium-grained, slightly silty, argillaceous limestone, from bottom of the ditch. Chitinozoa: 0.4 specimen per g. *Ancyrochitina gutnica*, *Conochitina aff. elegans*, *Desmochitina muldiensis*, *Linochitina cingulata*.

FRÖJEL 3, *Klinteberg Beds*, lower part: G 69—69 light greenish and brownish grey, medium-grained, slightly silty and argillaceous limestone, from base of the section. Chitinozoa: None.

GALGBERGET 1, *Höglint Beds*, top: G 66—403 whitish grey, fine-grained, oolitic limestone, 175—180 cm below the reference level (the Höglint—Tofta boundary). Chitinozoa: None. G 66—402 light greenish and whitish grey, coarse-oolitic limestone, 100—105 cm below the reference level. Chitinozoa: None. G 66—401 light greenish and brownish grey, medium-grained limestone, 0—5 cm below the reference level. Chitinozoa: None.

Tofta Beds, lower part: G 66—400 light brownish grey, almost dense limestone rich in stromatoporoids and algae, 5—10 cm above the reference level. Chitinozoa: None. G 66—399 light greenish grey and flamy pink, fine-grained limestone, 55—60 cm above the reference level. Chitinozoa: None. G 66—398 light greenish grey, fine-grained limestone rich in stromatoporoids, 135—140 cm above the reference level. Chitinozoa: None.

GANDARVE 1, *Halla Beds*: G 71—78 greyish brown, medium-grained limestone intercalated with dark grey, fine-grained, slightly silty limestone, 0—10 cm above base of the section (base of Hede's local 1.3-m unit) at the eastern edge of the concrete channel. Chitinozoa: 4.5 specimens per g. *Ancyrochitina gutnica*, *A. primitiva*, *Conochitina aff. elegans*, *Desmochitina acollaris*, *D. muldiensis*, *Linochitina cingulata*, *L. erratica*, *Sphaerochitina sp.* G 71—77 light greenish and brownish grey, medium-grained limestone very rich in brachiopods (coquina), 0.5 m below the reference level and 20 m east of the concrete channel. Chitinozoa: None. G 71—76 light greenish and brownish grey, almost dense limestone rich in stromatoporoids and rugose corals, 20—30 cm below the reference level. Chitinozoa: 0.3 specimen per g. *Ancyrochitina gutnica*.

GANDARVE 2, *Halla Beds*: G 66—316 light brownish grey, fine-grained, slightly argillaceous limestone, from base of the section. Chitinozoa: None. G 66—317 light greenish grey, almost dense limestone, 25 cm above G 66—316. Chitinozoa: None.

GANNES 1, *Hemse Beds*, unit d, base: G 66—293 light greenish and brownish grey, almost dense limestone rich in stromatoporoids, 0.5 m above the boundary between units c and d. Chitinozoa: None.

GANNES 2, *Hemse Beds*, unit d, lower part: G 71—89

greyish brown, fine-grained limestone, from top of the section. Chitinozoa: None.

GANNOR 1, *Hemse Beds*, Hemse Marl, uppermost part: G 69—139 light greenish grey, almost dense, argillaceous limestone, 2.3 m below the reference level (the Hemse—Eke boundary), 50 m northwest of the reference point. Chitinozoa: 8.9 specimens per g. *Ancyrochitina cf. diabolus*, *Angochitina ceratophora*, *A. echinata*, *Conochitina lauensis*, *C. sp.*, *Desmochitina hemsensis*, *D. squamosa*. G 69—140 light greenish grey, calcareous and argillaceous siltstone, 25—30 cm below the reference level, 55 m northwest of the reference point. Chitinozoa: 31.2 specimens per g. *Ancyrochitina cf. ancyrea*, *Angochitina ceratophora*, *A. crassispina*, *A. echinata*, *A. elongata*, *Conochitina lauensis*, *Desmochitina hemsensis*, *D. squamosa*, *Linochitina convexa*, *Sphaerochitina sp.*

Eke Beds, lowermost part: G 69—141 greenish and brownish grey, fine-grained, slightly silty and argillaceous limestone rich in brachiopods, 0—20 cm above the reference level. Chitinozoa: None. G 69—142 light greenish grey, fine-grained, silty limestone, 2 m above the reference level, 70 m northwest of the reference point. Chitinozoa: 56.3 specimens per g. *Angochitina ceratophora*, *A. echinata*, *A. elongata*, *Desmochitina hemsensis*, *Eisenackitina cf. lagenomorpha*, *E. philipi*, *Linochitina convexa*.

GANNOR 2, *Hemse Beds*, Hemse Marl, uppermost part: G 66—241 light greenish grey, fine-grained, argillaceous limestone, 2.5 m below the reference level (the Hemse—Eke boundary). Chitinozoa: 9.3 specimens per g. *Ancyrochitina cf. diabolus*, *Angochitina ceratophora*, *A. crassispina*, *A. echinata*, *Conochitina sp.*, *Eisenackitina cf. lagenomorpha*, *Linochitina convexa*, *Sphaerochitina sp.*

Eke Beds, lowermost part: G 66—239 light brownish grey, medium-grained crinoid limestone, 0—10 cm above the reference level and 15 m northwest of the reference point. Chitinozoa: None. G 66—240 light brownish grey, fine-grained limestone very rich in brachiopods, 1.5 m above the reference level and about 35 m northwest of the reference point. Chitinozoa: 4.2 specimens per g. *Angochitina echinata*, *A. elongata*, *Desmochitina squamosa*, *Eisenackitina philipi*, *Linochitina convexa*.

GANNOR 3, *Hemse Beds*, Hemse Marl, uppermost part: G 69—138 light greenish and brownish grey, fine-grained, argillaceous limestone rich in trilobites, from about 3.25 m below the Hemse—Eke boundary. The sample was collected at the reference point. Chitinozoa: 39.7 specimens per g. *Ancyrochitina ancyrea*, *A. cf. diabolus*, *Angochitina ceratophora*, *A. crassispina*, *A. echinata*, *A. elongata*, *Conochitina lauensis*, *C. sp.*, *Desmochitina hemsensis*, *Linochitina convexa*.

GANTHEM 1, *Klinteberg Beds*, unit c: G 71—83 light brownish grey, almost dense limestone rich in bryozoans, 0—50 cm below top of the section. Chitinozoa: None.

GARDRUNGS 1, *Slite Beds*, *Conchidium tenuistriatum* Beds: G 66—77 brownish grey, fine-grained, slightly argillaceous limestone, from base of the section. Chitinozoa: None. G 66—78 brownish grey, coarse-grained crinoid limestone, 150—155 cm above the base. Chitinozoa: None.

GARDRUNGS 2, *Slite Beds*, *Conchidium tenuistriatum* Beds: G 72—97 light brownish and greenish grey, coarse-grained limestone rich in crinoids and bryozoans, from base of the section. Chitinozoa: less than 0.1 specimen per g. *Conochitina sp.*, *Margachitina margaritana*.

GARNUDDEN 1, *Hemse Beds*, unit a: G 71—100 brownish grey, fine-grained limestone, from base of the section above the beach rubble. Chitinozoa: None. G 71—101 brownish grey, coarse-grained limestone rich in stromatoporoids and crinoids, 1 m above G 71—100. Chitinozoa: 0.1 specimen per g. *Conochitina latifrons*, *Sphaerochitina impia*.

GERETE 1, *Hemse Beds*, Hemse Marl, northwestern part: G 69—173 greenish and bluish grey, fine-grained, argillaceous limestone, the upper surface of which is a hardground, about 1 m below top of the section 10 m northeast of the bridge. Chitinozoa: 7.6 specimens per g. *Ancyrochitina cf. ancyrea*, *A. sp.*, *Conochitina latifrons*.

GERUMSKANALEN 1, *Hemse Beds*, Hemse Marl, north-western part: G 71—45 light greenish and brownish grey, fine-grained, argillaceous limestone, 1.5 m under the road surface. Chitinozoa: 3.1 specimens per g. *Ancyrochitina* cf. *diabolus*, *Angochitina ceratophora*, *A. elongata*, *Conochitina latifrons*.

GISLE 1, *Hamra Beds*, unit a: G 66—197 light brownish grey, fine-grained, slightly argillaceous limestone rich in calcareous algae, 0—10 cm below ground level. Chitinozoa: 2.7 specimens per g. *Sphaerochitina acanthifera*, *S.* cf. *acanthifera*.

GISSLAUSE 1, *Slite Beds*, unit g: G 66—323 light brownish grey, coarse-grained limestone rich in stromatoporoids, from excavated material. Chitinozoa: less than 0.1 specimen per g. *Ancyrochitina primitiva*, *Conochitina tuba*.

GLASSKÄR 1, *Burgsvik Beds*, lower part: G 72—62 light grey, slightly silty, fine-oolitic limestone, 0—5 cm below ground level. Chitinozoa: 0.1 specimen per g. *Eisenackitina* cf. *lagenomorpha*, *Sphaerochitina acanthifera*.

GLASSKÄR 2, *Burgsvik Beds*, lower part: G 72—63 brownish grey, fine-grained, slightly silty and argillaceous, oolitic limestone, 0—5 cm below ground level. Chitinozoa: 2.2 specimens per g. *Eisenackitina* cf. *lagenomorpha*, *Sphaerochitina acanthifera*.

GLASSKÄR 3, *Burgsvik Beds*, lower part: G 72—64 brownish grey, fine-grained, silty and argillaceous, oolitic limestone, 0—5 cm above the Eke—Burgsvik boundary. Chitinozoa: 1.8 specimens per g. *Eisenackitina* cf. *lagenomorpha*, *Sphaerochitina acanthifera*.

GLÄVES 2, *Hemse Beds*, Hemse Marl, southeastern part: G 66—258 light greenish and brownish grey, almost dense, argillaceous limestone, 0.5 m below ground level. Chitinozoa: 5.7 specimens per g. *Angochitina echinata*, *Conochitina lauensis*.

GNISVÄRD 1, *Upper Visby Beds*: G 66—140 grey, almost dense, argillaceous limestone, from excavated material. Chitinozoa: 12.3 specimens per g. *Ancyrochitina primitiva*, *Angochitina longicollis*, *Conochitina visbyensis*, *C. proboscifera*, *C. proboscifera* f. *gracilis*, *C. proboscifera* f. *truncata*, *Desmochitina densa*, *D. opaca*.

GODRINGS 1, *Halla Beds*, top: G 71—82 light greenish and brownish grey, slightly silty, calcareous mudstone, 0—10 cm below the reference level. Chitinozoa: 0.1 specimen per g. *Ancyrochitina* sp., *Sphaerochitina concava*.

Klinteberg Beds, unit a: G 71—81 light greenish and brownish grey, almost dense, slightly silty, argillaceous limestone. Chitinozoa: 0.1 specimen per g. *Conochitina* aff. *ele-gans*, *C. tuba*.

GODRINGS 2, *Halla Beds*, uppermost part: G 71—80 light brownish grey, almost dense, argillaceous limestone, 0—10 cm below top of the section. Chitinozoa: None.

GOGS 1, *Hemse Beds*, Hemse Marl, uppermost part: G 66—243b conglomerate of dark grey, fine-grained limestone with small pebbles of light greenish grey, calcareous mudstone, 0.4 m above bottom of the ditch and about 0.5 m below ground level. Chitinozoa: 1.6 specimens per g. *Angochitina crassispina*, *A. echinata*, *Linochitina convexa*. G 66—244 light brownish grey, calcareous and thinly laminated, argillaceous siltstone, 0.4 m below ground level. Chitinozoa: 0.9 specimen per g. *Angochitina ceratophora*, *A. echinata*, *A. elongata*, *Conochitina lauensis*, *Eisenackitina* cf. *lagenomorpha*, *Linochitina convexa*. G 71—40 light brownish grey, calcareous and silty mudstone very rich in *Dayia navicula* (coquina), from excavated material. Chitinozoa: 69.8 specimens per g. *Angochitina ceratophora*, *A. crassispina*, *Conochitina lauensis*, *Linochitina convexa*. G 71—41 light greyish brown, fine-grained, argillaceous limestone very rich in fossils (coquina), from excavated material. Martinsson's *Phlebolepis* lithology. Chitinozoa: 2.3 specimens per g. *Angochitina crassispina*, *A. echinata*, *Conochitina lauensis*, *Desmochitina hemsien-sis*.

GOGS 2, *Hemse Beds*, Hemse Marl, uppermost part: G 66—245 light brownish grey, fine-grained, silty limestone, 0.4 m below ground level. Chitinozoa: less than 0.1 specimen

per g. *Angochitina ceratophora*.

GOTHEMSHAMMAR 1, *Halla Beds*, unit c, upper part: G 66—308 dark brownish grey, fine-grained limestone and grey, almost dense, argillaceous limestone, 100—110 cm below the reference level (the Halla—Klinteberg boundary). Chitinozoa: None. G 66—307 same lithologies, 50—60 cm below the reference level. Chitinozoa: None. G 66—306 dark brownish grey and greenish grey, fine-grained, slightly argillaceous limestone, 0—10 cm below the reference level. Chitinozoa: less than 0.1 specimen per g. *Ancyrochitina* sp., *Conochitina* sp.

Klinteberg Beds, unit a, lower part: G 66—309 bluish grey, almost dense, argillaceous limestone with discontinuity surfaces, 0—10 cm above the reference level. Chitinozoa: None. G 66—310 bluish grey, fine-grained, argillaceous limestone, 10—20 cm above the reference level. Chitinozoa: 0.2 specimen per g. *Ancyrochitina* sp., *Sphaerochitina concava*, *S. lycoperdoides*.

GOTHEMSHAMMAR 2, *Halla Beds*, unit c, upper part: G 71—62 dark grey, fine-grained limestone and light greenish grey, calcareous mudstone very rich in pelecypods (coquina), from a loose boulder of the submarine beds 1.5—2 m below the Halla—Klinteberg boundary, 35 m NW of the reference point. Chitinozoa: None. G 66—315 light grey, almost dense, argillaceous limestone, 1.25 m below the reference level. Chitinozoa: 57.6 specimens per g. *Sphaerochitina concava*. G 66—311 light grey, almost dense, argillaceous limestone, 0.5 m below the reference level. Chitinozoa: 40.9 specimens per g. *Ancyrochitina gutnica*, *Conochitina tuba*, *Sphaerochitina concava*, *S. lycoperdoides*.

Klinteberg Beds, unit a, lower part: G 66—312 light brownish and greenish grey, almost dense, argillaceous limestone rich in fossils, 20—25 cm above the reference level. Chitinozoa: 15.6 specimens per g. *Sphaerochitina concava*, *S. lycoperdoides*. G 71—63 light greenish grey, almost dense limestone rich in fossils, 50—60 cm above the reference level. Chitinozoa: 20.4 specimens per g. *Ancyrochitina* sp., *Conochitina tuba*, *Sphaerochitina concava*, *S. lycoperdoides*. G 66—313 light brownish grey, almost dense, argillaceous limestone, 100—110 cm above the reference level. Chitinozoa: 32.5 specimens per g. *Sphaerochitina concava*, *S. lycoperdoides*. G 66—314 brownish grey, fine-grained limestone rich in calcareous algae, 175—180 cm above the reference level. Chitinozoa: 0.4 specimen per g. *Ancyrochitina gutnica*, *Sphaerochitina concava*.

GOTHEMSHAMMAR 7, *Halla Beds*, unit c, upper part: G 66—305 grey, almost dense, argillaceous limestone very rich in ostracodes, approximately 1.6 m below the Halla—Klinteberg boundary. Chitinozoa: None.

GOTHEMSHAMMAR 8, *Halla Beds*, unit c: G 71—64 greenish grey, calcareous mudstone, approximately 1.75 m below the Halla—Klinteberg boundary. Chitinozoa: 0.2 specimen per g. *Conochitina tuba*.

GROGARN 1, *Hemse Beds*, unit c: G 66—282 brownish grey, fine-grained limestone, from the lowermost bed. Chitinozoa: 14.5 specimens per g. *Ancyrochitina* sp., *Angochitina echinata*, *Conochitina latifrons*, *Sphaerochitina impia*.

GROGARN 2, *Hemse Beds*, unit c: G 66—284 grey, almost dense, argillaceous limestone, from base of the section. Chitinozoa: 8.4 specimens per g. *Angochitina echinata*, *A. elongata*, *Conochitina lauensis*, *Desmochitina hemsien-sis*. G 66—285 brownish grey, fine-grained limestone, 50 cm above G 66—284. Chitinozoa: 1.2 specimens per g. *Ancyrochitina* cf. *diabolus*, *Angochitina elongata*, *Linochitina convexa*.

GROGARN 3, *Hemse Beds*, unit d: G 66—283 light brown and reddish brown, coarse-grained crinoid limestone, about 4 m below top of the section. Chitinozoa: None.

GROGARNSHUVUD 1, *Hemse Beds*, unit c: G 71—103 brownish grey, fine-grained, argillaceous limestone, from the lowermost bed exposed at low-water in the western part of the locality. Chitinozoa: 46.2 specimens per g. *Ancyrochitina* cf. *diabolus*, *A.* sp., *Conochitina latifrons*, *Sphaerochitina impia*. G 71—58 brownish and greenish grey, fine-grained,

slightly argillaceous and silty limestone very rich in brachiopods (coquina), 50 cm above G 71—103. Chitinozoa: 0.1 specimen per g. *Ancyrochitina* sp., *Sphaerochitina impia*.

GRÖNDALEN 1, *Klinteberg Beds*, lower part: G 71—56 greyish brown, fine-grained limestone rich in crinoids, about 45 m a.s.l. Chitinozoa: 0.5 specimen per g. *Ancyrochitina gutnica*, *Linochitina erratica*.

GULLARVE 1, *Slite Beds*, *Slite Siltstone*, lower part: G 66—86 yellowish brown, slightly calcareous siltstone, 25—40 cm above base of the *Slite Siltstone*. Chitinozoa: None.

GULLARVE 2, *Halla Beds*, lower part: G 66—87 brownish grey, coarse-grained, slightly argillaceous limestone rich in stromatoporoids, 0—35 cm above bottom of the ditch and less than 1 m above the *Slite—Halla* boundary. Chitinozoa: 0.1 specimen per g. *Ancyrochitina gutnica*.

GULLSTAJNEN 1, *Sundre Beds*, lower-middle part: G 69—58 greenish grey and pink, coarse-grained crinoid limestone, 1 m from base of the section. Chitinozoa: None. G 69—59 light greenish and brownish grey, dense limestone rich in stromatoporoids and crinoids, 5 m above base of the section. Chitinozoa: None.

GUMBALDE 1, *Eke Beds*, lower part: G 66—243a light brown, almost dense limestone, from base of the section and approximately 1 m above the *Hemse—Eke* boundary. Chitinozoa: None. G 66—242 light brownish grey, almost dense limestone rich in crinoids and stromatoporoids, 3 m above base of the section. Chitinozoa: None.

GUSTAVSVIK 2, *Lower Visby Beds*, approximately 5 m below top: G 66—72 grey, almost dense, argillaceous limestone. Chitinozoa: 66.7 specimens per g. *Ancyrochitina pachyderma*, *Angochitina longicollis*, *Conochitina acuminata*.

GUTENVIKS 1, *Hemse Beds*, unit c: G 71—90 greenish grey, almost dense, argillaceous limestone, from excavated material. Chitinozoa: 10.3 specimens per g. *Angochitina elongata*, *Conochitina* aff. *elegans*, *C. lauensis*, *Desmochitina hemsiensis*, *Linochitina convexa*. G 71—91 greenish and brownish grey, almost dense, argillaceous limestone, 0.5 m below ground level. Chitinozoa: 14.4 specimens per g. *Angochitina elongata*, *Conochitina lauensis*, *Desmochitina hemsiensis*.

GUTEVÄGEN 3, *Höglint Beds*, unit b: G 66—410 light brownish and greenish grey, fine-grained, slightly argillaceous limestone, 2 m below base of the bioherm. Chitinozoa: less than 0.1 specimen per g. *Ancyrochitina* sp. G 66—409 light brown, coarse-grained limestone, 10—20 m below base of the bioherm. Chitinozoa: 0.1 specimen per g. *Conochitina leptosoma*, *C. visbyensis*.

GYLE 1, *Hemse Beds*, unit b: G 72—74 brownish grey, fine-grained, silty, slightly argillaceous limestone, 40—50 cm below top of the section at the reference point. Chitinozoa: 0.3 specimen per g. *Ancyrochitina* cf. *diabolus*, *Ancyrochitina* sp., *Gotlandochitina spinipes*, *Sphaerochitina impia*. G 72—75 same lithology, 35—40 cm below the top. Chitinozoa: 14.1 specimens per g. *Ancyrochitina* sp., *Gotlandochitina spinipes*, *Sphaerochitina impia*. G 71—76 brownish grey, fine-grained, silty limestone, 25—35 cm below the top. Chitinozoa: 8.5 specimens per g. *Ancyrochitina* cf. *diabolus*, *A. sp.*, *Angochitina elongata*, *Conochitina* sp., *Gotlandochitina spinipes*, *Sphaerochitina impia*. G 71—77 same lithology, 0—10 cm below the top. Chitinozoa: None.

HÄFTINGSKLINT 1, *Upper Visby Beds*, upper part: G 66—33 greenish grey, almost dense, argillaceous limestone, 300—310 cm below the reference level (base of the huge *Höglint* bioherm) at the reference point. Chitinozoa: 49.2 specimens per g. *Ancyrochitina primitiva*, *Conochitina proboscifera*, *C. proboscifera* f. *gracilis*, *Margachitina margaritana*.

Höglint Beds, unit a, base: G 66—32 greenish and brownish grey, coarse-grained limestone rich in crinoids and rugose corals, 145—155 cm below the reference level. Chitinozoa: less than 0.1 specimen per g. *Conochitina proboscifera* f. *truncata*. G 66—31 grey, medium-grained crinoid limestone, 20—25 cm below the reference level. Chitinozoa: 19.8 specimens per g. *Ancyrochitina primitiva*, *Conochitina proboscifera*, *C. proboscifera* f. *gracilis*, *C. proboscifera* f. *truncata*.

C. proboscifera f. *gracilis*, *C. proboscifera* f. *truncata*.

HAGANÄS 1, *Slite Beds*, *Slite Marl*, top: G 66—341 light grey, almost dense, argillaceous limestone, 145—150 cm below the reference level (the *Slite Marl—Rydsnäs Limestone* boundary). Chitinozoa: 6.1 specimens per g. *Ancyrochitina primitiva*, *Conochitina* cf. *proboscifera*, *C. tuba*, *Gotlandochitina martinssoni*. G 66—342 same lithology, 80—85 cm below the reference level. Chitinozoa: 4.6 specimens per g. *Ancyrochitina primitiva*, *A. sp.*, *Conochitina* aff. *elegans*, *C. tuba*, *Gotlandochitina martinssoni*.

Slite Beds, *Rydsnäs Limestone*: G 66—343 light brownish grey, medium-grained limestone rich in stromatoporoids, 45—50 cm above the reference level. Chitinozoa: 0.1 specimen per g. *Ancyrochitina primitiva*, *Conochitina tuba*, *Margachitina margaritana*. G 66—344 brownish grey, medium-grained limestone rich in stromatoporoids and crinoids, 145—150 cm above the reference level. Chitinozoa: 0.1 specimen per g. *Ancyrochitina primitiva*, *Conochitina tuba*.

HAGRUMMET 1, *Hemse Beds*, unit b: G 72—71 greenish grey, fine-grained, argillaceous and slightly silty limestone, 0.5 m below ground level. Chitinozoa: 1.3 specimens per g. *Ancyrochitina* cf. *primitiva*, *Conochitina latifrons*.

HÄGVIDE 1, *Hemse Beds*, *Hemse Marl*, southeastern part: G 66—259 grey, dense, argillaceous limestone, from base of the section, 2 m below ground level. Chitinozoa: 11.6 specimens per g. *Ancyrochitina* cf. *diabolus*, *Angochitina ceratophora*, *A. crassispina*, *A. echinata*, *Conochitina lauensis*, *Eisenackitina* cf. *lagenomorpha*, *Linochitina convexa*. G 66—260 brownish grey, almost dense, argillaceous limestone, 1.25 m above base of the section. Chitinozoa: 1.1 specimens per g. *Angochitina echinata*, *Conochitina lauensis*, *Eisenackitina* cf. *lagenomorpha*.

HALL 1, *Höglint Beds*, unit a, upper part: G 69—131 brownish grey, medium-grained, slightly argillaceous limestone, from top of the section. Chitinozoa: 26.8 specimens per g. *Ancyrochitina ancyrea*, *A. primitiva*, *Conochitina leptosoma*.

HÄLLAGRUND 1, *Slite Beds*, unit c, base: G 69—102 light brownish grey, fine-grained limestone, 20—30 cm above the *Höglint—Slite* boundary. Chitinozoa: 0.3 specimen per g. *Ancyrochitina gutnica*, *A. primitiva*, *Conochitina tuba*, *Conochitina* aff. *proboscifera*.

HALLBJÄNNE 1, *Eke Beds*, lower part: G 72—61 light greyish and yellowish brown, fine-grained, silty limestone, 10—20 cm below ground level. Chitinozoa: 9.4 specimens per g. *Angochitina* cf. *elongata*, *Eisenackitina philipi*, *Sphaerochitina* cf. *acanthifera*.

HALLBJÄNS 1, *Hamra Beds*, unit c: G 69—50 light brownish grey, coarse-grained crinoid limestone, from base of the section. Chitinozoa: 0.9 specimen per g. *Ancyrochitina* cf. *diabolus*, *Conochitina intermedia*. G 69—51 same lithology, 4 m above base of the section. Chitinozoa: None.

HÄLLINGE 1, *Klinteberg Beds*, unit b: G 71—86 light greenish grey, almost dense algal limestone, 1 m below top of the section. Chitinozoa: None.

HÄLLINGE 2, *Klinteberg Beds*, unit a: G 71—87 light brown, fine-grained, slightly dolomitic limestone, from bottom of the ditch and about 1 m below ground level. Chitinozoa: None.

HALLSARVE 1, *Eke Beds*, lower part: G 69—171 light yellowish brown, dense and medium-grained, slightly silty and argillaceous limestone, 150—160 cm above the *Hemse—Eke* boundary. Chitinozoa: 2.4 specimens per g. *Angochitina* cf. *echinata*, *Eisenackitina philipi*, *Linochitina convexa*.

HALLS HUK 1, *Upper Visby Beds*: G 66—351 brownish grey, fine-grained, argillaceous limestone, 20—25 cm below the reference level at the reference point and approximately 1.5 m above the *Lower-Upper Visby* boundary. Chitinozoa: 17.1 specimens per g. *Ancyrochitina ancyrea*, *A. primitiva*, *Conochitina proboscifera*, *C. proboscifera* f. *gracilis*, *C. visbyensis*, *Desmochitina densa*. G 66—352 grey, almost dense, argillaceous limestone, 170—175 cm above the reference level. Chitinozoa: 24.8 specimens per g. *Ancyrochitina primitiva*, *Conochitina proboscifera*, *C. proboscifera* f. *gracilis*,

C. proboscifera f. *truncata*, *C. visbyensis*.

HALLUTE 1, *Hemse Beds*, upper part: G 66—270 light brownish and greenish grey, fine-grained limestone very rich in stromatoporoids, from the lowermost part of the bioherm. Chitinozoa: less than 0.1 specimen per g. *Conochitina* sp.

HALOR 2, *Eke Beds*, middle-upper part: G 66—230 light brownish grey, fine-grained, argillaceous algal limestone, 50—60 cm below ground level and probably less than 1.5 m below the Eke—Burgsvik boundary (calculated). Chitinozoa: 1.8 specimens per g. *Eisenackitina* cf. *lagenomorpha*, *Sphaerochitina acanthifera*.

HALOR 3, *Eke Beds*, upper part: G 66—231 grey, slightly micaceous and silty, argillaceous limestone, 40—50 cm below ground level and probably less than 0.5 m below the Eke—Burgsvik boundary (calculated). Chitinozoa: 200.4 specimens per g. *Conochitina* sp., *Sphaerochitina acanthifera*.

HAMMARSHAGEHÄLLAR 1, *Sundre Beds*, middle part: G 69—8 reddish brown, almost dense limestone very rich in white crinoids, from top of the section. Chitinozoa: None.

HAMMARUDDEN 1, *Hemse Beds*, unit c: G 66—279 grey, fine-grained limestone, from the lowermost part of the section (at the syncline). Chitinozoa: 0.4 specimen per g. *Conochitina latifrons*, *Sphaerochitina dubia*, *S. impia*. G 66—280 brownish grey, fine-grained limestone, 80 cm above G 66—279. Chitinozoa: 2.6 specimens per g. *Sphaerochitina dubia*, *S. impia*.

HAMRA 1, *Hamra Beds*, unit c: G 71—20 light greyish brown, medium-grained, slightly silty limestone rich in stromatoporoids. Chitinozoa: 0.1 specimen per g. *Sphaerochitina sphaerocephala*.

HAMRA 2, *Sundre Beds*, lower part: G 72—143 light brownish grey, coarse-grained crinoid limestone, 0—10 cm below ground level. Chitinozoa: None.

HÄRDARVE 1, *Eke Beds*, upper part: G 66—225 brownish grey, almost dense, slightly silty and argillaceous limestone, 4.5 m below ground level and approximately 3.5 m below the Eke—Burgsvik boundary. Chitinozoa: 211 specimens per g. *Sphaerochitina acanthifera*.

HÄRDARVE 2, *Burgsvik Beds*, lowermost part: G 66—226 grey, micaceous, slightly calcareous siltstone, about 1 m below ground level. Chitinozoa: 8.5 specimens per g. *Sphaerochitina acanthifera*.

HAUGKLINTAR 1, *Mulde Beds*, upper part: G 69—71 greyish brown, fine-grained, slightly silty, argillaceous limestone, from top of the section. Chitinozoa: 4.5 specimens per g. *Ancyrochitina gutnica*, *Conochitina* aff. *elegans*, *C. pachycephala*, *Desmochitina muldiensis*, *Gotlandochitina cornuta*.

HAUGKLINTAR 2, *Klinteberg Beds*, lower part: G 69—70 greyish brown, fine-grained, slightly silty and argillaceous limestone, about 10 m above the road. Chitinozoa: 0.1 specimen per g. *Ancyrochitina* sp., *Conochitina pachycephala*.

HAU RÄVLAR 1, *Slite Beds*, unit g, lower part: G 69—123 light grey, fine-grained limestone, 20—30 cm below ground level. Chitinozoa: 0.3 specimen per g. *Ancyrochitina primitiva*.

HELGUMANNEN 1, *Högklint Beds*, lower-middle part: G 69—117 light greyish brown, coarse-grained limestone rich in crinoids and bryozoans, 4 m a.s.l. Chitinozoa: None.

HEMMUNGS 1, *Hemse Beds*, Hemse Marl, northwestern part: G 66—200 light brownish grey, almost dense, argillaceous limestone, 0.75 m below ground level. Chitinozoa: 14.6 specimens per g. *Ancyrochitina desmea*, *A.* sp., *Conochitina latifrons*, *C.* cf. *pachycephala*, *C. tuba*, *Gotlandochitina spinipes*, *G.* cf. *spinipes*.

HERRGÅRDSKLINT 1, *Hemse Beds*, Millklint Limestone: G 71—75 greenish grey, almost dense limestone very rich in pink stromatoporoids and crinoids, from base of the "cave" and about 5 m below top of the cliff. Chitinozoa: None. G 71—74 greenish grey, almost dense limestone very rich in stromatoporoids, about 75 m west of the cave and 4 m below top of the cliff. Chitinozoa: None.

HERRVIDE 1, *Eke Beds*, lower-middle part: G 66—229

brownish grey, almost dense, argillaceous limestone rich in calcareous algae, from the lowermost 10 cm of the section and about 0.75 m below ground level. Chitinozoa: 28.6 specimens per g. *Eisenackitina philipi*.

HERRVIK 1, *Hemse Beds*, unit d: G 69—163 brownish grey, almost dense, slightly silty and argillaceous limestone, 2 m above base of the section. Chitinozoa: 2.5 specimens per g. *Angochitina elongata*, *Conochitina* sp., *Sphaerochitina impia*.

HIDE 1, *Slite Beds*, Slite Marl: G 66—324 brownish grey, fine-grained, slightly argillaceous limestone very rich in pyrite, 5—10 cm below the reference level (= top of the Slite Marl). Chitinozoa: 0.2 specimen per g. *Ancyrochitina primitiva*, *Conochitina* aff. *proboscifera*.

Slite Beds, unit g: G 66—325 light grey, fine-grained limestone, 200—210 cm above the reference level. Chitinozoa: None.

HIDE FISKELÄGE 1, *Slite Beds*, Slite Marl, top: G 69—150 light greenish grey, almost dense, argillaceous limestone rich in *Halysites* in growth position, 40—50 cm below the reference level at the reference point. Chitinozoa: 3 specimens per g. *Ancyrochitina primitiva*, *Conochitina tuba*, *Linochitina cingulata*.

Slite Beds, unit g, base: G 69—149 light greenish and brownish grey, fine-grained, argillaceous limestone very rich in crinoids, bryozoans and rugose corals, 150—160 cm above the reference level about 15 m north of the reference point. Chitinozoa: 5.7 specimens per g. *Ancyrochitina ancyrea*, *A. gutnica*, *A. primitiva*, *Conochitina tuba*, *Gotlandochitina martinssoni*. G 69—148 light brownish grey, medium-grained limestone, 350—360 cm above the reference level at the reference point. Chitinozoa: less than 0.1 specimen per g. *Ancyrochitina primitiva*.

HIDE FISKELÄGE 2, *Slite Beds*, unit g, base: G 69—151 light greenish grey, almost dense, argillaceous limestone and light brownish grey, medium-grained, slightly argillaceous limestone, 30—40 cm below the reference level at the reference point. Chitinozoa: 1.4 specimens per g. *Ancyrochitina primitiva*, *Conochitina* aff. *elegans*, *C. tuba*, *Gotlandochitina martinssoni*.

HOBURGEN 1, *Burgsvik Beds*, upper part: G 66—171 light grey, micaceous, slightly calcareous and argillaceous siltstone, from one of the lenses 20 m north of the reference point. Chitinozoa: None.

Hamra Beds, unit c: G 71—39 brownish grey, fine-grained siltstone with small pebbles of grey, calcareous mudstone, from a loose boulder on the shore. Chitinozoa: 39.7 specimens per g. *Ancyrochitina pedavis*, *Angochitina* cf. *echinata*, *Conochitina intermedia*, *Gotlandochitina villosa*, *Linochitina hedei*, *Sphaerochitina sphaerocephala*, *S.* cf. *sphaerocephala*.

HOBURGEN 2, *Burgsvik Beds*, uppermost part: G 66—172 light grey, micaceous, slightly calcareous and argillaceous siltstone, 270—275 cm below the reference level (the Burgsvik—Hamra boundary). Chitinozoa: None. G 66—173 grey, slightly calcareous and silty mudstone, 220—225 cm below the reference level. Chitinozoa: 0.1 specimen per g. *Eisenackitina* cf. *lagenomorpha*. G 66—174 brownish grey, micaceous, slightly calcareous and silty, fine-grained sandstone, 130—135 cm below the reference level. Chitinozoa: None. G 66—175 brownish grey, pisolitic limestone, 105—110 cm below the reference level. Chitinozoa: 0.3 specimen per g. *Ancyrochitina* sp., *Sphaerochitina* cf. *acanthifera*. G 66—176 light brown, coarse-oolitic limestone, 5—10 cm below the reference level. Chitinozoa: None.

Hamra Beds, unit a, base: G 66—177 light brownish and greenish grey, almost dense, argillaceous limestone, 10—15 cm above the Burgsvik—Hamra boundary. Chitinozoa: 2 specimens per g. *Ancyrochitina* sp., *Sphaerochitina* cf. *acanthifera*, *S.* cf. *sphaerocephala*.

HOBURGEN 3, *Hamra Beds*, unit c: G 66—178 light brown, coarse-grained crinoid limestone, about 5 m a.s.l. Chitinozoa: 0.2 specimen per g. *Sphaerochitina sphaerocephala*. G 66—179 light brownish grey, coarse-grained crinoid limestone rich in stromatoporoids, about 5.5 m a.s.l. Chitino-

zoa: 0.4 specimen per g. *Ancyrochitina pedavis*, *Conochitina intermedia*, *Eisenackitina* cf. *lagenomorpha*. G 66—180 light brownish grey, coarse-grained crinoid limestone, from the roof of the lowermost cave, about 7 m a.s.l. Chitinozoa: 0.5 specimens per g. *Ancyrochitina* cf. *diabolus*, *A. pedavis*, *Conochitina intermedia*, *Sphaerochitina sphaerocephala*. G 66—181 light yellowish grey, medium-grained, slightly argillaceous limestone rich in stromatoporoids and crinoids, about 8 m a.s.l. Chitinozoa: None. G 66—182 brownish grey, dense, slightly argillaceous limestone rich in stromatoporoids, about 9 m a.s.l. Chitinozoa: None. G 66—183 brownish grey, coarse-grained crinoid limestone, about 9.5 m a.s.l. Chitinozoa: 11.7 specimens per g. *Ancyrochitina* cf. *diabolus*, *A. pedavis*, *Angochitina* cf. *echinata*, *Conochitina intermedia*, *Eisenackitina lagenomorpha*, *Sphaerochitina* cf. *sphaerocephala*. G 66—184 light brownish grey, coarse-grained crinoid limestone, about 9.75 m a.s.l. Chitinozoa: None. G 66—185 light greenish grey, dense, stromatoporoid limestone, about 10 m a.s.l. Chitinozoa: None. G 66—186 light brownish grey, coarse-grained crinoid limestone, about 11 m a.s.l. Chitinozoa: None. G 66—187 same lithology, about 12 m a.s.l. Chitinozoa: None.

HOBURGEN 4, *Hamra Beds*, unit c, upper part: G 66—189 brownish grey and pink, coarse-grained crinoid limestone, about 6 m below top of the section. Chitinozoa: less than 0.1 specimen per g. *Ancyrochitina* sp., *Eisenackitina lagenomorpha*.

Sundre Beds, lower part: G 66—188 light brownish grey and pink, coarse-grained crinoid limestone, 0.75 m above top of the bioherm. Chitinozoa: None. G 66—190 light brown and pink, medium-grained crinoid limestone, from top of the section. Chitinozoa: None.

HOLMHÄLLAR 1, *Sundre Beds*, middle part: G 69—9 light reddish brown, almost dense limestone rich in white crinoids and stromatoporoids (Holmhällar 1: 159). Chitinozoa: None. G 72—41 light greenish grey and pinkish brown, dense limestone, from the fissure-filling (Holmhällar 1: 215). Chitinozoa: less than 0.1 specimen per g. *Ancyrochitina* sp.

HÖRSNE 5, *Halla Beds*, unit b: G 66—34 brownish grey, almost dense, slightly argillaceous limestone, 0.5 m below top of the section, 130 m west of the reference point. Chitinozoa: 8.7 specimens per g. *Ancyrochitina gutnica*, *A.* cf. *primitiva*, *Gotlandochitina uncinata*.

HULTE 2, *Hemse Beds*, Hemse Marl, southeastern part: G 66—251 light brownish grey, almost dense, argillaceous limestone, 0.5 m below ground level. Chitinozoa: 1.1 specimens per g. *Angochitina echinata*, *Conochitina lauensis*, *Linochitina convexa*.

HUMMELBOSHOLM 1, *Eke Beds*, lower part: G 72—128 greyish brown, fine-grained, argillaceous and slightly silty algal limestone, 10—20 cm below ground level and approximately 0.5 m above the Hemse—Eke boundary. Chitinozoa: 64.2 specimens per g. *Conochitina granosa*, *Eisenackitina philipi*, *Sphaerochitina acanthifera*.

HUNNINGE 1, *Klinteberg Beds*, lower-middle part: G 66—90 greenish grey, almost dense crinoid limestone, 25—50 cm above base of the section in the northern part of the eastern wall. Chitinozoa: None. G 66—91 brownish grey, coarse-grained crinoid limestone, 150—160 cm above the base at the same spot. Chitinozoa: None. G 66—92 greenish and brownish grey, medium-grained limestone rich in *Conchidium*, 200—210 cm above the base at the same spot. Chitinozoa: less than 0.1 specimen per g. *Ancyrochitina* sp. G 71—35 light yellowish green, almost dense limestone rich in bryozoans, from a loose boulder. Chitinozoa: 1 specimen per g. *Ancyrochitina gutnica*, *Conochitina* aff. *elegans*, *C. pachycephala*, *Gotlandochitina* sp.

HUSRYGGEN 1, *Burgsvik Beds*, upper part: G 69—52 grey, calcareous, shaly mudstone, 210—215 cm below the reference level (top of the sandstone). Chitinozoa: 0.5 specimens per g. *Sphaerochitina acanthifera*. G 69—53 grey, calcareous and slightly silty mudstone, 110—115 cm below the reference level. Chitinozoa: 0.2 specimen per g. *Sphaerochitina acanthifera*. G 69—54 light brown, slightly calcareous

and silty, fine-grained sandstone, 0—15 cm below the reference level. Chitinozoa: 0.1 specimen per g. *Ancyrochitina* sp., *Sphaerochitina acanthifera*.

IREVIKEN 1, *Lower Visby Beds*: G 69—85 light greenish grey, almost dense, argillaceous limestone, 100—105 cm below the reference level. Chitinozoa: 17 specimens per g. *Ancyrochitina primitiva*, *Angochitina longicollis*, *Conochitina acuminata*, *C. proboscifera*, *Desmochitina densa*.

Upper Visby Beds: G 69—84 grey, almost dense, argillaceous limestone, about 7 m above the reference level. Chitinozoa: 36.6 specimens per g. *Ancyrochitina primitiva*, *Conochitina proboscifera*, *C. proboscifera* f. *gracilis*, *C. proboscifera* f. *truncata*, *C. visbyensis*, *Margachitina margaritana*.

Höglint Beds, unit a, lower part: G 69—88 brownish grey, fine-grained, slightly silty and argillaceous limestone, about 12 m above the reference level and 50 cm above base of the Höglint Beds. Chitinozoa: 5.5 specimens per g. *Ancyrochitina primitiva*, *Conochitina proboscifera*, *C. proboscifera* f. *truncata*, *C.* sp. G 69—89 same lithology rich in fossils, about 14 m above the reference level. Chitinozoa: 1.3 specimens per g. *Ancyrochitina primitiva*, *Conochitina flamma*, *C. proboscifera*, *C. proboscifera* f. *truncata*.

IREVIKEN 3, *Lower Visby Beds*: G 66—359 greenish grey, calcareous mudstone rich in tabulate corals, about 3 m below the reference level at the reference point. Chitinozoa: 3.2 specimens per g. *Ancyrochitina primitiva*, *Angochitina longicollis*, *Conochitina acuminata*, *C. proboscifera*, *Desmochitina densa*, *Margachitina margaritana*. G 66—360 grey, dense, argillaceous limestone, 0—10 cm below the reference level. Chitinozoa: 59.8 specimens per g. *Ancyrochitina primitiva*, *Angochitina longicollis*, *Conochitina acuminata*, *C. proboscifera*, *Desmochitina densa*. G 66—361 greenish grey, calcareous mudstone, 45—50 cm above the reference level. Chitinozoa: 30.7 specimens per g. *Ancyrochitina primitiva*, *Angochitina longicollis*, *Conochitina acuminata*, *C. proboscifera*, *Desmochitina densa*. G 66—358 greenish grey, calcareous mudstone with *Halysites*, 230—235 cm above the reference level (and immediately below the upper, major bentonite bed). Chitinozoa: 18.4 specimens per g. *Ancyrochitina primitiva*, *Angochitina longicollis*, *Conochitina acuminata*, *C. proboscifera*, *C.* cf. *proboscifera*. G 66—357 greenish grey, dense, argillaceous limestone, 485—490 cm above the reference level (approximately 10—20 cm below top of the Lower Visby Beds). Chitinozoa: 37.1 specimens per g. *Ancyrochitina primitiva*, *Angochitina longicollis*, *Conochitina* cf. *acuminata*, *C. proboscifera*, *C.* cf. *proboscifera*, *Desmochitina densa*.

Upper Visby Beds: G 66—356 greenish grey, almost dense, argillaceous limestone, 7.3 m above the reference level. Chitinozoa: 4.1 specimens per g. *Ancyrochitina primitiva*, *Conochitina proboscifera*, *C. proboscifera* f. *gracilis*, *C. proboscifera* f. *truncata*, *C. visbyensis*. G 66—355 brownish grey, fine-grained, slightly argillaceous limestone, 10.5 m above the reference level. Chitinozoa: 5.6 specimens per g. *Ancyrochitina primitiva*, *Conochitina proboscifera*, *C. proboscifera* f. *gracilis*, *C. proboscifera* f. *truncata*, *C. visbyensis*.

Höglint Beds, unit a, lowermost part: G 66—354 brownish grey, almost dense, slightly argillaceous limestone, about 16 m above the reference level. Chitinozoa: 8.7 specimens per g. *Ancyrochitina primitiva*, *Conochitina proboscifera*, *C. proboscifera* f. *truncata*. G 66—353 light grey, medium-grained, slightly argillaceous limestone, from the uppermost bed exposed in the cliff about 100 m southeast of the pillbox on top of the cliff. Chitinozoa: 4.1 specimens per g. *Ancyrochitina primitiva*, *Conochitina proboscifera*, *C. proboscifera* f. *truncata*, *Desmochitina densa*, *Margachitina margaritana*.

JAKOBS 1, *Hemse Beds*, Hemse Marl, uppermost part: G 72—132 greenish grey, calcareous and slightly silty mudstone, 1 cm below ground level. Chitinozoa: 18.8 specimens per g. *Angochitina crassispina*, *A. echinata*, *Conochitina lauensis*, *Desmochitina hemsensis*, *Linochitina erratica*.

JAKOBSBERG 1, *Slite Beds*, unit g: G 72—47 light brown, fine-grained, slightly argillaceous limestone, 10—30 cm below the "step" (along the path) in the section. Chitinozoa: 0.2 specimen per g. *Ancyrochitina primitiva*, *Cono-*

chitina tuba, *Gotlandochitina martinsoni*.

JUVES 1, *Hamra Beds*, unit c: G 69—60 light greyish brown, fine-grained, slightly silty and argillaceous limestone, 765—770 cm below the Hamra—Sundre boundary (35 cm below top of the thin-bedded, argillaceous unit at the base of Juvés 1). Chitinozoa: 0.1 specimen per g. *Eisenackitina lagenomorpha*, *Linochitina hedei*. G 69—61 light greyish brown, medium-grained limestone, 595—600 cm below the Hamra—Sundre boundary. Chitinozoa: None.

JUVES 2, *Hamra Beds*, unit c: G 66—102 light brownish grey, medium-grained limestone, 505—510 cm below the Hamra—Sundre boundary (40—45 cm below the reference level). Chitinozoa: 1.9 specimens per g. *Ancyrochitina* sp., *Conochitina* cf. *intermedia*, *Eisenackitina* cf. *lagenomorpha*, *Linochitina hedei*, *Pterochitina perivelata*, *Sphaerochitina sphaerocephala*. G 66—103 light brownish grey, fine-grained limestone, 475—480 cm below the Hamra—Sundre boundary. Chitinozoa: None. G 66—104 light brownish grey, fine-grained limestone, 420—425 cm below the Hamra—Sundre boundary. Chitinozoa: None. G 66—105 light brownish grey, coarse-grained crinoid limestone rich in stromatoporoids, 370—380 cm below the Hamra—Sundre boundary. Chitinozoa: None. G 66—106 light brownish grey, coarse-grained crinoid limestone, 300—305 cm below the Hamra—Sundre boundary. Chitinozoa: None.

JUVES 3, *Hamra Beds*, unit c, top: G 69—62 light greyish brown, fine-grained, slightly silty limestone, 240—245 cm below the Hamra—Sundre boundary. Chitinozoa: 0.6 specimen per g. *Ancyrochitina pedavis*, *Conochitina* cf. *intermedia*, *Eisenackitina* cf. *lagenomorpha*, *Linochitina hedei*. G 66—107 light brownish grey, medium-grained limestone, 91—100 cm below the boundary. Chitinozoa: None. G 66—108 light brown, medium-grained limestone, 62—70 cm below the boundary. Chitinozoa: 4.2 specimens per g. *Ancyrochitina pedavis*, *Conochitina intermedia*, *Linochitina hedei*, *Sphaerochitina sphaerocephala*. G 66—109 light brownish grey, fine-grained limestone, 10—15 cm below the boundary. Chitinozoa: 0.7 specimen per g. *Ancyrochitina pedavis*, *Conochitina intermedia*, *Linochitina hedei*. G 69—63 light yellowish grey, almost dense, slightly silty and argillaceous limestone, 0—10 cm below the boundary. Chitinozoa: 0.6 specimen per g. *Ancyrochitina pedavis*, *Gotlandochitina villosa*.

Sundre Beds, lower part: G 66—110 light brown, coarse-grained limestone rich in crinoids and stromatoporoids, 30—35 cm above the Hamra—Sundre boundary. Chitinozoa: None.

JUVES 4, *Sundre Beds*, lower part: G 66—111 light brownish grey, medium-grained crinoid limestone, 50—55 cm above the Hamra—Sundre boundary. Chitinozoa: 1.4 specimens per g. *Ancyrochitina* cf. *diabolus*, *Conochitina* cf. *intermedia*, *Linochitina hedei*. G 66—112 brown, medium-grained limestone, 95—100 cm above the boundary. Chitinozoa: 0.7 specimen per g. *Ancyrochitina* cf. *diabolus*, *Conochitina intermedia*, *Gotlandochitina villosa*. G 69—65 light brownish grey, fine-grained, slightly argillaceous limestone rich in crinoids, 110—115 cm above the boundary. Chitinozoa: 0.8 specimen per g. *Ancyrochitina pedavis*, *Eisenackitina lagenomorpha*, *Linochitina hedei*. G 66—113 brown, medium-grained limestone, 170—175 cm above the boundary. Chitinozoa: 1 specimen per g. *Ancyrochitina* cf. *diabolus*, *A. pedavis*, *Eisenackitina lagenomorpha*, *Gotlandochitina villosa*. G 69—64 light greyish brown, fine-grained, slightly silty limestone, 190—200 cm above the boundary. Chitinozoa: 0.1 specimen per g. *Conochitina intermedia*. G 66—114 light brownish grey, coarse-grained limestone rich in stromatoporoids, 240—250 cm above the boundary. Chitinozoa: less than 0.1 specimen per g. *Conochitina intermedia*.

KALBJERGATRÄSK 1, *Högklint Beds*, middle part: G 69—122 light brownish grey, fine-grained limestone, 140—160 cm below ground level. Chitinozoa: None.

KÄLLDAR 1, *Hemse Beds*, Hemse Marl, northwestern part: G 71—42 brownish grey, fine-grained, slightly argillaceous limestone with a discontinuity surface above which there is light grey, slightly silty, calcareous mudstone. Dumped

rock material. Chitinozoa: 5.2 specimens per g. *Ancyrochitina desmea*, *A. primitiva*, *Conochitina* cf. *pachycephala*, *C. latifrons*.

KÄLLSTÄDE 1, *Eke Beds*, lower part: G 66—269 light brown, medium-grained, slightly argillaceous limestone, 3.5 m above the road surface and approximately 3 m above the Hemse—Eke boundary. Chitinozoa: None.

KAMBS 1, *Tofta Beds*: G 66—374 light greenish grey, almost dense limestone rich in brown stromatoporoids, 0—10 cm below top of the section. Chitinozoa: None.

KAMBS 2, *Tofta Beds*: G 66—375 light greenish grey, fine-grained limestone rich in *Hermannina*, 0—10 cm below top of the section. Chitinozoa: None. G 66—376 light grey, fine-grained limestone, from excavated material. Chitinozoa: None.

KAMBS 3, *Tofta Beds*: G 69—184 light greenish grey, almost dense limestone, 0—10 cm below top of the section. Chitinozoa: None. G 69—185 greyish green and brownish grey, fine-grained algal limestone, from excavated material. Chitinozoa: None.

KAMBS 4, *Tofta Beds*: G 66—373 light grey, fine-grained limestone, from excavated material (0—150 cm below ground level). Chitinozoa: None.

KAPPELSHAMN 1, *Högklint Beds*, unit b, lower part: G 69—129 light brownish grey, coarse-grained crinoid limestone, 40—50 cm below top of the section at the reference point. Chitinozoa: 0.1 specimen per g. *Ancyrochitina primitiva*, *Conochitina mamilla*.

KAPPELSHAMN 2, *Högklint Beds*, unit b, lower part: G 69—130 light grey, fine-grained, slightly argillaceous limestone, from the lowermost bed exposed. Chitinozoa: 18 specimens per g. *Ancyrochitina ancyrea*, *A. primitiva*, *Conochitina leptosoma*, *C. mamilla*, *Desmochitina densa*.

KÄRNE 1, *Burgsvik Beds*, upper part: G 66—51 greenish grey, argillaceous crinoid limestone, from excavated material. Chitinozoa: None. G 66—237 light brownish and yellowish grey, fine-grained stromatoporoid limestone, from excavated material. Chitinozoa: None.

KATRINELUND 1, *Slite Beds*, Katrinelund Limestone: L. Jeppsson's sample LJ G 69—52 light grey, fine-grained limestone, about 1 m from top of the section in the northern wall. Chitinozoa: None.

KÄTTELVIKEN 1, *Burgsvik Beds*, upper part: G 69—36 light grey, micaceous and calcareous siltstone, 40—45 cm below the reference level (the Burgsvik—Hamra boundary). Chitinozoa: 1.2 specimens per g. *Sphaerochitina acanthifera*. G 69—37 light brownish grey, silty, pisolitic limestone, 35—40 cm below the reference level. Chitinozoa: 0.4 specimen per g. *Sphaerochitina acanthifera*. G 69—38 light greyish brown, slightly silty, pisolitic limestone, 0—5 cm below the reference level. Chitinozoa: 1.1 specimen per g. *Ancyrochitina* cf. *diabolus*, *A. sp.*, *Sphaerochitina acanthifera*.

Hamra Beds, unit a: G 69—39 light greyish brown, fine-grained, silty and argillaceous limestone rich in calcareous algae, 0—5 cm above the reference level. Chitinozoa: 0.6 specimen per g. *Ancyrochitina* sp., *Sphaerochitina* cf. *acanthifera*. G 69—40 light greyish brown, medium-grained, slightly silty and argillaceous algal limestone, 35—40 cm above the reference level. Chitinozoa: 0.2 specimen per g. *Ancyrochitina* sp., *Sphaerochitina* cf. *acanthifera*.

KÄTTELVIKEN 2, *Burgsvik Beds*, upper part: G 69—55 grey, calcareous, shaly mudstone, 50—55 cm above the reference level. Chitinozoa: 0.4 specimen per g. *Sphaerochitina* cf. *acanthifera*.

KÄTTELVIKEN 3, *Hamra Beds*, unit a: G 69—56 brownish grey, fine-grained, silty algal limestone, 0—10 cm above the Burgsvik—Hamra boundary. Chitinozoa: 4.6 specimens per g. *Ancyrochitina* cf. *diabolus*, *Sphaerochitina* cf. *acanthifera*, *S. cf. sphaerocephala*. Unit b: G 66—191 light brownish and yellowish grey, almost dense, argillaceous limestone rich in calcareous algae, 150—160 cm above the Burgsvik—Hamra boundary. Chitinozoa: 3.7 specimens per g. *Ancyrochitina* cf. *diabolus*, *A. pedavis*, *Angochitina* cf. *echinata*, *Sphaerochitina* cf. *acanthifera*, *S. cf. sphaerocephala*.

KÄTTELVIKEN 4, *Hamra Beds*, unit c, base: G 69—57 light greyish brown, coarse-grained limestone rich in crinoids and brachiopods, from about 5 m above the road. Chitinozoa: 0.4 specimen per g. *Ancyrochitina* cf. *diabolus*, *Sphaerochitina* cf. *sphaerocephala*.

KATTHAMMARSVIK 1, *Hemse Beds*, unit a: G 66—277 light brownish grey, medium-grained limestone rich in "*Megalomus*" *gotlandicus*. Chitinozoa: 0.1 specimen per g. *Sphaerochitina impia*.

KAUPARVE 1, *Hamra Beds*, lower-middle part: G 71—24 greenish grey, almost dense, argillaceous limestone rich in algae, 1 m below ground level. Chitinozoa: 1.6 specimens per g. *Eisenackitina lagenomorpha*, *Sphaerochitina acanthifera*.

KAUPUNGS 1, *Hemse Beds*, unit e, lower part: G 66—271 light brownish and greenish grey, medium-grained limestone, 75 cm below top of the section. Chitinozoa: None.

KAUPUNGS 2, *Hemse Beds*, unit c, upper part: G 71—66 light greyish brown, fine-grained, slightly dolomitic limestone, 1 m below top of unit c. Chitinozoa: 0.5 specimen per g. *Ancyrochitina* sp., *Angochitina elongata*, *Conochitina lauensis*.

KLEHAMMARSD 1, *Sundre Beds*, lowermost part: G 69—11 brownish grey, coarse-grained crinoid limestone, 0—10 cm above the Hamra—Sundre boundary. Chitinozoa: 1.5 specimens per g. *Ancyrochitina* cf. *diabolus*, *Eisenackitina lagenomorpha*, *E. oviformis*, *Gotlandochitina villosa*, *Linochitina hedei*.

KLINTEBERGET 1, *Klinteberg Beds*, lower part: G 66—149 light brownish grey, coarse-grained crinoid limestone rich in *Conchidium*, 0—25 cm above base of the section immediately south of the road (about 30 m a.s.l.). Chitinozoa: None. G 66—148 light brownish grey, medium-grained limestone, about 38 m a.s.l. at the northernmost part of the hill. Chitinozoa: None. G 66—147 light greenish grey, almost dense, slightly argillaceous limestone rich in stromatoporoids, about 42 m a.s.l. Chitinozoa: less than 0.1 specimen per g. *Conochitina* sp. G 66—150 light brownish grey, medium-grained limestone rich in *Conchidium*, about 43 m a.s.l. Chitinozoa: 0.2 specimen per g. *Ancyrochitina* cf. *ancyrea*, *Conochitina* sp.

Klinteberg Beds, lower-middle part: G 66—146 light greenish grey, almost dense, slightly argillaceous limestone rich in stromatoporoids, 47 m a.s.l. Chitinozoa: less than 0.1 specimen per g. *Ancyrochitina* sp. G 71—36 yellowish grey, calcareous mudstone (thin laminae), 49 m a.s.l. Chitinozoa: 3 specimens per g. *Ancyrochitina* cf. *gutnica*, *A. cf. primitiva*, *Conochitina pachycephala*, *C. tuba*, *Sphaerochitina cf. lycoperdoides*. G 70—1 yellowish grey, fine-grained, slightly argillaceous limestone rich in *Halysites*, 49.5 m a.s.l. Chitinozoa: 0.7 specimen per g. *Ancyrochitina* cf. *gutnica*, *Conochitina* cf. *pachycephala*, *Gotlandochitina* cf. *tabernaculifera*.

KLINTEBYS 1, *Slite Beds*, Slite Siltstone, top: G 66—143 grey, calcareous and argillaceous siltstone, 5—10 cm below the Slite—Halla boundary. Chitinozoa: 10.7 specimens per g. *Conochitina tuba*, *Desmochitina acollaris*, *Linochitina cingulata*.

Halla Beds: G 66—142 light brownish grey oolite, 0—5 cm above the Slite—Halla boundary. Chitinozoa: 1.9 specimens per g. *Ancyrochitina primitiva*.

KLINTEENKLAVEN 1, *Slite Beds*, Slite Siltstone: G 66—93 grey, slightly calcareous and argillaceous siltstone. Chitinozoa: 4.2 specimens per g. *Conochitina argillophila*, *C. tuba*, *Desmochitina acollaris*, *Gotlandochitina* sp., *Linochitina cingulata*, *L. odiosa*.

KLINTSKLINT 1, *Hemse Beds*, unit d: G 72—42 light greenish grey, almost dense limestone rich in light brown stromatoporoids, 50 cm below the reference level. Chitinozoa: less than 0.1 specimen per g. *Conochitina lauensis*.

KLOCKAREMYR 1, *Tofta Beds*: G 71—65 light greenish grey, almost dense limestone rich in calcareous algae, 5—15 cm below ground level. Chitinozoa: None.

KLUVSTAJN 1, *Slite Beds*, unit b: G 72—89 greyish brown, fine-grained argillaceous and slightly silty limestone, 40—50 cm below ground level. Chitinozoa: 1.1 specimens

per g. *Ancyrochitina primitiva*, *Conochitina* cf. *proboscifera*, *Margachitina margaritana*.

KNEIPPBYN 1, *Höglint Beds*, unit c, upper part: G 72—102 light greenish and brownish grey, fine-grained, slightly argillaceous, fine-oolitic limestone, 40—50 cm below ground level. Chitinozoa: None.

KNEIPPBYN 2, *Höglint Beds*, unit c, top: G 72—101 whitish brown, medium-grained, coarse-oolitic limestone, 0—50 cm below ground level. Chitinozoa: None.

KODINGS 1, *Hemse Beds*, Hemse Marl, southeastern part: G 66—252 light greenish grey, dense, argillaceous limestone, 1 m below ground level. Chitinozoa: 41.4 specimens per g. *Angochitina ceratophora*, *A. crassispina*, *A. echinata*, *A. elongata*, *Conochitina lauensis*, *Linochitina convexa*.

KODINGS 2, *Hemse Beds*, Hemse Marl, southeastern part: G 66—253 light greenish grey, dense, argillaceous limestone, 1 m below ground level. Chitinozoa: 7.7 specimens per g. *Angochitina crassispina*, *A. echinata*, *A. elongata*, *Conochitina lauensis*, *Linochitina erratica*.

KODINGS 3, *Hemse Beds*, Hemse Marl, southeastern part: G 66—255 light brown, almost dense limestone intercalated with light greenish grey, dense, argillaceous limestone, 90 cm below ground level. Chitinozoa: 0.7 specimen per g. *Ancyrochitina* sp., *Conochitina lauensis*, *Desmochitina hemsensis*, *Linochitina convexa*, *L. erratica*. G 66—254 light greenish grey, almost dense, argillaceous limestone, 75 cm below ground level. Chitinozoa: 19.6 specimens per g. *Angochitina crassispina*, *A. elongata*, *Conochitina* cf. *latifrons*, *C. lauensis*.

KORPKLINT 1, *Upper Visby Beds*, uppermost part: G 69—90 brownish and greenish grey, fine-grained, slightly silty and argillaceous limestone, 185—190 cm below the reference level (the Visby—Höglint boundary) at the cavity. Chitinozoa: 5.3 specimens per g. *Ancyrochitina primitiva*, *Conochitina proboscifera*, *C. proboscifera* f. *gracilis*, *C. proboscifera* f. *truncata*, *Margachitina margaritana*. G 69—91 greenish and brownish grey, almost dense, argillaceous limestone, 130—135 cm below the reference level. Chitinozoa: 5.4 specimens per g. *Ancyrochitina primitiva*, *Conochitina proboscifera*, *C. proboscifera* f. *gracilis*, *C. proboscifera* f. *truncata*, *Margachitina margaritana*. G 69—92 light brownish grey, fine-grained, argillaceous and slightly silty limestone, 75—80 cm below the reference level. Chitinozoa: 5.5 specimens per g. *Ancyrochitina primitiva*, *Conochitina proboscifera*, *C. proboscifera* f. *gracilis*, *C. proboscifera* f. *truncata*, *Margachitina margaritana*. G 69—93 greenish and brownish grey, medium-grained, argillaceous and slightly silty limestone, 42—48 cm below the reference level. Chitinozoa: 2.1 specimens per g. *Ancyrochitina primitiva*, *Conochitina proboscifera*, *C. proboscifera* f. *gracilis*, *C. proboscifera* f. *truncata*, *Margachitina margaritana*. G 69—94 light greenish and brownish grey, medium-grained, slightly argillaceous and silty limestone, 13—20 cm below the reference level. Chitinozoa: None. G 69—95 brownish grey, medium-grained, slightly argillaceous limestone and greenish grey, slightly silty, calcareous mudstone, 0—5 cm below the reference level. Chitinozoa: None.

Höglint Beds, unit a, lowermost part: G 69—96 light brownish grey, medium-grained, slightly argillaceous limestone, 0—5 cm above the reference level. Chitinozoa: None. G 69—97 light greenish and brownish grey, medium-grained, slightly argillaceous limestone with pink crinoids, 20—27 cm above the reference level. Chitinozoa: None. G 69—98 light brownish grey, medium-grained limestone rich in crinoids, 50—55 cm above the reference level. Chitinozoa: None.

KRASSE 1, *Klinteberg Beds*, middle part: G 69—81 light brownish grey, medium-grained limestone, 20—30 cm below ground level. Chitinozoa: None.

KROKEN 1, *Burgsvik Beds*, upper part: G 72—65 light grey, fine-grained, slightly argillaceous, fine-oolitic limestone, 5—10 cm below the Burgsvik—Hamra boundary. Chitinozoa: 0.2 specimen per g. *Ancyrochitina* sp., *Sphaerochitina acanthifera*.

KROKEN 2, *Burgsvik Beds*, upper part: G 72—66 light greenish grey, fine-grained, slightly silty and argillaceous,

fine-oolitic limestone, lateral of a Hamra bioherm. Chitinozoa: 40.1 specimens per g. *Sphaerochitina acanthifera*.

KUE 1, *Slite Beds*, Slite Marl, northwesternmost part: G 72—103 brown, fine-grained, silty and slightly argillaceous limestone, 75 cm below the road and immediately below the conglomerate. Chitinozoa: 0.6 specimen per g. *Ancyrochitina primitiva*, *Conochitina proboscifera* f. *truncata*, *C. tuba*, *Gotlandochitina* cf. *martinssoni*.

KUE 2, *Slite Beds*, Slite Marl, northwesternmost part: G 72—104 light greenish and brownish grey, fine-grained, argillaceous and slightly silty limestone, 60—75 cm below top of the section. Chitinozoa: 1.3 specimens per g. *Conochitina* cf. *proboscifera*, *C. tuba*, *Gotlandochitina* sp.

KULLANDS 1, *Hemse Beds*, Hemse Marl, northwestern part: G 71—44 light greenish and brownish grey, medium-grained, argillaceous limestone very rich in brachiopods, from excavated material. Chitinozoa: 5.8 specimens per g. *Ancyrochitina desmea*, *A. cf. primitiva*, *Angochitina echinata*, *A. elongata*, *Conochitina latifrons*, *C. cf. pachycephala*.

KULLUNDE 1, *Burgsvik Beds*, lowermost part: G 71—31 brownish grey, calcareous siltstone, 30—40 cm below ground level and 150 m west-northwest of the reference point and less than 0.5 m above the Eke—Burgsvik boundary. Chitinozoa: 83.1 specimens per g. *Sphaerochitina acanthifera*. G 71—32 brownish grey, calcareous siltstone, 30—40 cm below ground level and 250 m west-northwest of the reference point and less than 0.5 m above the Eke—Burgsvik boundary. Chitinozoa: 32.6 specimens per g. *Sphaerochitina acanthifera*.

KULLUNDE 2, *Eke Beds*, middle-upper part: G 71—33 light greenish brown, fine-grained, slightly argillaceous algal limestone rich in brachiopods, 10—20 cm below ground level. Chitinozoa: 0.7 specimen per g. *Sphaerochitina acanthifera*.

KUPPEN 1, *Hemse Beds*, unit d: G 66—291 brownish grey, coarse-grained limestone, 0—15 cm above the reference line at the reference point. Chitinozoa: 0.1 specimen per g. *Ancyrochitina* sp., *Conochitina lauensis*.

KUPPEN 2, *Hemse Beds*, unit d: G 66—288 light greenish grey, fine-grained, slightly argillaceous limestone (between the huge stromatoporoids), 50—100 cm below the reference level at the reference point. Chitinozoa: None. G 66—289 light brownish grey, coarse-grained limestone, 0—30 cm above the reference level. Chitinozoa: None. G 66—290 light brownish grey, coarse-grained limestone rich in stromatoporoids and crinoids, 40—50 cm above the reference level. Chitinozoa: None.

KUSE 1, *Höglint Beds*, unit c: G 72—88 light brownish and greenish grey, almost dense algal limestone, 0.5 m below ground level. Chitinozoa: None.

KVÄNNVÄTEN 1, *Slite Beds*, *Pentamerus gotlandicus* Beds or slightly younger: G 66—38 light greenish grey, medium-grained limestone, 2.5—2.6 m below top of the section. Chitinozoa: None. G 66—39 same lithology, 1.5 m below the top. Chitinozoa: None. G 66—40 same lithology, from top of the section. Chitinozoa: None.

KVARNBERGET 1, *Slite Beds*, Slite Marl, upper part: G 69—160 brownish and light greenish grey, fine-grained, argillaceous limestone, 150—160 cm below the reference level (the boundary between Slite Marl and unit g) at the southern part of the section. Chitinozoa: 6.1 specimens per g. *Ancyrochitina gutnica*, *A. primitiva*, *Conochitina tuba*, *Gotlandochitina martinssoni*, *G. spinosa*, *Linochitina cingulata*, *L. odiosa*, *Margachitina margaritana*.

KYLLAJ 2, *Slite Beds*, unit g: G 66—327 light brownish grey, coarse-grained limestone, from base of the section. Chitinozoa: None.

KYLLAJ 3, *Slite Beds*, unit g: G 66—328 light brownish grey, medium-grained limestone, from top of the section. Chitinozoa: None.

LAIKARN 1, *Halla Beds*, lower part: G 69—174 light greenish grey, almost dense, slightly silty and argillaceous limestone, 1 m above base of the section. Chitinozoa: None.

LAJKUNGSRUM 1, *Burgsvik Beds*, upper part: G 69—34 yellowish brown, fine-grained, oolitic limestone very rich in calcareous algae, 0—10 cm below top of the section. Chitinozoa: 0.2 specimen per g. *Sphaerochitina acanthifera*.

LAMBSKVIE 1, *Hemse Beds*, unit c: G 66—42 brownish grey, almost dense, slightly argillaceous limestone, from top of the section. Chitinozoa: 0.4 specimen per g. *Ancyrochitina* cf. *desmea*, *A. cf. diabolus*, *A. cf. primitiva*, *Conochitina latifrons*, *Sphaerochitina impia*.

LANDTRÄSK 1, *Tofta Beds*, top: G 66—372A light grey, fine-grained limestone, 0—15 cm above base of the section. Chitinozoa: None. G 66—372B same lithology with dark grey, irregular chert nodules, 15—25 cm (top) above base of the section. Chitinozoa: None.

LÄNGARS 1, *Slite Beds*, Slite Marl: G 66—326 brownish and greenish grey, fine-grained, argillaceous limestone, from excavated material. Chitinozoa: 2.3 specimens per g. *Ancyrochitina primitiva*, *Conochitina tuba*, *Gotlandochitina martinssoni*, *Linochitina* cf. *cingulata*. G 69—165 (additional material collected in 1969 from a temporary excavation within some tens of metres from the proper locality) light greenish grey, almost dense, argillaceous limestone, 20—25 cm below ground level. Chitinozoa: 5.6 specimens per g. *Ancyrochitina primitiva*, *A. cf. primitiva*, *Conochitina tuba*, *Gotlandochitina martinssoni*.

LANGHAMMARSHAMMAR 1, *Höglint Beds*, lower-middle part: G 66—4 light brownish grey, fine-grained limestone, from lower part of the exposure. Chitinozoa: 1 specimen per g. *Ancyrochitina ancyrea*, *A. primitiva*, *Conochitina leptosoma*, *C. mamilla*, *C. proboscifera* f. *truncata*, *Desmochitina densa*.

LANGHAMMARSHAMMAR 2, *Höglint Beds*, lower part, top: G 69—121 light grey, fine-grained limestone, from lowermost part of the section. Chitinozoa: 0.1 specimen per g. *Ancyrochitina primitiva*.

LANGHAMMARSVIKEN 1, *Höglint Beds*, lower part: G 69—120 grey, medium-grained limestone. Chitinozoa: 3.7 specimens per g. *Ancyrochitina primitiva*, *Desmochitina densa*.

LÄNNABERGET 1, *Slite Beds*, unit g: light grey, medium-grained limestone, from about 15 m a.s.l. Chitinozoa: None.

LANSA 1, *Slite Beds*, unit d: G 69—164 light yellowish and greyish brown, medium-grained limestone, from top of the section. Chitinozoa: None.

LANSAHOLM 1, *Slite Beds*, unit g, top: G 69—100 light brownish grey, medium-grained limestone, from base of the section. Chitinozoa: less than 0.1 specimen per g. *Ancyrochitina* cf. *primitiva*.

LASSOR 1, *Hemse Beds*, upper part: G 72—51 greenish grey, almost dense limestone rich in stromatoporoids, 50—60 cm below top of the section. Chitinozoa: None.

LAU BACKAR 1, *Eke Beds*, *Rhizophyllum* Limestone, upper part: G 66—268 light brown, fine-grained, argillaceous limestone, 1.5 m below ground level. Chitinozoa: 18.2 specimens per g. *Angochitina echinata*, *A. elongata*, *Conochitina* sp., *Desmochitina hemsiensis*, *Eisenackitina* cf. *lagenomorpha*, *E. philipi*, *Linochitina convexa*. G 71—102 light greenish grey, calcareous mudstone, about 75 cm below ground level. Chitinozoa: 53.7 specimens per g. *Angochitina echinata*, *A. elongata*, *Conochitina* cf. *lauensis*, *C. sp.*, *Desmochitina hemsiensis*, *Eisenackitina* cf. *lagenomorpha*, *E. philipi*, *Linochitina convexa*.

LAUSVIK 1, *Hemse Beds*, Hemse Marl, upper part: G 69—170 grey, argillaceous limestone and calcareous, shaly mudstone, 10—20 cm below ground level and approximately 12 m below the Hemse—Eke boundary. Chitinozoa: 10.2 specimens per g. *Angochitina ceratophora*, *A. crassispinosa*, *Conochitina lauensis*, *Linochitina convexa*.

LAUTER 1, *Höglint Beds*, lower-middle part: G 69—116 light greenish and brownish grey, fine-oolitic limestone, from base of the exposure. Chitinozoa: 14.7 specimens per g. *Ancyrochitina ancyrea*, *A. primitiva*, *Conochitina mamilla*, *Gotlandochitina corniculata*.

LAUTERHORN 1, *Höglint Beds*, lower-middle part: G 69—115 light brownish grey, coarse-grained crinoid limestone, between the bioherms. Chitinozoa: None.

LAUTERHORNSVIK 1, *Höglint Beds*, lower-middle

part: G 66—3 light brownish grey, fine-grained limestone, from lower part of the exposure, about 0.5 m a.s.l. Chitinozoa: less than 0.1 specimen per g. *Ancyrochitina primitiva*.

LAUTERHORNSVIK 2, *Höglint Beds*, lower-middle part G 69—114 brownish grey, medium-grained limestone rich in calcareous algae and crinoids, from base of the exposure. Chitinozoa: less than 0.1 specimen per g. *Ancyrochitina primitiva*.

LEISUNGS 1, *Hemse Beds*, Hemse Marl, southeastern part: G 66—57 greenish grey, calcareous mudstone, from excavated material. Chitinozoa: 4.3 specimens per g. *Ancyrochitina* cf. *diabolus*, *A.* cf. *primitiva*, *Angochitina echinata*, *A. elongata*, *Conochitina lauensis*, *Linochitina convexa*. G 66—58 bluish grey, calcareous mudstone, from excavated material. Chitinozoa: 22.6 specimens per g. *Angochitina ceratophora*, *A. crassispina*, *A. echinata*, *Conochitina lauensis*, *Linochitina convexa*. G 66—59 light greenish grey, thinly laminated, calcareous mudstone, from excavated material. Chitinozoa: 13.9 specimens per g. *Angochitina crassispina*, *A. echinata*, *Conochitina lauensis*, *Linochitina convexa*.

LEISUNGS 2, *Hemse Beds*, Hemse Marl, southeastern part: G 66—60 grey, almost dense, argillaceous limestone, 1 m below ground level. Chitinozoa: 7.6 specimens per g. *Angochitina crassispina*, *A. echinata*, *A. elongata*, *Conochitina lauensis*, *Linochitina convexa*.

LERBERGET 1, *Slite Beds*, Slite Marl, Lerberget Marl, lower part: G 69—188 (collected by A. Martinsson) brownish grey, fine-grained, argillaceous limestone, from base of the section. Chitinozoa: 9.6 specimens per g. *Ancyrochitina* cf. *primitiva*, *Conochitina tuba*, *Gotlandochitina uncinata*, *Linochitina cingulata*. G 69—189 (coll. A.M.) same lithology, some few metres above base of the section. Chitinozoa: 11.5 specimens per g. *Ancyrochitina* cf. *primitiva*, *Conochitina tuba*, *C.* cf. *tuba*, *Gotlandochitina uncinata*, *Linochitina cingulata*, *L. odiosa*.

LERBERGET 2, *Slite Beds*, Slite Marl, Lerberget Marl, lower part: G 69—191 (collected by A. Martinsson) brownish grey, fine-grained, slightly silty, argillaceous limestone, from base of the section. Chitinozoa: 0.3 specimen per g. *Ancyrochitina* cf. *primitiva*, *Conochitina tuba*, *C.* sp., *Gotlandochitina* cf. *valbyttiensis*, *Linochitina cingulata*, *Margachitina margaritana*.

LERBERGET 3, *Slite Beds*, Slite Marl, Lerberget Marl, lower part: G 69—190 (collected by A. Martinsson) brownish grey, fine-grained, argillaceous limestone, from base of the section. Chitinozoa: 15.2 specimens per g. *Ancyrochitina* cf. *primitiva*, *Conochitina argillophila*, *C. gutta*, *C. tuba*, *C.* sp., *Gotlandochitina uncinata*, *G. valbyttiensis*, *Linochitina cingulata*.

LICKEDARVE 1, *Slite Beds*, unit c: G 69—126 light brown, fine-grained limestone, from excavated material (0—1.5 m below ground level). Chitinozoa: None.

LICKERSHAMN 1, *Höglint Beds*, unit a, base: G 66—366 light greenish grey, coarse-grained, slightly argillaceous limestone with pink crinoids, 10—20 cm above the Upper Visby—Höglint boundary below the huge bioherm. Chitinozoa: 1 specimen per g. *Ancyrochitina ancyrea*, *A. primitiva*, *Conochitina proboscifera* f. *truncata*, *C. visbyensis*, *Margachitina margaritana*.

LICKERSHAMN 2, *Höglint Beds*, unit a: G 66—368 grey, medium-grained, slightly argillaceous limestone, 50—60 cm above the Upper Visby—Höglint boundary at the cascade, about 30 m east of the bridge. Chitinozoa: 19.6 specimens per g. *Ancyrochitina ancyrea*, *A. primitiva*, *Conochitina proboscifera*, *C. proboscifera* f. *truncata*. G 66—369 grey, fine-grained, argillaceous limestone, 1.5 m above the reference level. Chitinozoa: 21.8 specimens per g. *Ancyrochitina primitiva*, *Conochitina proboscifera*, *C. proboscifera* f. *truncata*, *Margachitina margaritana*. G 66—367 brownish grey, fine-grained, slightly argillaceous limestone, about 9 m above the reference level, about 20 m west of the bridge. Chitinozoa: 2.6 specimens per g. *Ancyrochitina primitiva*, *Conochitina flamma*, *C. proboscifera*.

LICKERSHAMN 3, *Höglint Beds*, unit a, top: G 66—363

light greenish grey, fine-grained limestone rich in stromatopores, 2 m below top of the huge bioherm. Chitinozoa: less than 0.1 specimen per g. *Ancyrochitina ancyrea*, *A. primitiva*. G 66—364 light brownish grey, fine-grained limestone, from the uppermost 10 cm of the bedded limestone. Chitinozoa: None.

LIKARVE 1, *Slite Beds*, unit a: G 72—100 light brown, coarse-grained bryozoan limestone, 5—15 cm below ground level. Chitinozoa: None.

LILLA HALLVARDS 1, *Hemse Beds*, Hemse Marl, northwestern part: G 66—202 grey, dense, argillaceous limestone, 15—40 cm below ground level. Chitinozoa: 1.3 specimens per g. *Ancyrochitina* cf. *primitiva*, *Angochitina elongata*, *Conochitina* cf. *lauensis*, *Linochitina convexa*, *Sphaerochitina impia*.

LILLA HALLVARDS 2, *Hemse Beds*, Hemse Marl, northwestern part: G 69—133 brownish grey, almost dense, slightly argillaceous limestone, 1.25 m below ground level. Chitinozoa: 6.6 specimens per g. *Angochitina elongata*.

LILLA HOME 1, *Slite Beds*, Katrinelund Limestone: G 72—96 light greenish and brownish grey, fine-grained limestone rich in stromatopores and calcareous algae, 50—60 cm below top of the section. Chitinozoa: None.

LILLA SIMUNDE 1, *Hamra Beds*, unit c: G 71—19 greyish brown, fine-grained, silty limestone rich in rugose corals, 10—20 cm below ground level. Chitinozoa: 0.2 specimen per g. *Ancyrochitina* cf. *diabolus*, *Conochitina* cf. *intermedia*.

LILLA SNÖGRINDE 1, *Klinteberg Beds*, lower-middle part: G 66—151 light greenish grey, dense limestone, 0—50 cm from base of the section at the reference point. Chitinozoa: None. G 66—152 light brownish grey, almost dense limestone rich in crinoids, about 3 m above G 66—151. Chitinozoa: 0.4 specimen per g. *Conochitina pachycephala*.

LILLA SNÖGRINDE 2, *Klinteberg Beds*, middle part: G 66—153 light brownish grey, almost dense limestone rich in crinoids and stromatopores, 0—20 cm above base of the section at the reference point. Chitinozoa: None. G 66—154 light greenish and yellowish grey, medium-grained stromatopore limestone, 3 m above G 66—153 and about 10 m north of it. Chitinozoa: None.

LILLA SNÖGRINDE 3, *Klinteberg Beds*, lower-middle part: G 69—72 light greyish brown and whitish brown, medium-grained limestone, 0—20 cm above base of the section. Chitinozoa: None.

LINDE 1, *Hemse Beds*, upper part: G 66—165 light brownish grey, coarse-grained limestone rich in crinoids and stromatopores, 0—20 cm above base of the section at the telephone pole. Chitinozoa: less than 0.1 specimen per g. *Conochitina* sp. G 66—166 light brownish grey, fine-grained, slightly argillaceous limestone, about 2 m above the base, southwest of the telephone pole. Chitinozoa: 1.3 specimens per g. *Angochitina* cf. *echinata*, *Conochitina lauensis*. G 66—167 light brownish grey, fine-grained limestone, 4.75—4.95 m above the base and along the path. Chitinozoa: None. G 66—168 same lithology, about 5.5 m above the base and to the southwest of the steps. Chitinozoa: less than 0.1 specimen per g. *Conochitina lauensis*. G 66—169 light brownish grey, coarse-grained crinoid limestone rich in stromatopores, about 8.75 m above the base. Chitinozoa: None.

LINDSTRÖMS GROTTA 1, *Klinteberg Beds*, lower part: G 71—54 light greyish yellow, fine-grained limestone rich in stromatopores, from the uppermost 0.5 m of the section, about 55 m a.s.l. Chitinozoa: None.

LINGVIDE 1, *Eke Beds*, lower part: G 66—227 brownish grey, fine-grained, slightly argillaceous limestone, from excavated material. Chitinozoa: 18.4 specimens per g. *Sphaerochitina acanthifera*.

LJUGARN 1, *Hemse Beds*, upper part: reddish brown, dense limestone, between the bioherms. Chitinozoa: None.

LUKSE 1, *Hemse Beds*, Hemse Marl, northwestern part: G 66—203 grey, almost dense, argillaceous limestone, 75 cm below ground level. Chitinozoa: 9.9 specimens per g. *Ancyrochitina desmea*, *A.* cf. *desmea*, *Angochitina elongata*, *Cono-*

chitina latifrons, *Linochitina erratica*.

LYRUNGS 1, *Hemse Beds*, probably middle part: G 66—261 greenish grey, almost dense limestone rich in whitish grey and pink stromatoporoids, from bottom of the rivulet, 15 m south of the bridge. Chitinozoa: 0.1 specimen per g. *Conochitina lauensis*. G 66—262 same lithology, from bottom of the rivulet, 3 m north of the bridge. Chitinozoa: None.

MAIGU 1, *Slite Beds*, outlier of unit g: G 69—156 light greenish grey, almost dense limestone rich in stromatoporoids, from lower part of the section (at sea level). Chitinozoa: None.

MAIGU 2, *Slite Beds*, outlier of unit g: G 69—155 grey, medium-grained limestone, between the sea-stacks on the shore. Chitinozoa: 1.3 specimens per g. *Ancyrochitina* cf. *primitiva*, *Clathrochitina clathrata*, *Conochitina argillophila*, *C. tuba*, *Desmochitina acollaris*, *Gotlandochitina uncinata*.

MALMS 1, *Hemse Beds*, Hemse Marl, southeastern part, top: G 72—124 light yellowish and greenish grey, calcareous and slightly silty mudstone, 0—5 cm below the Hemse—Eke boundary. Chitinozoa: 133.2 specimens per g. *Ancyrochitina* sp., *Angochitina echinata*, *Conochitina lauensis*, *Desmochitina hemsensis*, *D. squamosa*, *Linochitina convexa*.

Eke Beds: G 72—126 brownish grey, fine-grained, slightly silty, argillaceous algal limestone very rich in fossils (coquina), 20—30 cm above the Hemse—Eke boundary. Chitinozoa: 23.1 specimens per g. *Angochitina echinata*, *Desmochitina hemsensis*, *Eisenackitina philipi*, *Linochitina convexa*.

MARBODAR 1, *Hemse Beds*, Hemse Marl, northwestern part: G 72—50 grey, calcareous and micaceous, slightly silty mudstone, 20 cm below ground level. Chitinozoa: 54.8 specimens per g. *Angochitina ceratophora*, *A. echinata*, *Conochitina lauensis*, *Linochitina convexa*.

MARPES 1, *Slite Beds*, unit c: G 69—106 light greyish brown, fine-grained limestone, from top of the section. Chitinozoa: None.

MARPES 2, *Slite Beds*, unit c: G 69—111 light brownish grey, medium-grained, partly fine-oolitic limestone, from upper part of the section. Chitinozoa: None.

MARPESHOLM 1, *Slite Beds*, unit c: G 69—107 light brownish grey, coarse-grained limestone rich in brachiopods, 0—15 cm above the Högklint—Slite boundary. Chitinozoa: None.

MARSÄNGEN 1, *Högklint Beds*, southwestern facies, upper part: G 72—99 light brown, fine-grained, slightly silty limestone, 50—60 cm below ground level. Chitinozoa: 0.4 specimen per g. *Ancyrochitina* cf. *ancyrea*, *A. ansarvicensis*, *A. pachyderma*, *Conochitina leptosoma*, *Gotlandochitina corniculata*.

MARTILLE 1, *Slite Beds*, Katrinelund Limestone: G 72—90 light brown, fine-grained, fine-oolitic limestone, 10—20 cm below ground level. Chitinozoa: None.

MARTILLE 2, *Slite Beds*, Katrinelund Limestone: G 72—91 light greyish brown, fine-grained, fine-oolitic limestone, 45—55 cm above base of the section. Chitinozoa: 0.1 specimen per g. *Ancyrochitina primitiva*, *Conochitina* sp. MARTILLE 3, *Slite Beds*, Katrinelund Limestone: G 72—92 light greyish brown, fine-grained, fine-oolitic limestone, 50—70 cm below ground level. Chitinozoa: None.

MARTILLE 4, *Slite Beds*, Katrinelund Limestone: G 72—93 light greyish brown, almost dense limestone, 50—60 cm below ground level. Chitinozoa: None.

MARTILLE 5, *Slite Beds*, unit a: G 72—94 light greenish grey, almost dense algal limestone, 1 m below ground level. Chitinozoa: None.

MARTILLE 6, *Slite Beds*, Katrinelund Limestone: G 72—95 light brownish grey, fine-grained, fine-oolitic limestone, 0—30 cm above ground. Chitinozoa: None.

MEDBYS 1, *Hemse Beds*, probably middle part: G 66—263 light greenish grey, almost dense limestone rich in whitish grey and pink stromatoporoids, from bottom of the ditch and 15 m south of the reference point. Chitinozoa: None. G 66—264 dark brownish red, dense limestone rich in white stromatoporoids, from bottom of the ditch and 20 m south of the reference point. Chitinozoa: None.

MILLKLINT 2, *Hemse Beds*, Millklint Limestone: G 66—273 brownish grey, fine-grained limestone, 0—15 cm above base of the section. Chitinozoa: less than 0.1 specimen per g. *Conochitina* sp. G 66—274 light brownish grey, medium-grained limestone, 1.5 m above the base. Chitinozoa: None. G 66—275 same lithology, 3 m above the base. Chitinozoa: None.

MILLKLINT 3, *Hemse Beds*, Millklint Limestone: G 71—71 light brown, fine-grained limestone, 30—40 cm above the reference level. Chitinozoa: None. G 71—69 brownish grey and brown, fine-grained, slightly silty limestone, 2 m above the reference level. Chitinozoa: 0.4 specimen per g. *Angochitina* cf. *crassispina*, *A. cf. echinata*, *Conochitina lauensis*. G 71—68 light brown and brownish grey, fine-grained, slightly silty limestone rich in brachiopods, 2.5 m above the reference level. Chitinozoa: 0.7 specimen per g. *Angochitina ceratophora*, *A. crassispina*, *A. echinata*, *Conochitina lauensis*, *Linochitina convexa*. G 71—67 brownish grey, medium-grained limestone with small pebbles of light grey mudstone, 3 m above the reference level. Chitinozoa: 1.8 specimens per g. *Angochitina ceratophora*, *A. echinata*, *Conochitina lauensis*, *Linochitina convexa*. G 71—70 light brown, medium-grained limestone, about 3.5 m above the reference level. Chitinozoa: None.

MILLKLINTDALEN 1, *Hemse Beds*, Millklint Limestone: G 71—72 greyish brown, fine-grained limestone, from the lower part of the small, abandoned quarry. Chitinozoa: 0.2 specimen per g. *Angochitina crassispina*, *Conochitina lauensis*, *Linochitina convexa*.

MILLKLINTDALEN 2, *Hemse Beds*, Millklint Limestone: G 71—73 light greyish brown, fine-grained limestone, from top of the section. Chitinozoa: less than 0.1 specimen per g. *Linochitina convexa*.

MÖLLBOS 1, *Halla Beds*, unit b: G 66—321 brownish grey, almost dense, argillaceous limestone, 20 m northwest of the reference point. Chitinozoa: 0.4 specimen per g. *Ancyrochitina* cf. *primitiva*, *Conochitina* cf. *tuba*, *Gotlandochitina* cf. *uncinata*. G 66—319 same lithology (*Medusaegraptus* in this sample), loose boulder at the same spot. Chitinozoa: 0.4 specimen per g. *Ancyrochitina* cf. *gutnica*, *A. cf. primitiva*, *Gotlandochitina* sp. G 66—322 same lithology, from uppermost 20 cm of the section and close to the reference point. Chitinozoa: 2.2 specimens per g. *Ancyrochitina* cf. *gutnica*, *A. cf. primitiva*, *Conochitina* sp., *Gotlandochitina* sp.

MÖLLBOS 2, *Halla Beds*, unit b: G 66—320 whitish grey, fine-grained stromatopore limestone and light brownish and greenish grey crinoid limestone, from lowermost part of the section. Chitinozoa: None.

MÖLNER 1, *Mulde Beds*, upper part: G 66—94 light brownish grey, dense, argillaceous limestone rich in *Gothograptus nassa*, from base of the section. Chitinozoa: 9.6 specimens per g. *Ancyrochitina gutnica*, *Conochitina* aff. *elegans*, *C. pachycephala*, *C. aff. proboscifera*, *Gotlandochitina cornuta*, *G. valbyttiensis*. G 66—95 light brown, dense, argillaceous limestone, 75 cm above G 66—94. Chitinozoa: 3.2 specimens per g. *Ancyrochitina* cf. *gutnica*, *Conochitina* aff. *elegans*, *C. pachycephala*, *C. aff. proboscifera*, *Gotlandochitina* sp. G 66—96 light brownish grey, fine-grained, argillaceous limestone, 165 cm above G 66—94. Chitinozoa: 1.1 specimens per g. *Ancyrochitina* sp., *Conochitina* aff. *elegans*, *C. cf. tuba*, *Sphaerochitina* cf. *concava*.

MULDE 1, *Slite Beds*, Slite Siltstone: G 72—151 light yellowish and greenish brown, fine-grained, silty and argillaceous limestone. Chitinozoa: 10.8 specimens per g. *Ancyrochitina* cf. *gutnica*, *A. cf. primitiva*, *Sphaerochitina* cf. *concava*.

MULDE 2, *Mulde Beds*, uppermost part: G 66—135 grey, fine-grained, slightly argillaceous limestone, from the lowermost bed, 30 m east of the road. Chitinozoa: 76.1 specimens per g. *Ancyrochitina* cf. *gutnica*, *A. cf. primitiva*, *Conochitina* aff. *elegans*, *C. pachycephala*. G 66—134 light brownish grey, fine-grained, silty limestone, from the uppermost bed ca. 75 m east of the road. Sample about 50 cm above G 66—135. Chitinozoa: 11.7 specimens per g. *Ancyrochitina* cf. *gutnica*,

A. cf. primitiva, *Conochitina* aff. *elegans*, *C. aff. proboscifera*, *C. sp.*, *Gotlandochitina* cf. *cornuta*, *G. cf. uncinata*, *Sphaerochitina lycoperdoides*.

MULDE TEGELBRUK 1, *Mulde Beds*, lower-middle part: G 66—133 brownish grey, fine-grained, argillaceous limestone, from excavated material. Chitinozoa: 23.1 specimens per g. *Ancyrochitina* cf. *gutnica*, *Conochitina* aff. *elegans*, *C. pachycephala*, *C. aff. proboscifera*, *Gotlandochitina cornuta*, *G. sp.*

MUNKEBOS 1, *Slite Beds*, *Slite Marl*, *Pentamerus gotlandicus* Beds or slightly younger: G 71—79 light greenish grey, argillaceous and slightly silty limestone, 0—15 cm below top of the section north of the rivulet and about 25 m west of the reference point. Chitinozoa: 7.2 specimens per g. *Ancyrochitina primitiva*, *Clathrochitina clathrata*, *Conochitina argillophila*, *C. aff. elegans*, *C. gutta*, *C. aff. proboscifera*, *C. tuba*, *C. sp.*, *Desmochitina acollaris*, *Gotlandochitina uncinata*, *Linochitina odiosa*, *Margachitina margaritana*.

MUSKMYR 1, *Sundre Beds*, lower part: G 69—13 light greenish grey, coarse-grained crinoid limestone rich in stromatoporoids, from base of the section. Chitinozoa: None.

NABBAN 1, *Eke Beds*, lower part: G 72—59 light brownish grey, medium-grained limestone, on the shore some metres north of the point with the well-bedded limestone. Chitinozoa: 0.7 specimen per g. *Angochitina ceratophora*, *A. cf. elongata*, *Eisenackitina philipi*, *Linochitina convexa*.

NABBAN 2, *Eke Beds*, lower part: G 72—60 grey, medium-grained, slightly silty limestone. Chitinozoa: 0.1 specimen per g. *Angochitina* sp., *Eisenackitina philipi*, *Sphaerochitina* cf. *acanthifera*.

NÄRS FYR 1, *Hamra Beds*, lower part: G 66—47 light yellowish grey crinoid limestone, 0—10 cm below ground level. Chitinozoa: None.

NISSE 1, *Hemse Beds*, *Hemse Marl*, northwestern part: G 66—201 grey, dense, argillaceous limestone, from base of the section, immediately northeast of the reference point. Chitinozoa: 208.8 specimens per g. *Angochitina crassispina*, *A. elongata*, *Conochitina lauensis*, *Linochitina convexa*.

NORDERSLÄTT 1, *Slite Beds*, *Slite Marl*, *Pentamerus gotlandicus* Beds: G 71—57 light greenish grey, almost dense limestone rich in light yellowish brown crinoids, from the lowermost bed exposed. Chitinozoa: 5.4 specimens per g. *Ancyrochitina* cf. *primitiva*, *Conochitina* aff. *elegans*, *C. tuba*, *C. sp.*, *Gotlandochitina uncinata*, *Linochitina cingulata*, *L. odiosa*, *Margachitina margaritana*.

NORRA GATTET 1, *Höglint Beds*, unit c, top: G 69—105 light brownish grey, fine-grained and partly fine-oolitic limestone rich in brachiopods and rugose corals, from base of the section. Chitinozoa: None.

NORRA GATTET 2, *Slite Beds*, unit c, base: G 69—101 light brownish grey, medium-grained limestone rich in stromatoporoids, crinoids and bryozoans, from base of the section. Chitinozoa: less than 0.1 specimen per g. *Ancyrochitina primitiva*.

NORRBYS 1, *Slite Beds*, unit g: G 66—394 light brownish grey, coarse-grained limestone rich in bryozoans and stromatoporoids, 1.5 m above base of the section. Chitinozoa: less than 0.1 specimen per g. *Ancyrochitina primitiva*.

NORRVANGE 1, *Slite Beds*, unit a: G 69—128 light brownish and greenish grey, fine-grained limestone very rich in bryozoans and rugose corals, from top of the section. Chitinozoa: None.

NORS 1, *Höglint Beds*, unit b, upper part: G 69—124 light brownish grey, medium-grained limestone, from top of the section. Chitinozoa: None.

NYAN 1, *Eke Beds*, base: G 72—52 light brownish and greenish grey, medium-grained limestone, 40 cm below ground level, probably about 10 cm above the Hemse—Eke boundary. Chitinozoa: 0.2 specimen per g. *Angochitina* sp., *Conochitina* sp. G 72—53 grey, fine-grained, slightly argillaceous limestone, from excavated material, probably 10—25 cm above the Hemse—Eke boundary. Chitinozoa: 8.6 specimens per g. *Angochitina echinata*, *Desmochitina hemsensis*, *Eisenackitina philipi*, *Linochitina convexa*, *L. erratica*.

NYAN 2, *Hemse Beds*, *Hemse Marl*, *Dayia* Flags: G 72—58 greenish grey, fine-grained, silty and argillaceous limestone very rich in *Dayia navicula* (coquina), 99—101 cm below the reference level (the Hemse—Eke boundary). Chitinozoa: 25.9 specimens per g. *Ancyrochitina* cf. *ancyrea*, *A. cf. diabolus*, *Angochitina crassispina*, *A. echinata*, *Conochitina lauensis*, *Desmochitina hemsensis*, *D. squamosa*, *Linochitina convexa*. G 72—57 as above, 78—81 cm below the reference level. Chitinozoa: 8.6 specimens per g. *Ancyrochitina* cf. *ancyrea*, *Angochitina crassispina*, *A. echinata*, *Conochitina lauensis*, *Desmochitina hemsensis*, *Linochitina convexa*, *Sphaerochitina* sp. G 72—56 as above, 45—51 cm below the reference level. Chitinozoa: 12.6 specimens per g. *Angochitina* cf. *crassispina*, *A. echinata*, *Conochitina lauensis*, *Desmochitina hemsensis*, *D. squamosa*, *Linochitina erratica*. G 72—55 light grey, calcareous and argillaceous siltstone rich in brachiopods, 0—10 cm below the reference level. Chitinozoa: 122.2 specimens per g. *Ancyrochitina* cf. *diabolus*, *Angochitina ceratophora*, *A. echinata*, *Conochitina lauensis*, *Desmochitina hemsensis*, *D. squamosa*, *Linochitina convexa*.

Eke Beds, basalmost part: G 72—54 brownish grey, medium-grained, slightly silty and argillaceous limestone, 0—7 cm above the reference level. Chitinozoa: 3.5 specimens per g. *Angochitina ceratophora*, *A. echinata*, *Desmochitina hemsensis*, *Eisenackitina philipi*, *Linochitina erratica*.

NYGARDS 1, *Slite Beds*, *Slite Marl*, *Pentamerus gotlandicus* Beds: G 66—318 light grey, almost dense, argillaceous limestone, from excavated material. Chitinozoa: 6.7 specimens per g. *Ancyrochitina* cf. *primitiva*, *Clathrochitina clathrata*, *Conochitina argillophila*, *C. aff. elegans*, *C. aff. proboscifera*, *C. tuba*, *Desmochitina acollaris*, *D. muldiensis*, *Gotlandochitina uncinata*, *Linochitina* cf. *cingulata*, *L. odiosa*.

NYGARDS 2, *Halla Beds*, unit b: G 72—86 greyish brown, almost dense, slightly argillaceous and silty limestone, 0.5 m below ground level. Chitinozoa: None.

NYHAMN 1, *Lower Visby Beds*: G 66—370 nodules of light grey, almost dense, argillaceous limestone, from base of the section. Chitinozoa: 21.9 specimens per g. *Ancyrochitina primitiva*, *Angochitina longicollis*, *Conochitina acuminata*, *C. proboscifera*, *Desmochitina densa*. G 66—371 light greenish grey, argillaceous limestone, 50—55 cm above the base. Chitinozoa: 18 specimens per g. *Ancyrochitina pachyderma*, *A. primitiva*, *Angochitina longicollis*, *Conochitina acuminata*, *Desmochitina densa*.

NYMÄNETORP 1, *Höglint Beds*, unit b, upper part: G 66—349 light grey to whitish grey, fine-grained limestone, 0—20 cm below the reference level at the reference point. Chitinozoa: None.

OIVIDE 1, *Slite Beds*, *Conchidium tenuistriatum* Beds: G 66—79 brownish grey, fine-grained, slightly argillaceous limestone, 10—15 cm above base of the section. Chitinozoa: 0.3 specimen per g. *Ancyrochitina primitiva*, *Clathrochitina clathrata*, *Conochitina argillophila*, *C. gutta*, *C. aff. elegans*, *C. aff. proboscifera*, *C. tuba*, *C. sp.*, *Desmochitina acollaris*, *Gotlandochitina valbyttiensis*, *Linochitina odiosa*. G 66—80 brownish grey, coarse-grained limestone, 135—140 cm above the base. Chitinozoa: 0.1 specimen per g. *Conochitina* sp.

OJMUNDSBOD 1, *Sundre Beds*, lower part: G 72—142 grey and greyish brown, fine-grained, silty, stromatoporoid limestone. Chitinozoa: 0.6 specimen per g. *Conochitina intermedia*, *Gotlandochitina villosa*, *Sphaerochitina sphaerocephala*.

OLLAJVS 1, *Hamra Beds*, unit c: G 71—18 brown, fine-grained, slightly silty limestone, 0—15 cm below top of the section. Chitinozoa: 0.1 specimen per g. *Gotlandochitina villosa*.

OLSVENNE 1, *Hemse Beds*, *Hemse Marl*, uppermost part: G 72—134 grey, calcareous and silty mudstone, 15—25 cm below ground level. Chitinozoa: 13.9 specimens per g. *Ancyrochitina* cf. *ancyrea*, *A. cf. diabolus*, *Angochitina ceratophora*, *A. crassispina*, *A. echinata*, *Conochitina lauensis*, *Desmochitina hemsensis*, *D. squamosa*, *Linochitina convexa*, *L. erratica*. G 72—135 brownish grey, fine-grained, argillaceous and silty limestone very rich in *Dayia navicula* (co-

quina), from excavated material. Chitinozoa: 58.2 specimens per g. *Ancyrochitina* cf. *diabolus*, *Angochitina crassispina*, *A. echinata*, *Conochitina lauensis*, *Desmochitina hemsiensis*, *D. squamosa*, *Linochitina convexa*.

OLSVENNE 2, *Eke Beds*, lowermost part: G 72—136 brownish grey, calcareous and silty mudstone, 30 cm below ground level. Chitinozoa: 23.2 specimens per g. *Conochitina* sp., *Eisenackitina* cf. *philipi*, *E.* sp., *Linochitina* sp., *Sphaerochitina acanthifera*.

OLSVENNE 3, *Eke Beds*, lowermost part: G 72—137 greenish grey, calcareous and silty mudstone, 50 cm below ground level. Chitinozoa: 6.3 specimens per g. *Angochitina crassispina*, *Eisenackitina philipi*.

ÖRTER 1, *Klinteberg Beds*, lower part: G 69—78 light brownish grey, medium-grained limestone, 0.5 m above bottom of the brook. Chitinozoa: None.

ÖSTERBY 1, *Hemse Beds*, unit b: G 72—73 light greenish and brownish grey, almost dense, slightly silty and argillaceous limestone, from bottom of the ditch and 40—50 cm below ground level. Chitinozoa: 2.3 specimens per g. *Gotlandochitina* cf. *spinipes*, *Sphaerochitina impia*.

ÖSTERGARNSHOLM 1, *Hemse Beds*, unit d: G 69—161 greenish grey, almost dense limestone very rich in crinoids, about 1 m a.s.l. Chitinozoa: None.

ÖSTERGARNSHOLM 2, *Hemse Beds*, unit d: G 69—162 greenish grey, almost dense limestone rich in stromatoporoids and crinoids, from the marl-pockets. Chitinozoa: None.

OTES 1, *Sundre Beds*, middle part: G 66—116 light brownish grey, coarse-grained limestone rich in crinoids, from top of the section. Chitinozoa: 0.2 specimen per g. *Eisenackitina* cf. *lagenomorpha*, *E. oviformis*.

OTES 2, *Sundre Beds*, middle part: G 69—14 light brownish grey, medium-grained limestone, from base of the section. Chitinozoa: None.

OTES 3, *Sundre Beds*, middle part: G 69—18 light brownish grey, coarse-grained crinoid limestone rich in stromatoporoids, from top of the section. Chitinozoa: None.

PETSARVE 2, *Eke Beds*, middle-upper part: G 66—223 light brownish grey, fine-grained, argillaceous limestone rich in calcareous algae, 20 cm below ground level. Chitinozoa: 41.4 specimens per g. *Sphaerochitina acanthifera*.

PETSARVE 3, *Eke Beds*, middle-upper part: G 66—222 light brownish grey, fine-grained, argillaceous limestone rich in calcareous algae, 20 cm below ground level. Chitinozoa: 55 specimens per g. *Sphaerochitina acanthifera*.

PETSARVE 4, *Eke Beds*, middle-upper part: G 66—221 light brownish grey, fine-grained, argillaceous limestone rich in calcareous algae, 20 cm below ground level. Chitinozoa: 37.7 specimens per g. *Conochitina lauensis*, *Sphaerochitina acanthifera*.

PETSARVE 5, *Eke Beds*, middle-upper part: G 66—220 light brownish grey, fine-grained, argillaceous limestone rich in calcareous algae, 20 cm below ground level. Chitinozoa: 4.1 specimens per g. *Sphaerochitina acanthifera*, *S.* cf. *acanthifera*.

PETSARVE 6, *Eke Beds*, middle-upper part: G 66—219 brownish grey, fine-grained, argillaceous limestone rich in calcareous algae, 20 cm below ground level. Chitinozoa: 0.4 specimen per g. *Sphaerochitina acanthifera*.

PETSARVE 7, *Eke Beds*, middle-upper part: G 66—218 brownish grey, fine-grained, argillaceous limestone rich in calcareous algae, 20 cm below ground level. Chitinozoa: 0.5 specimen per g. *Conochitina lauensis*, *Desmochitina squamosa*, *Sphaerochitina acanthifera*, *S.* cf. *sphaerocephala*.

PETSARVE 8, *Eke Beds*, middle-upper part: G 66—217 brownish grey, fine-grained, argillaceous limestone rich in calcareous algae, 20 cm below ground level. Chitinozoa: 13.1 specimens per g. *Sphaerochitina* cf. *acanthifera*.

PETSARVE 9, *Eke Beds*, middle-upper part: G 66—216 brownish grey, fine-grained, argillaceous limestone rich in calcareous algae, 20 cm below ground level. Chitinozoa: 43.3 specimens per g. *Conochitina lauensis*, *Desmochitina hemsiensis*, *Sphaerochitina* cf. *acanthifera*.

PETSARVE 10, *Eke Beds*, middle-upper part: G 66—215

brownish grey, fine-grained, argillaceous limestone rich in calcareous algae, 20 cm below ground level. Chitinozoa: 6.9 specimens per g. *Sphaerochitina acanthifera*.

PETSARVE 11, *Eke Beds*, middle-upper part: G 66—214 brownish grey, fine-grained, argillaceous limestone rich in calcareous algae, 20 cm below ground level. Chitinozoa: 3.9 specimens per g. *Conochitina lauensis*, *Sphaerochitina* cf. *acanthifera*.

PETSARVE 12, *Eke Beds*, middle-upper part: G 66—213 brownish grey, fine-grained, argillaceous limestone rich in calcareous algae, 20 cm below ground level. Chitinozoa: 1.8 specimens per g. *Sphaerochitina* cf. *acanthifera*.

PETSARVE 13, *Eke Beds*, middle-upper part: G 66—212 brownish grey, fine-grained, argillaceous limestone, 20 cm below ground level. Chitinozoa: 42.3 specimens per g. *Sphaerochitina* cf. *acanthifera*.

PETSARVE 14, *Eke Beds*, middle-upper part: G 66—211 brownish grey, fine-grained, argillaceous limestone very rich in fossils (coquina), 20 cm below ground level. Chitinozoa: 91.1 specimens per g. *Sphaerochitina* cf. *acanthifera*.

PETSARVE 15, *Eke Beds*, middle-upper part: G 66—210 brownish grey, fine-grained, argillaceous limestone rich in calcareous algae, 20 cm below ground level. Chitinozoa: 0.1 specimen per g. *Sphaerochitina* cf. *acanthifera*.

PRÄSTBÅTELS 1, *Klinteberg Beds*, lower part: G 72—78 light brownish grey, coarse-grained, slightly silty limestone, 0.8 m above base of Hede's local bed b at the reference point. Chitinozoa: None.

PRÄSTBÅTELS 2, *Klinteberg Beds*, lower part: G 72—80 light greenish grey, fine-grained limestone rich in calcareous algae, 0.5 m below top of Hede's local bed b, 50 m west of the reference point. Chitinozoa: None. G 72—79 brownish grey, fine-grained, argillaceous and slightly silty limestone, 0.8 m above base of Hede's local bed c. Chitinozoa: 27.7 specimens per g. *Ancyrochitina* sp., *Conochitina* aff. *elegans*, *Sphaerochitina lycoperdoides*.

PRÄSTBÅTELS 3, *Klinteberg Beds*, lower part: G 72—83 grey, almost dense, argillaceous limestone, 0—10 cm below top of Hede's local bed c, 10 m east of the reference point. Chitinozoa: None. G 72—82 light greenish grey, almost dense, slightly argillaceous and silty limestone, 0—10 cm above base of Hede's local bed d. Chitinozoa: None. G 72—81 light yellowish grey, fine-grained, silty and argillaceous limestone, 15—20 cm above base of Hede's local bed d. Chitinozoa: 2.6 specimens per g. *Conochitina* aff. *elegans*, *Sphaerochitina* cf. *lycoperdoides*.

PUTTARSJAUS 2, *Slite Beds*, unit g: G 66—329 brown, coarse-grained stromatoporoid limestone, about 15 m a.s.l. Chitinozoa: None. G 66—330 light brownish grey, coarse-grained limestone rich in crinoids and *Trimerella*, about 16 m a.s.l. Chitinozoa: less than 0.1 specimen per g. *Conochitina* sp. G 66—331 light brown, coarse-grained crinoid limestone, about 20 m a.s.l. Chitinozoa: None.

RÅGAKRE 1, *Klinteberg Beds*, lower part: G 69—77 light brown, coarse-grained crinoid limestone rich in stromatoporoids, 85—100 cm below top of the section. Chitinozoa: None.

RAMMTRÄSK 1, *Hemse Beds*, lower-middle part: G 71—51 light greenish grey, almost dense limestone very rich in pink stromatoporoids and crinoids, about 42.5 m a.s.l. (3 m above base of the section) at the "cave". Chitinozoa: None.

RANGSARVE 1, *Hemse Beds*, upper part: G 66—52 brownish grey, coarse-grained, slightly argillaceous crinoid limestone, from base of the section, about 1 m under the road surface. Chitinozoa: 1.9 specimens per g. *Angochitina elongata*, *Conochitina lauensis*. G 66—53 yellowish grey, fine-grained, argillaceous limestone, 1 m above base of the section. Chitinozoa: 9 specimens per g. *Angochitina elongata*, *Conochitina lauensis*. G 66—54 light yellowish grey, calcareous mudstone, 2 m above the base. Chitinozoa: 2.6 specimens per g. *Angochitina elongata*, *Conochitina lauensis*. G 66—55 grey, medium-grained, argillaceous limestone rich in fossils, 3 m above the base. Chitinozoa: 0.7 specimen per g. *Ango-*

chitina elongata, *Desmochitina squamosa*. G 66—56 dark grey, medium-grained, slightly argillaceous crinoid limestone, 4 m above the base. Chitinozoa: 0.5 specimen per g. *Angochitina elongata*, *Conochitina lauensis*, *Desmochitina squamosa*.

REMB5 1, *Sundre Beds*, middle part: G 69—10 yellowish brown, almost dense limestone very rich in white and pink crinoids and stromatoporoids, 1 m above base of the section. Chitinozoa: None.

ROBBJÄNS KVARN 1, *Slite Beds*, *Slite Siltstone*, middle: G 72—145 grey and greyish brown, calcareous siltstone, from bottom of the ditch, 50 m northwest of the reference point. Chitinozoa: 0.9 specimen per g. *Desmochitina acollaris*, *Linochitina cingulata*.

ROBBJÄNS KVARN 2, *Slite Beds*, *Slite Siltstone*, upper part: G 72—146 light brownish grey, calcareous siltstone, 0.5 m below the *Slite*—*Halla* boundary and 5 m southeast of the reference point. Chitinozoa: 42.8 specimens per g. *Ancyrochitina* cf. *gutnica*, *Conochitina* aff. *elegans*, *C. pachycephala*, *Desmochitina muldiensis*, *Gotlandochitina uncinata*, *Linochitina cingulata*.

Halla Beds: G 72—147 light greenish and yellowish grey, fine-grained, argillaceous and slightly silty limestone, 10 cm above the *Slite*—*Halla* boundary. Chitinozoa: 35.9 specimens per g. *Ancyrochitina gutnica*, *Gotlandochitina* cf. *uncinata*.

ROES 1, *Hamra Beds*, unit b: G 71—22 light brown, fine-grained, silty limestone, 0.4 m below ground level. Chitinozoa: 4.8 specimens per g. *Sphaerochitina* cf. *acanthifera*, *S.* cf. *sphaerocephala*.

RONEHAMN 1, *Eke Beds*, upper part: G 66—235 grey, almost dense, slightly silty, argillaceous limestone rich in calcareous algae, 5—15 cm below the *Eke*—*Burgsvik* boundary (2.5 m below the reference level) at the reference point. Chitinozoa: 190.4 specimens per g. *Sphaerochitina acanthifera*.

Burgsvik Beds, lower part: G 66—234 grey, calcareous and argillaceous siltstone, 5—15 cm above the *Eke*—*Burgsvik* boundary. Chitinozoa: 65.2 specimens per g. *Sphaerochitina acanthifera*. G 66—233 light grey, micaceous, calcareous, and argillaceous siltstone, 100—110 cm above the *Eke*—*Burgsvik* boundary. Chitinozoa: 31 specimens per g. *Sphaerochitina acanthifera*. G 66—232 light greenish grey, micaceous and slightly calcareous siltstone, 195—200 cm above the *Eke*—*Burgsvik* boundary. Chitinozoa: 201.6 specimens per g. *Sphaerochitina acanthifera*.

RONNINGS 1, *Eke Beds*, upper part: G 66—61 grey, fine-grained, slightly argillaceous limestone, about 1 m under the road surface. Chitinozoa: 1.3 specimens per g. *Sphaerochitina acanthifera*.

RONNINGS 2, *Burgsvik Beds*, lowermost part: G 69—20 greenish grey, calcareous and micaceous, lenticular siltstone, about 0.5 m below ground level. Chitinozoa: 100 specimens per g. *Sphaerochitina acanthifera*.

ROVALDS 1, *Burgsvik Beds*, uppermost part: G 69—21 grey, calcareous and micaceous siltstone, 0—8 cm above the reference level at the reference point. Chitinozoa: less than 0.1 specimen per g. *Sphaerochitina acanthifera*. G 69—22 grey, fine-grained, slightly oolitic, silty limestone rich in brachiopods, 110—115 cm above the reference level. Chitinozoa: None. G 69—23 light greyish brown, silty, oolitic limestone, 130—135 cm above the reference level. Chitinozoa: None. G 69—24 light grey, fine-grained, micaceous, slightly oolitic, silty limestone rich in fossils (*Ilionia prisca* and *Protochonetes striatellus*), from a loose siltstone boulder (from an interval of 0—150 cm below the reference level). Chitinozoa: 9.9 specimens per g. *Sphaerochitina* cf. *acanthifera*.

ROVALDS 2, *Burgsvik Beds*, uppermost part: G 69—25 grey, calcareous, shaly mudstone, 80—85 cm below the reference level (the *Burgsvik*—*Hamra* boundary). Chitinozoa: 0.2 specimen per g. *Sphaerochitina acanthifera*, *S.* cf. *acanthifera*. G 69—26 grey, calcareous siltstone very rich in fossils (coquina), 50—60 cm below the reference level. Chitinozoa: less than 0.1 specimen per g. *Sphaerochitina acanthifera*. G 69—27 light brownish grey, silty, pisolitic limestone,

5—10 cm below the reference level. Chitinozoa: 0.2 specimen per g. *Sphaerochitina acanthifera*.

Hamra Beds, lowermost part: G 69—28 light brownish grey, fine-grained, slightly oolitic, silty limestone rich in calcareous algae, 0—10 cm above the reference level. Chitinozoa: 0.3 specimen per g. *Ancyrochitina* sp., *Sphaerochitina* cf. *acanthifera*. G 69—29 light brown, fine-grained, slightly silty algal limestone, 30—35 cm above the reference level. Chitinozoa: 11.3 specimens per g. *Eisenackitina* cf. *lagenomorpha*, *Sphaerochitina* cf. *acanthifera*.

ROVALDS 3, *Burgsvik Beds*, uppermost part: G 66—206 light grey, silty, slightly oolitic and calcareous, fine-grained sandstone, 160—165 cm below the reference level (the *Burgsvik*—*Hamra* boundary). Chitinozoa: 0.1 specimen per g. *Angochitina* sp., *Eisenackitina* cf. *lagenomorpha*, *Sphaerochitina* cf. *acanthifera*. G 66—207 light brownish grey, silty limestone very rich in fossils (coquina), 125—130 cm below the reference level. Chitinozoa: 0.1 specimen per g. *Angochitina* sp., *Conochitina* cf. *intermedia*, *Sphaerochitina* cf. *acanthifera*. G 66—208 light brownish grey, slightly silty, pisolitic limestone, 50—60 cm below the reference level. Chitinozoa: 1.1 specimens per g. *Desmochitina*? sp., *Sphaerochitina acanthifera*, *S.* cf. *acanthifera*. G 66—209 light brownish grey, fine-grained limestone, 0—5 cm below the reference level. Chitinozoa: 0.8 specimen per g. *Sphaerochitina acanthifera*, *S.* cf. *acanthifera*.

SALLMUNDS 1, *Sundre Beds*, lower-middle part: G 69—5 light greenish grey and light brown, almost dense limestone very rich in white and pinkish crinoids, 0—10 cm below ground level. Chitinozoa: None.

SALLMUNDSUDD 1, *Sundre Beds*, middle part: G 69—6 light greenish grey, almost dense limestone rich in white and pinkish crinoids and stromatoporoids, from base of the section. Chitinozoa: None.

SAMSUGNS 1, *Slite Beds*, unit g: G 66—11 light brown, medium-grained limestone, from base of the section at the entrance of the quarry. Chitinozoa: None. G 66—10 grey, almost dense, slightly argillaceous limestone, 1 m above the base. Chitinozoa: None. G 66—9 light yellowish grey, almost dense limestone, 2 m above the base. Chitinozoa: None. G 66—8 whitish grey, coarse-grained limestone, 3 m above the base. Chitinozoa: None. G 66—7 light brownish grey, almost dense limestone, 4 m above the base. Chitinozoa: None. G 66—6 light brownish grey, almost dense limestone rich in stromatoporoids, 5 m above the base. Chitinozoa: None. G 66—12 light greenish and brownish grey, dense limestone, from a local boulder. Chitinozoa: None.

SAMSUGNS 2, *Slite Beds*, unit g: G 66—13 light yellowish grey, fine-grained slightly argillaceous limestone, from excavated material. Chitinozoa: 0.8 specimen per g. *Ancyrochitina* cf. *gutnica*, *A.* cf. *primitiva*.

SAMSUGNS 3, *Slite Beds*, unit g: G 66—14 light brown, fine-grained limestone, from top of the section. Chitinozoa: None.

SANDARVE 2, *Hemse Beds*, upper part: G 71—43 greenish and brownish grey, fine-grained limestone rich in stromatoporoids, 3 m below top of the section. Chitinozoa: None.

SANDARVE 3, *Hemse Beds*, upper part: G 66—164 greenish grey, fine-grained limestone rich in crinoids and stromatoporoids, from local boulders. Chitinozoa: None.

SIBBJÄNS 1, *Hamra Beds*, unit b: G 71—3 brown, fine-grained, argillaceous limestone rich in rugose corals, 0.5 m below ground level. Chitinozoa: 22.1 specimens per g. *Ancyrochitina pedavis*, *Angochitina* cf. *echinata*, *Sphaerochitina* cf. *acanthifera*, *S.* cf. *sphaerocephala*.

SIBBJÄNS 2, *Hamra Beds*, unit b: G 71—21 light brown, fine-grained, slightly silty limestone, 0—10 cm below ground level. Chitinozoa: 0.5 specimen per g. *Ancyrochitina pedavis*, *Conochitina* cf. *intermedia*, *Sphaerochitina* cf. *acanthifera*, *S.* cf. *sphaerocephala*.

SIGFRIDE 1, *Slite Beds*, *Slite Marl*, northwesternmost part: G 69—153 light greenish and brownish grey, fine-grained, argillaceous limestone rich in brachiopods and trilobites, 75 cm below ground level. Chitinozoa: 1.7 specimens

per g. *Ancyrochitina* cf. *gutnica*, *A.* cf. *primitiva*, *Conochitina tuba*, *C.* cf. *tuba*, *Desmochitina acollaris*, *Margachitina margaritana*.

SIGSARVE 1, *Eke Beds*, lower part: G 66—98 greenish grey, almost dense, argillaceous limestone. Sample from dumped material. Chitinozoa: 73 specimens per g. *Angochitina* cf. *crassispina*, *A. echinata*, *A.* cf. *elongata*, *Conochitina lauensis*, *Desmochitina hemsiensis*, *D. squamosa*, *Eisenackitina philipi*, *Linochitina convexa*, *Sphaerochitina* cf. *acanthifera*.

SIGVALDE 1, *Hemse Beds*, lower part: G 66—267 light greenish grey, fine-grained limestone rich in crinoids and stromatoporoids (whitish and pink), from 42.5 m a.s.l. (3 m above base of the section). Chitinozoa: 0.1 specimen per g. *Angochitina* sp., *Conochitina* sp., *Sphaerochitina impia*.

SINNARVE 1, *Slite Beds*, *Slite Marl*, *Conchidium tenuistriatum* Beds: G 66—82 grey, almost dense, argillaceous limestone, 25—30 cm below top of the section. Chitinozoa: 11.9 specimens per g. *Ancyrochitina gutnica*, *A. primitiva*, *Clathrochitina clathrata*, *Conochitina* aff. *elegans*, *C.* aff. *proboscifera*, *C. tuba*, *Desmochitina acollaris*, *Gotlandochitina martinssoni*, *G. spinosa*, *G. valbyttiensis*, *Margachitina margaritana*. G 66—83 same lithology, 0—5 cm below the top. Chitinozoa: 16.4 specimens per g. *Ancyrochitina ancyrea*, *A. gutnica*, *Clathrochitina clathrata*, *Conochitina* aff. *elegans*, *C.* aff. *proboscifera*, *C. tuba*, *Gotlandochitina martinssoni*, *G. spinosa*, *G. valbyttiensis*, *Margachitina margaritana*.

SION 1, *Slite Beds*, *Conchidium tenuistriatum* Beds: G 72—46 light greenish and brownish grey, medium-grained limestone rich in crinoids, 0—15 cm below ground level. Chitinozoa: None.

SKALS 1, *Eke Beds*, lowermost part: G 72—138 brownish grey, fine-grained, silty and argillaceous limestone, 50 cm below ground level. Chitinozoa: 6.5 specimens per g. *Ancyrochitina* sp., *Conochitina lauensis*, *Desmochitina hemsiensis*, *Linochitina* cf. *erratica*, *Sphaerochitina* cf. *acanthifera*.

SKÅNE 1, *Hemse Beds*, unit c: G 66—286 brownish grey, fine-grained limestone. Chitinozoa: 1.5 specimens per g. *Ancyrochitina* cf. *diabolus*, *A.* cf. *primitiva*, *Angochitina elongata*, *Conochitina latifrons*, *C.* cf. *lauensis*, *Gotlandochitina* sp., *Linochitina convexa*, *Sphaerochitina dubia*. G 66—287 grey, fine-grained, argillaceous limestone, 15 cm above G 66—286. Chitinozoa: 13.3 specimens per g. *Ancyrochitina* cf. *diabolus*, *A.* cf. *primitiva*, *Angochitina elongata*, *Conochitina latifrons*, *C.* cf. *lauensis*, *Desmochitina hemsiensis*, *Gotlandochitina* sp., *Linochitina convexa*, *Sphaerochitina dubia*, *S. impia*.

SKRADARVE 1, *Hamra Beds*, unit a: G 69—19 greyish brown, fine-grained, slightly silty, argillaceous limestone rich in calcareous algae, 0.4 m below ground level. Chitinozoa: 0.1 specimen per g. *Sphaerochitina* cf. *acanthifera*.

SKYMNINGS 1, *Slite Beds*, unit a: G 69—125 light yellowish brown, fine-grained limestone, 75 cm below ground level. Chitinozoa: less than 0.1 specimen per g. *Ancyrochitina* sp.

SLÄTTFLIS 1, *Slite Beds*, *Conchidium tenuistriatum* Beds: G 72—45 light greenish grey, fine-grained limestone, 10—20 cm below top of the section. Chitinozoa: None.

SLITEBROTTET 1, *Slite Beds*, *Slite Marl*: G 66—386 grey, medium-grained, slightly argillaceous limestone and greenish grey, calcareous mudstone, 28 m below sea level, 375 m southeast of the reference point. Chitinozoa: 5.8 specimens per g. *Ancyrochitina gutnica*, *A. primitiva*, *Conochitina tuba*, *Gotlandochitina martinssoni*, *G. spinosa*, *G. valbyttiensis*. G 66—387 greenish grey, calcareous mudstone, 23 m below sea level, about 300 m east of the reference point: 12.9 specimens per g. *Ancyrochitina primitiva*, *Conochitina tuba*, *Desmochitina acollaris*, *Gotlandochitina martinssoni*, *G. spinosa*, *G. valbyttiensis*. G 66—388 grey, fine-grained, argillaceous limestone rich in fossils, 18 m below sea level, about 350 m south-southeast of the reference point. Chitinozoa: 3.6 specimens per g. *Ancyrochitina primitiva*, *Conochitina tuba*, *Desmochitina acollaris*, *Gotlandochitina martinssoni*, *G. spinosa*. G 66—389 light greenish grey, fine-grained, argillaceous and

slightly silty limestone, 11 m below sea level, about 350 m south-southwest of the reference point. Chitinozoa: 3.4 specimens per g. *Ancyrochitina primitiva*, *Conochitina tuba*, *Gotlandochitina* cf. *martinssoni*, *G. spinosa*, *Margachitina margaritana*. G 66—390 grey, medium-grained, argillaceous limestone, 5 m below sea level, about 475 m southeast of the reference point. Chitinozoa: 3.4 specimens per g. *Ancyrochitina primitiva*, *Conochitina tuba*, *Gotlandochitina martinssoni*, *G. spinosa*. G 66—391 grey, calcareous mudstone, 1 m a.s.l., about 500 m southeast of the reference point. Chitinozoa: 5.8 specimens per g. *Ancyrochitina primitiva*, *Conochitina tuba*, *Gotlandochitina* cf. *martinssoni*, *G. cf. spinosa*, *Margachitina margaritana*.

Slite Beds, unit g: G 66—392 brownish grey, coarse-grained, slightly argillaceous limestone, 7 m a.s.l., about 435 m east-northeast of the reference point. Chitinozoa: 0.4 specimen per g. *Ancyrochitina* sp., *Conochitina tuba*, *Margachitina margaritana*. G 66—393 light brownish grey, coarse-grained limestone, 16 m a.s.l., about 560 m east of the reference point. Chitinozoa: None.

SMISS 1, *Klinteberg Beds*, *Klinteberg Marl*, upper part: G 71—47 brownish grey, medium-grained, slightly argillaceous limestone with nodules of greenish grey, calcareous mudstone and greyish brown stromatoporoids, from excavated material. Chitinozoa: 1.7 specimens per g. *Ancyrochitina* cf. *primitiva*, *Conochitina* aff. *elegans*, *C.* cf. *latifrons*, *Gotlandochitina militaris*. G 71—48 light grey, almost dense, argillaceous limestone, from excavated material. Chitinozoa: 14.2 specimens per g. *Ancyrochitina* cf. *ancyrea*, *Conochitina* aff. *elegans*, *C.* cf. *pachycephala*, *C. tuba*, *Gotlandochitina militaris*.

SMOJGE 1, *Halla Beds*, lower part: G 69—179 light greyish green, almost dense, slightly silty limestone rich in light greyish brown stromatoporoids and crinoids, 0—25 cm above the concrete plinth. Chitinozoa: None.

SNÄCKGÅRDSBADEN 1, *Upper Visby Beds*, upper part: G 66—408 brownish grey, medium-grained, slightly argillaceous, pyritiferous limestone, about 3 m below the reference level (the Visby—Höglint boundary) in the northern part of the section. Chitinozoa: 10.8 specimens per g. *Ancyrochitina primitiva*, *Conochitina proboscifera*, *C. proboscifera* f. *truncata*, *Desmochitina densa*. G 66—407 grey, almost dense, argillaceous limestone, about 1 m below the reference level in the southern part of the section. Chitinozoa: 13.1 specimens per g. *Ancyrochitina primitiva*, *Conochitina* cf. *acuminata*, *C. proboscifera*, *C. proboscifera* f. *truncata*, *Margachitina margaritana*.

Höglint Beds, unit a, lowermost part: G 66—406 grey, fine-grained, argillaceous limestone, about 1 m above the reference level in the southern part of the section. Chitinozoa: 23.7 specimens per g. *Ancyrochitina primitiva*, *Conochitina proboscifera*, *C. proboscifera* f. *truncata*.

SNAUVALDS 1, *Hemse Beds*, *Hemse Marl*, northwestern part: G 66—199 grey, almost dense, argillaceous limestone, from base of the section. Chitinozoa: 8.9 specimens per g. *Ancyrochitina* sp., *Angochitina* cf. *ceratophora*, *Conochitina* cf. *latifrons*.

SNODER 1, *Hemse Beds*, *Hemse Marl*, northwestern part: G 66—97 greenish grey, dense, argillaceous limestone. Sample from excavated material. Chitinozoa: 9.9 specimens per g. *Ancyrochitina desmea*, *Conochitina* cf. *tuba*, *Conochitina* sp., *Gotlandochitina spinipes*, *Linochitina convexa*.

SNODER 2, *Hemse Beds*, *Hemse Marl*, northwestern part: G 66—204 grey, almost dense, argillaceous limestone, from bottom of the ditch immediately southwest of the bridge. Chitinozoa: 5.9 specimens per g. *Ancyrochitina desmea*, *A.* cf. *primitiva*, *Conochitina* cf. *latifrons*, *C.* cf. *tuba*, *Gotlandochitina spinipes*, *Linochitina concava*. G 66—205 same lithology, 2 m above base of the section. Chitinozoa: 6.5 specimens per g. *Ancyrochitina desmea*, *A.* cf. *primitiva*, *Angochitina* sp., *Conochitina* cf. *latifrons*, *C.* cf. *tuba*, *Gotlandochitina spinipes*, *Linochitina convexa*.

SPILLINGS 2, *Slite Beds*, unit g: G 66—16A dark grey, medium-grained crinoid limestone, from base of the section,

20 m west of the reference point. Chitinozoa: 0.3 specimen per g. *Conochitina tuba*, *C. sp.* G 66—16B light brownish grey, coarse-grained limestone, 0.5 m above the base. Chitinozoa: 0.3 specimen per g. *Conochitina tuba*, *Gotlandochitina martinssoni*, *G. spinosa*. G 66—16C grey, fine-grained, slightly argillaceous limestone, 1 m above the base. Chitinozoa: 2.3 specimens per g. *Ancyrochitina primitiva*, *Conochitina tuba*, *Gotlandochitina martinssoni*, *G. spinosa*. G 66—16E dark grey, medium-grained limestone, 2 m above the base. Chitinozoa: 0.2 specimen per g. *Conochitina sp.*, *Gotlandochitina martinssoni*, *G. spinosa*. G 66—16D greenish and reddish, flamy, dense limestone, 3.5 m above the base. Chitinozoa: None. G 66—15 brownish grey, fine-grained limestone, from a boulder in northern part of the quarry. Chitinozoa: None.

STAVE 1, *Slite Beds*, *Slite Marl*, central part: G 66—397 grey and brown, fine-grained, argillaceous limestone, 10—20 cm above the concrete plinth. Chitinozoa: 5 specimens per g. *Ancyrochitina cf. primitiva*, *Conochitina tuba*, *Gotlandochitina martinssoni*, *G. valbyttiensis*.

STENSTUGARDS 1, *Klinteberg Beds*, lower part: G 69—80 light brownish grey, fine-grained, slightly dolomitic limestone, 5—15 cm below top of the section in the eastern part of the quarry. Chitinozoa: None.

STORA BANNE 1, *Slite Beds*, unit g, base: G 66—348 light brownish grey and pink, fine-grained limestone rich in stromatoporoids, 1 m above base of the section. Chitinozoa: None.

STORA HAJSLUNDS 1, *Eke Beds*, lowermost part: G 72—130 greenish grey, fine-grained, argillaceous limestone rich in brachiopods, 25 cm below ground level. Chitinozoa: 79.2 specimens per g. *Eisenackitina philipi*, *Sphaerochitina acanthifera*.

STORA MYRE 1, *Slite Beds*, unit d: G 66—0 light brownish grey, fine-grained, argillaceous limestone, 20—30 cm below ground level. Chitinozoa: 10.4 specimens per g. *Ancyrochitina cf. primitiva*, *Clathrochitina clathrata*, *Gotlandochitina valbyttiensis*.

STORA SIGLAJVS 1, *Eke Beds*, lowermost part: G 72—133 greyish brown, fine-grained, silty and argillaceous limestone, 75—90 cm under the road surface and less than 1 m above the Hemse—Eke boundary. Chitinozoa: 69 specimens per g. *Conochitina sp.*, *Eisenackitina cf. lagenomorpha*, *E. philipi*, *Sphaerochitina acanthifera*.

STORA SOLBJÄRGE 2, *Klinteberg Beds*, middle-upper part: G 66—155 light brownish grey, fine-grained limestone rich in *Conchidium* and crinoids, 0—50 cm below top of the section, about 50 m north of point 49.4. Chitinozoa: None.

STORA TUNE 1, *Klinteberg Beds*, lower part: G 69—79 light brownish grey, fine-grained limestone rich in stromatoporoids, 0.5 m below ground level. Chitinozoa: less than 0.1 specimen per g. *Conochitina cf. pachycephala*.

STORA VEDE 1, *Slite Beds*, unit g: G 72—87 light brownish grey, fine-grained, slightly silty limestone, from the lowermost 0.5 m of the section. Chitinozoa: 1.5 specimens per g. *Ancyrochitina primitiva*, *Conochitina tuba*, *Margaritina margaritana*.

STORA VIKARE 1, *Halla Beds*, unit b: G 72—84 light brownish and greenish grey, almost dense, slightly argillaceous limestone, 0.5 m below top of the hillock. Chitinozoa: None.

STORA VIKARE 2, *Halla Beds*, unit b: G 72—85 greyish brown, almost dense, slightly argillaceous and silty limestone, 10 cm below ground level. Chitinozoa: None.

STORBURG 1, *Burgsvik Beds*, upper part: G 69—44 light brownish grey, fine-grained, silty limestone very rich in fossils (coquina), 50—60 cm below the reference level (the Burgsvik—Hamra boundary) at the reference point. Chitinozoa: 0.1 specimen per g. *Sphaerochitina cf. acanthifera*. G 69—45 light brownish grey, fine-grained, silty, coarse-oolitic limestone, 0—5 cm below the reference level. Chitinozoa: None.

Hamra Beds: G 69—46 light brownish grey, fine-grained, slightly argillaceous, silty limestone rich in calcareous algae (unit a), 0—20 cm above the reference level. Chitinozoa: 1.5 specimens per g. *Ancyrochitina sp.*, *Sphaerochitina cf. acanthifera*. G 69—47 light brownish grey, fine-grained,

slightly silty, argillaceous limestone (unit b), 2.25 m above the reference level. Chitinozoa: 1.1 specimens per g. *Ancyrochitina sp.*, *Sphaerochitina cf. acanthifera*, *S. cf. sphaerocephala*. G 69—48 light brownish grey, fine-grained and laminated, silty limestone (unit b), about 14 m above the reference level. Chitinozoa: 8.2 specimens per g. *Ancyrochitina cf. diabolus*, *A. pedavis*, *Conochitina cf. intermedia*, *Sphaerochitina sphaerocephala*. G 69—49 brownish grey, fine-grained and laminated, silty limestone (unit c, top), 0—20 cm below the Hamra—Sundre boundary and approximately 24 m above the reference level. Chitinozoa: 6.6 specimens per g. *Ancyrochitina cf. diabolus*, *A. pedavis*, *Conochitina intermedia*, *Eisenackitina cf. lagenomorpha*, *Gotlandochitina villosa*.

STORMS 1, *Sundre Beds*, lower part: G 71—13 brown, medium-grained limestone, 0.5 m below ground level. Chitinozoa: 0.1 specimen per g. *Ancyrochitina pedavis*, *Gotlandochitina villosa*, *Pterochitina perivelata*, *Sphaerochitina sphaerocephala*.

STORMS 2, *Sundre Beds*, lower part: G 71—14 light brownish grey, medium-grained limestone, 0—10 cm below top of the section. Chitinozoa: less than 0.1 specimen per g. *Ancyrochitina pedavis*, *Gotlandochitina villosa*.

STORMYR 1, *Slite Beds*, *Slite Marl*, northwestern part: G 69—167 light grey, almost dense, argillaceous limestone, from excavated material. Chitinozoa: 0.9 specimen per g. *Ancyrochitina primitiva*, *Conochitina cf. tuba*, *Gotlandochitina cf. martinssoni*.

STRANDAKERSVIKEN 1, *Högklint Beds*, unit c, top: G 69—109 light greenish grey, almost dense limestone, 0—10 cm below the Högklint—Slite boundary. Chitinozoa: None. G 69—110 brownish grey, fine-grained, slightly argillaceous limestone, 10—20 cm below the Högklint—Slite boundary. Chitinozoa: 8.5 specimens per g. *Ancyrochitina cf. ancyrea*, *A. ansarviensis*, *A. cf. primitiva*, *Conochitina leptosoma*, *C. mamilla*, *C. cf. proboscifera*, *Gotlandochitina corniculata*.

STRANDS 1, *Hamra Beds*, unit b: G 66—101 brownish grey, almost dense, argillaceous limestone, from uppermost part of the ditch. Chitinozoa: 6.1 specimens per g. *Ancyrochitina pedavis*, *Conochitina intermedia*, *Sphaerochitina cf. acanthifera*, *S. sphaerocephala*.

STUTSVIKEN 1, *Högklint Beds*, unit c, top: G 69—103 greyish brown, almost dense limestone, 0—10 cm below the Högklint—Slite boundary. Chitinozoa: 0.1 specimen per g. *Ancyrochitina ansarviensis*.

Slite Beds, unit c, base: G 69—104 light brown, coarse-grained limestone very rich in rugose corals, 5—15 cm above the Högklint—Slite boundary. Chitinozoa: 0.1 specimen per g. *Ancyrochitina sp.*

SUDERS 1, *Sundre Beds*, middle part: G 69—7 brownish grey, medium-grained limestone rich in crinoids, 50 cm below ground level. Chitinozoa: 0.2 specimen per g. *Ancyrochitina cf. diabolus*, *Eisenackitina oviformis*, *Gotlandochitina villosa*.

SUDERSLÄTT 1, *Klinteberg Beds*, lower part: G 69—183 light greenish and brownish grey, fine-grained, slightly argillaceous limestone rich in stromatoporoids and crinoids, from the uppermost part of the section. Chitinozoa: less than 0.1 specimen per g. *Conochitina pachycephala*.

SUNNKYRKE 1, *Eke Beds*, lower part: G 72—107 light yellowish brown, coarse-grained limestone rich in crinoids and bryozoans, 60 cm above base of the section in the north-eastern part of the northwest wall. Chitinozoa: 2.5 specimens per g. *Angochitina cf. echinata*, *Conochitina sp.*, *Eisenackitina cf. philipi*, *Linochitina convexa*. G 72—106 light greenish and brownish grey, coarse-grained, slightly argillaceous limestone rich in bryozoans, 175 cm above the base. Chitinozoa: None.

SUTARVE 1, *Klinteberg Beds*, unit f, top: G 71—95 greyish brown, fine-grained limestone, 0—10 cm below the reference level. Chitinozoa: 0.1 specimen per g. *Ancyrochitina sp.*

Hemse Beds, unit a: G 71—96 light greyish brown, fine-grained limestone 10—20 cm above the reference level. Chitinozoa: None. G 71—94 light greenish, yellowish and

brownish grey, almost dense, slightly argillaceous limestone, 30–50 cm above the reference level (calculated distance). Chitinozoa: 2.2 specimens per g. *Conochitina latifrons*, *Sphaerochitina dubia*, *S. impia*.

SUTARVE 2, *Klinteberg Beds*, unit f, top: G 71–97 light greenish grey almost dense, argillaceous limestone, about 1 m below ground level. Chitinozoa: 5.1 specimens per g. *Gotlandochitina tabernaculifera*, *Sphaerochitina cf. dubia*.

SUTARVE 3, *Klinteberg Beds*, unit f, upper part: G 71–98 light greenish grey, almost dense limestone very rich in light greyish brown stromatoporoids, from excavated material. The sample belongs somewhere within the uppermost 4 m of unit f. Chitinozoa: less than 0.1 specimen per g. *Gotlandochitina* sp.

SVARVARE 1, *Slite Beds*, *Slite Marl*, *Pentamerus gotlandicus* Beds: G 66–138 grey, almost dense, argillaceous limestone, approximately 50 cm below the marlstone-siltstone boundary. Chitinozoa: 54.9 specimens per g. *Ancyrochitina gutnica*, *Conochitina* aff. *elegans*, *C. pachycephala*, *C. tuba*, *C. sp.*, *Desmochitina acollaris*, *Gotlandochitina martinsoni*, *G. uncinata*, *G. valbyttiensis*, *Linochitina cf. cingulata*, *L. odiosa*.

Slite Beds, *Slite Siltstone*, base: G 66–136 grey, calcareous siltstone. Chitinozoa: 12.5 specimens per g. *Conochitina argillophila*, *C. aff. elegans*, *C. pachycephala*, *C. tuba*, *Desmochitina acollaris*, *Linochitina cingulata*, *L. odiosa*.

SVARVEN 1, *Höglint Beds*, unit b: G 66–26 light brownish grey, almost dense limestone, 200–210 cm below the reference level. Chitinozoa: 0.2 specimen per g. *Ancyrochitina ancyrea*, *A. primitiva*, *Conochitina leptosoma*, *Margachitina margaritana*. G 66–25 brownish grey, medium-grained limestone, 100–110 cm below the reference level. Chitinozoa: 0.5 specimen per g. *Ancyrochitina primitiva*, *Conochitina mamilla*, *C. visbyensis*. G 66–24 brownish grey, fine-grained limestone, 0–10 cm below the reference level. Chitinozoa: 16.8 specimens per g. *Ancyrochitina ancyrea*, *A. primitiva*, *Conochitina mamilla*, *Desmochitina densa*, *Margachitina margaritana*. G 66–23 light yellowish grey, fine-grained limestone, 90–100 cm above the reference level. Chitinozoa: 3.1 specimens per g. *Ancyrochitina ancyrea*, *A. primitiva*, *Conochitina mamilla*. G 66–22 brownish grey, fine-grained limestone, 195–205 cm above the reference level. Chitinozoa: 1.6 specimens per g. *Ancyrochitina primitiva*, *Conochitina leptosoma*, *C. mamilla*, *Desmochitina densa*. G 66–21 brownish grey, fine-grained, slightly argillaceous limestone, 300–305 cm above the reference level. Chitinozoa: 4.6 specimens per g. *Ancyrochitina ancyrea*, *A. primitiva*, *Conochitina leptosoma*, *C. mamilla*, *C. visbyensis*, *Desmochitina densa*. G 66–20 light yellowish grey, almost dense limestone, about 4 m above the reference level. Chitinozoa: 1 specimen per g. *Ancyrochitina ancyrea*, *A. primitiva*, *Conochitina mamilla*, *Desmochitina densa*. G 66–19 brownish grey, coarse-grained limestone, about 5 m above the reference level. Chitinozoa: 0.1 specimen per g. *Conochitina mamilla*. G 66–18 light yellowish grey, coarse-grained limestone, about 6 m above the reference level. Chitinozoa: None. G 66–17 brownish grey, medium-grained limestone, about 7 m above the reference level. Chitinozoa: 1 specimen per g. *Ancyrochitina ancyrea*, *A. primitiva*, *Conochitina mamilla*, *C. visbyensis*.

TALINGS 1, *Slite Beds*, unit g: G 66–1 brownish grey, fine-grained, slightly argillaceous limestone, 0–5 cm above the reference level. Chitinozoa: 0.4 specimen per g. *Conochitina tuba*, *Gotlandochitina spinosa*.

TÄNGLINGS 1, *Hemse Beds*, lower-middle part: G 66–265 light brownish and greenish grey, medium-grained limestone rich in stromatoporoids, 1 m above base of the northernmost part of the section. Chitinozoa: None.

TÄNGLINGS 2, *Hemse Beds*, lower-middle part: G 66–69 brownish grey, medium-grained, slightly argillaceous limestone, from base of the northern part of the section. Chitinozoa: 0.3 specimen per g. *Angochitina elongata*, *Conochitina latifrons*. G 71–53 light greenish grey, medium-grained limestone, 0.5 m above the base. Chitinozoa: 0.4 specimen

per g. *Angochitina elongata*, *Conochitina latifrons*. G 66–266 light brownish grey, medium-grained limestone, 1 m above the base. Chitinozoa: 0.7 specimen per g. *Ancyrochitina* sp., *Conochitina latifrons*, *Sphaerochitina impia*. G 66–70 light brownish grey, coarse-grained crinoid limestone, 1.5 m above the base. Chitinozoa: 0.2 specimen per g. *Ancyrochitina cf. diabolus*, *Angochitina elongata*, *Sphaerochitina cf. impia*. G 71–52 light brownish and greenish grey, coarse-grained crinoid limestone, 2 m above the base. Chitinozoa: 1.3 specimens per g. *Ancyrochitina cf. primitiva*, *Angochitina elongata*, *Conochitina latifrons*. G 66–71 light brown, coarse-grained limestone, 3 m above the base. Chitinozoa: less than 0.1 specimen per g. *Sphaerochitina* sp.

TÄRNÅRDEN 1, *Sundre Beds*, lower part: G 72–141 greenish grey, white and pink, coarse-grained crinoid limestone. Chitinozoa: 0.1 specimen per g. *Ancyrochitina* sp.

TINGS 1, *Klinteberg Beds*, unit f: G 66–43 brownish grey, fine-grained stromatoporoid limestone, 1.5 m below top of the section. Chitinozoa: None. G 66–45 brown, medium-grained limestone, 0.75 m below the top. Chitinozoa: None. G 66–46 greenish and brownish grey, medium-grained crinoid limestone, from top of the section. Chitinozoa: None.

TIPPSARVE 1, *Klinteberg Beds*, lower part: G 69–73 light brownish grey, coarse-grained crinoid limestone rich in stromatoporoids, 0–15 cm above base of the section. Chitinozoa: 0.3 specimen per g. *Ancyrochitina* sp., *Sphaerochitina concava*. G 69–74 light brown, coarse-grained crinoid limestone, 5 m above the base. Chitinozoa: None.

TJÄNGDARVE 1, *Hemse Beds*, *Hemse Marl*, southeastern part: G 66–256 light brownish grey, almost dense, argillaceous limestone, 5–15 cm below top of the section. Chitinozoa: 3.2 specimens per g. *Ancyrochitina* sp., *Desmochitina hemsensis*, *Linochitina convexa*.

TJAUTET 1, *Slite Beds*, unit e: G 72–43 light grey, almost dense limestone, 365–375 cm below top of unit e in the southern wall and 10 m from the corner. Chitinozoa: None. G 72–44 light greenish and yellowish brown, fine-grained, slightly argillaceous limestone, 2–9 cm below top of unit e. Chitinozoa: None.

Slite Beds, unit g: light brownish grey, fine-grained limestone, 5–15 cm above base of unit g. Chitinozoa: None. Unnumbered sample: light grey, medium-grained limestone rich in *Megalomus*, about 3 m above base of unit g. Chitinozoa: None.

TJELDERSHOLM 1, *Slite Beds*, *Pentamerus gotlandicus* Beds — *Atrypa reticularis* Beds: brownish grey, almost dense, argillaceous limestone rich in fossils, 25 cm below the reference level, immediately south of the reference point. Chitinozoa: 1.1 specimens per g. *Clathrochitina clathrata*, *Conochitina argillophila*, *C. tuba*, *C. sp.*, *Desmochitina acollaris*. G 69–143 light greenish and brownish grey, fine-grained, silty limestone, 30–40 cm above the reference level. Chitinozoa: 1.3 specimens per g. *Ancyrochitina cf. primitiva*, *Clathrochitina cf. clathrata*, *Conochitina cf. argillophila*, *C. aff. elegans*, *C. aff. proboscifera*, *Gotlandochitina cf. uncinata*.

TJULS 1, *Slite Beds*, *Slite Marl*, middle part: G 66–84 grey, almost dense, argillaceous limestone, from bottom of the ditch. Chitinozoa: 17.8 specimens per g. *Ancyrochitina gutnica*, *Conochitina tuba*, *Linochitina cingulata*.

TOMSARVE 1, *Eke Beds*, lower part: G 66–99 brownish grey, almost dense, argillaceous limestone, from the upper 25 cm of the section. Chitinozoa: 43.5 specimens per g. *Conochitina lauensis*, *Sphaerochitina acanthifera*.

TORE 1, *Hamra Beds*, unit c: G 71–8 light brown, fine-grained, splintery limestone, about 1 m below the Hamra—Sundre boundary. Chitinozoa: None.

Sundre Beds, lower part: G 71–9 light brown, fine-grained limestone rich in white and pink crinoids, 10–20 cm above the Hamra—Sundre boundary. Chitinozoa: None. G 71–10 light brown and pink, medium-grained crinoid limestone, about 2 m above the boundary. Chitinozoa: None.

TRÄDGÅRDEN 1, *Slite Beds*, *Slite Marl*, *Pentamerus gotlandicus* Beds, top: G 69–181 light greenish and brownish

grey, fine-grained, slightly silty and argillaceous limestone, 1 m below the reference level at the reference point. Chitinozoa: 7.8 specimens per g. *Conochitina* aff. *proboscifera*, *C. tuba*, *C. sp.*, *Gotlandochitina uncinata*, *Linochitina odiosa*, *L. cf. cingulata*.

Halla Beds, lower part: G 69—182 light yellowish brown and whitish grey, almost dense limestone, 1 m above the reference level. Chitinozoa: None.

TRÅSKALVRET 1, *Slite Beds*, unit c: G 69—108 light greyish brown, almost dense limestone, from top of the section. Chitinozoa: None.

TRÅSKE 1, *Hemse Beds*, unit b: G 71—99 light greenish and brownish grey, fine-grained, argillaceous limestone, 30 cm below ground level. Chitinozoa: 0.8 specimen per g. *Ancyrochitina* sp., *Sphaerochitina impia*.

TROINGSGÅRDET 1, *Hemse Beds*, unit a: G 66—276 light brownish grey, coarse-grained limestone rich in crinoids, 20—35 cm below top of the section. Chitinozoa: 0.7 specimen per g. *Ancyrochitina* cf. *diabolus*, *A. cf. primitiva*, *Sphaerochitina* cf. *impia*.

TROINGSGÅRDET 2, *Hemse Beds*, unit a: G 69—168 brownish grey, medium-grained limestone, 1 m above the road surface. Chitinozoa: less than 0.1 specimen per g. *Conochitina latifrons*.

TUBOD 1, *Hamra Beds*, middle-upper part: G 71—23 brownish grey, fine-grained, silty limestone. Chitinozoa: 0.2 specimen per g. *Sphaerochitina* cf. *acanthifera*, *S. cf. sphaerocephala*.

TULE 1, *Klinteberg Beds*, unit e: G 71—88 light greenish and brownish grey, fine-grained limestone, 0—10 cm below ground level. Chitinozoa: 0.2 specimen per g. *Conochitina* aff. *elegans*, *C. cf. tuba*.

UDDVIDE 1, *Burgsvik Beds*, uppermost part: G 66—64 light grey, micaceous, calcareous, silty, fine-grained sandstone, 85—90 cm below the reference level (the Burgsvik—Hamra boundary) at the reference point. Chitinozoa: 0.1 specimen per g. *Sphaerochitina acanthifera*. G 66—63 grey, coarse-oolitic limestone, 55—60 cm below the reference level. Chitinozoa: 0.1 specimen per g. *Sphaerochitina acanthifera*. G 66—65 brownish grey, fine-grained, slightly silty limestone very rich in calcareous algae, brachiopods and pelecypods (coquina), 25—30 cm below the reference level. Chitinozoa: None.

Hamra Beds, unit a: G 66—66 brownish grey, almost dense, argillaceous algal limestone, 0—5 cm above the reference level. Chitinozoa: 0.2 specimen per g. *Sphaerochitina acanthifera*. G 66—67 brownish grey, almost dense, slightly argillaceous limestone very rich in small calcareous algae (pisolitic texture), 15—20 cm above the reference level. Chitinozoa: 0.4 specimen per g. *Sphaerochitina acanthifera*. G 66—68 light brown, fine-grained, argillaceous algal limestone, 90—100 cm above the reference level. Chitinozoa: 4.4 specimens per g. *Sphaerochitina acanthifera*, *S. cf. acanthifera*.

UDDVIDE 2, *Burgsvik Beds*, uppermost part: G 69—41 light yellowish brown, slightly silty, oolitic limestone, 125—130 cm below the reference level (the Burgsvik—Hamra boundary) at the reference point. Chitinozoa: less than 0.1 specimen per g. *Sphaerochitina acanthifera*. G 69—42 brownish grey, slightly silty, pisolitic limestone, 35—45 cm below the reference level. Chitinozoa: None. G 69—43 light greyish brown, fine-grained, silty limestone very rich in pelecypods (coquina), 20—25 cm below the reference level. Chitinozoa: 0.5 specimen per g. *Sphaerochitina acanthifera*.

UNGHANSE 1, *Burgsvik Beds*, top: G 71—1 light brownish grey, pisolitic limestone, 0—20 cm below the Burgsvik—Hamra boundary. Chitinozoa: 0.2 specimen per g. *Ancyrochitina* sp., *Sphaerochitina* cf. *acanthifera*.

Hamra Beds, unit a: G 71—2 light brown, oolitic algal limestone, 0—5 cm above the Burgsvik—Hamra boundary. Chitinozoa: 0.1 specimen per g. *Conochitina* cf. *intermedia*, *Sphaerochitina* cf. *acanthifera*.

UTOJE 1, *Slite Beds*, unit c: G 69—127 light brownish grey, fine-grained limestone, 1 m below ground level. Chitinozoa: None.

nozoa: None.

VAKTEN 1, *Hemse Beds*, Hemse Marl, northwestern part: G 69—134 light bluish grey, calcareous mudstone, 5—15 cm below ground level. Chitinozoa: 6.1 specimens per g. *Ancyrochitina* cf. *diabolus*, *A. cf. primitiva*, *Angochitina* cf. *elongata*, *Conochitina latifrons*, *Linochitina* sp., *Sphaerochitina* sp.

VALAR 1, *Burgsvik Beds*, upper part: G 69—2 light grey, calcareous and argillaceous, fine-grained sandstone with load-casts, 0—10 cm below top of the sandstone. Chitinozoa: less than 0.1 specimen per g. *Conochitina* sp. G 69—3 light greenish grey, plastic clay, 0—5 cm above top of the sandstone. Chitinozoa: 0.1 specimen per g. *Sphaerochitina acanthifera*. G 69—4 light greenish grey and greyish yellow, pisolitic limestone, 55—60 cm above top of the sandstone. Chitinozoa: 1.5 specimens per g. *Sphaerochitina acanthifera*, *S. cf. acanthifera*.

VALAR 2, *Burgsvik Beds*, upper part: G 69—35 light yellowish brown, slightly silty, pisolitic limestone, 155 cm above top of the sandstone. Chitinozoa: less than 0.1 specimen per g. *Sphaerochitina acanthifera*.

VALBYTTE 1, *Slite Beds*, Slite Marl, slightly younger than the *Conchidium tenuistriatum* Beds: G 66—139 grey, almost dense, argillaceous limestone, 0—35 cm below top of the ditch. Chitinozoa: 5.5 specimens per g. *Ancyrochitina gutnica*, *A. cf. primitiva*, *Conochitina* aff. *elegans*, *C. aff. proboscifera*, *C. tuba*, *C. sp.*, *Desmochitina acollaris*, *Gotlandochitina martinsoni*, *G. spinosa*, *G. valbyttiensis*, *Linochitina cingulata*, *L. cf. odiosa*, *Margachitina margaritana*. G 71—34 light greenish grey, almost dense, argillaceous limestone, from excavated material. Chitinozoa: 7.6 specimens per g. *Ancyrochitina gutnica*, *Clathrochitina clathrata*, *Conochitina* aff. *elegans*, *C. aff. proboscifera*, *C. cf. tuba*, *Desmochitina acollaris*, *D. cf. muldiensis*, *Gotlandochitina martinsoni*, *G. spinosa*, *G. valbyttiensis*, *Linochitina cingulata*, *Margachitina margaritana*.

VALLE 1, *Slite Beds*, Slite Marl, *Pentamerus gotlandicus* Beds: G 66—144 light brownish grey, almost dense, argillaceous limestone, 0—15 cm below top of the section. Chitinozoa: 9.6 specimens per g. *Ancyrochitina* cf. *primitiva*, *Clathrochitina clathrata*, *Conochitina argillophila*, *C. aff. elegans*, *C. aff. proboscifera*, *C. tuba*, *C. sp.*, *Desmochitina acollaris*, *D. muldiensis*, *Linochitina odiosa*.

VALLE 2, *Slite Beds*, Slite Marl, *Pentamerus gotlandicus* Beds: G 66—145 light greenish grey, almost dense, argillaceous limestone rich in gastropods, 100—125 cm below top of the section. Chitinozoa: 8.4 specimens per g. *Ancyrochitina* sp., *Conochitina* cf. *argillophila*, *C. aff. elegans*, *C. aff. proboscifera*, *C. tuba*, *Desmochitina acollaris*, *D. muldiensis*, *Linochitina odiosa*, *Sphaerochitina* sp.

VALLEVIKEN 1, *Slite Beds*, Slite Marl: G 69—152 light greenish and brownish grey, fine-grained argillaceous limestone very rich in fossils, 12 m a.s.l., about 100 m southeast of the reference point. Chitinozoa: 1.6 specimens per g. *Ancyrochitina* sp., *Conochitina tuba*.

VALLSTENA 2, *Slite Beds*, Slite Marl, *Pentamerus gotlandicus* Beds or slightly older: G 66—41b greenish grey, argillaceous limestone, from top of section, 20 m southeast of the reference point. Chitinozoa: 4.9 specimens per g. *Ancyrochitina* cf. *primitiva*, *Clathrochitina clathrata*, *Conochitina argillophila*, *C. aff. proboscifera*, *C. tuba*, *Gotlandochitina uncinata*, *G. valbyttiensis*. G 66—41a same lithology, 0.5 m below top at the same place. Chitinozoa: 1.6 specimens per g. *Clathrochitina* cf. *clathrata*, *Conochitina* cf. *argillophila*, *C. aff. elegans*, *C. cf. pachycephala*, *C. aff. proboscifera*, *C. tuba*, *Gotlandochitina uncinata*, *G. valbyttiensis*, *Linochitina* sp.

VANGES 1, *Hemse Beds*, Hemse Marl, southeastern part, top: G 66—236 grey, almost dense, slightly silty, argillaceous limestone, 0.75 m below ground level and approximately 1 m below the Hemse—Eke boundary. Chitinozoa: 33.5 specimens per g. *Angochitina ceratophora*, *A. crassispinosa*, *A. echinata*, *Conochitina lauensis*, *Linochitina convexa*.

VÄRSÄNDE 1, *Mulde Beds*, lower part: G 72—150 greenish grey, fine-grained, argillaceous and slightly silty limestone,

0.5 m below ground level. Chitinozoa: 5.2 specimens per g. *Ancyrochitina gutnica*, *Gotlandochitina?* sp.

VASSMUNDS 1, *Hemse Beds*, unit c: G 66—278 reddish and greenish grey, fine-grained limestone rich in crinoids, from base of the section. Chitinozoa: less than 0.1 specimen per g. *Sphaerochitina impia*.

VASSMUNDS 2, *Hemse Beds*, unit c: G 66—281 light grey, almost dense, slightly argillaceous limestone rich in stromatoporoids, from top of the section. Chitinozoa: None.

VÄSTARBERGET 1, *Slite Beds*, Slite Marl, Lerberget Marl, upper part: G 69—192 (collected by A. Martinsson) brownish grey, fine-grained, argillaceous, slightly silty limestone, from the lower part of the Lerberget Marl section. Chitinozoa: 9.9 specimens per g. *Ancyrochitina* cf. *primitiva*, *Conochitina* cf. *gutta*, *C. tuba*, *C. cf. tuba*, *Linochitina cingulata*, *L. odiosa*, *Margachitina margaritana*. G 69—193 (coll. A. M.) brownish grey, fine-grained, argillaceous limestone, from the upper part of the Lerberget Marl section. Chitinozoa: 6.1 specimens per g. *Ancyrochitina* cf. *primitiva*, *Conochitina tuba*, *C. cf. tuba*, *C. sp.*, *Linochitina* cf. *cingulata*, *Margachitina margaritana*.

VÄSTERBACKAR 1, *Sundre Beds*, middle-upper part: G 66—192 light brownish grey and pink, coarse-grained crinoid limestone, 0.5 m above base of the section at the reference point. Chitinozoa: None. G 66—193 same lithology rich in stromatoporoids, 1.5 m above the base. Chitinozoa: None. G 66—194 same lithology, 2 m above the base. Chitinozoa: None. G 66—195 brownish grey, coarse-grained limestone rich in stromatoporoids and pink crinoids, 3 m above the base. Chitinozoa: None. G 66—196 whitish grey, coarse-grained crinoid limestone, from top of the section. Chitinozoa: None.

VÄSTLAUS 1, *Hemse Beds*, Hemse Marl, southeastern part: G 66—257 light brownish and greenish grey, almost dense, argillaceous limestone, 0—10 cm below top of the section, 10 m northeast of the concrete construction. Chitinozoa: 9.2 specimens per g. *Angochitina crassispina*, *A. cf. echinata*, *A. cf. elongata*, *Conochitina lauensis*, *C. cf. lauensis*, *Linochitina* cf. *convexa*.

VÄSTÖS 1, *Höglint Beds*, unit b: G 66—350 grey, fine-grained limestone rich in stromatoporoids, 3 m under the road surface. Chitinozoa: less than 0.1 specimen per g. *Ancyrochitina primitiva*.

VÄSTÖS KLINT 1, *Höglint Beds*, unit b: G 66—30 light brown, fine-grained, slightly silty and argillaceous limestone, 3 m below the reference level (the boundary between units b and c). Chitinozoa: 0.3 specimen per g. *Ancyrochitina primitiva*, *Margachitina margaritana*. G 66—29 same lithology, 2 m below the reference level. Chitinozoa: 0.1 specimen per g. *Conochitina mamilla*. G 66—28 light brownish grey, fine-grained limestone, 1 m below the reference level. Chitinozoa: None.

Höglint Beds, unit c: G 66—27 light brown, almost dense, stromatoporoid limestone, 1.5 m above the reference level. Chitinozoa: None.

VIDFÄLLE 1, *Hemse Beds*, unit b: G 72—72 light greenish grey, almost dense, argillaceous limestone, 0.5 m below ground level. Chitinozoa: 18.8 specimens per g. *Ancyrochitina* cf. *diabolus*, *A. cf. primitiva*, *Desmochitina hemsensis*, *Sphaerochitina impia*.

VIKE 1, *Slite Beds*, Slite Marl, *Pentamerus gotlandicus* Beds or slightly older: G 66—304 brownish grey, fine-grained, slightly argillaceous limestone, 75 cm under the road surface. Chitinozoa: 11.6 specimens per g. *Ancyrochitina gutnica*, *A. cf. primitiva*, *Clathrochitina* cf. *clathrata*, *Conochitina* cf. *tuba*, *Desmochitina acollaris*, *Margachitina margaritana*.

VIVUNGS 1, *Klinteberg Beds*, middle-upper part: G 69—82 light greyish brown, coarse-grained limestone rich in crinoids and stromatoporoids, 50—65 cm below top of the section. Chitinozoa: None.

YGNE 2, *Upper Visby Beds*, upper part: G 66—384 brownish grey, fine-grained limestone and greenish grey, calcareous mudstone, 0—10 cm above base of the section at the reference point. Chitinozoa: 18.2 specimens per g.

Ancyrochitina primitiva, *Conochitina proboscifera*, *Desmochitina densa*. G 66—383 greyish brown, fine-grained, slightly argillaceous limestone, 140—150 cm above the base. Chitinozoa: 1.1 specimens per g. *Ancyrochitina primitiva*, *Angochitina longicollis*, *Conochitina proboscifera*, *C. proboscifera* f. *gracilis*, *C. proboscifera* f. *truncata*, *Desmochitina densa*. G 66—385 brownish grey, fine-grained, slightly argillaceous limestone and greenish grey, calcareous mudstone, 275—280 cm above base of the section. Chitinozoa: 2.6 specimens per g. *Ancyrochitina primitiva*, *Angochitina longicollis*, *Conochitina proboscifera*, *C. proboscifera* f. *truncata*.

Descriptions of Chitinozoa

It is my very definite opinion that the chitinozoans belonged to the animal kingdom. Hence, the zoological nomenclature is adhered to. The genera are described in alphabetical order as are the species under each genus. This is done for several reasons. Firstly, no references to families are made. The systematics of the chitinozoans is in a state of disorder on the generic level. Several species are tossed between the genera and a synonymy list by a critical student may include three or even more generic names for a single species. It should be kept in mind that the chitinozoans were discovered in 1929.

Several families have been introduced, but, as can be expected for a group of extinct fossils of uncertain zoological position, the stability of the systematics on the family level is far from convincing.

The second reason for using an alphabetical order is my concern for those who will use this paper in their work. It is much easier to search for a specific taxon in an alphabetically arranged list than to remember under which family a certain person grouped the taxon this or that year.

Because of the type and reasonable number of illustrations reproduced here, the descriptions were written as short as possible. Details in the morphological descriptions are not always observable in the figures reproduced. A lot of details were noted but not photographed during my SEM work and of the photographs recorded on the SEM I have not made use of more than about one fifth in this paper.

Terminology

The terms used in descriptions of the morphology of chitinozoans differ somewhat even among scientists using the same language. Nor is the concept of several of the morphological terms unanimously used in the same way among different specialists. Unfortunately, several authors (e.g. Laufeld 1967) do not explain in which sense they use the terms adopted, which may cause confusion. In the present paper the terminology introduced by the Commission Internationale de Microflore du Paléozoïque (Combaz et al. 1967) is mainly adhered to, but in order to possibly avoid ambiguity of linguistic character and to point out some differences the terminology used in this paper is explained below.

Aboral: referring to the closed part of the vesicle opposite to the aperture.

Aboral scar: thin-walled, central part of the base.

Aperture: the main opening by which the vesicle communicates with the exterior. The aperture is located along the longitudinal axis and may be the adoral part of the lip, neck or chamber.

Appendices: processes extending from the basal edge. They will be referred to as reduced, elongated, branching, clavate, coalescent, rhizoid, or deformed as defined by Combaz et al. (1967, Fig. 4).

Basal callus: thickened, central part of the base.

Basal edge: the convex part of the vesicle constituting the transition between chamber and base.

Basal process: process protruding aborally of the central part of the base.

Base: the part of chamber aborally of the basal edge.

Body: synonym of chamber.

Carina: flange at the basal edge.

Chain: three or more vesicles connected along their longitudinal axes.

Chamber: the part of vesicle between the base and the flexure or, where the latter is lacking, the collar or lip.

Collar: the subcylindrical or orally widened part of vesicle between the aperture and the chamber in forms lacking neck.

Distal: in outward direction from the longitudinal axis.

Flank: the part of chamber between the shoulder and the basal edge.

Flexure: the concave part of vesicle constituting the transition between chamber and neck.

Longitudinal axis: imaginary axis running from the aboral pole through the centre of the aperture.

Neck: the vesicle part between the flexure and the lip or, where the latter is lacking, the aperture.

Operculum: thin disc closing the vesicle at the transition between the chamber and the collar or, where the latter is lacking, the aperture.

Oral: referring to the part of vesicle where the aperture is located.

Ornamentation: sculpture of the vesicle wall. The following descriptive terms will be used: spinose, verrucate, granulate, and rugose.

Prosoma: plug in the neck.

Proximal: inward direction towards the longitudinal axis.

Shoulder: convex part of the chamber aborally of the flexure in forms with subcylindrical flanks.

Spinose ornamentation: sculptural elements of vesicle wall consisting of spines which will be referred to as simple, lambda, branching, or coalescent.

Twin: two specimens connected along their longitudinal axes.

Velum: membranous flange extending from the chamber orally of the basal edge.

Vesicle: the organic test as a whole.

Vesicle form: cylindrical, cylindro-spheroidal, spheroidal, conical, cylindro-conical, ovoidal, or discoidal as defined by Combaz et al. (1967, Fig. 2).

Vesicle wall: the organic wall of the test enclosing the central cavity and consisting of one or more layers. The interior and exterior part of the vesicle wall may be smooth or ornamented.

Genus *Ancyrochitina* Eisenack, 1955

Type species.—*Conochitina ancyrea* Eisenack, 1931.

Remarks.—In the diagnosis of this genus Eisenack (1955a: 163) included the statement that the basal edge is provided with relatively few appendices, "verhältnismässig wenigen (etwa 4—10, meist 5—8)". In the present paper a new species, *Ancyrochitina ansarviensis*, is referred to the genus *Ancyrochitina*, although it is provided with a comparatively great number of appendices, as is the Ordovician species *A. multiradiata* Eisenack, 1959. In 1967 I referred *A. multiradiata* and *Ancyrochitina cervicornis* (Eisenack, 1931) to the genus *Spinachitina*, erected by Schallreuter in 1963, because of their fairly sharp basal edge and their great number of appendices. That procedure has not been accepted (see, e.g., Eisenack 1968a: 184—185; 171) and the genus *Spinachitina* has been regarded as superfluous. Still I am not convinced about this, but until SEM studies have been performed on the Ordovician species mentioned, *A. ansarviensis* is referred to *Ancyrochitina*, even though the number of appendices hardly can be described as comparatively few.

Ancyrochitina spinosa (Eisenack, 1932) is transferred to the new genus *Gotlandochitina* in this paper.

Species in Gotland.—*Ancyrochitina ancyrea* (Eisenack, 1931); *A. ansarviensis* n. sp.; *A. desmea* Eisenack, 1964; *A. cf. diabolus* Eisenack, 1937; *A. gutnica* n. sp.; *A. pachyderma* n. sp.; *A. pedavis* n. sp.; *A. primitiva* Eisenack, 1964.

Ancyrochitina ancyrea (Eisenack, 1931)

Figs. 4—5.

Synonymy □ *Conochitina ancyrea* n. sp.—Eisenack 1931: 88—89, Fig. 2, Pl. 2: 8—11, Pl. 4: 4. □ *Conochitina protancyrea* n. sp.—Eisenack 1937: 224, Pl. 15: 16—20. □ *Ancyrochitina ancyrea* (Eisenack 1931)—Eisenack 1955a: 163—164, 175, Pl. 2: 7—9. □ *Ancyrochitina ancyrea* Eisenack 1955a—Beju & Danet 1962: 529, Pl. 1: 1—9. □ *Ancyrochitina ancyrea* (Eisenack 1931)—Eisenack 1964a: 324—325, Pl. 27: 7, 15; Pl. 28: 6—7; non Pl. 29: 4. □ *Ancyrochitina cf. ancyrea* (Eis.)—Taugourdeau 1966a, Pl. 1: 16. □ *Ancyrochitina ancyrea* (Eisenack, 1931)—Eisenack 1968: 172, Pl. 27: 11. □ *Ancyrochitina ancyrea* (Eisenack 1931)—Eisenack 1970: 306, Fig. 1 G—L. □ *Ancyrochitina ancyrea* (Eis. 1931)—Laufeld 1971: 295, Pl. 1: C.

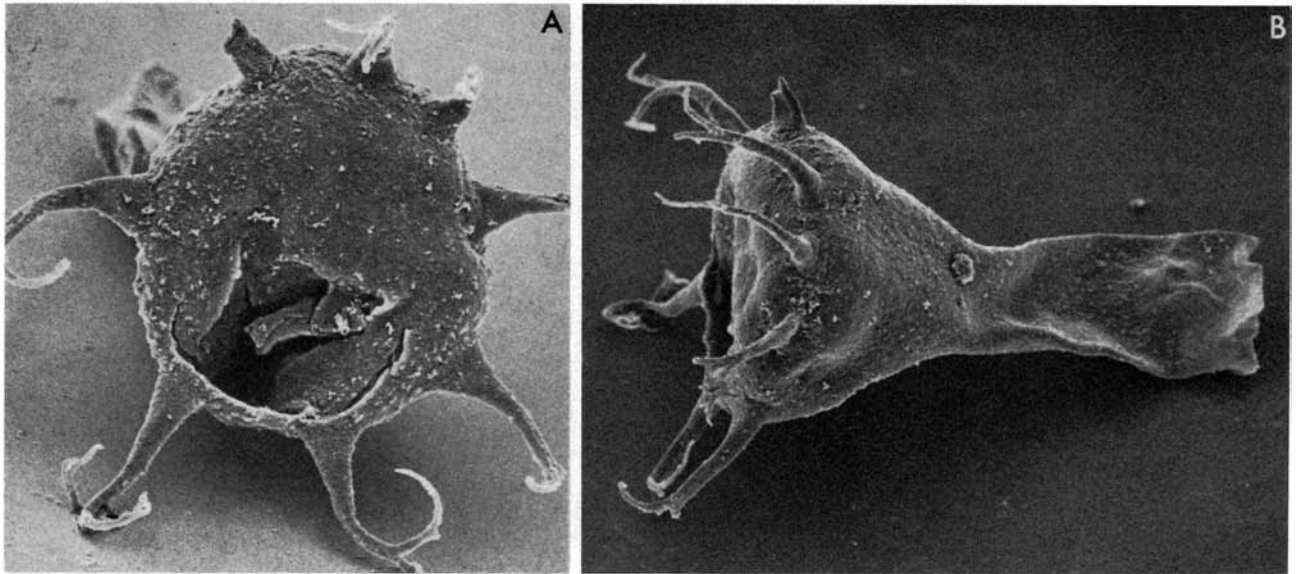


Fig. 4. *Ancyrochitina ancyrea* (Eisenack, 1931). Sinnarve 1, Slite Marl, *Conchidium tenuistriatum* Beds (G 66—83). LO

4591t. A. Specimen in aboral view. $\times 720$. B. Same specimen in lateral view. $\times 530$.

Remarks.—Eisenack's emended diagnosis of 1955 has been strictly adhered to in this paper with one exception. Forms with appendices branching in an antler-like or irregular way (Eisenack 1955a: 163 "hirschgeweihähnlich oder recht unregelmässig verzweigt") have not been included in *A. ancyrea*. If that part of the diagnosis is adhered to the taxon will be of wastebasket character. If this restriction is adopted a major part of all forms referred to *A. ancyrea* will not be conspecific with that species as may be seen above. The holotype and paratypes figured by Eisenack in 1931 (Pl. 2: 8—11) belong to a population of morphologically well-defined specimens. Unfortunately, the neotype have appendices which branch in a more complicated way than those of the holotype. The old as well as the new type material was selected from erratic boulders and, since type stratum and locality were not designated, it is impossible to get more material of exactly the same age. The only way out of this dilemma is to stick within the width of variation of the neotype (and the other figured specimen of the same sample, 1955a, Pl. 2: 9) and the 1931 type material. This has been done in the present paper. Therefore, some specimens classified as *A. ancyrea* by Eisenack himself have not been included here (e.g. Eisenack 1955a; Pl. 2: 10—11).

Occurrence.—*A. ancyrea* has a long stratigraphical range. In Gotland it was encountered in the Lower and Upper Visby Beds, although not in great and homogeneous populations. The species occurs abundantly and in very homogeneous populations in several samples through the entire Högklint Beds. It occurs in more or less homogeneous populations at scattered levels in the remaining part of the Gotlandian sequence at least to the very top of the Hemse Beds. Specimens from three different populations are figured herein. As seen in the figures there are slight but

distinct differences in some morphological characters. It remains an open question whether the differences are due to intraspecific variation for ecological reasons or if the variation is interspecific. For the present, it would result in chaos in the systematics if the different forms were classified as different species. As part of the variation is meristic in character, e.g. the number of appendices, a biometric study would be most useful. However, the problem cannot be solved in this connection, because of the extremely time-consuming task of making a great number of counts in a great number of populations.

A. ancyrea has been reported from several parts of the world and from strata of Ordovician through Devonian age, but as restricted herein, it is a species (or possibly more than one) characteristic of the Silurian. As may be seen from the synonymies it occurred from the Balto-Scandian area and towards the south at least to Podolia and Roumania. It is most probable that the species was cosmopolitan as claimed in the literature, but this will remain an open question until revisions of several earlier chitinozoan assemblages have been undertaken.

Ancyrochitina ansarviensis n. sp.

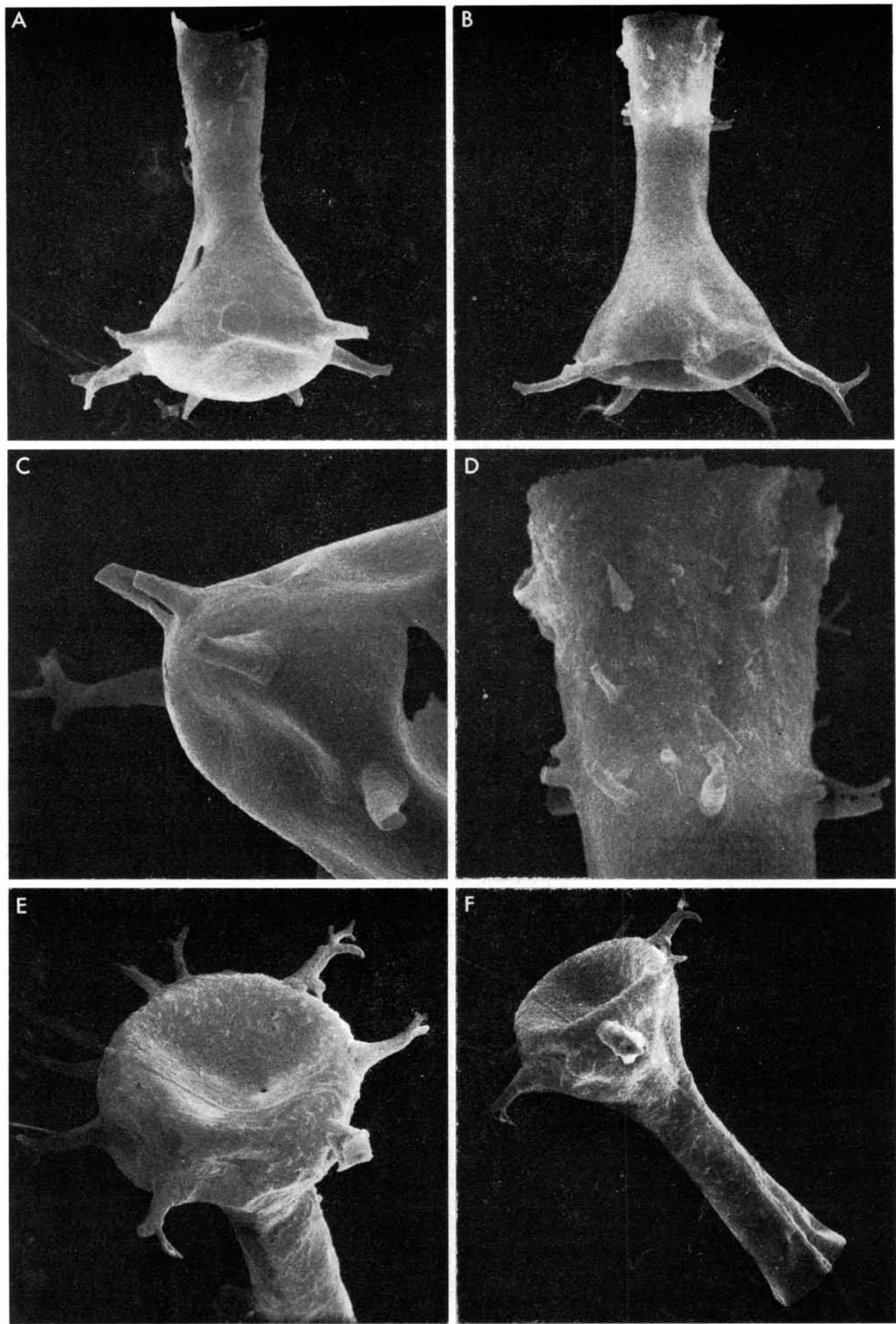
Fig. 6.

Derivation of name.—Latin *Ansarviensis*, from the parish of Ansarve, the type locality.

Holotype.—LO 4615 T.

Type stratum.—Högklint Beds, southwestern facies, upper part (Sample G 72—98).

Type locality.—Ansarve 2, Gotland.



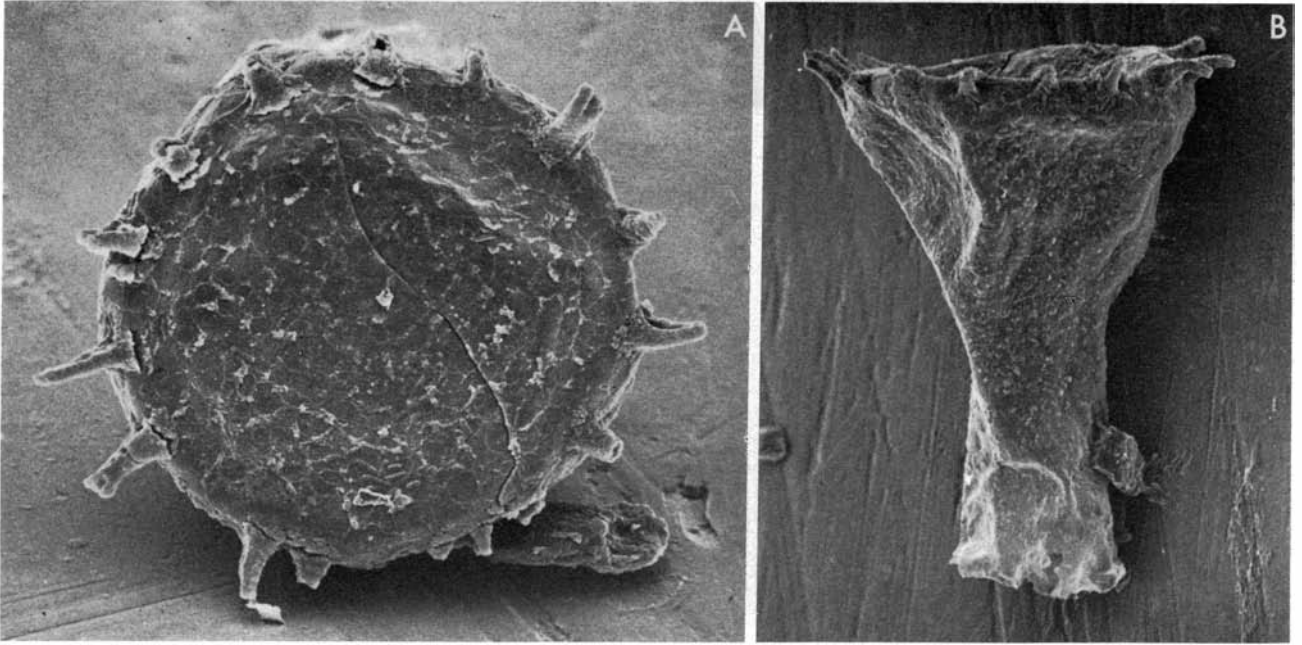


Fig. 6. *Ancyrochitina ansarviensis* n. sp. Ansarve 2, Högklint Beds, southwestern facies (G 72—98). LO 4615 T. A. Holotype in aboral view. Note that the appendices are attached to

the vesicle from outside. $\times 1200$. B. Holotype in lateral view $\times 750$.

Diagnosis.—*Ancyrochitina* species with cylindro-conical vesicle and with a neck that comprises less than half of the total length. The neck is widened towards the aperture which is finely fringed. The basal edge is bluntly rounded and is provided with 15—20 short and hollow spines.

Dimensions.—Population from the type stratum in microns: length (excl.) 90—120 (holotype 93), width (excl.) 50—65 (holotype 59), maximum length of appendices 17.5, commonly 10—15.

Description.—The body wall appears smooth at low magnifications, but a fine granulation is seen at a magnification of $7500\times$. The appendices are conical and some are split in the distal end, but they do not branch. In some specimens two appendices are attached closely and in the longitudinal direction.

For a discussion about the generic designation of this species, see under Genus *Ancyrochitina*.

Occurrence.—*A. ansarviensis* seems to be an excellent index fossil, because of its short stratigraphical range. The species occurs only in the uppermost part of the Högklint Beds, where it is restricted to the upper part of unit c and the marly, southwestern facies. The population from Strandakersviken 1 in the Fårö island cannot be distinguished from that of Ansarve 1.

Ancyrochitina desmea Eisenack, 1964

Fig. 7.

Synonymy □ *Ancyrochitina desmea* n. sp.—Eisenack 1964: 325, Pl. 29: 1—3 non Pl. 28: 12—14.

Emended diagnosis.—*Ancyrochitina* species with 6—8 appendices at the basal edge which are branching 4 or 5 times and with a series of spines branching 3—5 times in the middle part of the neck.

Dimensions.—Population from Snoder 1 (type locality) in microns: length (excl.) 108—146, width (excl.) 52—61, width (incl.) 93—125, maximum span of spines at the neck 80, extension of spines at the basal edge in longitudinal direction 43—52. The population measured by Eisenack is composed of larger specimens.

Remarks.—The restriction of the diagnosis here has been made in order to prevent the species from becoming a waste-basket taxon. The populations encountered in Gotland are most homogeneous and the species is an excellent time marker.

Fig. 5. *Ancyrochitina ancyrea* (Eisenack, 1931). A—D. Kappelshamn 2, Högklint Beds, unit b (G 69—130). LO 4657t. E—F. Eke 3, Hemse Marl, uppermost part (G 71—38). LO 4641t. A. Specimen in oblique lateral view. Note that the appendices are hollow and without any connection with the interior of the vesicle. $\times 500$. B. Specimen in oblique lateral view. $\times 500$. C. specimen in lateral view showing the hollow, branched appendices. $\times 1000$. D. Same specimen as in B showing spines at the finely fringed aperture. $\times 1500$. E. Specimen in oblique aboral view. Saliva threads. $\times 700$. F. Same specimen in oblique lateral view. $\times 500$.

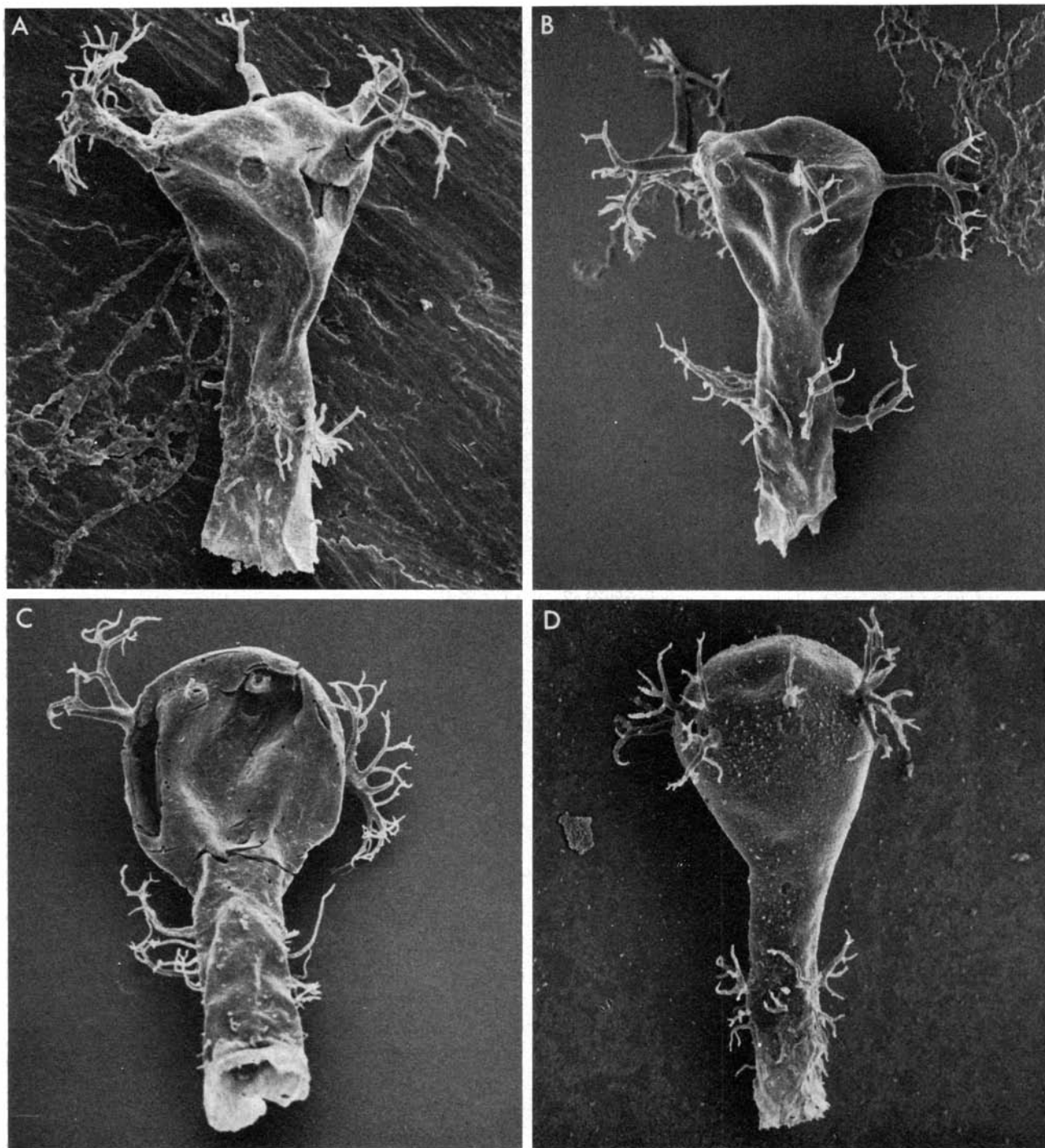


Fig. 7. *Ancyrochitina desmea* Eisenack, 1964. A. Snoder 2, Hemse Marl, northwestern part (G 66—205). LO 4658t. B—D. Snoder 1, Hemse Marl, northwestern part (G 66—97).

LO 4612t. A. Specimen in lateral view. $\times 660$. B. Specimen in lateral view. $\times 530$. C. Specimen in oblique oral view. $\times 600$. D. Specimen in lateral view. $\times 600$.

The neck is subcylindrical but slightly widened towards the finely fringed aperture. The neck comprises half or more of the length of vesicle. The basal edge is broadly rounded and the base is convex, but specimens with flat or concave bases occur. The vesicle wall is smooth or finely verrucate between the spines. The hollow spines have no connection (lumen) with the interior of the same kind as *Gotlandochitina martinsoni* n. sp.

The specimens classified as *A. cf. desmea* by Eisenack (1964, Pl. 28: 12—14) are referred to the species *A. pedavis*, which is a younger *Ancyrochitina* species replacing *A. desmea* in the muddy environment.

Occurrence.—*A. desmea* is an excellent time marker. It occurs solely in unit c of the Hemse Beds and in the northwestern, older part of the Hemse Marl.

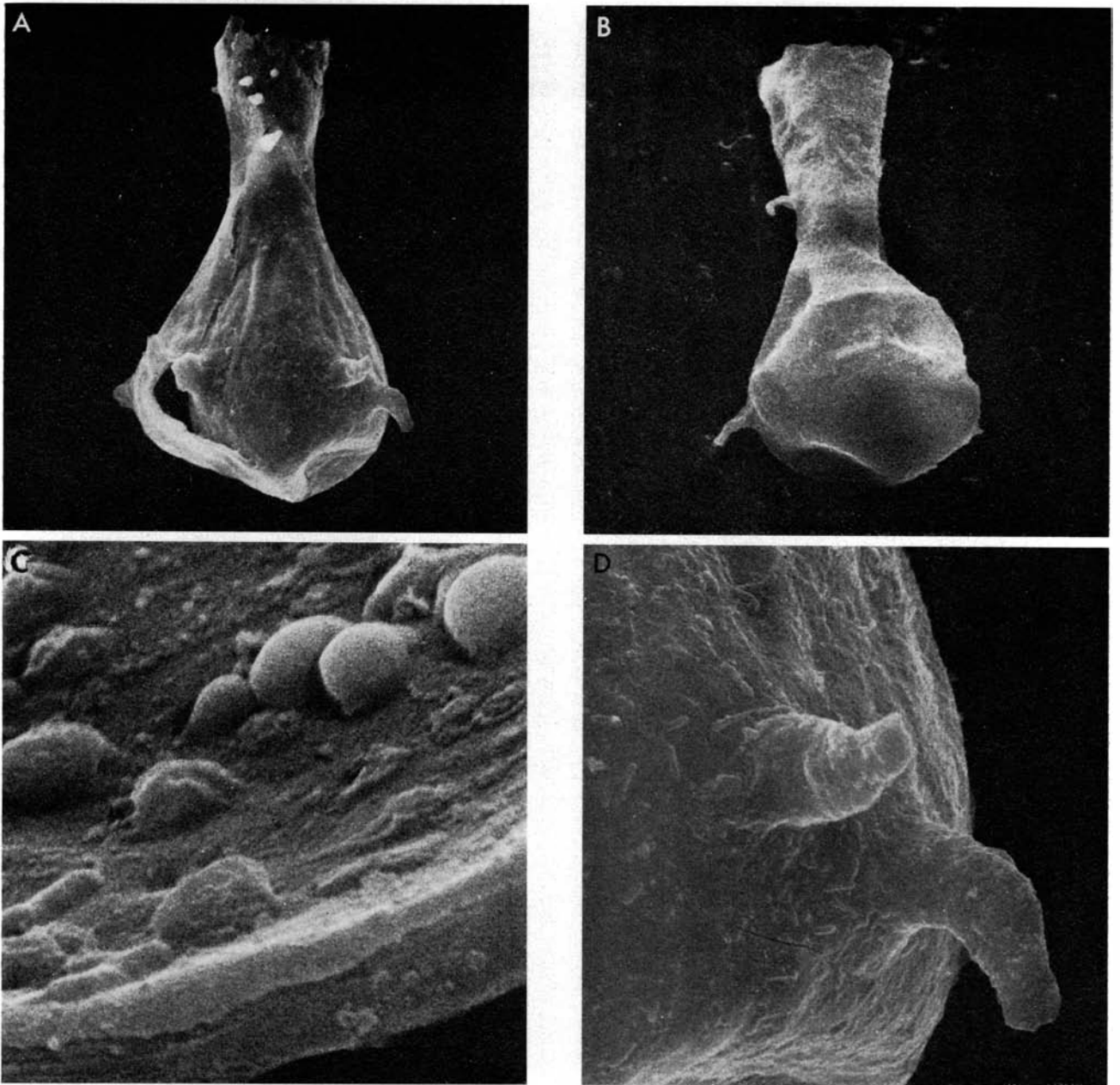


Fig. 8. *Ancyrochitina* cf. *diabolus* Eisenack, 1937. A, D. Faludden 2, Hamra Beds, unit c (G 71—16). LO 4660t. B, C. Gerumskanalen 1, Hemse Marl, northwestern part (G 71—45). LO 4663t. A. Specimen in oblique lateral view.

×500. B. Specimen in oblique aboral view. ×500. C. Ornamentation on the interior part of the vesicle wall at the base. Note that the vesicle wall consists of two layers. ×10,000. D. Same specimen as in A. Detail of appendices. ×2000.

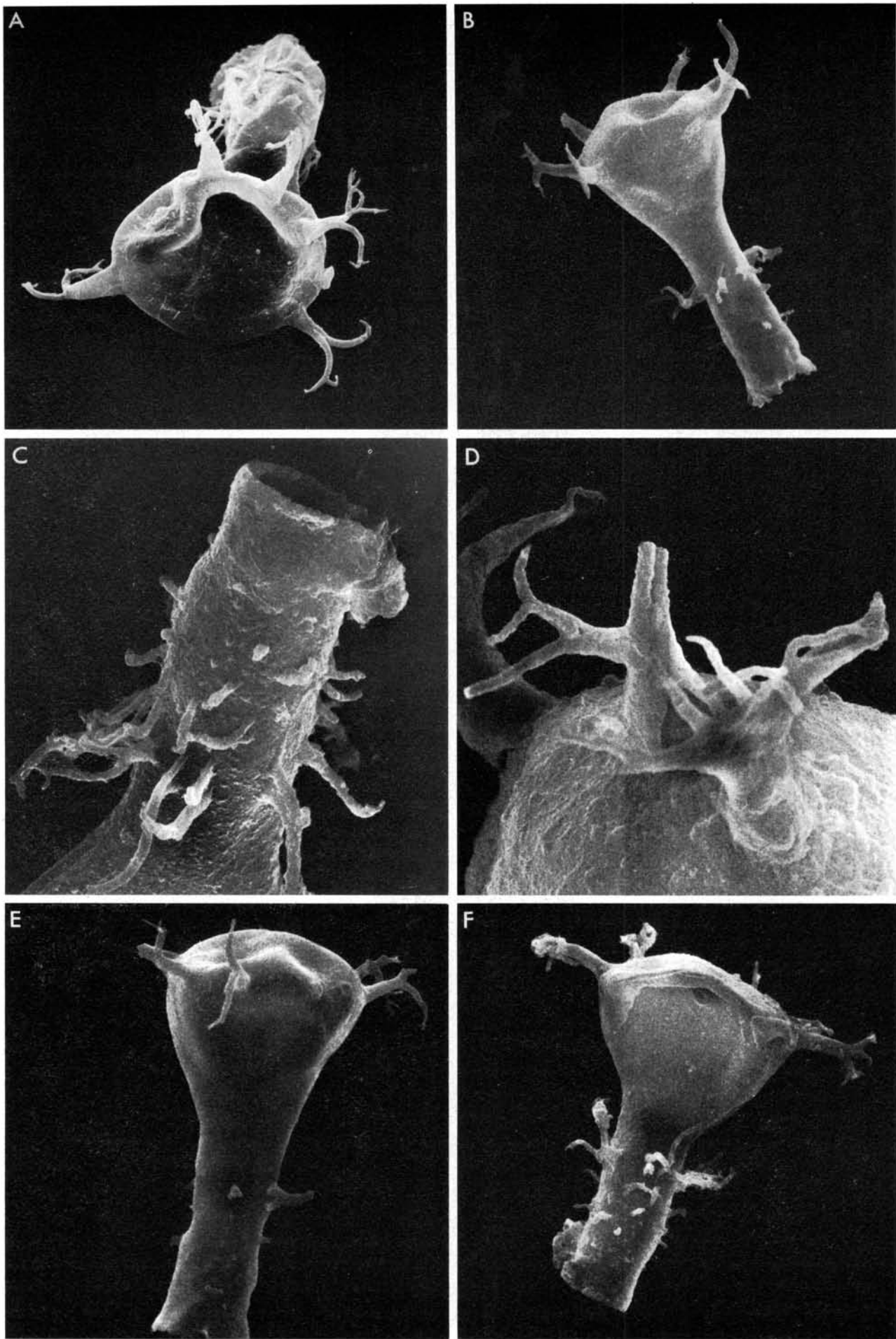
Ancyrochitina cf. *diabolus* (Eisenack, 1937)
nom. correct.

Fig. 8.

Synonymy □ *Conochitina diabolus* n. sp.—Eisenack 1937: 223—224, Pl. 15: 21—22. □ *Ancyrochitina diabolus* (Eisenack 1937)—Eisenack 1955a: 176, Pl. 3: 4. □ *Ancyrochitina diabolus* Eisenack 1937—Eisenack 1964a: 326. □ *Ancyrochitina diabolus* (Eisenack, 1937)—Eisenack 1968a: 173, Pl. 28: 1—6; Pl. 29: 9—12.

Remarks.—In several samples within the interval from unit a of the Hemse Beds through the Sundre Beds

isolated *Ancyrochitina* specimens of doubtful affinity occur. These chitinozoans have a cylindro-spheroidal vesicle with a broadly rounded basal edge provided with 5—7 short but wide, horn-like appendices. The appendices are curved, commonly in an aboral direction. The neck is slightly widened at the aperture, which is straight and unfringed. In some specimens the neck is provided with verrucae or short spines; other specimens lack this kind of ornamentation. They can not be classified with any other Gotlandian species. Some specimens, especially in the Hamra and Sundre Beds are similar to *A. diabolus*, and so all these are classified as *A. cf. diabolus* in this paper. Eisenack (1964a: 326; 1968a: 173) remarked that populations of



A. diabolus do not occur in Gotland and his conclusion is supported by this study. The "type stratum" of *A. diabolus* is located in strata slightly younger than those exposed in Gotland and the untypical Hamra—Sundre specimens may be regarded as forerunners.

Occurrence.—*A. cf. diabolus* was encountered in the Hemse Beds, upper part of the Burgsvik Beds, Hamra Beds, and the lower and middle part of the Sundre Beds.

Ancyrochitina gutnica n. sp.

Fig. 9.

Derivation of name.—Latin *Gutnicus*, inhabitant of Gotland.

Holotype.—LO 4599 T.

Type stratum.—Slite Marl, slightly younger than the *Conchidium tenuistriatum* Beds (Sample G 71—34).

Type locality.—Valbytte 1, Gotland.

Diagnosis.—*Ancyrochitina* species with cylindro-conical vesicle and convex base. The bluntly to broadly rounded basal edge carries 7—10, commonly 8, hollow and long appendices which have a broad base and branch 2—4 times. The neck is provided with well-developed, curved spines.

Dimensions.—Population from the type stratum in microns: length (excl.) 130—160 (holotype 134), width (incl.) 105—140 (holotype 136), width (excl.) 65—85 (holotype 78), maximum length of appendices 40 (holotype 39), commonly 25—30.

Description.—The neck comprises about half of the total length and is widened towards the aperture which is smooth and unfringed. The shoulder is bluntly rounded. A broadly rounded shoulder is seen in most specimens but it can be lacking. The spines are long and well-developed in the aboral part of the neck but decrease in size towards the aperture. Some of the spines of the neck are coalescent and occasionally branch once. The spines are bluntly curved. Most

appendices have a long unbranched and wide proximal part. The vesicle wall is almost smooth, but at high magnifications a delicate verrucate ornamentation is noticed.

Occurrence.—*A. gutnica* makes its debut in the Katrinelund Limestone of the Slite Beds and is then encountered in all lithologies of the Slite Beds, where it is a characteristic element most abundant in the marly facies. It is common in the Mulde Beds but then loses its importance. The last populations are met with in the lower-middle part of the Klinteberg Beds.

Ancyrochitina pachyderma n. sp.

Fig. 10.

Derivation of name.—Greek *παχυδερμος*, thick-skinned, referring to the wide appendices which have a thick, spongy wall.

Holotype.—LO 4617 T.

Type stratum.—Lower Visby Beds (Sample G 66—371).

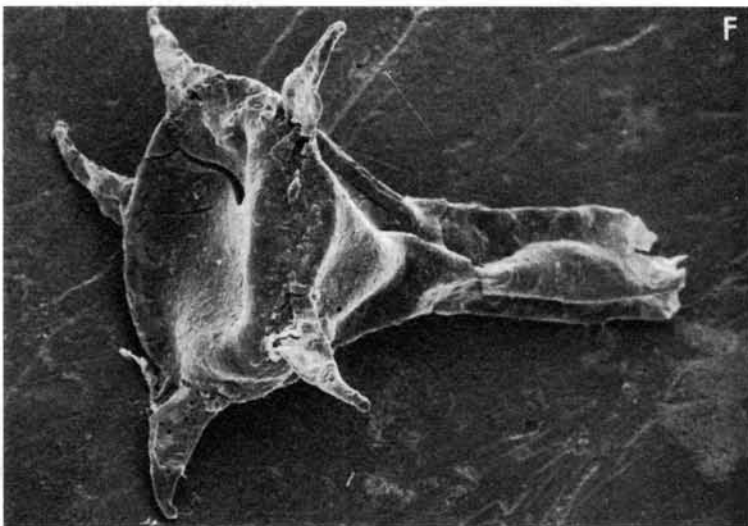
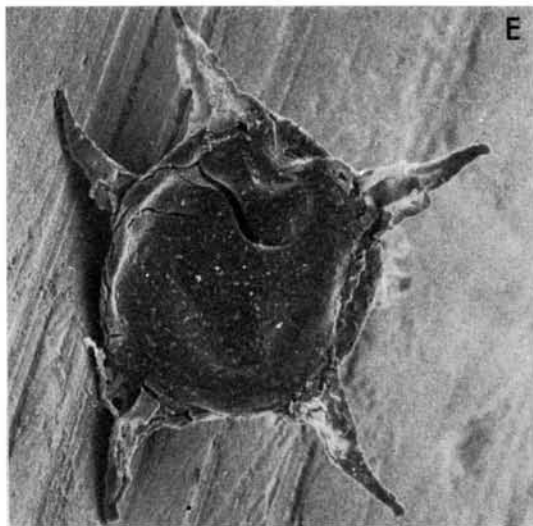
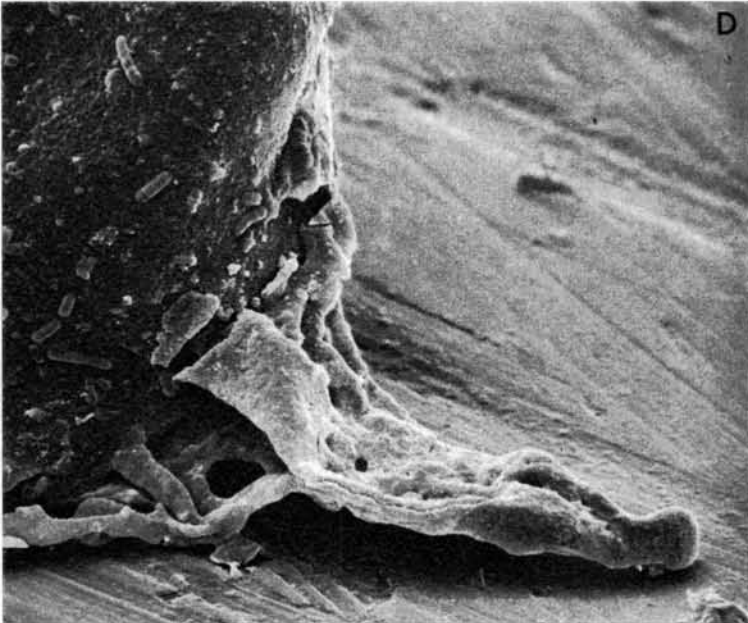
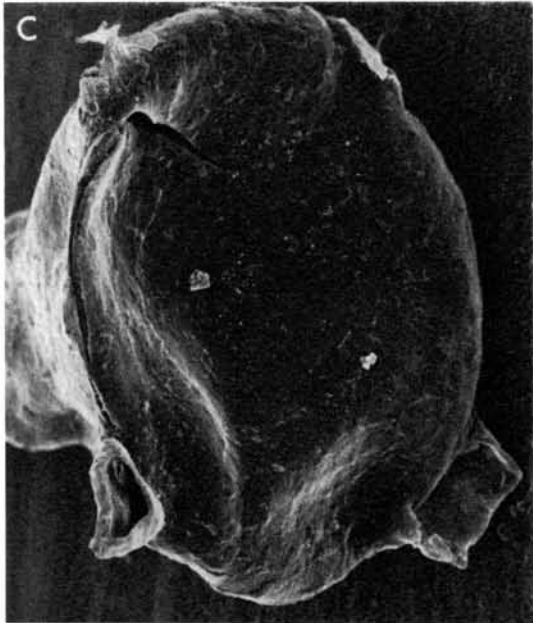
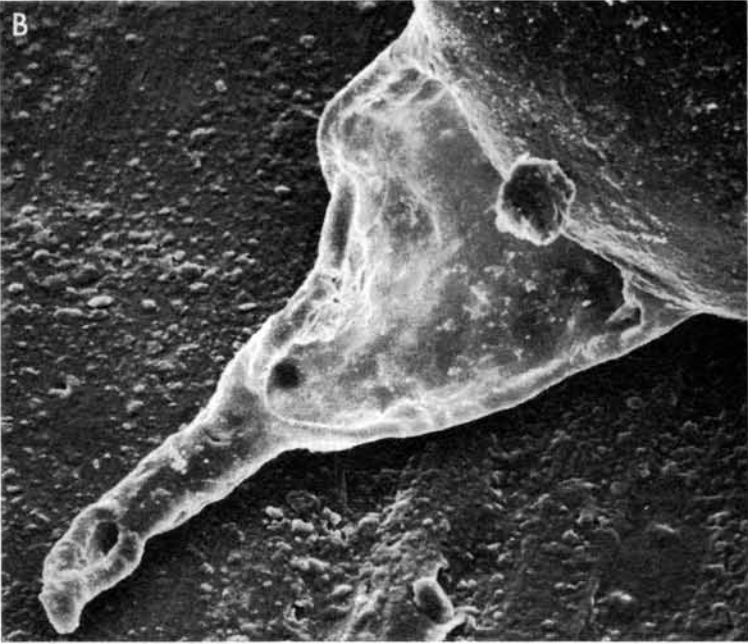
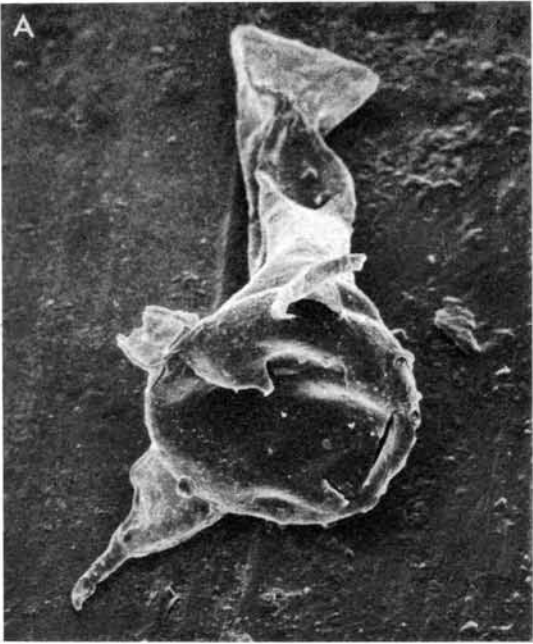
Type locality.—Nyhamn 1, Gotland.

Diagnosis.—*Ancyrochitina* species with cylindro-conical vesicle and bluntly rounded basal edge carrying 4—5 very wide but tapering appendices. The latter, which are flattened in oral-aboral direction, are triangular in the same view.

Dimensions.—Population from the type stratum in microns: length (excl.) 105—125 (holotype 120), width (incl.) 110—125, width (excl.) 50—70 (holotype 60), width of appendices at the basal edge in aboral view 12—35 (holotype 23), length of appendices 15—40 (holotype 36). Population from Ansarve 2 in microns: length 115—130, width (incl.) 110—120, width (excl.) 50—65, width of appendices at the basal edge in aboral view 20—40, length of appendices 20—35. The differences are not statistically significant.

Description.—The neck comprises half of the total vesicle length or more and is slightly widened towards the aperture which is unfringed. The flexure is broadly rounded but a shoulder is absent. The appendices are hollow and commonly fenestrated. They are composed of a homogeneous but spongy tissue. The body wall is very finely granulate which is noticeable only at magnifications exceeding 3000 ×. The over-all appearance of *A. pachyderma* is similar to *A. clathrospinosa* Eisenack 1968. Unfortunately, no specimens of the latter species were encountered, despite a thorough search in the Lower and Upper Visby Beds, the possible type strata of *A. clathrospinosa*. The similarity is only superficial and judging from Eisenack's figure

Fig. 9. *Ancyrochitina gutnica* n. sp. A. Distorted specimen in oblique aboral view. Askryggen 1, Slite Marl, *Pentamerus gotlandicus* Beds (G 71—55). LO 4664t. 30 kV. ×600. B. Specimen in lateral view. Follingbo 7, Slite Marl, north-western part (G 71—59). LO 4665t. ×400. C. Holotype, neck in oblique lateral view. Valbytte 1, Slite Marl, slightly younger than the *Conchidium tenuistriatum* Beds (G 71—34). LO 4699T. ×2000. D. Oblique aboral view of specimen showing appendices. Same data as B. ×2000. E. Specimen in lateral view. Same data as B. ×500. F. Holotype in lateral view. Same data as C. ×500.



(1959a, Pl. 3: 9; 1968a, Pl. 29: 15) the appendices of the latter species display an entirely different construction. Hence, I agree in Eisenack's supposition that *A. clathrospinosa* cannot be classified within any hitherto described genus.

Occurrence.—*A. pachyderma* was encountered in a few samples only. In these samples the species is fairly common. Its stratigraphical range thus comprises the Lower Visby Beds and the marly, southwestern facies of the Högklint Beds, but the species was not met with in between these strata.

Ancyrochitina pedavis n. sp.

Fig. 11.

Synonymy □ *Ancyrochitina* cf. *desmea* pars—Eisenack 1964a, Pl. 28: 13—14.

Derivation of name.—Latin *pes*, foot, and *avis*, bird, referring to the appendices which resemble a bird's foot.

Holotype.—LO 4618 T.

Type stratum.—Hamra Beds, lower part (Sample G 71—11).

Type locality.—Digrans 1, Gotland.

Diagnosis.—*Ancyrochitina* species with cylindro-spheroidal to cylindro-conical vesicle. The neck comprises half to two thirds of the vesicle length. The base is highly convex and the basal edge is broadly rounded. There are 6—8 long and hollow appendices branching 2—4 times in their distal part. The neck is provided with long spines, commonly curved parallel with the longitudinal axis as are the appendices.

Dimensions.—Population from the type stratum in microns: length (excl.) 105—160, holotype 120; width (incl.) 85—115, holotype 92; maximum length of appendices 16—48, holotype 26; maximum length of appendices in oral-aboral direction 20—45, holotype

20; maximum length of spines on the neck 13, holotype 7.

Description.—The fairly slender neck is more or less abruptly widened in its oral part. The aperture is coarsely fringed. The flexure is broadly rounded but conspicuous and the shoulder is broadly rounded or absent. The appendices are wide in their proximal part and branch in their distal part. After the first ramification the two branches are commonly parallel with the longitudinal axis of the vesicle. Occasionally, there is a thin web-like structure between the lateral branches. *A. pedavis* is distinguished from *A. desmea* primarily by the absence of complex spines on the neck but also by the less complex ramifications of the appendices.

Occurrence.—*A. pedavis* is a very characteristic index fossil with a short stratigraphical range. It makes its appearance in the lower part of the Hamra Beds and is met with commonly throughout these beds and up into the lower part of the Sundre Beds. It seems most probable that the species does not range into the submarine *Beyrichia* Limestone, since Eisenack, who has studied a great number of glacial erratics of that lithology, has never reported any *Ancyrochitina* specimens that fit the description of this species.

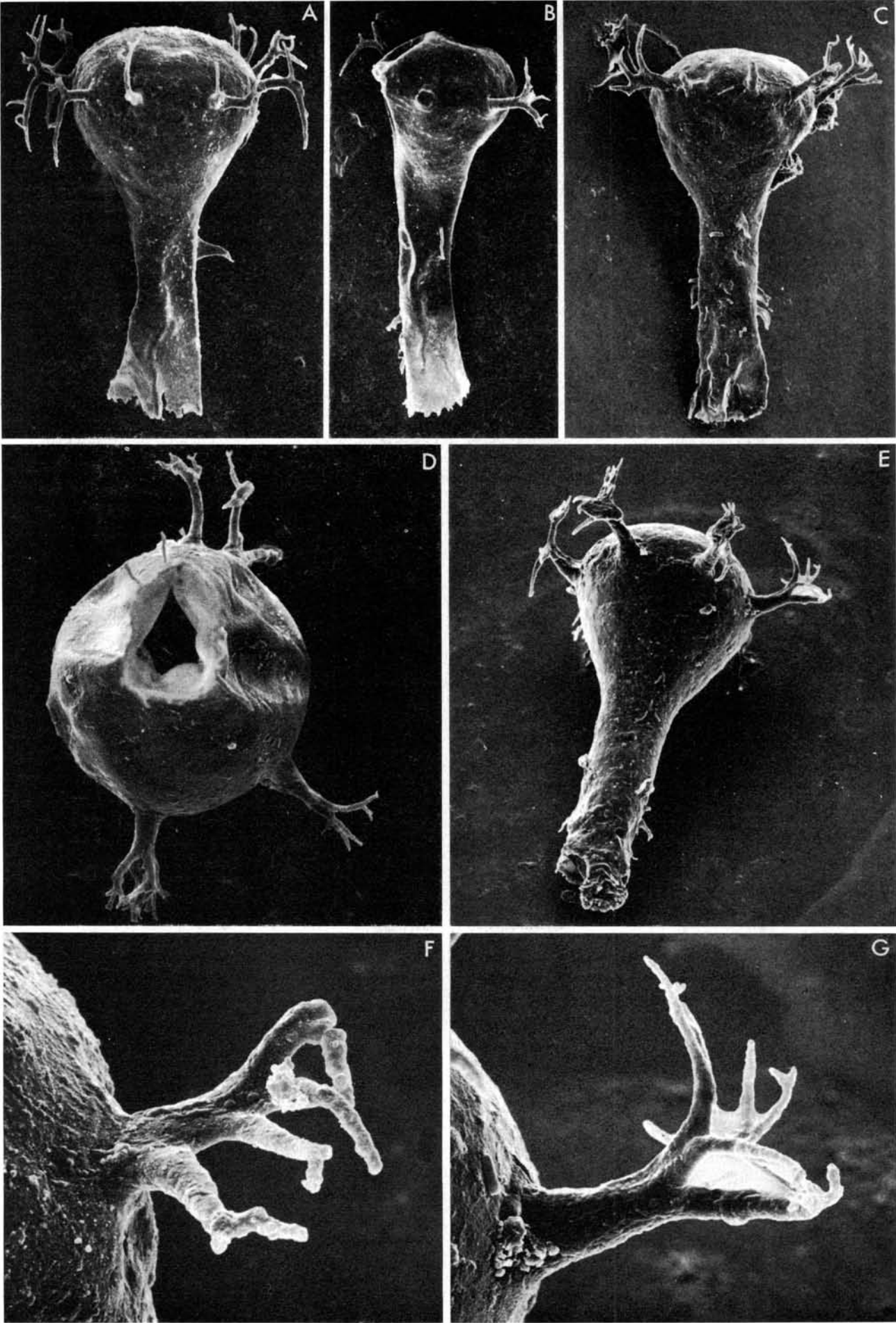
Ancyrochitina primitiva Eisenack, 1964

Figs. 12—13.

Synonymy □ *Ancyrochitina primitiva* n. sp.—Eisenack 1964a: 323—324, Pl. 27: 1—6, 8—14; Pl. 28: 1—5. □ *Ancyrochitina primitiva* Eisenack, 1964—Eisenack 1968a: 172, Pl. 24: 6, 13—15; Pl. 27: 5—9, 10—11. □ *Ancyrochitina primitiva* Eisenack 1964—Eisenack 1970: 307, Figs. 1 M, 2 A—B. □ *Ancyrochitina* cf. *primitiva* Eis. 1964—Laufeld 1971, Pl. 1: E.

Remarks.—In his original diagnosis Eisenack (1964a: 323) stated that *A. primitiva* is characterized by a flat or slightly concave base and by its 4—9, commonly 5—7, fairly short, thick-based, unbranched appendices. Further, he pointed out that the appendices were perpendicular to the longitudinal axis or curved in the oral direction and that the subcylindrical neck lacks or is provided with spines. To this diagnosis he added that the species shows such great variation that each of the above-mentioned characters may be absent. The type stratum is located somewhere in the Slite Marl of Slitebrottet 1, where the Slite Marl has an exposed thickness of about 50 m, a tenth of the thickness of the entire Silurian of Gotland. The present study confirms the stratigraphical range reported by Eisenack (1964a: 334—335) for *A. primitiva* in Gotland. Populations that fit the diagnosis occur already in the Lower Visby Beds. The species ranges to the very top of the Hemse Beds. Several of the populations of the

Fig. 10. *Ancyrochitina pachyderma* n. sp. A—C. Ansarve 2, Högklint Beds, southwestern facies (G 72—98). LO 4616t. D—F. Nyhamn 1, Lower Visby Beds (G 66—371). LO 4617T. A. Specimen in oblique aboral view. ×600. B. Same specimen, detail of appendix. Note that the appendix is hollow in its lateral part and fenestrate in its proximal part. ×2400. C. Specimen in oblique aboral view. Note the spongy material in the wall of the appendix. ×1200. D. Holotype, detail of appendix. ×2400. E. Holotype in aboral view. ×600. F. Holotype in oblique aboral view. ×600.



Klinteberg and Hemse Beds, however, are not typical and are designated *A. cf. primitiva*. The populations of the Lower and Upper Visby Beds lack a spinose ornamentation on the neck. Such an ornamentation is characteristic, however, for several populations of the Högklint Beds and almost all of the Slite Beds and for some of those of the Halla and Mulde Beds. Most populations of the Klinteberg and Hemse Beds again lack a spinose ornamentation on the neck. The populations of the Mulde Beds and the Hemse Marl have short and almost conical appendices. It has been noticed that among specimens of typical populations of the Slite Marl the base can be flat as well as convex or concave and therefore this character seems to depend on the state of preservation only. The same is true of the curvature of the appendices. *A. primitiva* has hollow appendices. Some 30 specimens from several different populations have been studied by the SEM in order to check if there is a pore (lumen) in the vesicle wall from the interior of the appendices to the interior of the vesicle. But not a single case has been noticed. The appendices of *A. primitiva* were not formed from the interior of the vesicle wall. Instead the appendices seem to be welded to the exterior of the vesicle wall by some tissue which surrounded and formed the vesicle. The formation of the appendices seems to be the last stage in the formation of the vesicle. The exterior surface of the vesicle wall has exactly the same shape inside and outside the appendices. The interior surface of the vesicle wall shows no modifications whatsoever in the parts immediately under the appendices. There are no scars or concentric structures and when studying the interior of the vesicles it is not possible to establish where the appendices are located.

Occurrence.—Lower Visby Beds—Hemse Beds (the Tofta Beds excluded), Gotland. Eisenack (1964a: 335, 337; 1970: 321) reported *A. primitiva* from the “Wenlockian Middle Nodular Beds of Dudley, England” and the Wenlockian Jaani stage (St. Johannis) and the Ludlovian Paadla Stage (Attel) in Estonia. Laufeld (1971: 295) reported its occurrence in the Restevo Beds of Podolia. *A. primitiva* has been reported from several other areas. These occurrences are not dealt with here, because these reports lack or have insignificant illustrations.

Fig. 11. *Ancyrochitina pedavis* n. sp. *A.* Specimen in lateral view. Note that the first ramification of appendices is along the longitudinal axis of the vesicle. Hoburgen 1, Hamra Beds, unit c (G 71—39). LO 4621t. $\times 600$. *B.* Specimen in lateral view. Note that the hollow appendix lacks connection with the interior of the vesicle. Same data as *A.* $\times 455$. *C.* Holotype in lateral view. Digraans 1, Hamra Beds, lower part (G 71—11). LO 4618T. $\times 600$. *D.* Specimen in oral view. Note that the appendices branch along the longitudinal axis of the vesicle. Same data as *A.* $\times 900$. *E.* Specimen in oblique lateral view. Same data as *C.* $\times 600$. *F.* Detail of appendix. Same data as *C.* $\times 3050$. *G.* Same specimen as in *E.* Detail of appendix. Note the web-like structure. $\times 2400$.

Genus *Angochitina* Eisenack, 1931, emend. 1968

Type species.—*Angochitina echinata* Eisenack, 1931.

Species in Gotland.—*Angochitina ceratophora* Eisenack, 1964; *A. crassispina* Eisenack, 1964; *A. echinata* Eisenack, 1931; *A. elongata* Eisenack, 1931; *A. longicollis* Eisenack, 1959.

Angochitina ceratophora Eisenack, 1964

Fig. 14.

Synonymy □ *Angochitina ceratophora* n. sp.—Eisenack 1964a: 320—321, Pl. 30: 7—9. □ *Angochitina ceratophora* Eisenack, 1964—Eisenack 1968: 177, Pl. 28: 30—32. □ *Angochitina cf. ceratophora*—Eisenack 1968: 177, Pl. 28: 27.

Remarks.—Eisenack's description (1964a: 320—321) of the species needs few additions. The aperture is finely fringed and the spines on the neck commonly have a coalescent base. The base can be elongated longitudinally. In several specimens the spines are disc-like. Commonly the spines and appendices are irregularly curved. The appendices are hollow and lack connection through a pore (lumen) with the interior of the vesicle. The measurements reported by Eisenack (1964a: 320) are representative for most populations.

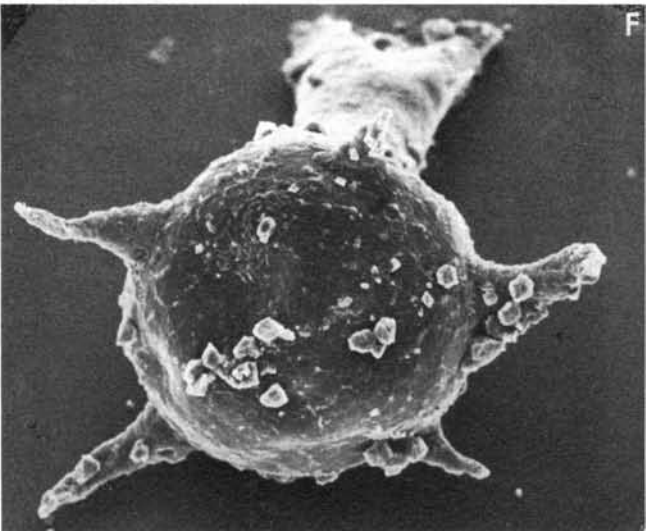
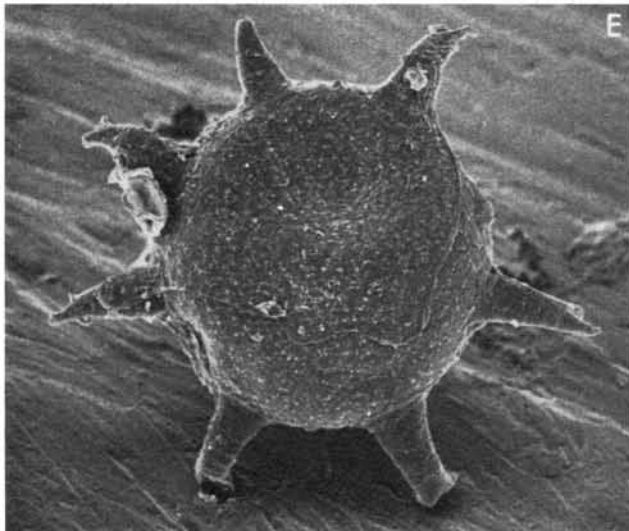
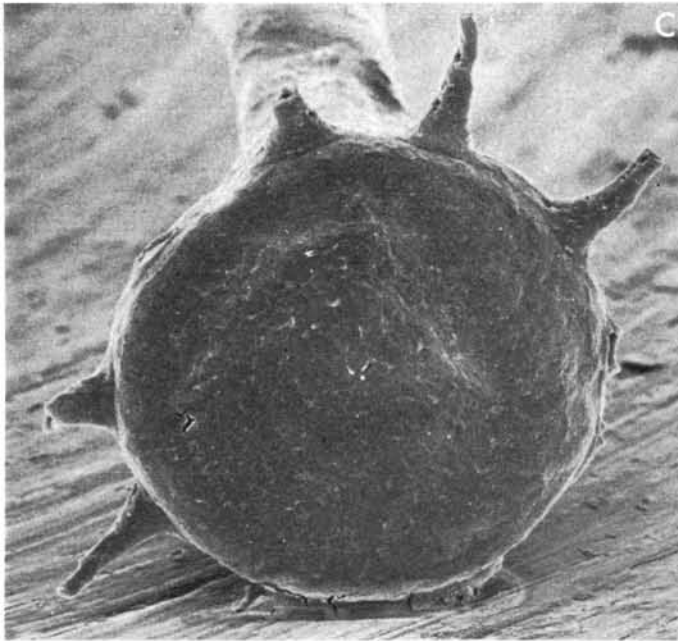
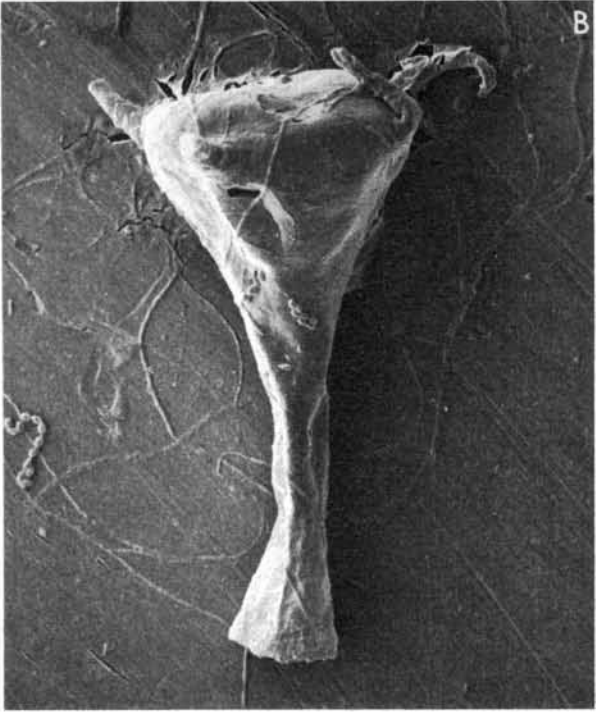
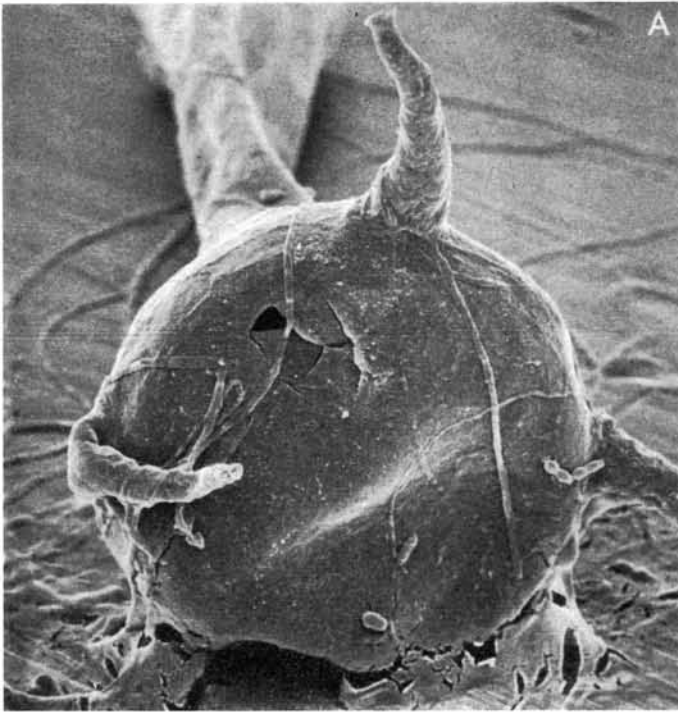
Occurrence.—*A. ceratophora* has a stratigraphical range identical with that of *A. crassispina*. It occurs in the Millklint Limestone, the uppermost formation of the Hemse Beds in limestone facies, but in the Hemse Marl it makes its debut already in the early, north-western part and then ranges through the Hemse Marl in its entirety. The latest occurrences of *A. ceratophora* are within the lower part of the Eke Beds. Specimens from the Sundre Beds referred to as *A. cf. ceratophora* by Eisenack (1964: 333, 335) are probably forerunners of *A. filosa*. The present study has not confirmed the occurrence of *A. ceratophora* in beds younger than the Eke Beds.

Angochitina crassispina Eisenack, 1964

Fig. 15.

Synonymy □ *Angochitina crassispina* n. sp.—Eisenack 1964a: 320, Pl. 30: 3—4. □ *Angochitina crassispina* Eisenack, 1964—Eisenack 1968: 178.

Remarks.—There is very little to add to Eisenack's description of this species. As pointed out by him (Eisenack 1964a: 320) the spines are hollow. There is



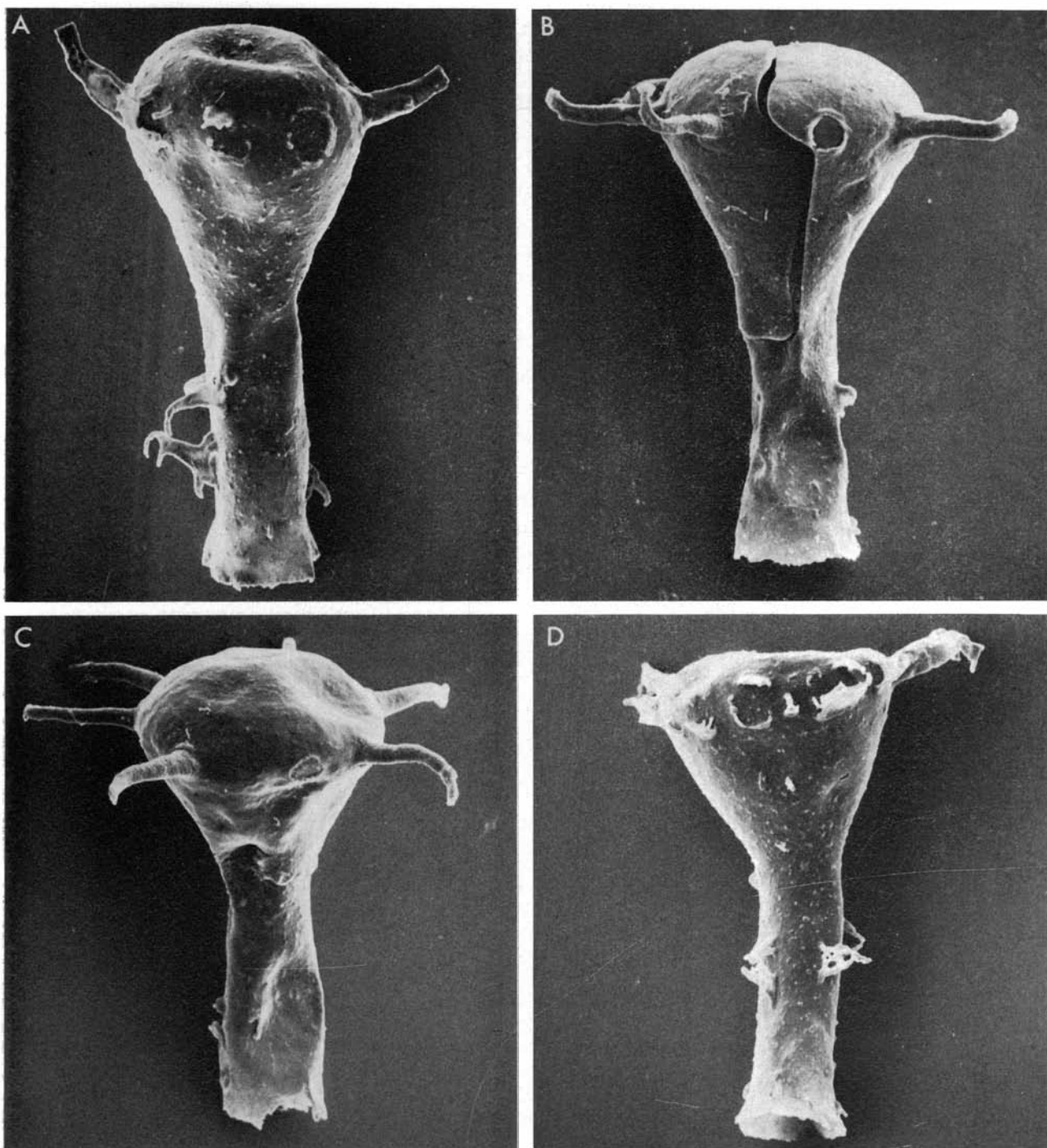


Fig. 13. *Ancyrochitina* cf. *primitiva* Eisenack, 1964. Mulde 1, Slite Siltstone (G 72—151). LO 4670t. A. Specimen in oblique lateral view. $\times 600$. B. Specimen in lateral view. $\times 600$. C. Specimen in oblique lateral view. $\times 600$. D. Specimen in lateral view. $\times 530$. Note the different directions in which the appendices curve within one and the same population.

Fig. 12. A—E, *Ancyrochitina primitiva* Eisenack, 1964. A. Specimen in aboral view. Nyhamn 1, Lower Visby Beds (G 66—370). LO 4666t. $\times 1020$. B. Same specimen in lateral view. $\times 530$. C. Specimen in aboral view. Same data as A. $\times 990$. D. Same specimen in lateral view. $\times 550$. E. Specimen in aboral view. Långars 1, Slite Marl (G 66—326). LO 4667t. $\times 720$. F. *Ancyrochitina* cf. *primitiva* Eisenack, 1964. Specimen in oblique aboral view. Vidfälle 1, Hemse Beds, unit b (G 72—72). LO 4669t. $\times 840$.

no pore (lumen) in the vesicle wall connecting the interior of a spine with the interior of the vesicle. The vesicle wall in between the spines is very smooth and a very fine granulation can be seen only at a magnification of about $10,000\times$. Occasionally some of the spines are developed as lambda-spines. The aperture is coarsely fringed. The dimensions reported by Eisenack are representative for most populations.

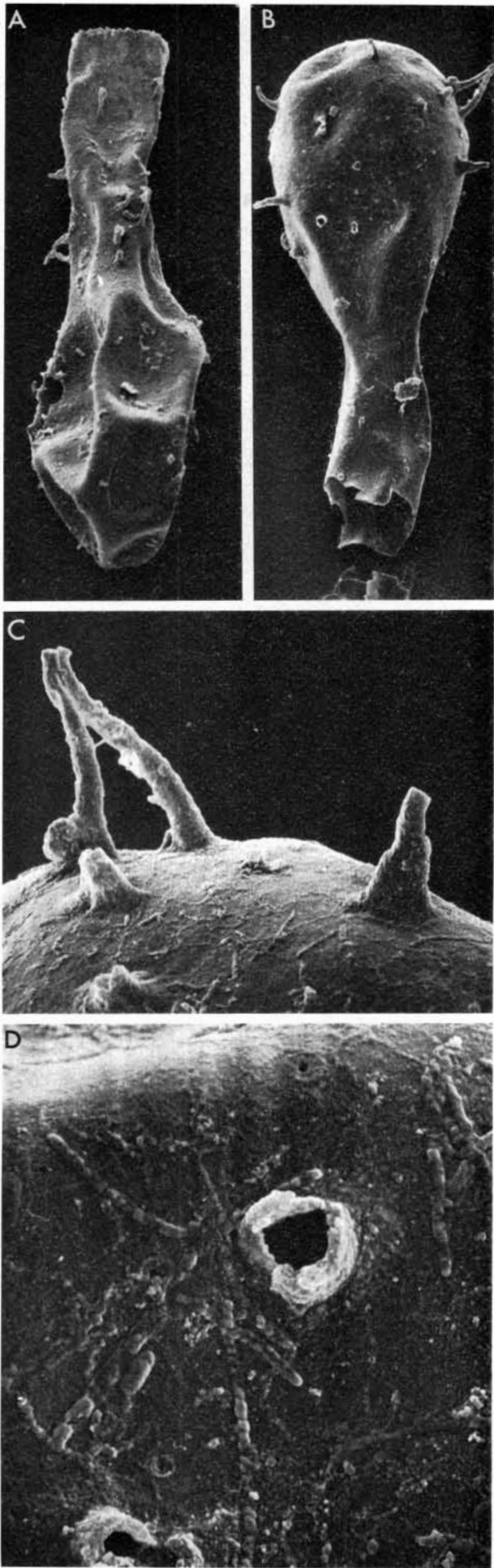
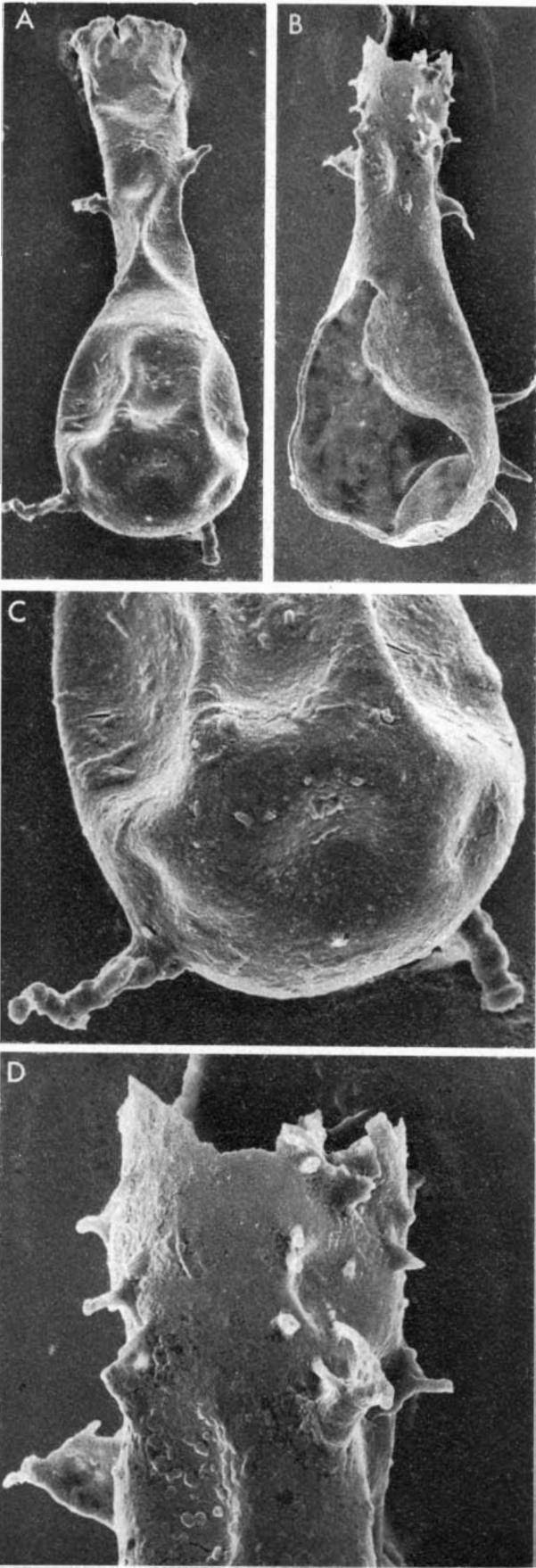


Fig. 14. Angochitina ceratophora Eisenack, 1964. Bodudd 1, Hemse Marl, top (G 72—140). LO 4648t. *A.* Lateral view. $\times 480$. *B.* Lateral view. $\times 550$. *C.* Detail of *A.* $\times 1200$. *D.* Detail of *B.* $\times 1800$.

Occurrence.—*A. crassispina* has a short stratigraphical range. In those parts of the Hemse Beds which are developed as limestones the species does not appear until in the Millklint Limestone, but it occurs all through the Hemse Marl. *A. crassispina* has its last occurrence in the lower part of the Eke Beds. Its occurrence in the Eke Beds immediately below the Burgsvik Beds at Burgen 3 confirms that only the lower part of the Eke Beds is represented in that area. Eisenack (1964a: 333; 335) has reported the species also from the Sundre Beds. Its occurrence there is not corroborated by this study and it seems probable that forerunners to *A. filosa* are involved.

Angochitina echinata Eisenack, 1931

Figs. 16—17.

Synonymy □ *Angochitina echinata* n. sp.—Eisenack 1931: 82, Pl. 1: 6—7. □ *Angochitina echinata* Eisenack 1931—Eisenack 1964a: 319, Pl. 29: 9—11. □ *Lagenochitina* ? sp.—Taugourdeau 1966, Pl. 2: 45. □ *Angochitina echinata* Eisenack, 1931—Eisenack 1968: 177, Pl. 31: 16.

Remarks.—The holotype and the paratype figured by Eisenack (1931, Pl. 1: 6—7) were extracted from an erratic boulder designated as *Beyrichia* Limestone. No other microfossils were reported from the same slab. The types were probably lost during the war. A neotype was selected among specimens from the topmost part of the Hemse Beds in Gotland (Eisenack 1964a, Pl. 29: 10). Hence, it is quite apparent that the neotype is considerably older than the lost holotype. This should be kept in mind, should the holotype be retrieved, since it is possible that two different species are involved.

A. echinata is covered by fairly long spines all over the vesicle. The spines on the neck decrease in size towards the aperture. Most spines are hollow but more or less massive spines occur. The vesicle wall is granulated in between the spines. The aperture is smooth or finely fringed. Densely spined populations can be hard to discriminate from long-spined specimens of *A. elongata* (in its neotype concept).

In the Hamra and lower Sundre Beds there are populations of less densely spined specimens. These are designated as *A. cf. echinata* herein. It cannot be discounted that the latter populations could be forerunners to *A. echinata* as of the holotype concept. The

species was reported from the Hemse and Sundre Beds by Eisenack (1964a: 345).

Dimensions.—Population from the uppermost part of the Hemse Marl at Bodudd 1 in microns: length (incl.) 150—200, width (incl.) 50—75.

Occurrence.—*A. echinata* makes its appearance in unit c of the Hemse Beds and in the younger, south-eastern part of the Hemse Marl. Characteristic populations are met with in the lower part of the Eke Beds. The species then disappears in the southwest, but it is encountered also in the *Rhizophyllum* Limestone in the northeast. The less densely spined populations, designated as *A. cf. echinata*, appear in unit a of the Hamra Beds and are encountered up into the lower part of the Sundre Beds. As mentioned before *A. echinata* was erected on specimens from the slightly younger *Beyrichia* Limestone. Eisenack (1972a: 71, Pl. 17: 1—14) has reported a species designated as *A. echinata* from the *transgrediens* zone in the Leba core from northernmost Poland. He remarked that most specimens have shorter spines than *A. echinata* populations from Gotland. This, and the very short necks of the Leba populations, make it improbable that the latter are conspecific with *A. echinata* in the neotype sense.

Angochitina elongata Eisenack, 1931

Fig. 18.

Synonymy □ *Angochitina elongata* n. sp.—Eisenack 1931: 82, Pl. 1: 8—9. □ *Angochitina elongata* Eisenack 1931—Eisenack 1964a: 319, Pl. 30: 2. □ *Angochitina elongata* Eisenack, 1931—Eisenack 1968: 177. □ *Lagenochitina elongata* Eis.—Taugourdeau 1966: 41.

Remarks.—The holotype and paratype described and figured by Eisenack in 1931 were extracted from an erratic boulder. They were probably destroyed during the war. Judging from the figures (Eisenack 1931, Pl. 1: 8—9) it is evident that these specimens were characterized by a very elongated body, hence the name of the species. The neotype (1964a, Pl. 30: 2) was selected from a population from the northwestern part of the Hemse Marl in Gotland. Apparently the neotype is provided with a denser spinose ornamentation and a less elongated body than the old types.

In this connection it is interesting to note that there are two types of populations of *A. elongata* in Gotland, one of these is similar to the old types, the other one is similar to the neotype. However, there are transitions between them, and so there is no reason for distinguishing them as separate species. The populations similar to the neotype are encountered above all in the northwestern part of the Hemse Marl and at Rangsarve 1. The populations similar to the lost types are met with mainly in the southeastern part of the

Fig. 15. *Angochitina crassispina* Eisenack, 1964. Gogs 1, Hemse Marl, uppermost part (G 71—40). LO 4636t. A. Specimen in lateral view. ×600. B. Specimen in lateral view. ×600. C. Detail of B. ×2400. D. Detail of B. Note the small holes made by parasites. ×6000.

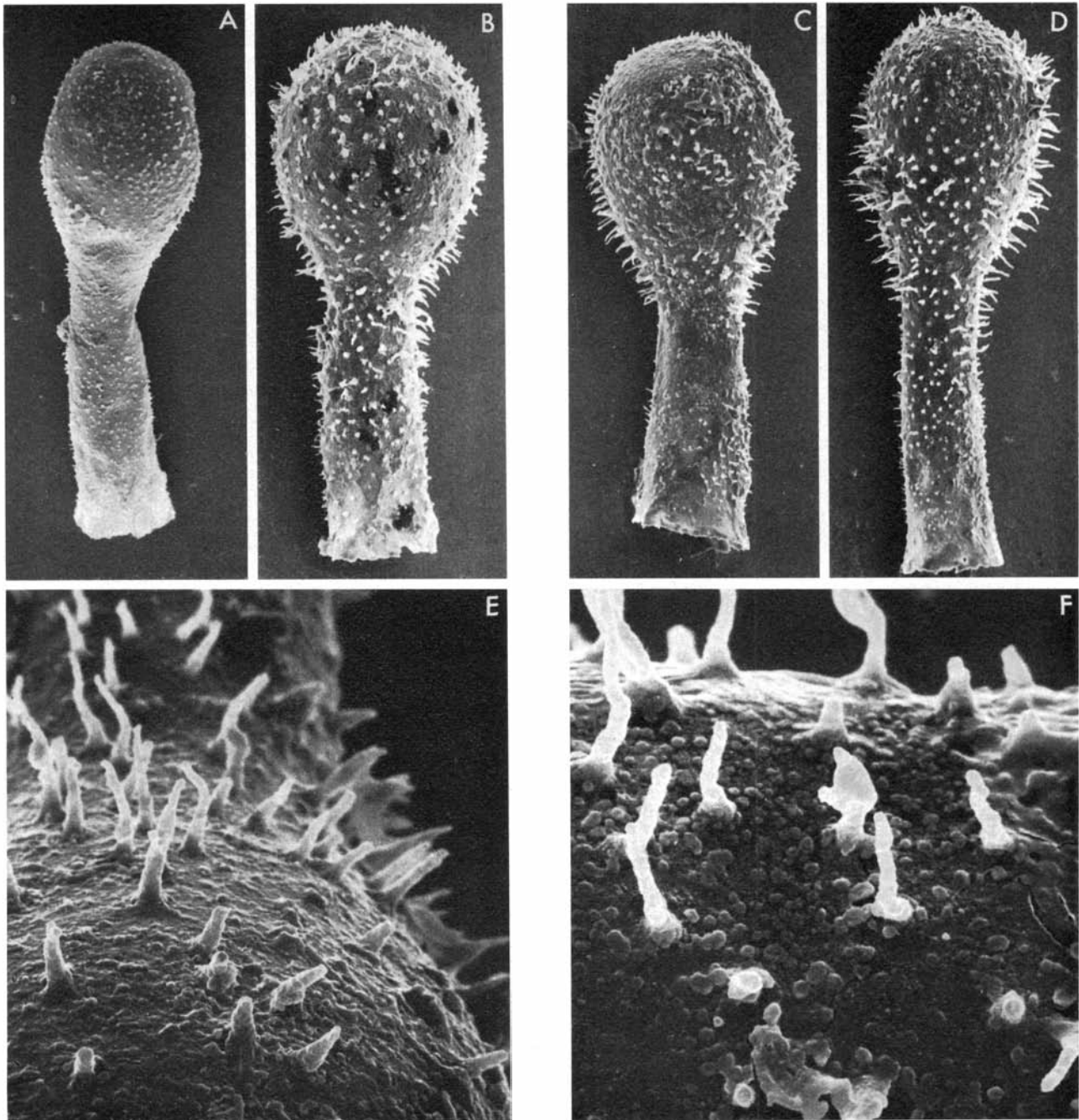


Fig. 16. *Angochitina echinata* Eisenack, 1931. Bodudd 1, Hemse Marl, top (G 72—140). LO 4649t. A. Specimen with short spines in lateral view. $\times 420$. B. Specimen in lateral view. $\times 530$. C. Specimen in lateral view. $\times 480$.

D. Specimen in lateral view. $\times 450$. E. Specimen in oblique aboral view showing spinose ornamentation aboral of the flexure. $\times 2400$. F. Same specimen as in D. Spinose ornamentation on the aboral part of the body. $\times 4500$.

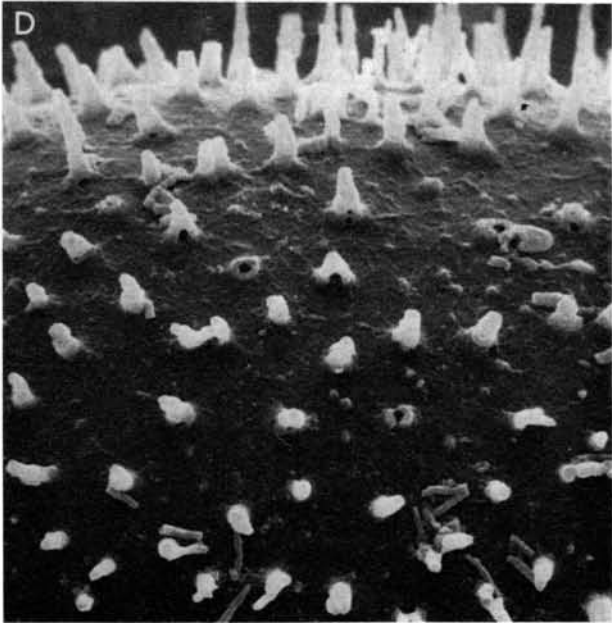
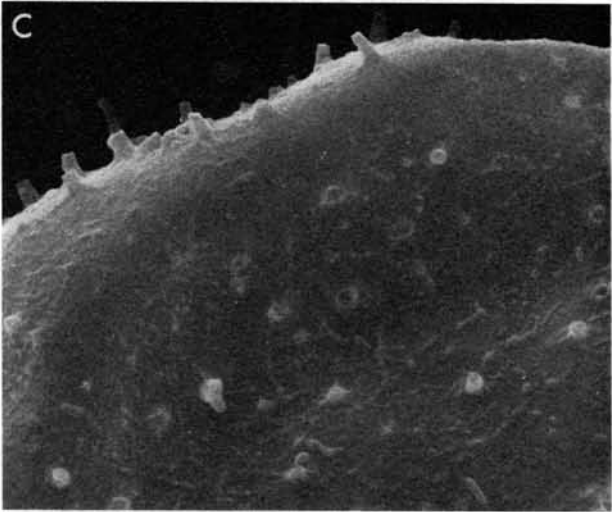
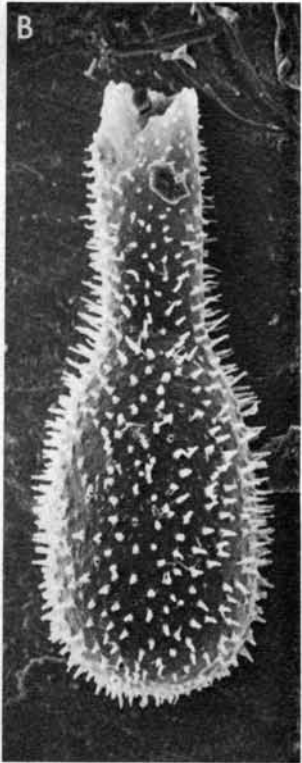
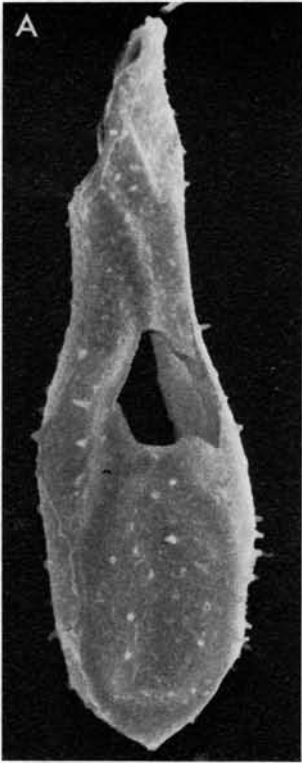
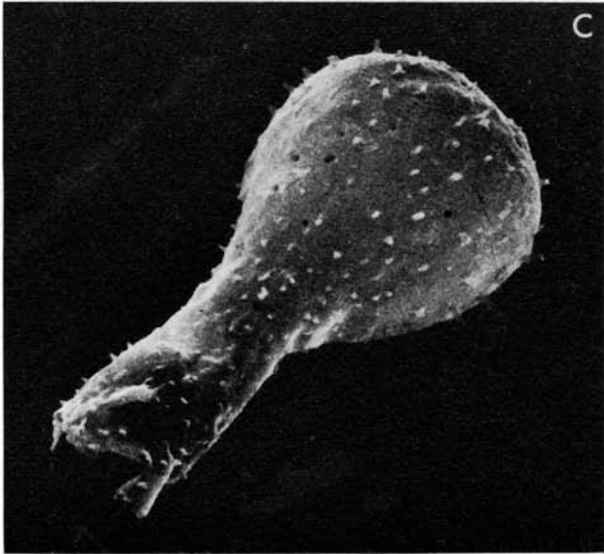
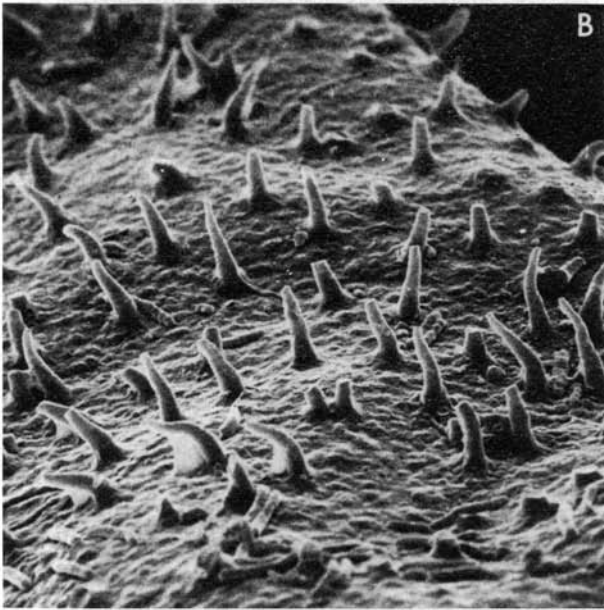
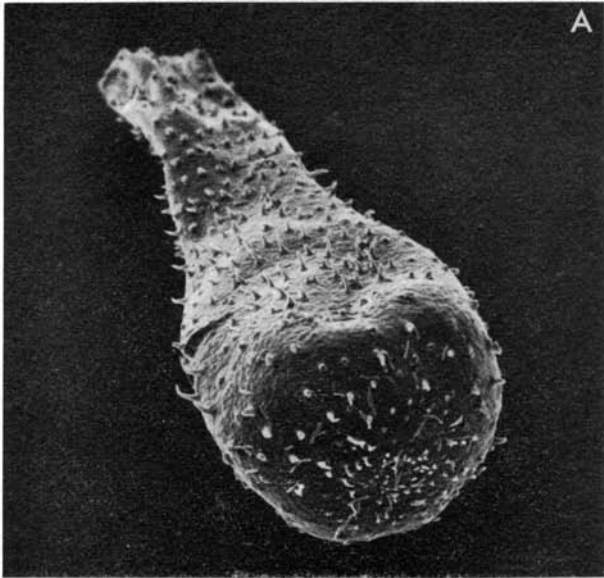
Hemse Marl and in the Eke Beds of the Lau Backar area. Both types are figured below.

Commonly the spines of *A. elongata* are hollow. Several spines have a central cavity which is filled with a spongy material that makes them look massive. The latter spines have hollow, coalescent bases. There is no pore (lumen) through the vesicle wall under the spines.

The dimensions reported by Eisenack (1964a: 319) are characteristic for all populations encountered in Gotland.

Fig. 17. *Angochitina* cf. *echinata* Eisenack, 1931. A. Specimen from Digrans 1, Hamra Beds (G 71—11). LO 4620t. $\times 600$. B. Detail of A. $\times 2400$. C. Specimen from Hoburgen 1, Hamra Beds (G 71—39). LO 4622t. $\times 500$.

Fig. 18. *Angochitina elongata* Eisenack, 1931. A. Specimen in lateral view. Note the elongated body. Eke 3, Hemse Marl, uppermost part (G 71—38). LO 4642t. $\times 500$. B. Specimen in lateral view. Note the short but very densely spaced spines. Rangsarve 1, Hemse Beds, upper part (G 66—54). LO 4671t. $\times 600$. C. Detail of A. $\times 1500$. D. Detail of B. $\times 2400$. A and B are representatives of the two types of populations discussed in the text.



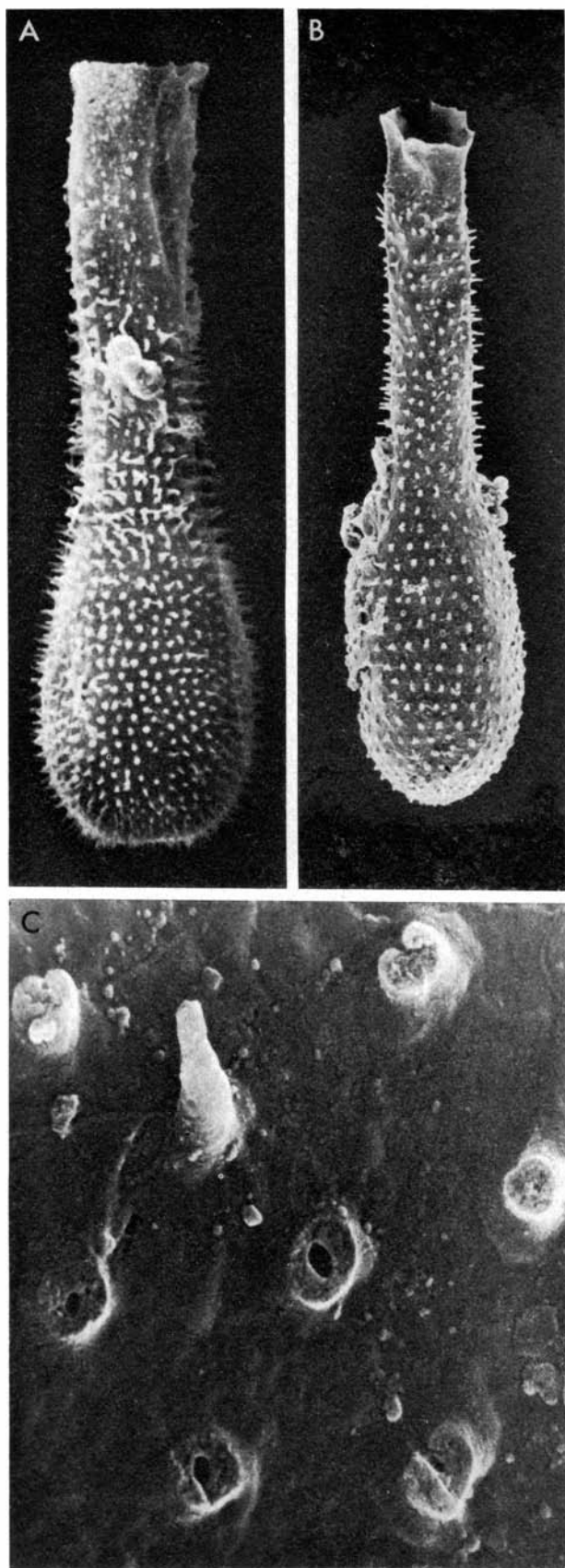


Fig. 19. *Angochitina longicollis* Eisenack, 1959. A. Specimen in lateral view. Gustavsvik 2, Lower Visby Beds (G 66—72). LO 4672t. $\times 375$. B. Specimen in lateral view. Ireviken 3, Lower Visby Beds (G 66—357). LO 4674t. $\times 385$. C. Spines in the middle part of vesicle. Note that some spines are hollow and some not closed but with a spongy interior. Buske 1, Upper Visby Beds (G 66—378). LO 4677t. $\times 6000$.

Occurrence.—*A. elongata* makes its debut in the uppermost part of the Klinteberg Marl and ranges through the Hemse Beds and up into the *Rhizophyllum* Limestone of the Eke Beds. Kaljo (1970: 179) reported the occurrence of *A. elongata* in the Middle and Upper part of the Paadla Stage in Estonia.

Angochitina longicollis Eisenack, 1959
nom. correct.

Fig. 19.

Synonymy □ *Angochitina longicolla* n. sp.—Eisenack 1959a: 13, Pl. 2: 8—9. □ *Angochitina longicolla* Eisenack, 1959—Eisenack 1964a: 319, Pl. 30: 1. □ *Angochitina longicolla* Eisenack—Taugourdeau & Jekhowsky 1964: 857, Pl. 1: 2—7. □ *Lagenochitina longicolla* (Eis.)—Taugourdeau 1966a: 41. □ *Lagenochitina* sp.—Taugourdeau 1966a, Pl. 2: 39. □ *Angochitina* cf. *capillata* (Eis.)—Taugourdeau 1966a, Pl. 2: 40. □ *Angochitina* cf. *longicolla* (Eis.)—Taugourdeau 1966a: Pl 2: 42. □ *Angochitina longicolla* Eisenack, 1959—Eisenack 1968a: 177, Pl. 28: 36. □ *Angochitina longicolla* Eis. 1959—Laufeld 1971: 295.

Remarks.—In the oralmost part of the neck the spinose ornamentation decreases in size almost abruptly, but verrucae occur out to the aperture, which is finely fringed. At least the basal part of the spines is hollow and those which seem to be massive have a central cavity filled with a spongy substance. Several spines have a coalescent base and some spines are of the branching type. The spongy substance was probably formed in connection with the coalescence of spines.

Dimensions.—Eisenack's measurements are representative for most populations, even though specimens with a length of 305 microns were recorded.

Occurrence.—*A. longicollis* makes its debut in the submarine Llandoveryan strata above the reddish brown beds in the Rosendal core. (The reddish brown strata reaches up to -155.5 m.) The populations between -135.5 and -155 m have short spines and are also uncharacteristic in having widely scattered spines. *A. longicollis* was encountered in all samples from the Lower Visby Beds, and it is common in the lowermost 2—3 m of the Upper Visby Beds. It then decreases in abundance abruptly and disappears some few metres below the boundary between the Upper Visby and Höglint Beds. In Dalarna, central Sweden, *A. longicollis* first appears somewhere in the Middle Llandovery, though later than in the lower part of the *M. gregarius* zone. In Scania the species has never been met with in rocks younger than those of *spiralis* age (Laufeld 1971: 295). Kaljo's (1970: 178) report on the occurrence of *A. longicollis* in the Ohesaare boring is most interesting. The species was recorded in the Adavere beds (interval 345.8—370 m of Late

Llandoveryan age) and in the lowermost, Early Wenlockian, 7—8 metres of the Jaani beds.

A. longicollis has been reported in several other publications, but because of the lack of illustrations, or unconvincing figures, these occurrences are left aside here. The species is most useful in correlation, and there are good reasons for ignoring some reports on its occurrence in latest Silurian rocks.

Genus *Clathrochitina* Eisenack, 1959

Emended diagnosis.—Chitinozoans with cylindro-conical vesicle and broadly rounded flexure but without shoulder. The neck, which comprises half of the vesicle length or more, is widened at the aperture, which is fringed. The base is concave or convex and the bluntly rounded basal edge is provided with appendices which are covered by a cingulum, which is composed of the thin outer layer of the vesicle wall. The vesicle is covered by a spinose ornamentation.

Remarks.—The genus has no relationship with *Cyathochitina* as suggested by Cramer (1967b). Eisenack's opinion (1968a: 174) that *Clathrochitina* is related with *Ancyrochitina* is corroborated by this study. The thin cingulum is fragmented easily and a fenestrate web is left, as seen in Eisenack's figures (1959a, Fig. 4, Pl. 1: 3). The cingulum in *Clathrochitina* is a remarkable structure. Most probably it is the remaining part of the tissue that once formed the chitinozoan vesicle. There is still some doubt whether it is appropriate to use the cingulum as a generic character in this connection. I have done so since the populations of the taxon are restricted stratigraphically but occur all along the strike of these beds from the west coast to the east coast of Gotland. A special study of the histology has started.

Species in Gotland.—*Clathrochitina clathrata* Eisenack, 1959.

Clathrochitina clathrata Eisenack, 1959

Fig. 20.

Synonymy □ *Clathrochitina clathrata* n. sp.—Eisenack 1959a: 15, Fig. 4, Pl. 1: 3.

Emended diagnosis.—*Clathrochitina* species with 8—12 appendices covered by the cingulum. The neck is covered by well-developed spines which decrease in size towards the aperture.

Dimensions.—Population from Oivide 1 in microns: length (incl.) 115—165, width (incl.) 65—95.

Remarks.—Unfortunately, specimens of the species tend to collapse when put under vacuum and when

bombarded by electrons in the SEM. Hence, it is difficult to obtain pictures showing the over-all shape of the vesicle. However, the fragmentation makes it easier to study the construction of the vesicle wall. The outer wall-layer of the base and aboral part of the body starts forming the cingulum just oral and aboral of the bases of the spines. In this zone the attachment of the cingulum is easily cracked, as seen in the figures. The cingulum covers the appendices completely in undamaged specimens.

Occurrence.—*C. clathrata* is stratigraphically restricted to parts of the Slite Beds, viz. units e, f, g, and the *Pentamerus gotlandicus*—*Atrypa reticularis* Beds. The type locality was not established more precisely, but it seems probable that the type locality is located in the *Pentamerus gotlandicus* Beds in the east-south-eastern part of the Slite Marl.

Genus *Conochitina* Eisenack, 1931

Type species.—*Conochitina claviformis* Eisenack, 1931.

Remarks.—*Conochitina* was erected by Eisenack in 1931. The genus was restricted by the same author in 1955 and 1965. In 1966 Taugourdeau divided the genus into the three genera *Conochitina*, *Euconochitina* and *Bursachitina*. In 1968 Eisenack (1968a: 158) remarked that the variation within some species belonging to *Conochitina* s.l. is so great that different specimens could be referred to more than one of Taugourdeau's three genera. Thus, Eisenack concluded (1968a: 158), it is impossible to treat Taugourdeau's three taxa as genera and, instead, ranked them as subgenera. Eisenack (1968a: 158) also changed the diagnoses. In 1970 Jansonius pointed out that *Bursachitina* is a junior synonym of the genus *Eisenackitina* Jansonius, 1964. In 1972 Eisenack emended the diagnosis of *Bursachitina* and raised it to generic rank again (1972a: 72), but later in 1972 Eisenack recognized Jansonius' opinion and transferred the *Bursachitina* species to the genus *Eisenackitina*. For the sake of brevity other authors' nomenclatural changes of and within the taxa concerned during this time interval have been omitted.

In this paper the genus *Eisenackitina* as defined by Jansonius (1964: 912) will be used. The remaining *Conochitina* (s.l.) species will be referred to as *Conochitina*.

Species in Gotland.—*Conochitina acuminata* Eisenack, 1959; *C. argillophila* n. sp.; *C. aff. elegans*; *C. flamma* n. sp.; *C. granosa* n. sp.; *C. gutta* n. sp.; *C. intermedia* Eisenack, 1955; *C. latifrons* Eisenack, 1964; *C. lauenensis* n. sp.; *C. leptosoma* n. sp.; *C. mamilla* n. sp.; *C. pachycephala* Eisenack, 1964; *C. proboscifera* Eisenack, 1937; *C. aff. proboscifera*; *C. tuba* Eisenack, 1932; *C. visbyensis* n. sp.

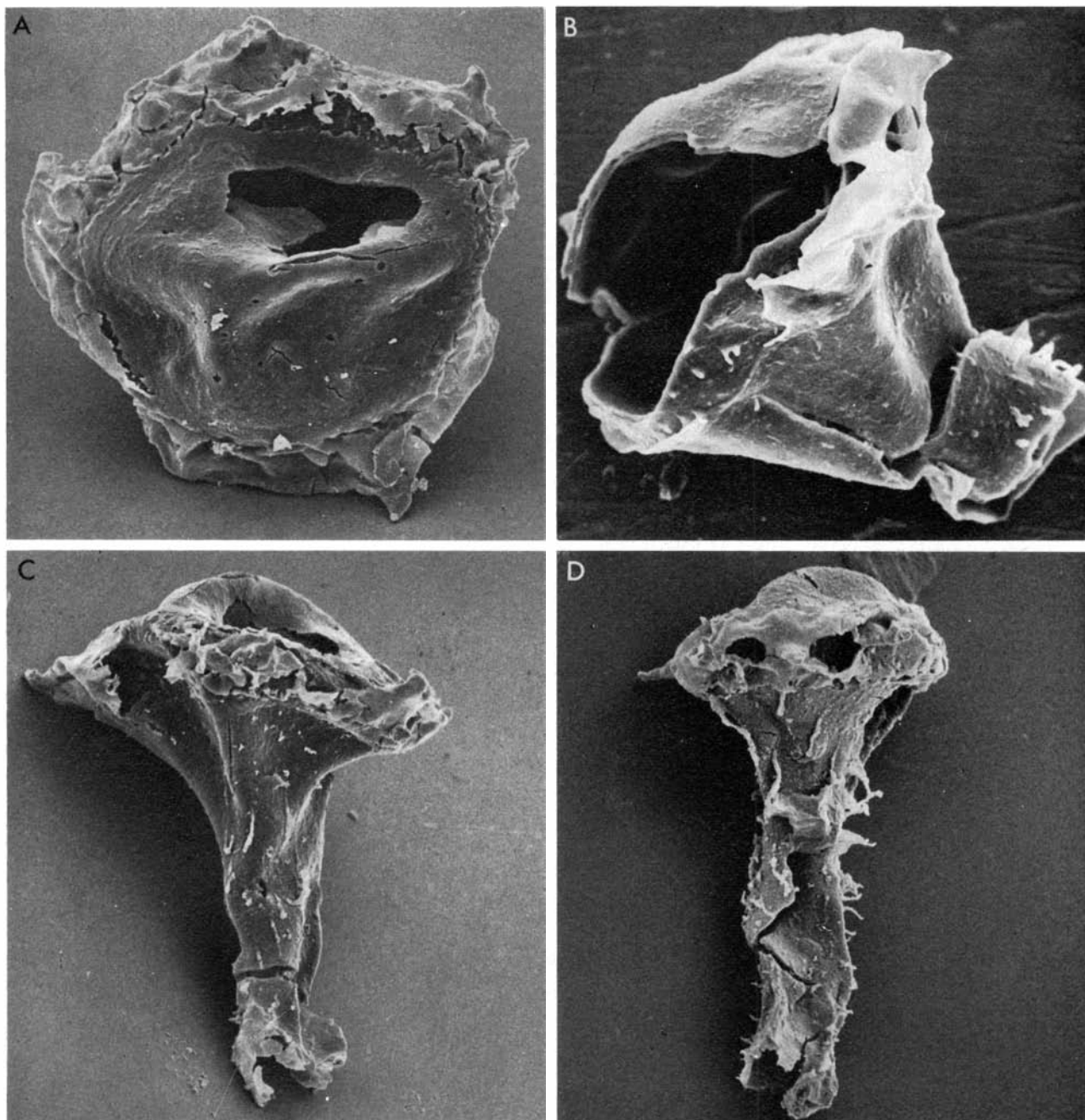


Fig. 20. *Clathrochitina clathrata* Eisenack, 1959. A. Specimen in aboral view. Sinnarve 1, Slite Marl, *Conchidium tenuistriatum* Beds (G 66—83). LO 4592t. $\times 1000$. B. Specimen in oblique lateral view. Oivide 1, Slite Beds, *Conchidium*

tenuistriatum Beds (G 66—79). LO 4588t. $\times 960$. C. Distorted specimen in lateral view. Same data as A. $\times 1000$. D. Specimen in lateral view. Note the spinose ornamentation. Same data as A. $\times 600$.

Conochitina acuminata Eisenack, 1959

Fig. 21.

Synonymy □ *Conochitina acuminata* n. sp.—Eisenack 1959a: 6, Pl. 3: 10—11. □ *Conochitina acuminata* Eisenack—Taugourdeau & Jekhowsky 1964: 857, Pl. 1: 9. □ *Conochitina acuminata* Eis.—Taugourdeau 1966a: 35, Pl. 1: 19, 22, Pl. 2: 49. □ *Conochitina acuminata* Eisenack, 1959—Eisenack 1968a: 159, Pl. 25: 12—15, non figs. 10—11.

Remarks.—There is very little to add to Eisenack's original description. The oralmost part of the neck is always widened at the aperture. The vesicle wall is composed by very thin lamellae, and when slightly corroded the surface looks like it was covered by roofing tiles.

Dimensions.—The measurements recorded by Eisenack (1959a: 6) are representative for those populations of *C. acuminata* that occur in the sequence of strata above sea level.

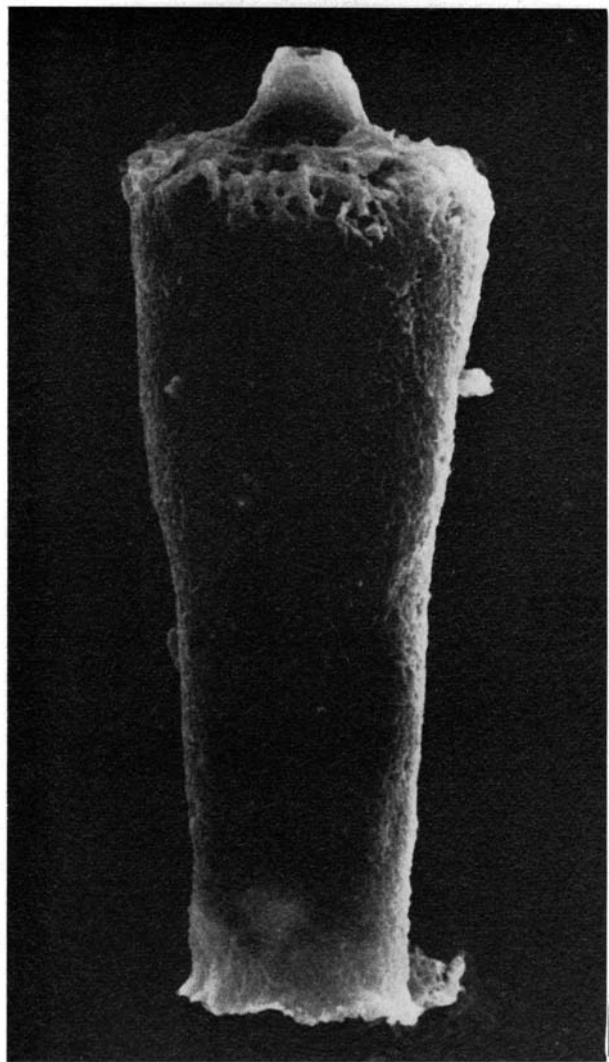


Fig. 21. *Conochitina acuminata* Eisenack, 1959. Specimen in lateral view. The filthy substance at the basal edge is due to contamination. Gustavsvik 2, Lower Visby Beds (G 66—72). LO 4673t. $\times 600$.

Occurrence.—Typical populations of *C. acuminata* occur only in the Lower Visby Beds and below, although the species occurs also in the Upper Visby Beds. The long specimens which occur in the Högklint Beds and earlier referred to *C. acuminata* (e.g. Eisenack 1968a, Pl. 25: 10—11) are herein distinguished as a separate, new species, *C. flamma*.

Conochitina argillophila n. sp.

Fig. 22.

Derivation of name.—Greek *αργίλλος*, clay, marl, and Latinized Greek *philus*, companion of, referring to the muddy environment in which the species dwelled.

Holotype.—LO 4595 T.

Type stratum.—Slite Marl, *Pentamerus gotlandicus* Beds or slightly younger (Sample G 71—79).

Type locality.—Munkebos 1, Gotland.

Diagnosis.—Short and wide *Conochitina* species with convex base and bluntly rounded basal edge and straight flanks that are somewhat constricted just oralward of the basal edge and slightly widened at the aperture which is straight and smooth. There is a basal callus and a basal scar. The vesicle wall is smooth.

Dimensions.—Population from Munkebos 1 in microns: length 140—170 (holotype 160), width at the basal edge 60—80 (holotype 65), width of the narrowest part of the vesicle 40—55 (holotype 42), width of the aperture 42—58 (holotype 46).

Description.—Some populations (e.g. at Maigu 2) are composed of shorter but wider specimens with more rapidly narrowing flanks. The central part of the base protrudes slightly in most specimens.

Occurrence.—*C. argillophila* is restricted to the upper part of the Slite Beds, appearing in the *Conchidium tenuistriatum* Beds and disappearing in the Slite Siltstone.

Conochitina aff. *elegans* Eisenack, 1931

Synonymy □ *Conochitina elegans* Eisenack 1931—Beju & Danet 1962: 531, Pl. 1: 31—32. □ *Conochitina* cf. *elegans*—Eisenack 1964: 315—316, Pl. 26: 7—10, Fig. 9. □ *Conochitina* cf. *elegans*—Eisenack 1968, Pl. 25: 9.

Remarks.—This Silurian species is not conspecific with the Ordovician species *Conochitina elegans* Eisenack, 1931. In agreement with earlier authors, it is left under open nomenclature since its erection to nomenclatural status should be made in connection with a detailed reinvestigation of the Ordovician species. The exterior morphology of the two species is generalized and the few useful characters vary to such an extent that the two taxa cannot be kept separate solely on that basis. However, the disjunct stratigraphical occurrence makes it clear that two separate taxa are involved. A study of the internal structures, e.g. the prosome, is needed before a distinction between them can be made. The populations of *C. aff. elegans* encountered during the course of this study are similar to those described and figured by Eisenack (1964a: 315—316, Fig. 9, Pl. 26: 7—10). It should be added that the vesicle wall is perfectly smooth.

Occurrence.—*C. aff. elegans* was encountered in the Slite Beds, where its first appearance is in the *Conchidium tenuistriatum* Beds, and in the Halla, Mulde,

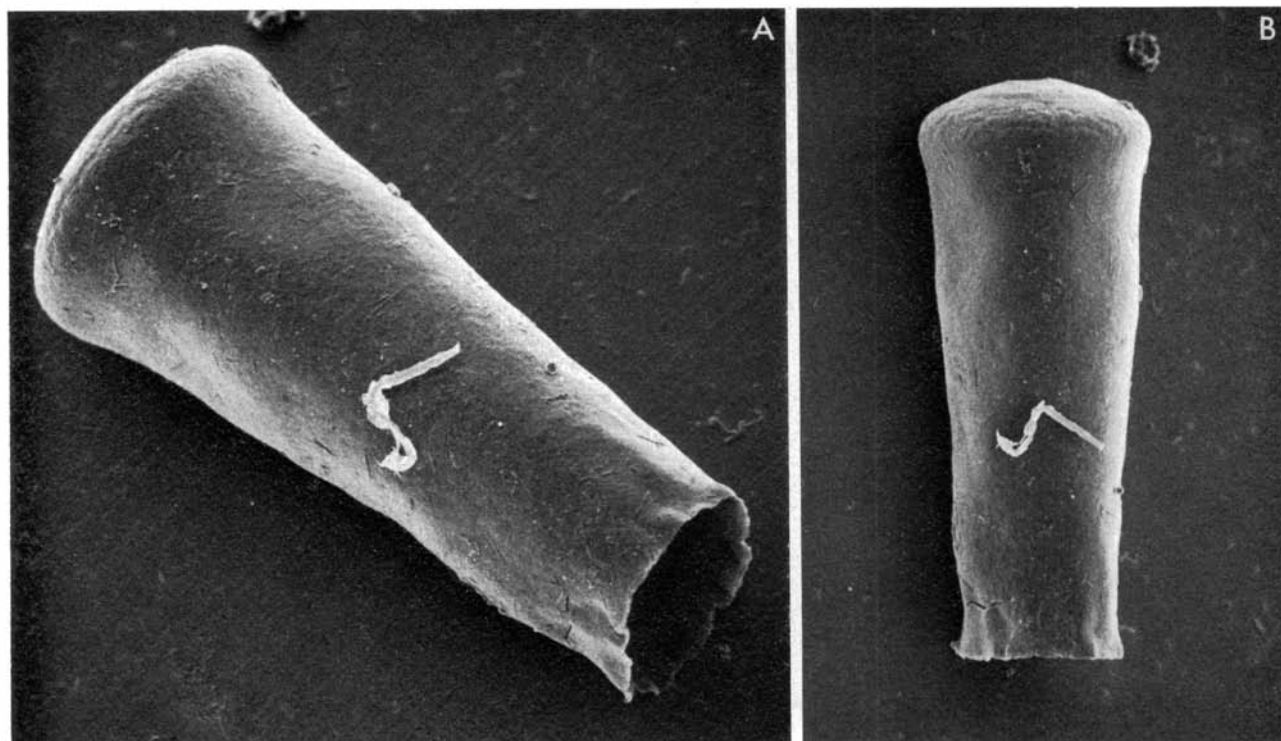


Fig. 22. *Conochitina argillophila* n. sp. Munkebos 1, Slite Marl, *Pentamerus gotlandicus* Beds or slightly younger (G

71—79). LO 4595T. A. Holotype in oblique lateral view. $\times 690$. B. Holotype in lateral view. $\times 480$.

Klinteberg and Hemse Beds. The species disappears in middle Hemse time. Its latest occurrence is in the northwestern part of the Hemse Marl and in unit c.

Beju & Danet (1962: 531) reported specimens belonging to this taxon from undefined Silurian in boreholes in the Moldoveneasca Basin of Roumania. Eisenack (1964a: 334) reported the species from the Slite and Mulde Beds of Gotland. He referred some few specimens from the northwestern part of the Hemse Marl to this taxon, and further, some specimens from the Visby Beds. The latter occurrence was not corroborated by this study. Eisenack (1964a: 334) also established its occurrence in the Wenlockian ("Middle Nodular Beds") of Dudley, Great Britain. Lister (1970: 22) mentioned *C. cf. elegans* when enumerating acritarch and chitinozoan taxa from the Wenlock Limestone of Shropshire. I have studied material from Lister's locality, Pitch Coppice in the Ludlow district, and can only confirm that it is the same species as that in Gotland.

Conochitina flamma n. sp.

Fig. 23.

Synonymy □ *Conochitina acuminata* Eisenack 1959—Eisenack 1964a, Pl. 26: 3. □ *Conochitina acuminata* Eisenack, 1959—Eisenack 1968a, Pl. 25: 10—11.

Derivation of name.—Latin *flamma*, torch, flame, referring to the over-all shape of the vesicle when the aboral part is oriented upwards.

Holotype.—LO 4630 T.

Type stratum.—Höglint Beds, unit a (Sample G 66—367).

Type locality.—Lickershamn 2, Gotland.

Diagnosis.—*Conochitina* species with subcylindrical to elongatedly conical vesicle with bluntly rounded basal edge which is provided with a very small but sharp edge. Aborally of this the protruding base narrows towards a subconical basal process. The flanks of the vesicle are slightly constricted oralward of the basal edge and the aperture is straight and smooth.

Dimensions.—Population from the type stratum in microns: length 215—260 (holotype 241), width at the basal edge 41—53 (holotype 52), width at the narrowest part immediately oral of the basal edge 39—49 (holotype 46), width of aperture 31—46 (holotype 37), distance from basal edge to tip of the basal process 15—29 (holotype 25).—The vesicle is slightly widened at the aperture. The vesicle wall is finely granulate. The slight constriction of the vesicle just oralward of the basal edge is a characteristic feature in *C. flamma*. Further, it is distinguished from

its predecessor *C. acuminata* by its sharp edge along the basal edge. It is more slender than *C. acuminata*.

Occurrence.—*C. flamma* is a species characteristic of the Höglint Beds to which it is restricted. So far it has only been encountered in unit a and in the marly, southwestern facies. Eisenack (1964a, Pl. 26: 3; 1968, Pl. 25: 10—11) earlier figured some specimens of the species, classified as *C. acuminata*, from the Höglint Beds at Höglint.

Conochitina granosa n. sp.

Fig. 24.

Derivation of name.—Latin *granosus*, granular, granulous, referring to the ornamentation of the vesicle wall.

Holotype.—LO 4619 T.

Type stratum.—Hamra Beds, lower part (Sample G 71—11).

Type locality.—Digrans 1, Gotland.

Diagnosis.—*Conochitina* species with subconical vesicle which is widened in the oral part and with its widest part between the middle of the vesicle and the base. Aboralward of the maximum width, the body narrows towards the broadly rounded basal edge. The base is convex and provided with basal callus and scar. The vesicle wall is covered by granules or very short spines which decrease in size in the oral half of the vesicle and at the basal edge.

Dimensions.—Population from the type stratum in microns: length 95—120 (holotype 100), greatest width 48—55 (holotype 51), smallest width 30—38 (holotype 33), width of aperture 33—42 (holotype 37), width of granules about 1, height of granules about 1.5.

Description.—The granules decrease in size in the aboralmost part of the body, and at the basal edge the ornamentation is verrucate. Several of the granules are connected by low ridges in the vesicle wall. The base is not provided with ornamentation. The base shows a concentric growth pattern. The basal callus

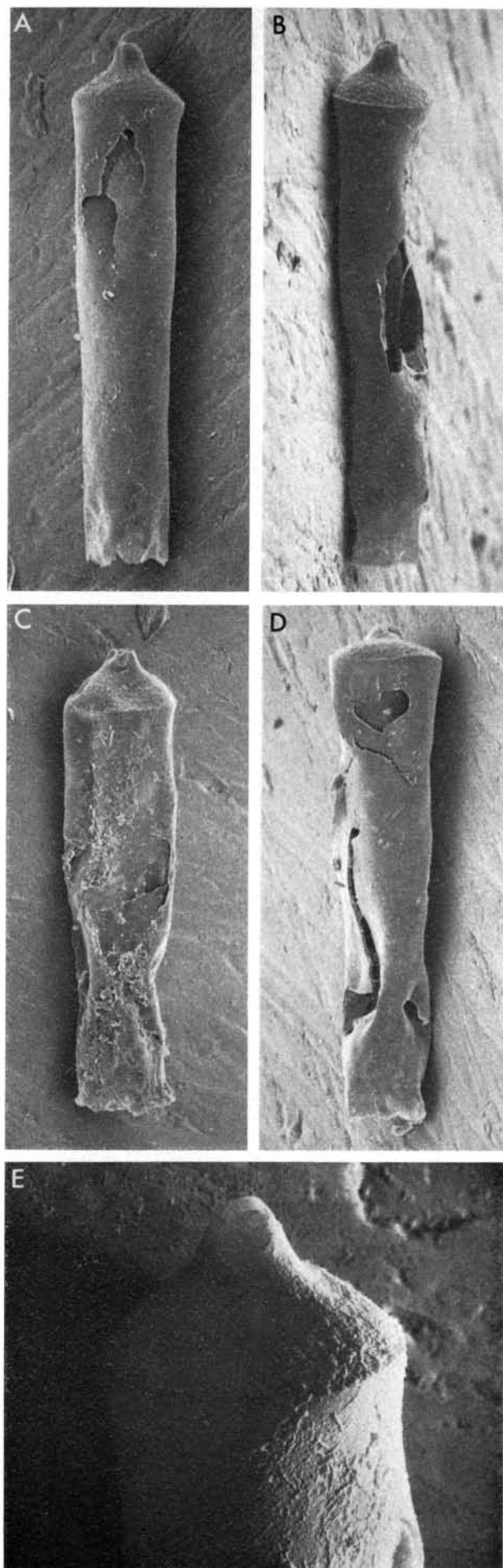
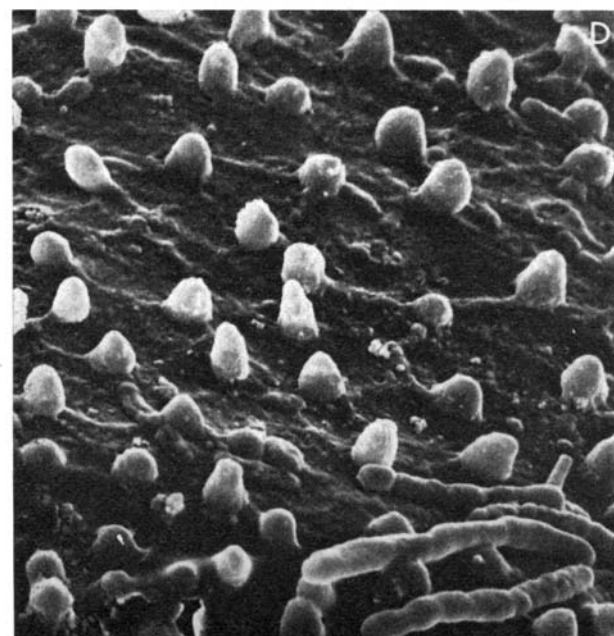
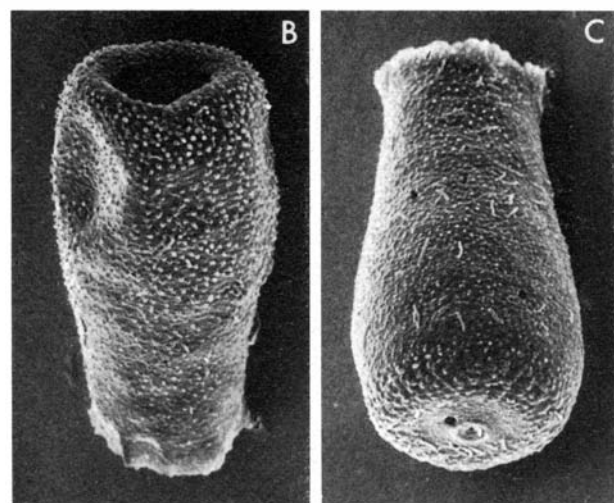
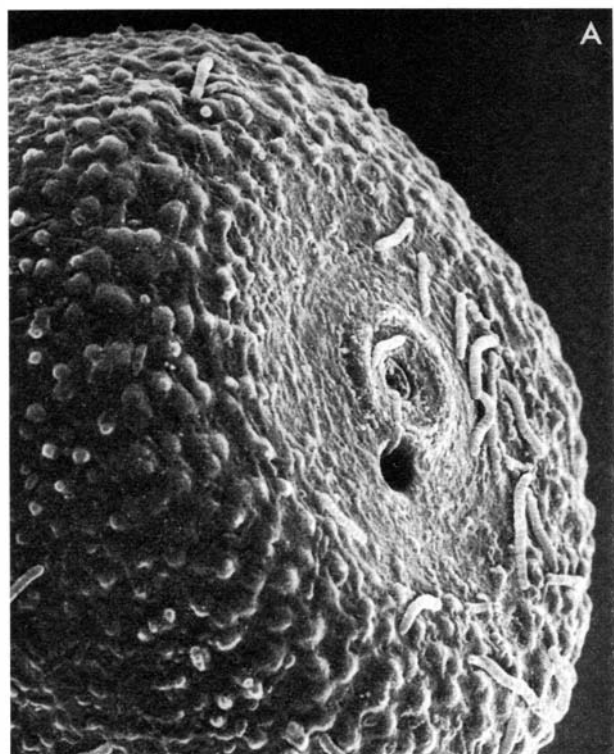


Fig. 23. *Conochitina flamma* n. sp. Lickershamn 2, Höglint Beds, unit a (G 66—367). A. Holotype in lateral view. LO 4630T. $\times 350$. B. Specimen in lateral view. Note the sharp basal edge. $\times 360$. LO 4630t. C. Somewhat distorted specimen in lateral view. $\times 350$. LO 4630t. D. Slightly fragmented specimen in lateral view. $\times 350$. LO 4630t. E. Oblique aboral view of specimen showing basal process. LO 4630t. $\times 1200$. Secondary electron emission.



protrudes conspicuously from the base. The species is easily distinguished from *C. intermedia* and similar species by the location of the widest part of vesicle, about a third of the vesicle length oralward of the basal edge. Further, the flanks are curved markedly in *C. granosa*, whereas the flanks of *C. intermedia* are almost straight.

Occurrence.—*C. granosa* was encountered in only a few samples. Its stratigraphical range is restricted to the lower part of the Eke Beds and unit a of the Hamra Beds. It is common in the type stratum.

Conochitina gutta n. sp.

Fig. 25.

Derivation of name.—Latin *gutta*, drop, droplet, referring to the over-all shape of the vesicle when the aboral pole is oriented downwards.

Holotype.—LO 4594 T.

Type stratum.—Slite Marl, *Pentamerus gotlandicus* Beds or slightly younger (Sample G 71—79).

Type locality.—Munkebos 1, Gotland.

Diagnosis.—*Conochitina* species with cylindro-conical vesicle with broadly rounded flexure. The shoulder is broadly rounded or lacking. The basal edge is broadly rounded and inconspicuous. The base is highly convex and protrudes with concave flanks towards the basal callus, inside of which there is a basal scar. The vesicle wall is provided with rugose ornamentation.

Dimensions.—Population from the type stratum in microns: length 175—210 (holotype 197), greatest width 75—95 (holotype 88), width of aperture 44—53 (holotype 46).

Description.—The shape of base and ornamentation are the most characteristic features in this species. In lateral view the base is similar to a short and blunt cone. The flanks of the cone, however, are concave in most specimens. The basal scar is deep and wide but there is no connection with the interior of the vesicle since the scar is closed by a thick membrane or the inner layer of the vesicle wall. The ornamentation

Fig. 24. *Conochitina granosa* n. sp. Digrans 1, Hamra Beds, lower part (G 71—11). A. Oblique aboral view of base of the holotype. Note the perforations caused by parasites. The worm-like threads are recent microbes. LO 4619T. $\times 2400$. B. Oblique aboral view of specimen with invaginated and fragmented base. LO 4619t. $\times 600$. C. Oblique lateral view of the holotype. LO 4619T. $\times 600$. D. Detail of ornamentation of the specimen in A. $\times 6000$.

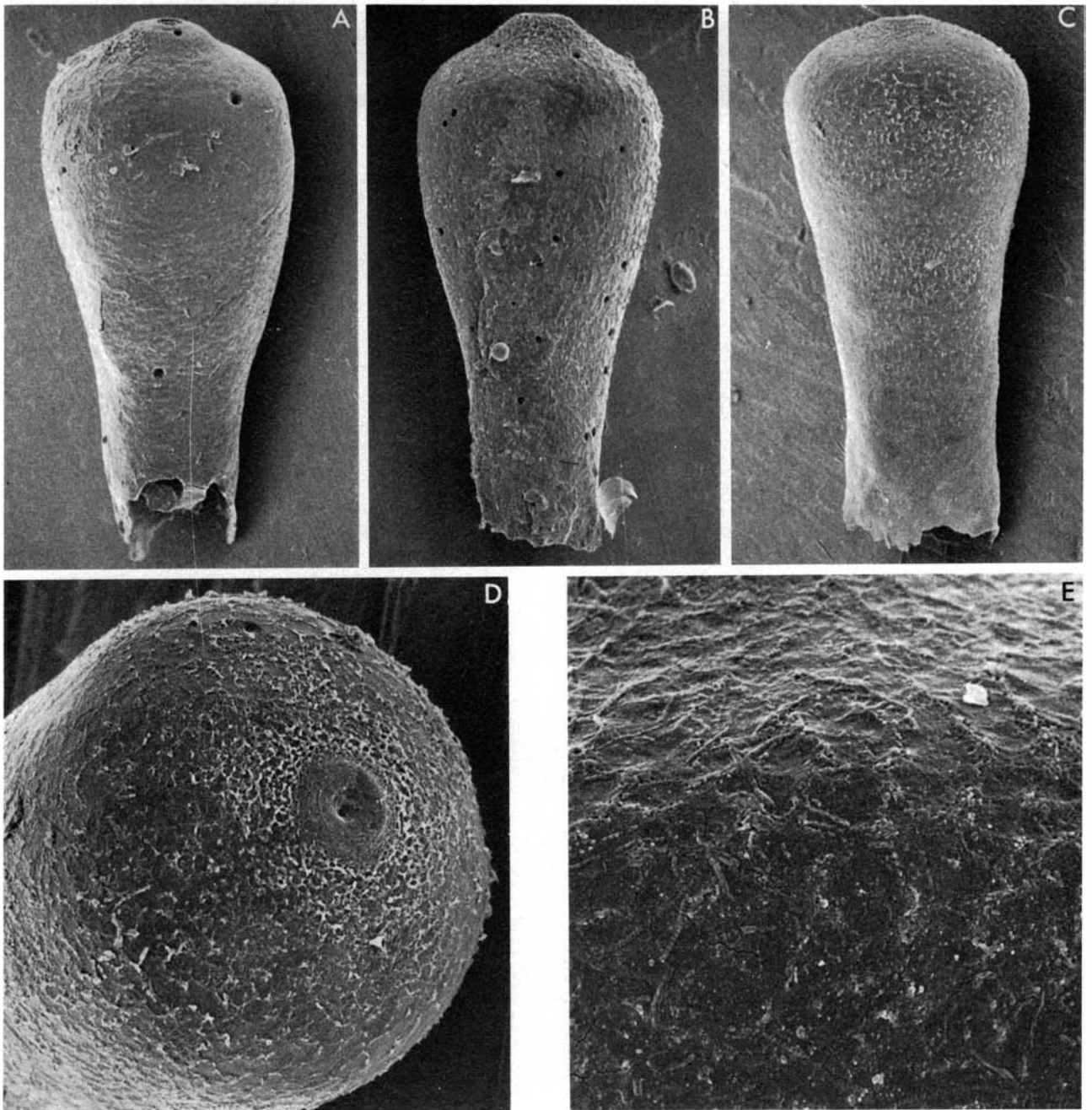


Fig. 25. *Conochitina gutta* n. sp. Munkebos 1, Slite Marl, *Pentamerus gotlandicus* Beds or slightly younger (G 71–79). A. Specimen in lateral view. Note the perforations caused by parasites. LO 4668t. $\times 455$. B. Holotype in lateral view. LO 4668T. $\times 430$. C. Specimen in lateral view. LO 4668t.

$\times 480$. D. Oblique aboral view of the base of the specimen in A. Note the polygonal pattern in the rugose ornamentation. $\times 1020$. E. Detail of vesicle wall at the basal edge. LO 4668t. $\times 2400$.

consists of thin rugae which are arranged in a polygonal pattern or show a diffuse pattern parallel with the longitudinal axis. The ornamentation is well-developed on the base and in the aboral part of the body and decreases in size towards the straight and smooth aperture. The vesicle wall of several specimens has been perforated by parasites.

Occurrence.—*C. gutta* occurs only in the Slite Beds, where it is restricted to the interval *Conchidium tenuistriatum* Beds—*Pentamerus gotlandicus* Beds. It

is lacking in unit g in between, but was encountered also in the northwestern part of the Slite Marl.

Conochitina intermedia Eisenack, 1955

Fig. 26.

Synonymy □ *Conochitina intermedia* n. sp.—Eisenack 1955a: 161–162, Pl. 3: 8. □ *Conochitina intermedia* Eisenack 1955—Eisenack 1964a: 317–318, Pl. 26: 14,

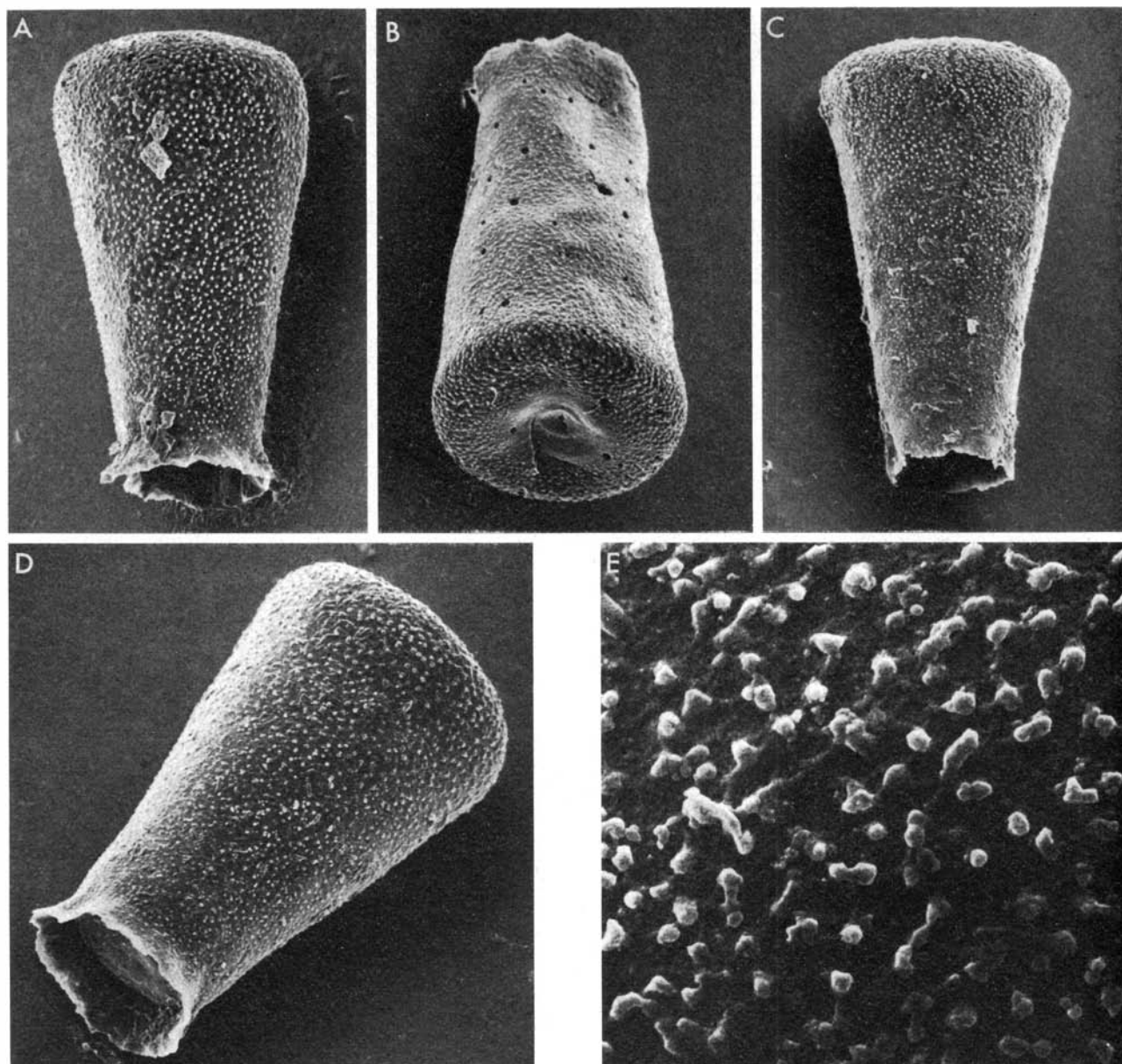


Fig. 26. *Conochitina intermedia* Eisenack, 1955. A. Specimen in oblique lateral view. Digrafs 1, Hamra Beds, lower part (G 71—11). LO 4678t. $\times 600$. B. Specimen in oblique aboral view. Note the perforations caused by parasites. Same data as A. $\times 480$. C. Specimen in oblique lateral view.

Same data as A. $\times 440$. D. Specimen in oblique lateral view. Note the operculum. Same data as A. E. Ornamentation in the aboral part of vesicle. Bankvåt 1, Hamra Beds, unit b (G 71—28). LO 4679t. $\times 3000$.

non fig. 15. \square *Conochitina intermedia* Eisenack, 1955—Eisenack 1968a: 161, Pl. 25: 26—27. \square *Conochitina intermedia* Eisenack 1955—Eisenack 1972b: 123, Pl. 34: 10—15.

Remarks.—The flanks are straight and the aperture widens abruptly in *C. intermedia*. The species has a characteristic ornamentation of small granules. They decrease in size towards the aperture. The ornamentation also covers the major part of the base leaving only the central part around the inconspicuous basal callus free. There is an inconspicuous basal scar. Well-preserved specimens have a flat or slightly concave base. However, in agreement with *C. granosa*, several

specimens have a highly concave, invaginated base where a hole marks the former position of the basal callus. *C. intermedia* is provided with a disc-like operculum located just at the smallest width of vesicle. The neck widens oralward of the operculum. The edge of the operculum hermetically seals the interior of the vesicle from outside. At a magnification of $10,000\times$ it can be established that the edge of the operculum follows the interior surface of the neck in its smallest details. The vesicle wall has a thickness of 3 microns in the middle part of the vesicle and 4 microns just oralward of the basal edge. The vesicle wall consists of a single layer. The height of the ornamentation is 0.5—1 micron.

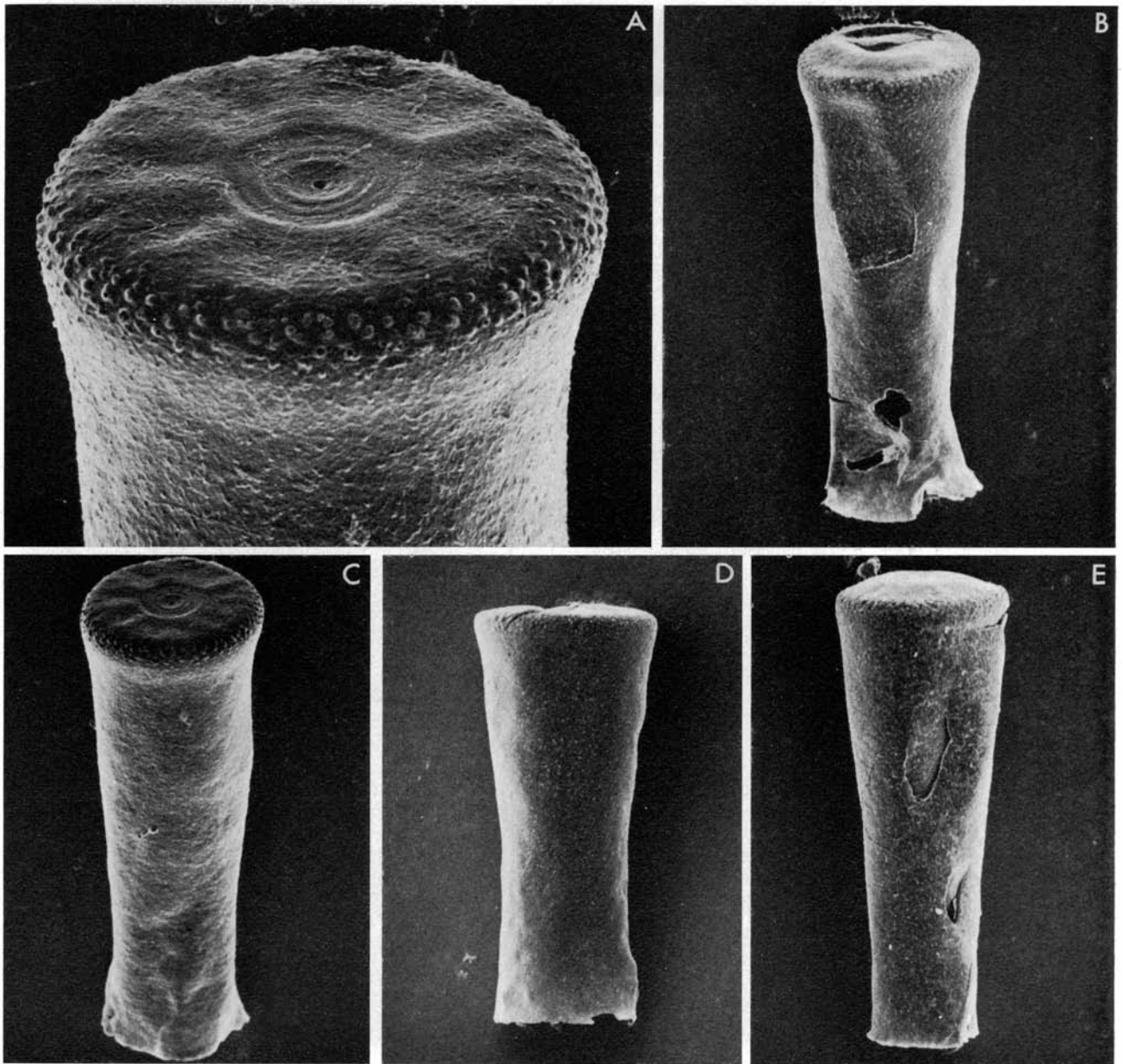


Fig. 27. *Conochitina latifrons* Eisenack, 1964. Grogarnshuvud 1, Hemse Beds, unit c (G 71—103). LO 4626t. A. Specimen in oblique aboral view. Note the concentric striation and the basal callus and scar. $\times 1200$. B. Specimen in oblique

lateral view. $\times 400$. C. Same specimen as A. $\times 385$. D. Specimen in lateral view. $\times 355$. E. Specimen in oblique lateral view. $\times 290$.

Occurrence.—*C. intermedia* ranges all through the Hamra Beds and was also encountered in the lower part of the Sundre Beds. Uncharacteristic specimens were met with in the upper part of the Burgsvik Beds. Eisenack (1964a: 332—333) reported the occurrence of *C. intermedia* in the Hemse and Hamra Beds. A specimen from the Hemse Beds figured by Eisenack (1964a, Pl. 26: 15) and classified as *C. cf. intermedia* is a specimen of *C. lauensis* n. sp. Hence, there is no reason for changing the diagnosis of *C. intermedia* to include forms with concave flanks (cf. Eisenack 1964a: 317). Eisenack (1955a: 161—162) erected *C. intermedia* on material from the *Beyrichia* Limestone. There are several reports of *C. intermedia* in the literature, but since no or inaccurate figures accom-

pany the reports they will not be dealt with here with the following exception.

Kaljo (1970: 179) reported the species from the middle and upper part of the Paadla Stage and the lower part of the Kuresaare Stage in Estonia. It seems most probable that more than one species is involved, possibly *C. lauensis*.

Conochitina latifrons Eisenack, 1964

Fig. 27.

Synonymy □ *Conochitina latifrons* n. sp.—Eisenack 1964a: 316, Pl. 26: 11—12. □ *Conochitina latifrons*

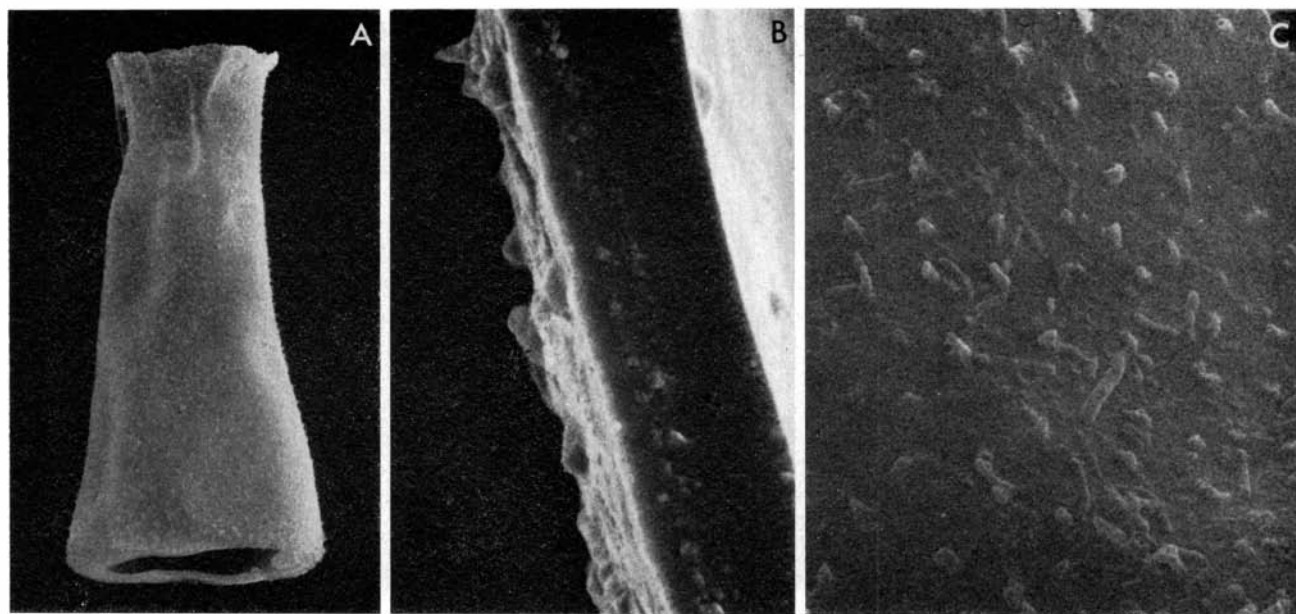


Fig. 28. *Conochitina lauensis* n. sp. Gogs 1, Hemse Marl, uppermost part (G 71—40). A. Holotype in oblique lateral view. Note the ornamentation over the entire vesicle. LO

4643T. $\times 500$. B. Vesicle wall in transverse section. LO 4643t. $\times 12,000$. C. Ornamentation of the holotype. $\times 3000$.

Eisenack, 1964—Eisenack 1968a: 161, Pl. 25: 21—25.
☐ *Conochitina latifrons* Eisenack 1964—Eisenack 1970: 305, Fig. 10.

Remarks.—*C. latifrons* is characterized by the constriction of the vesicle just oralward of the bluntly rounded basal edge. Another useful character is the ornamentation by which the species also is distinguished from *C. lauensis* and *C. intermedia*. The ornamentation consists of verrucae which are very small on the flanks and lacking in the oral part of the vesicle. The verrucae are well-developed only at the basal edge and are lacking on the base. There is a basal scar in the central part of a sunken area of the base. Only the central portion of the base shows concentric lines. The thickness of the vesicle wall is only about half of that in *C. intermedia*. The dimensions reported by Eisenack (1964a: 317) are representative for most populations.

Occurrence.—*C. latifrons* makes its debut at the very top of the Klinteberg Marl and then ranges through units a, b, and c of the Hemse Beds. It was also encountered in the northwestern part of the Hemse Marl. Sparse and untypical specimens were still met with in the southeastern part of the Hemse Marl, but its range can be summarized as latest Klinteberg time to middle Hemse time. *C. latifrons* shows a peak in abundance in its type stratum, unit c of the Hemse Beds. The species was reported from a sample of Paadla age from Udafer, Estonia, by Eisenack (1970: 305) and, in the same year, Kaljo (1970: 179) reported that *C. latifrons* is a species characteristic of the lower third of the Paadla Stage in Estonia. No figures accompanied Kaljo's report, but for stratigraphical reasons this report is included here.

Conochitina lauensis n. sp.

Fig. 28.

Synonymy ☐ *Conochitina* cf. *intermedia*—Eisenack 1964a, Pl. 26: 15.

Derivation of name.—Latin *Lauensis*, from the parish of Lau, referring to the type locality.

Holotype.—LO 4635 T.

Type stratum.—Hemse Marl, uppermost part (Sample G 71—40).

Type locality.—Gogs 1, Gotland.

Diagnosis.—*Conochitina* species with subconical to cylindro-conical vesicle with concave flanks and bluntly rounded basal edge. The flexure is broadly rounded and inconspicuous and a shoulder is lacking. The aperture is slightly widened and finely fringed. The entire vesicle is covered by granules or small spines, with the exception of the central part of the base.

Dimensions.—Population from the type stratum in microns: length 115—145 (holotype 134), greatest width 60—75 (holotype 69), width of aperture 40—55 (holotype 45).

Description.—The greatest width of vesicle is at the basal edge and the smallest width at the oral third of the vesicle. There is a basal scar in the centre of a sunken area showing concentric structure. The vesicle wall, which is composed of two layers, is 2 microns thick in the middle part of the vesicle. *C. lauensis* is

distinguished from *C. latifrons* by its concave flanks which show no constriction oralward of the basal edge. Furthermore, *C. lauensis* has a more well-developed ornamentation which covers the flanks of the vesicle. *C. intermedia* has straight flanks and a more well-developed ornamentation than *C. lauensis*. However, these three species are closely related and succeed each other stratigraphically. Hence, it is probable that they will prove most useful in correlations.

Occurrence.—*C. lauensis* ranges stratigraphically from unit c of the Hemse Beds to the lower-middle Eke Beds. It succeeds *C. latifrons* with an overlap in unit c of the Hemse Beds and is succeeded by *C. intermedia* without any overlap between their stratigraphical ranges.

Conochitina leptosoma n. sp.

Fig. 29.

Derivation of name.—Latinized Greek *leptos*, thin, slender, and *soma*, body, referring to the over-all shape of the vesicle.

Holotype.—LO 4634 T.

Type stratum.—Högklint Beds, southwestern facies, upper part (Sample G 66—141).

Type locality.—Ansarve 3, Gotland.

Diagnosis.—*Conochitina* species with extremely slender, subcylindrical vesicle and with a constriction of the flanks somewhat oral of the broadly rounded basal edge. The base is convex and provided with a short but wide basal process. The aperture is straight and smooth and the vesicle wall lacks ornamentation.

Dimensions.—Population from the type stratum in microns: length 575—950 (holotype 696), width 65—85 (holotype 71).

Description.—The vesicle tapers continuously from the basal edge to the aperture except for slightly oral of the basal edge where a slight but conspicuous con-

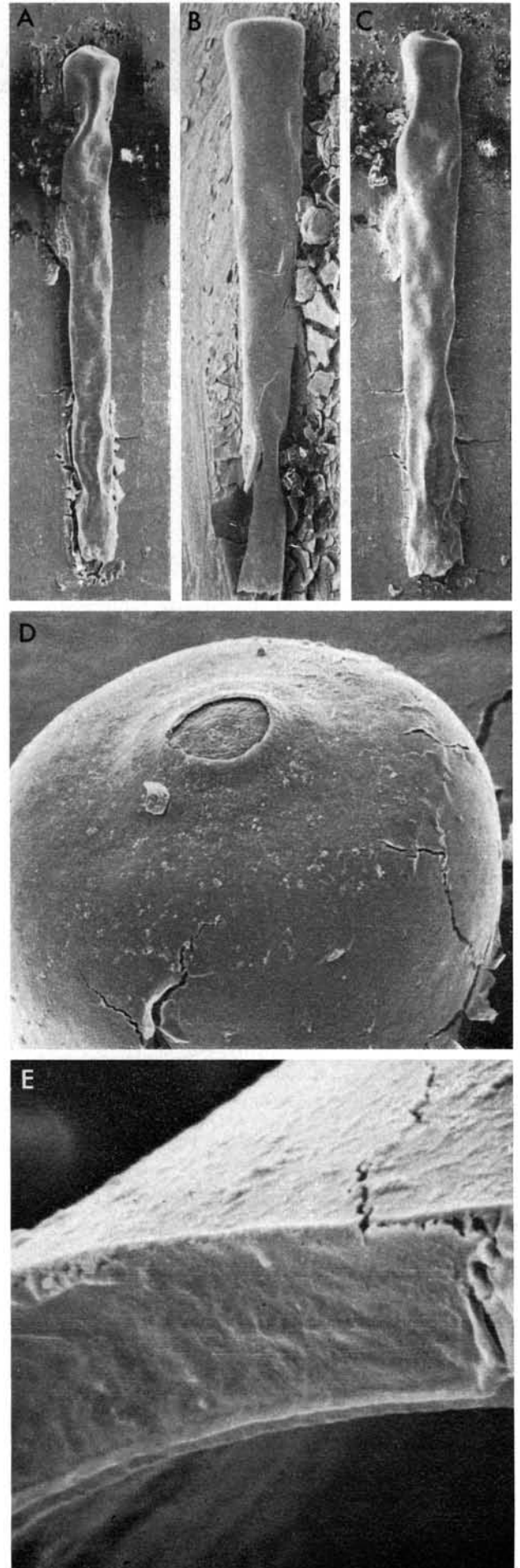


Fig. 29. *Conochitina leptosoma* n. sp. Ansarve 3, Högklint Beds, southwestern facies, upper part (G 66—141). A. Holotype in lateral view. LO 4634T. $\times 120$. B. Specimen in lateral view. LO 4634t. $\times 155$. C. Holotype slightly tilted. $\times 135$. D. Specimen showing base in oblique aboral view. Note that the interior wall layer seals the hole. LO 4634t. $\times 1020$. E. Transverse section of vesicle wall of the same specimen as in D. $\times 10,200$.

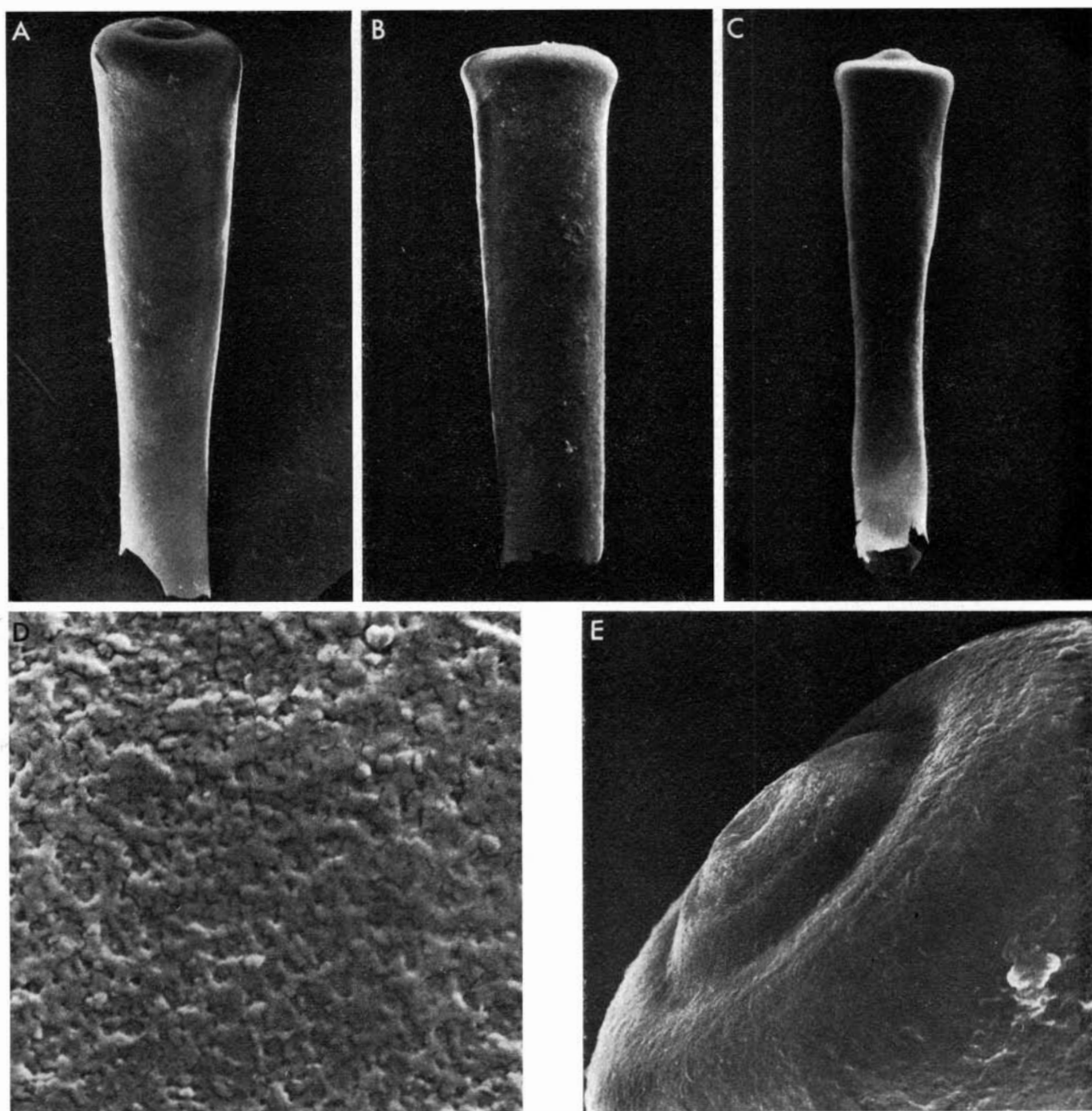


Fig. 30. *Conochitina mamilla* n. sp. Lauter 1, Högklint Beds, lower-middle part (G 69—116). A. Specimen in oblique lateral view. LO 4632t. $\times 200$. B. Specimen in lateral view.

LO 4632t. $\times 200$. C. Holotype in lateral view. LO 4632T. $\times 150$. D. Detail of vesicle wall. LO 4632t. $\times 10,000$. E. Same specimen as in A. $\times 1000$.

striction is located. The convex base with its wide basal process is a further characteristic of the species. The vesicle wall is perfectly smooth. In aboral views it can be established that the vesicle wall is composed of two layers, of which the inner, membraneous one is attached to the interior of the base and covers the hole under the basal process.

Occurrence.—*C. leptosoma* is restricted to the Högklint Beds and ranges from the upper part of unit a to the upper part of unit c and the marly, southwestern facies.

Conochitina mamilla n. sp.

Fig. 30.

Derivation of name.—Latin *mamilla*, mammilla, referring to the shape of the central part of the base.

Holotype.—LO 4632 T.

Type stratum.—Högklint Beds, lower-middle part (Sample G 69—116).

Type locality.—Lauter 1, Gotland.

Diagnosis.—*Conochitina* species with subcylindrical or elongatedly conical vesicle and broadly rounded basal edge. The vesicle is constricted immediately oralward of the basal edge. The base has a furrow-like depression inside the basal edge and inside the furrow the central part of the base protrudes like a mammilla (or, geologically speaking, like a shield volcano) provided with a basal scar. The vesicle wall is perfectly smooth and the aperture straight and smooth.

Dimensions.—Population from the type stratum in microns: length 450—685 (holotype 550), width 115—135 (holotype 125), width of aperture 65—85 (holotype 73).

Description.—The constriction oralward of the basal edge and the shape of the base are the characteristic features of *C. mamilla*. The protruding, central part of the base shows a concentric pattern. Most probably this part is a modification of a basal callus since it is massive. However, the basal scar is wide and crater-like and shows similarity with the basal process of *C. acuminata* in that respect. At high magnifications a punctate pattern in the vesicle wall is revealed.

Occurrence.—*C. mamilla* is restricted to the Högklint Beds, where it was encountered in units b and c only.

Conochitina pachycephala Eisenack, 1964

Fig. 31.

Synonymy □ *Conochitina pachycephala* n. sp.—Eisenack 1964a: 315, Pl. 26: 6, Figs. 4—8. □ *Conochitina* sp.—Jansonius 1967, Pl. 1: K, L, N, O.

Remarks.—There is little to add to Eisenack's description of the species. The constriction of the vesicle just oralward of the basal edge is a characteristic feature in this species. This is also true of the concentrically striated basal process. As supposed by Jansonius (1967: 357) the hole of the basal process is sealed from the interior of the vesicle by a membrane which covers the interior, aboral part of the vesicle. The vesicle wall is smooth. The apertural part of the neck is very thin oralward of the prosome and has collapsed in most specimens. Jansonius (1967, Pl. 1: K, L, N) demonstrated that the oral part of the neck can be wide and lip-like. Commonly the vesicle wall has been perforated by parasites, in agreement with most other large *Conochitina* species.

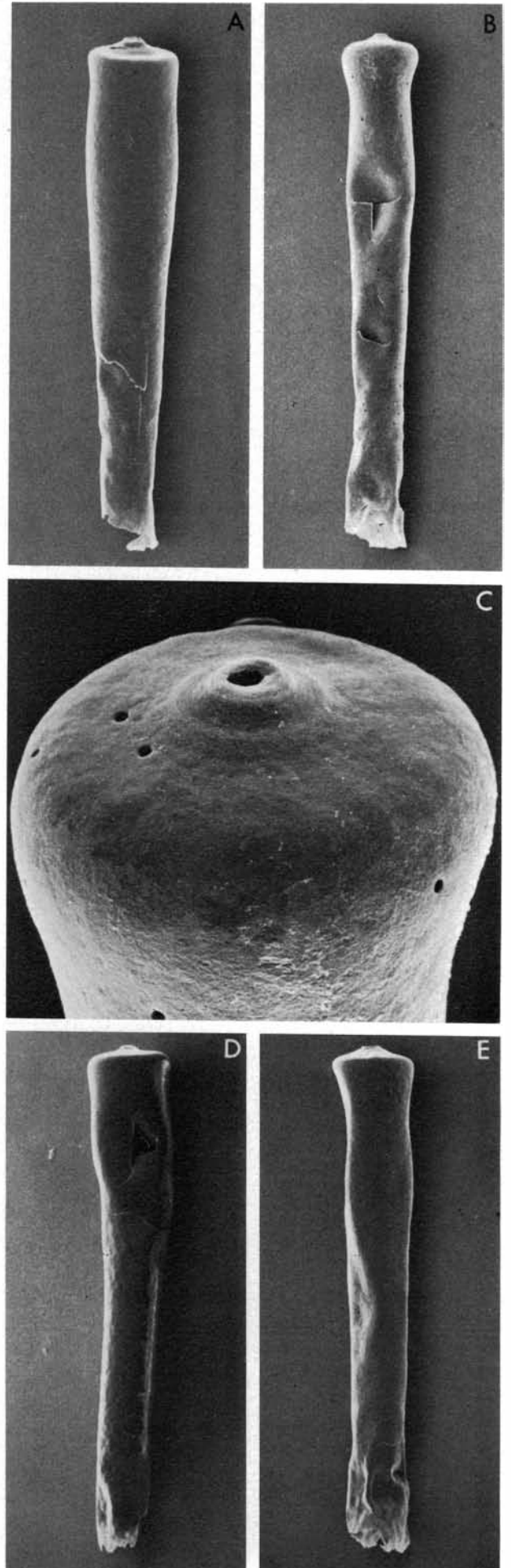


Fig. 31. *Conochitina pachycephala* Eisenack, 1964. Mulde 2, Mulde Beds, uppermost part (G 66—135). LO 4681t. A. Specimen in oblique lateral view. $\times 190$. B. Specimen in lateral view. $\times 155$. C. Same specimen as B. Oblique aboral view of the base. Note the perforations caused by parasites. $\times 960$. D. Specimen in lateral view. $\times 180$. E. Specimen in lateral view. $\times 170$.

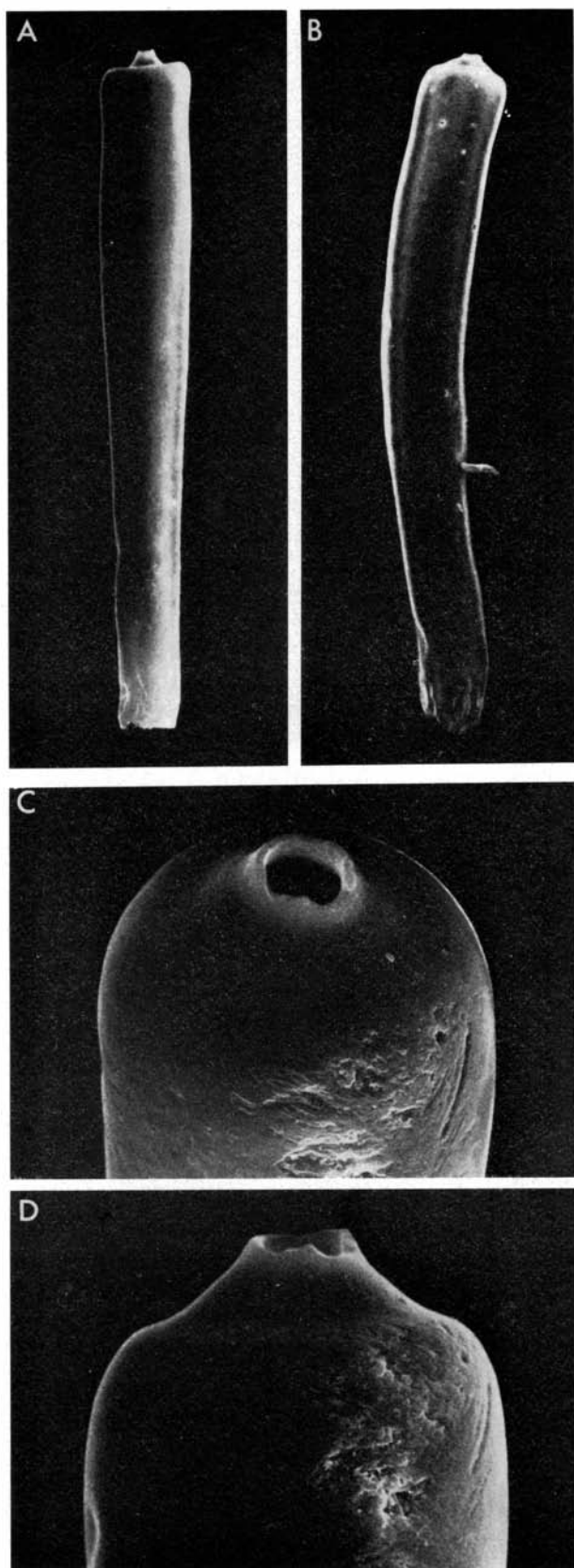


Fig. 32. *Conochitina proboscifera* Eisenack, 1937. Buske 1, Upper Visby Beds (G 66—378). LO 4682t. A. Atypical specimen with bluntly rounded basal edge in lateral view. $\times 100$. B. Characteristic specimen in lateral view. Note the curvature of the vesicle. $\times 100$. C. Specimen in oblique aboral view showing the basal process. Note the perforations caused by parasites. $\times 500$. D. Same specimen as in C in lateral view. $\times 500$.

Occurrence.—*C. pachycephala* ranges from the uppermost part of the Slite Beds, where it occurs from the *Pentamerus gotlandicus* Beds and upwards, through the Mulde Beds and into the middle part of the Klinteberg Beds. Scattered untypical specimens of *C. cf. pachycephala* were encountered also in the topmost part of the Klinteberg Marl and lowermost part of the Hemse Marl. Eisenack (1968a: 344) reported the species from the Wenlockian of Dudley, Great Britain, and Kaljo (1970: 179) stated its occurrence in the upper half of the Jaani beds in Estonia, but as no figures accompanied Kaljo's report it remains an open question if *C. pachycephala* or a similar species is concerned.

Conochitina proboscifera Eisenack, 1937

Figs. 32—33.

Synonymy □ *Conochitina proboscifera* n. sp.—Eisenack 1937: 225, Pl. 15: 4—5. □ *Conochitina proboscifera* Eisenack 1937—Eisenack 1959a: 5—6, Pl. 3: 1—2. □ *Conochitina proboscifera* Eisenack 1937—Eisenack 1964a: 313—314, Pl. 26: 1—2, non Fig. 1. □ *Conochitina proboscifera* Eisenack—Taugourdeau & Jekhowsky 1964: 859—860, Pl. 1: 10—13, Pl. 2: 14—21, Pl. 3: 22, 25, Pl. 4: 38—39. □ *Conochitina proboscifera* Eis.—Taugourdeau 1966a: 35, Pl. 2: 43—44. □ *Conochitina proboscifera* Eisenack, 1937—Eisenack 1968a: 159, Pl. 24: 4, Pl. 25: 1—2, Pl. 31: 13; Fig. 2. □ *Conochitina proboscifera* Eisenack 1937—Eisenack 1970: 305, Fig. 1: A, C, D. □ *Conochitina proboscifera* Eis. 1937—Laufeld 1971: 295, Pl. 1: H. □ *Conochitina proboscifera* Eisenack 1937—Eisenack 1972b, Pl. 34: 29.

Remarks.—*C. proboscifera* is an interesting species because of its great variation in over-all shape. Taugourdeau and Magloire (1964: 674, Fig. 1) used the species as an example when discussing possible dimorphism among the chitinozoans. Taugourdeau and Jekhowsky (1964: 859) made a biometric study of the variation of size in *C. proboscifera*.

In the present paper two *formae* have been distinguished from the main populations. These two forms, which do not occur in the Lower Visby Beds, will be discussed separately.

Populations have been referred to *C. proboscifera* when the length:width is 1:6—8. The maximum length is 950 microns. The vesicle is almost cylindrical. The vesicle wall is very thick but consists of a single layer only, except for its aboralmost part. The hole under the basal process is sealed by a second, inner wall layer. *C. proboscifera* carries a prosome and commonly the neck shows a slight constriction where the prosome is located. The prosome is barrel-like and consists of a tube which is constricted in its oral part where transverse, thin lamellae are arranged. In its aboral part the prosome widens and its edge extends as a skirt

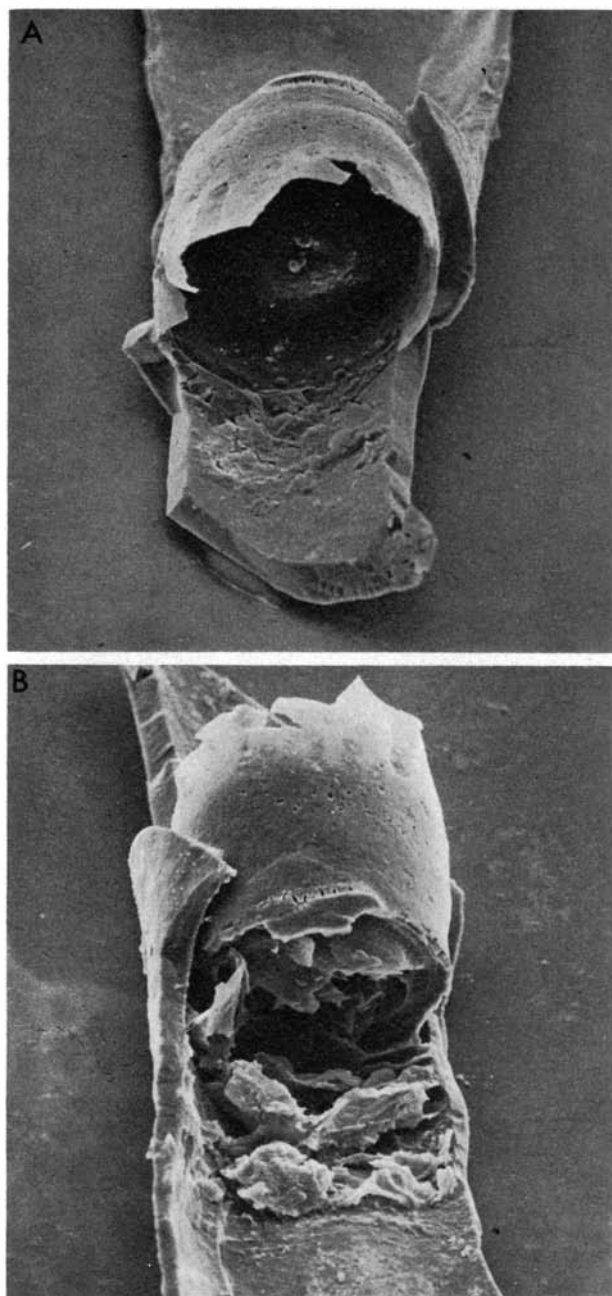


Fig. 33. *Conochitina proboscifera* Eisenack, 1937. Buske 1, Lower Visby Beds (G 66—377). LO 4683t. A. Prosome *in situ* in oblique aboral view. The vesicle wall was partly removed in order to reveal the prosome and its attachment in the neck. Note the peripheral flange extending in aboral direction and the scars in the concave aboral part of the prosome. $\times 600$. B. Same specimen. Prosome in oral view. Note the lamellar construction. $\times 600$.

along the vesicle wall towards the interior of the vesicle.

Occurrence.—Populations classified as *C. proboscifera* ranges from the Lower Visby Beds to the top of the Höglint Beds. The species was encountered also in unit b of the Slite Beds and in the northwesternmost part of the Slite Marl as scattered specimens or un-

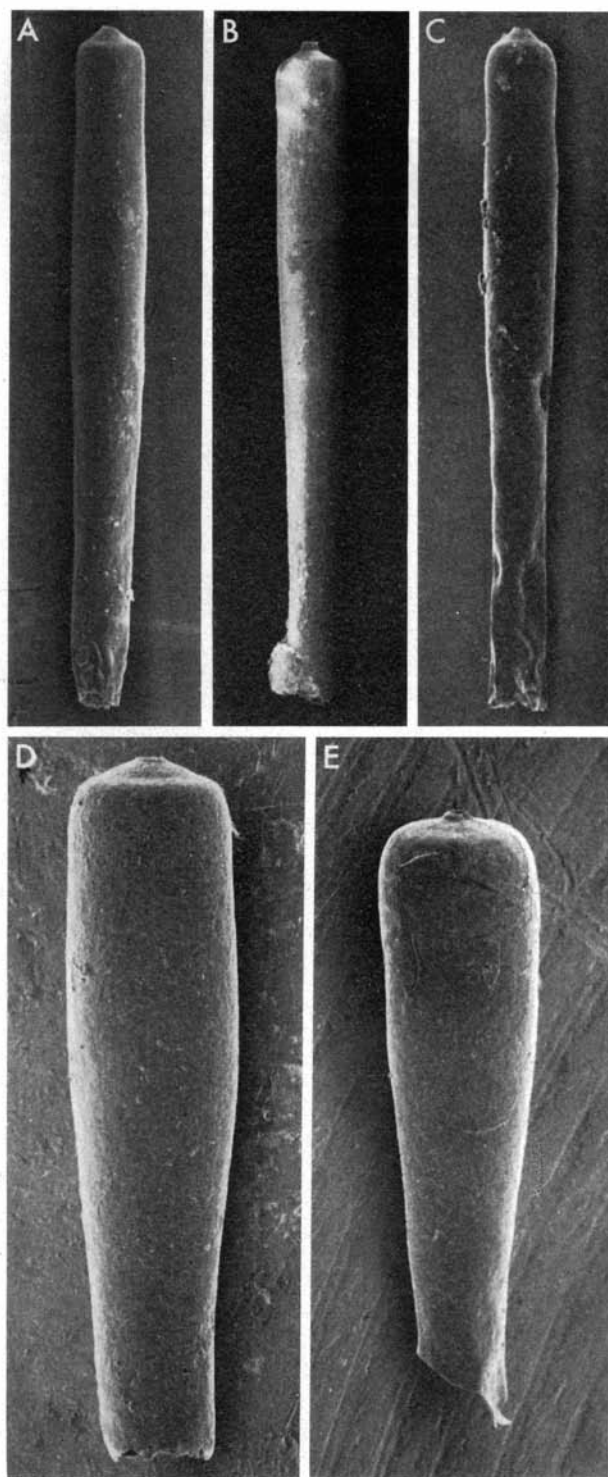


Fig. 34. A—C. *Conochitina proboscifera* forma *gracilis*. Buske 1, Upper Visby Beds (G 66—378). LO 4684t. D—E. *Conochitina proboscifera* forma *truncata*. Halls Huk 1, Upper Visby Beds (G 66—352). LO 4685t. A. Specimen in lateral view. $\times 108$. B. Specimen in lateral view. $\times 81$. C. Specimen in lateral view. $\times 108$. D. Specimen in lateral view. Note that the specimen is preserved in its full length. $\times 240$. E. Specimen in lateral view. $\times 240$.

characteristic populations. Eisenack (1968a: 334) earlier reported scattered specimens also in the Mulde Beds.

Forma gracilis

Fig. 34: A—C.

Remarks.—Populations have been referred to *f. gracilis* when the length : width is 1 : 9—10. The maximum length is 1075 microns. *Forma gracilis* is characterized also by the continuous tapering of the vesicle in oral direction and by the elongated base and basal process. The vesicle wall is similar to *C. proboscifera* in its typical form.

Occurrence.—*Forma gracilis* is restricted to the Upper Visby Beds and lowermost part of unit a of the Höglint Beds.

Forma truncata

Fig. 34: D—E.

Remarks.—Populations have been referred to *f. truncata* when the length : width is 1 : 3—5. The maximum length is 500 microns. *Forma truncata* is characterized also by having a flexure and shoulder and by the less protruding base and basal process. The vesicle wall is similar to *C. proboscifera* in its typical form.

Occurrence.—*Forma truncata* makes its debut in the Upper Visby Beds and ranges through the Höglint Beds. It was also encountered in the northwesternmost part of the Slite Marl.

Conochitina aff. *proboscifera*

Fig. 35.

Remarks.—In several samples from the Slite and Mulde Beds scattered specimens of chitinozoans with a superficial similarity with *C. proboscifera* occur. They were never encountered as homogeneous populations. Hence, they cannot be classified with any degree of certainty. Most specimens show affinities with *C. proboscifera* as far as the base is concerned. They have a broadly rounded basal edge and a central protruding part with a basal scar. The protruding part is more similar to a well-developed basal callus than to a basal process as that in *C. proboscifera*. Several specimens have a concave, invaginated base, a feature not recorded in *C. proboscifera*. The length of the specimens varies between 150 and 500 microns and the width between 25 and 70. For that reason they cannot be grouped with *C. proboscifera*. These specimens were recorded as *C. aff. proboscifera* in the present study. The variation of this taxon is great and some specimens could have been classified as *C. aff. elegans*, *C. aff. pachycephala*, *C. aff. tuba*, or *C. aff. claviformis*. As no homogeneous populations were encountered they are herein referred to as *C. aff. proboscifera*, a somewhat unorthodox procedure which has been used for the sake of brevity. I am aware of

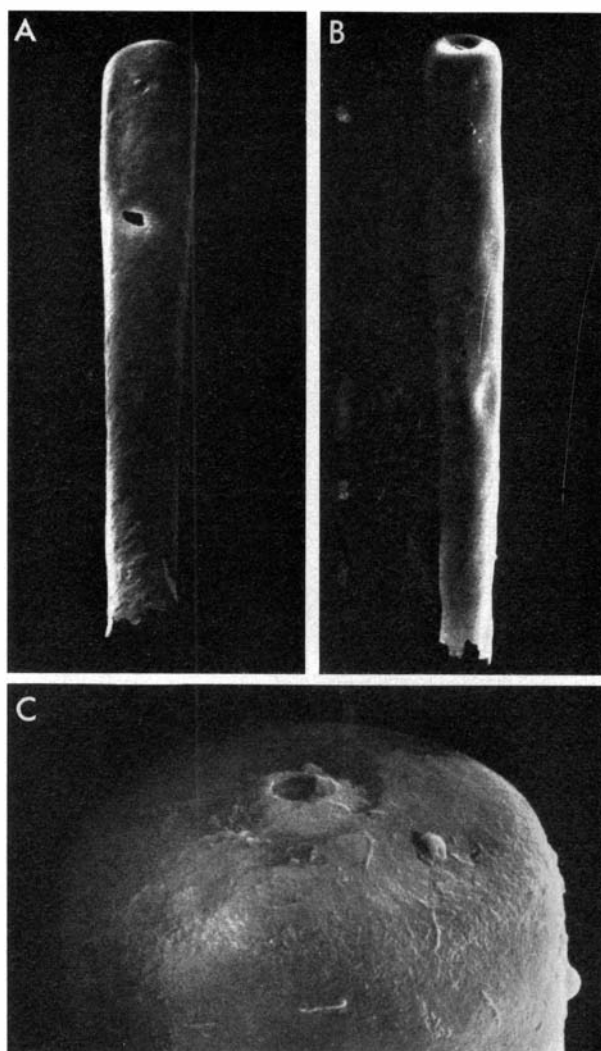


Fig. 35. *Conochitina* sp. aff. *proboscifera*. A—B. Valbytte 1, Slite Marl, slightly younger than the *Conchidium tenuistriatum* Beds (G 71—34). LO 4600t. C. Munkebos 1, Slite Marl, *Pentamerus gotlandicus* Beds or slightly younger (G 71—79). LO 4597t. A. Specimen in oblique lateral view. $\times 500$. B. Specimen in oblique lateral view. $\times 400$. C. Specimen showing the base in oblique aboral view. Note that the basal process is sealed from the interior of the vesicle by the inner layer of the vesicle wall. $\times 1000$.

the fact that a “splitter” probably would have erected a number of new taxa instead.

Occurrence.—*C. aff. proboscifera* was encountered in units d, f, g. and the *Pentamerus gotlandicus* Beds of the Slite Beds and through the Mulde Beds.

Conochitina tuba Eisenack, 1932

Fig. 36.

Synonymy □ *Conochitina tuba* n. sp.—Eisenack 1932: 271, Pl. 12: 8—10. □ *Conochitina tuba* Eisenack 1932—Eisenack 1962a: 294—295, Pl. 14: 13, Fig. 2. □

Conochitina tuba Eisenack 1932—Eisenack 1964a: 316, Pl. 26: 13.

Remarks.—As pointed out by Eisenack (1962a: 294—295, 1964a: 316) *C. tuba* shows a great variation in over-all shape and size. In typical populations the flanks of the body are straight. The basal edge is broadly to bluntly rounded, and the base is provided with a short, but wide, basal process. The process is button-like with a basal scar in its centre. There is no connection between the basal scar and the interior of the vesicle, since the aboral part of the vesicle wall consists of two layers, the innermost of which coats the interior part of the basal scar. Commonly the vesicle wall is perfectly smooth. In some populations some specimens are provided with a very low rugose ornamentation which is well-developed only in the aboral part of the vesicle. Eisenack (1962a: 295) reported that minute hairs of a maximum height of 2 microns occasionally cover the vesicles. It seems probable that the ornamented forms are forerunners to *C. gutta* which is provided with a rugose ornamentation. The variation of length in the present material was recorded at 170—282 microns.

Occurrence.—*C. tuba* makes its appearance in the Katrinelund Limestone and the northwestern part of the Slite Marl, and occurs in typical populations until unit a of the Klinteberg Beds. The latest population was recorded in the older, northwesternmost part of the Hemse Marl, but most records of the species in the Klinteberg Beds consist of atypical specimens.

According to Kaljo (1970: 179) *C. tuba* is characteristic of the upper half of the Jaagarahu beds in Estonia. No figures accompanied his report.

Conochitina visbyensis n. sp.

Fig. 37.

Derivation of name.—Latin *Visbyensis*, inhabitant of Visby, referring geographically to the Visby area and stratigraphically to the Visby Beds.

Holotype.—LO 4631 T.

Type stratum.—Upper Visby Beds (Sample G 66—378).

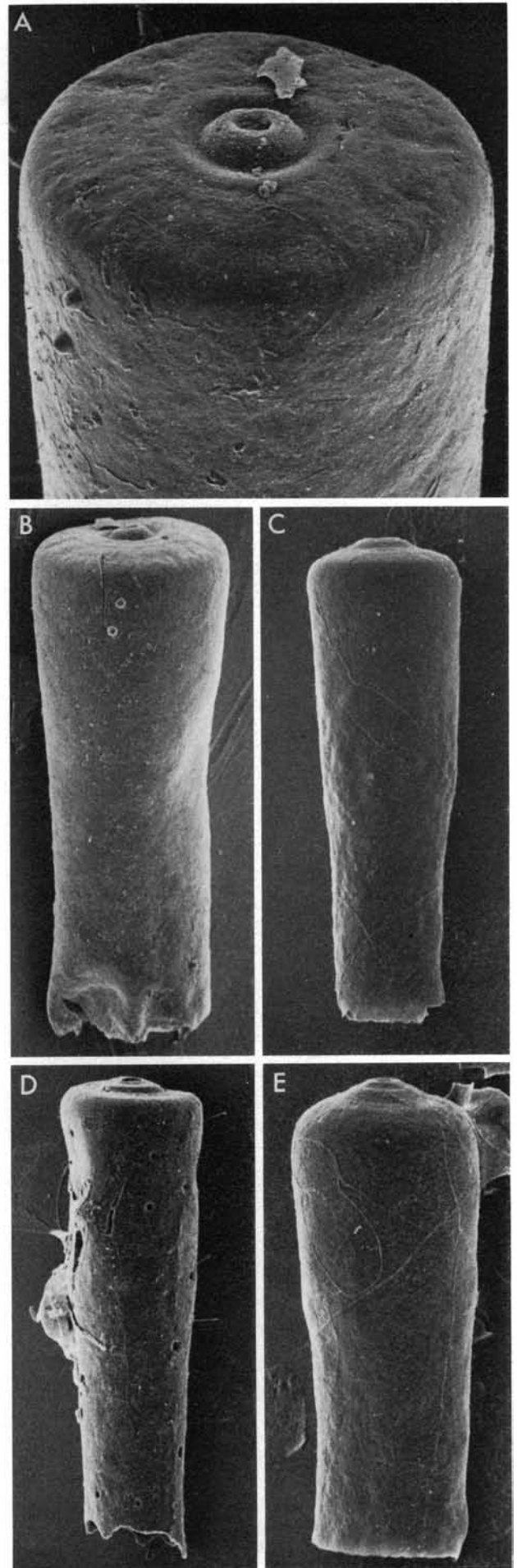
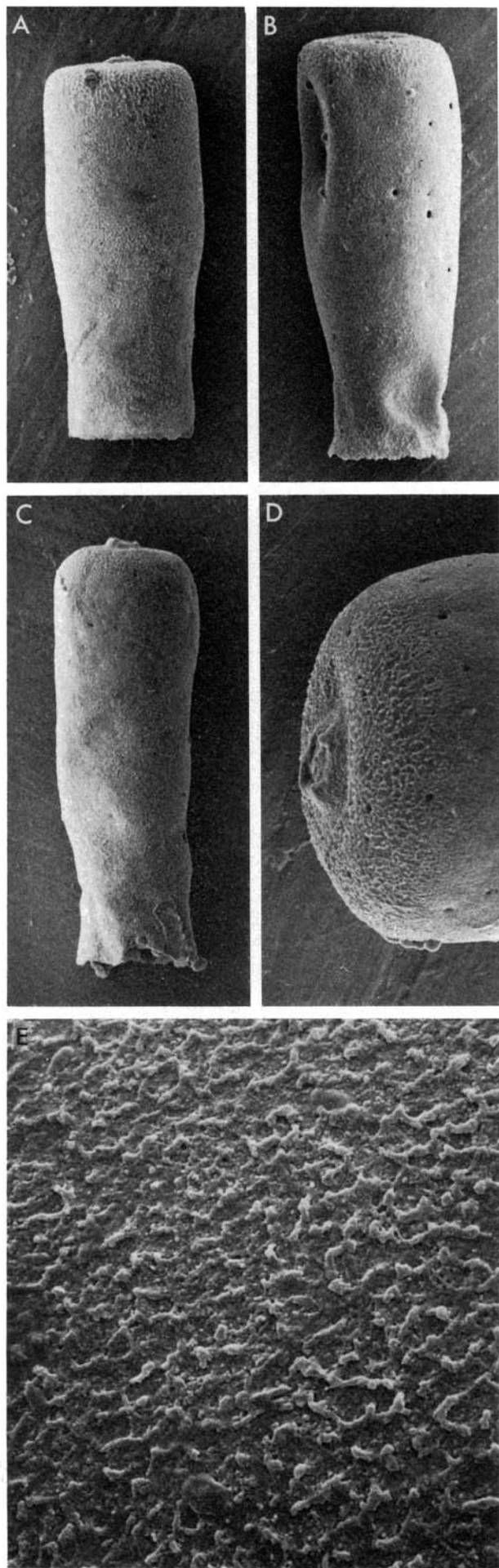


Fig. 36. *Conochitina tuba* Eisenack, 1932. A—B. Smis 1, Klinteberg Marl, upper part (G 71—48). LO 4605t. A. Specimen showing base in oblique aboral view. Note the furrow, basal callus and scar. $\times 1200$. B. Same specimen in oblique lateral view. $\times 480$. C, E. Bore-hole Rosendal, 6.50—6.60 m, Slite Beds, unit g. LO 4686t. C. Specimen in lateral view. $\times 340$. E. Specimen in lateral view. $\times 480$. D. Västärberget 1, Lerberget Marl (G 69—192). LO 4687t. Specimen in lateral view. $\times 290$.



Type locality.—Buske 1, Gotland.

Diagnosis.—Small *Conochitina* species with subcylindrical vesicle with broadly rounded or inconspicuous flexure and shoulder. The basal edge is broadly rounded and the base slightly concave but provided with a short and wide basal process. The aperture is finely fringed and the vesicle wall has a fine, rugose ornamentation.

Dimensions.—Population from the type stratum in microns: length 96—125 (holotype 106), width 38—52 (holotype 44), width of aperture 33—41 (holotype 35).

Remarks.—The greatest width of vesicle is somewhere in between the shoulder and the basal edge, depending on the development of flexure and shoulder. The aperture is slightly widened. The opening of the basal process is sealed from the interior of the vesicle by the interior layer of the aboral part of the vesicle wall. The rugose ornamentation is well-developed only in the aboral part of the vesicle, where the rugae are arranged in a more or less polygonal pattern.

Occurrence.—*C. visbyensis* has a stratigraphical range restricted to the Upper Visby Beds and units a and b of the Höglint Beds.

Genus *Desmochitina* Eisenack 1931, restr. 1968

Type species.—*Desmochitina nodosa* Eisenack, 1931.

Remarks.—The definition of *Desmochitina* used here is that of Eisenack (1968a: 179). Nevertheless, *D. acollaris* and *D. hemsensis* are referred to *Desmochitina*. Eisenack's diagnosis includes a statement that *Desmochitina* species should be provided with a collar. *D. hemsensis* has only a trace of a collar, and *D. acollaris* lacks this type of structure. It is most probable, however, that the two species mentioned are closely related to, e.g., *D. densa* and other species in Gotland provided with a collar. Hence, the two species are placed in the genus *Desmochitina*. Under all circumstances it is premature to introduce a new genus for species lacking collar, but probably occurring in chains.

Species in Gotland.—*D. acollaris* Eisenack, 1959; *D. densa* Eisenack, 1962; *D. hemsensis* n. sp.; *D. muldiensis* n. sp.; *D. opaca* n. sp.; *D. squamosa* n. sp.

Fig. 37. *Conochitina visbyensis* n. sp. Buske 1, Upper Visby Beds (G 66—378). A. Holotype in lateral view. Note the ornamentation. LO 4631T. $\times 385$. B. Specimen in lateral view. LO 4631t. $\times 385$. C. Specimen in lateral view. LO 4631t. $\times 385$. D. Same specimen showing the base in oblique lateral view. $\times 960$. E. Holotype, ornamentation in the middle part of the vesicle. $\times 3850$.

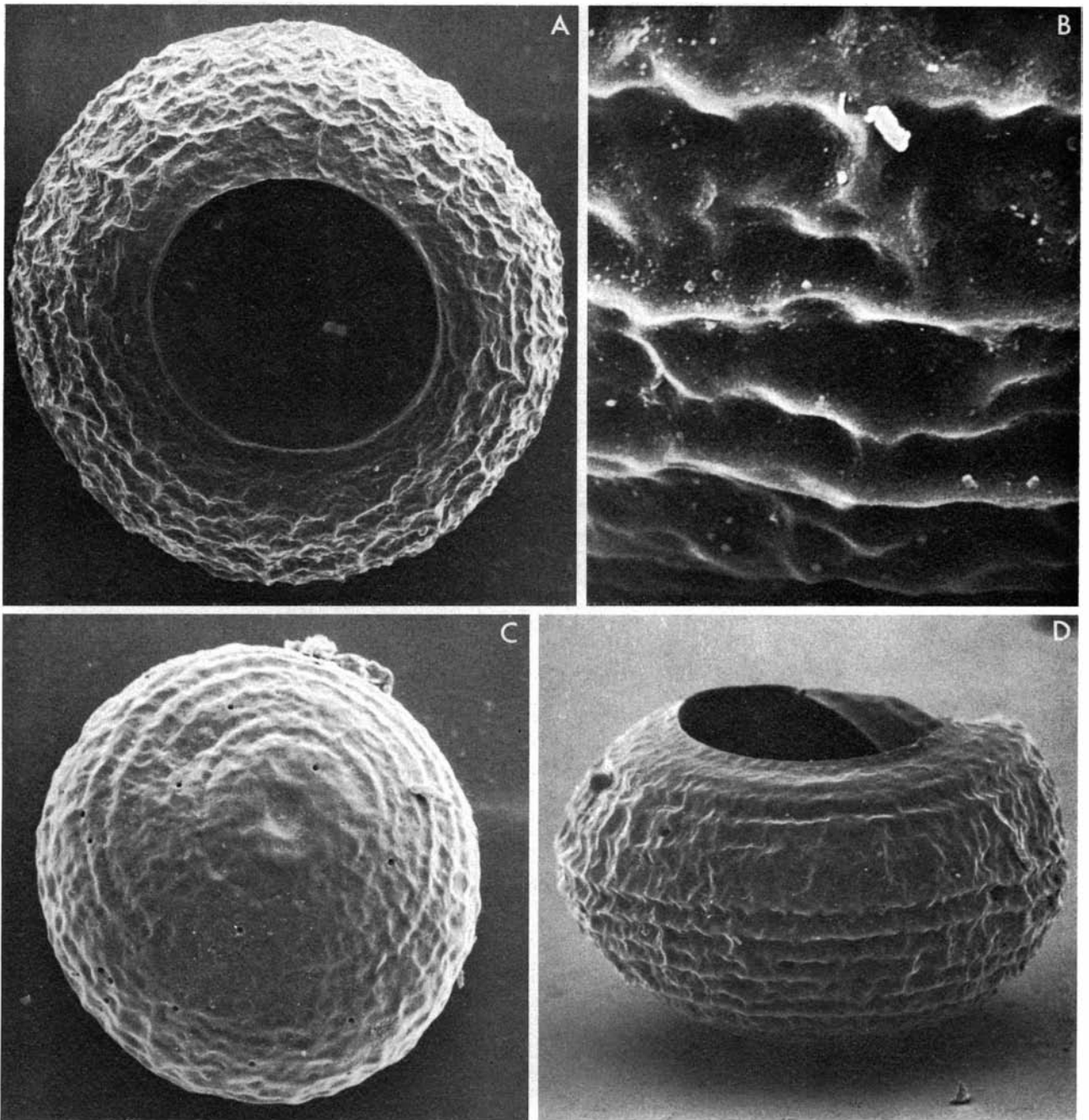


Fig. 38. *Desmochitina acollaris* Eisenack, 1959. Vike 1, Slite Marl, *Pentamerus gotlandicus* Beds or slightly older (G 66—304). LO 4688t. A. Specimen in oral view. $\times 1200$. B. Sculpture of the middle part of vesicle wall of the specimen

in D. $\times 6000$. C. Specimen in aboral view. Note the perforations caused by parasites. $\times 1200$. D. Specimen in lateral view. $\times 1200$.

Desmochitina acollaris Eisenack, 1959

Fig. 38.

Synonymy □ *Desmochitina? acollare* n. sp.—Eisenack 1959a: 16—17, Pl. 3: 14. □ *Desmochitina acollaris* Eisenack, 1959—Eisenack 1968a: 182.

Remarks.—The vesicle wall of *D. acollaris* is very thin. In some populations the outside of the wall is perfectly smooth but in other it has a characteristic relief. In

some samples specimens with the two types of surfaces occur together. Hence, the sculpture was probably not caused by the diagenesis. The two types occur within the same stratigraphic interval. As the two types are identical in all other characters there is very little reason to treat them as separate taxa, especially since some of the sculptured forms lack a sculpture on the base. When most well-developed the vesicle is ornamented by 15—20 rugae running perpendicularly to the longitudinal axis. Another system of rugae runs perpendicularly to the former, but commonly the

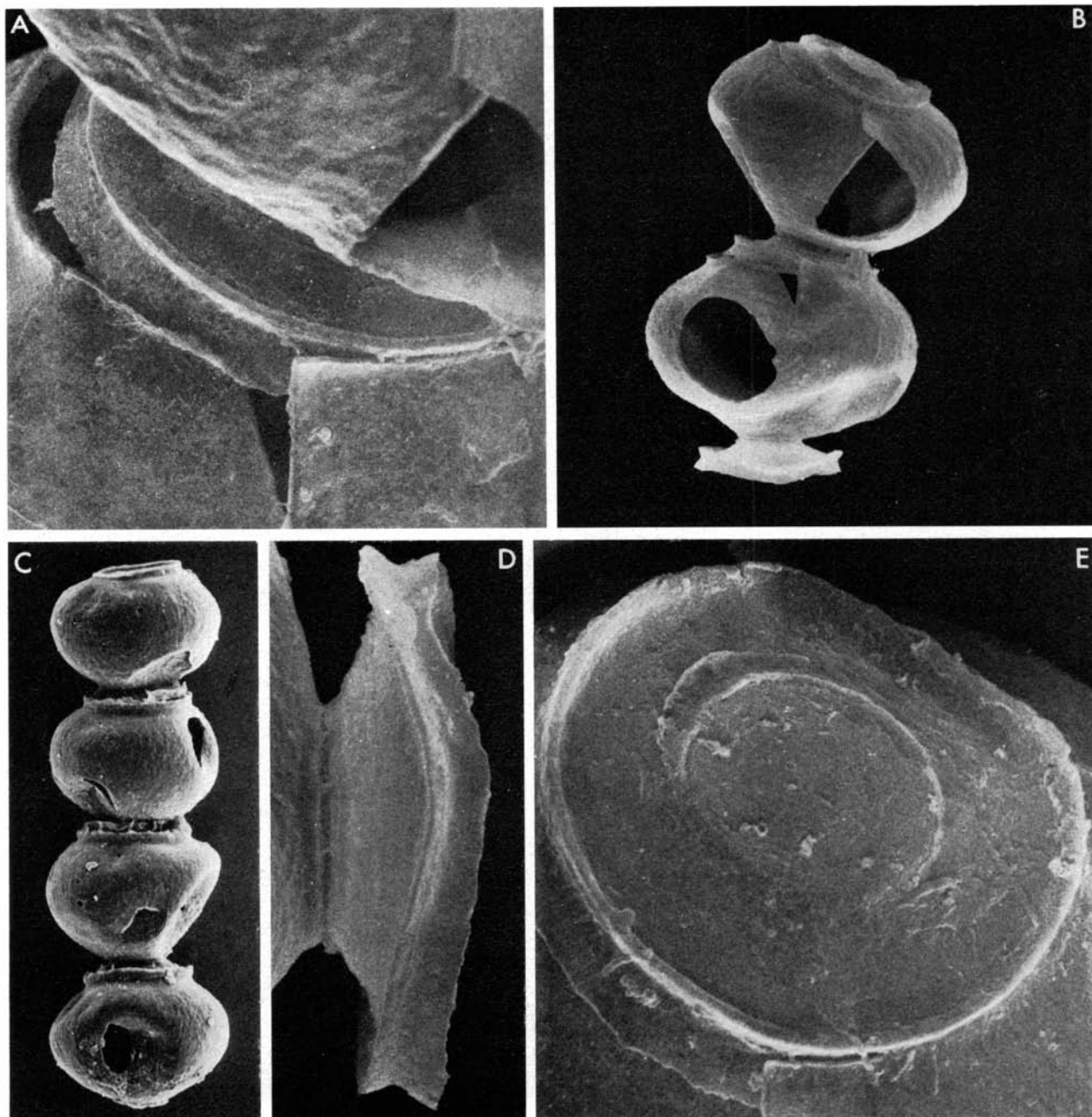


Fig. 39. *Desmochitina densa* Eisenack, 1962. A—B, D—E. Halls Huk 1, Upper Visby Beds (G 66—351). LO 4689t. C. Ireviken 3, Lower Visby Beds (G 66—357). LO 4690t. A. Oblique aboral view of the connection between the two vesicles in B. Note that the operculum as a flange-like,

widened aboral part. $\times 2000$. B. Twin in lateral view. $\times 500$. C. Chain in lateral view. $\times 385$. D. Lateral view of the operculum attached to the base of the lower vesicle in B. $\times 2000$. E. Oblique oral view of the operculum of the upper vesicle in B. $\times 2000$.

longitudinal system is less developed. In the oral part of the vesicle the two systems have about the same development and form a reticulate pattern.

Opercula have not been encountered, but judging from the shape of the aperture they are very thin. The edge of the aperture is provided with a bevel to which the operculum was attached. The aperture shows no differentiation and the name of the species is most convenient as there is no trace of a collar. Therefore, *D. acollaris* is easily distinguished from *D. hemsiensis* n. sp., because the latter species is pro-

vided with a thickened rim at the aperture. Twins or chains have not been encountered.

Occurrence.—*D. acollaris* occurs in the uppermost, southwestern facies of the Höglint Beds and from the base to the very top of the Slite Beds and in one locality, Gandarve 1, in the Halla Beds. Eisenack (1964a: 329) reported the occurrence of a few *D. acollaris* in the Visby Beds. That occurrence was not confirmed by the present study. Possibly some specimens of *D. densa* lacking collar were mistaken for *D. acol-*

laris. It is almost impossible to distinguish between specimens of *D. densa* with detached collars and *D. acollaris* without a SEM study.

Desmochitina densa Eisenack, 1962

Fig. 39.

Synonymy □ *Desmochitina densa* n. sp.—Eisenack 1962a: 311–312, Fig. 8, Pl. 17: 14. □ *Desmochitina densa* Eis. 1962—Cramer 1964a: 348, Pl. 22: 1–3. □ *Desmochitina densa* (Eis.)—Taugourdeau 1966a, Pl. 2: 34–35. □ *Desmochitina densa* Eis. 1962—Laufeld 1971: 295, Pl. 1: A.

Remarks.—The vesicle has a finely rugose ornamentation.

D. densa is commonly encountered as twins or chains. This can be explained by the type of operculum in this species. When the collar is partly detached it is possible to observe that the earlier formed vesicle (the one in oral direction) is attached by a large part of its base to the wide, central and protruding part of the operculum. The operculum is attached to the aperture in a most effective way since the aboral part of it is widened. The flange-like aboral part of the operculum prevents the operculum from being pushed out by pressure inside the vesicle. In several specimens the oral part of the operculum is widened and this kind of construction prevents the operculum from being pushed into the vesicle by pressure from outside. However, the oral flange is the less resistant one and this also explains why so many vesicles with the detached opercula lying in the vesicle are encountered. Under all circumstances this type of construction excludes the supposition that the opercula in *D. densa* were movable and were opened and closed repeatedly. Instead, the operculum was an effective seal constructed for protecting the organism living inside the vesicle until the organism escaped its shelter once and for all.

Occurrence.—*D. densa* was encountered in the Lower and Upper Visby Beds and in the lower-middle part of the Höglint Beds. The species has a peak in its abundance in the Lower Visby Beds but then decreases in abundance more or less continuously. Eisenack (1962a: 312, 1964a: 326, 329) earlier remarked that *D. densa* was more common in the Lower Visby Beds than in the Höglint Beds. Taugourdeau & Jekhowsky (1964: 861) reported the occurrence of one or two specimens in the Upper Visby Beds. *D. densa* is an excellent index fossil for late Llandovery-early Wenlock. Cramer (1964: 348) reported the species from León, northwestern Spain and from the Ross Brook Formation in Nova Scotia (Cramer 1970a: 746). Laufeld (1971: 295) established its presence in the Restevo Beds of Podolia. There are several other reports of *D. densa* in the literature.

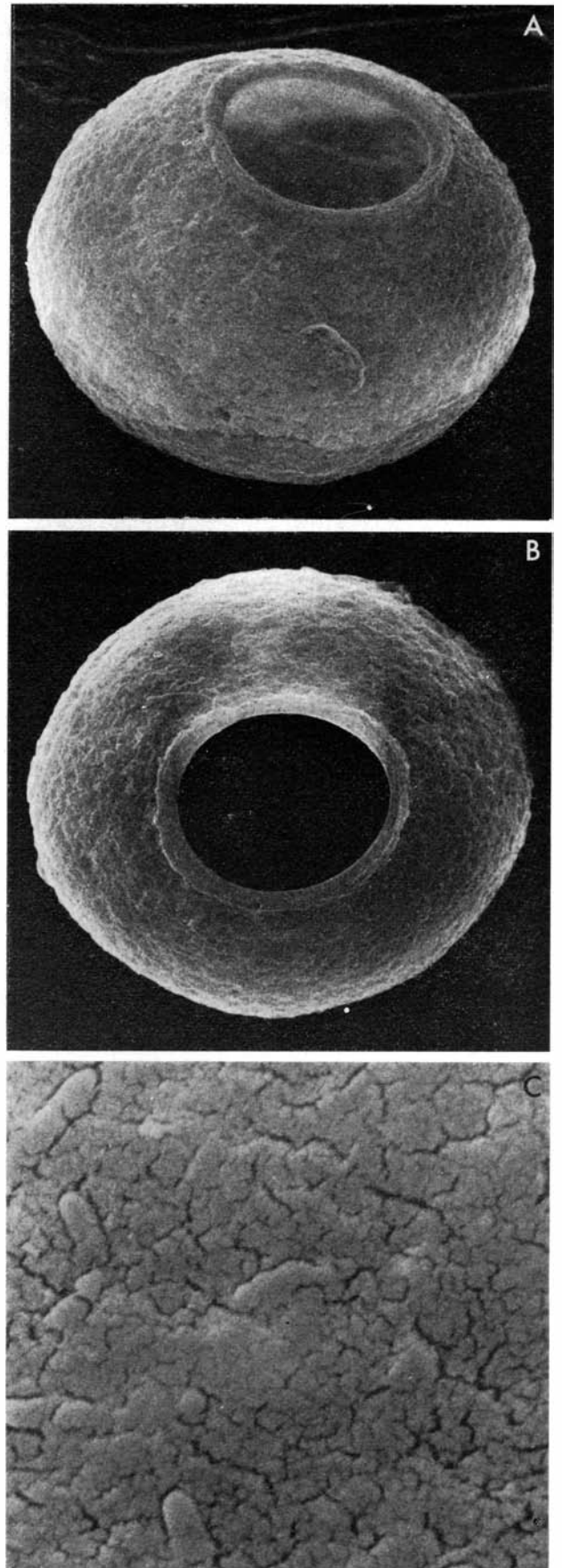


Fig. 40. *Desmochitina hemsiensis* n. sp. Eke 3, Hemse Marl, uppermost part (G 71–38). A. Holotype in oblique oral view. LO 4640T. $\times 1000$. B. Holotype in oral view. $\times 1000$. C. Surface of the vesicle wall of another specimen. LO 4640t. $\times 10,000$.

Desmochitina hemsensis n. sp.

Fig. 40.

Derivation of name.—Latin *Hemsensis*, from the Hemse Beds, in the uppermost part of which the type stratum is located.

Holotype.—LO 4640 T.

Type stratum.—Hemse Marl, uppermost part (Sample G 71—38).

Type locality.—Eke 3, Gotland.

Diagnosis.—*Desmochitina* species where the width exceeds the length. The aperture has a thickened rim which is the point of attachment for a very short, rapidly widened collar. The vesicle wall is rugose.

Dimensions.—Population from type stratum in microns: Length 50—70 (holotype 58), width 60—85 (holotype 70), interior width of aperture 26—35 (holotype 30), width of collar 28—40 (holotype 37).

Description.—The aperture is narrow and the short collar is so rapidly widened that its lateral part is almost perpendicular to the longitudinal axis. At high magnifications a concentric pattern perpendicular to the longitudinal axis is observed and at still higher magnifications rod-like thickenings of the very thin, almost transparent vesicle wall are revealed. *D. hemsensis* is distinguished from *D. acollaris* by its narrower aperture, thickened rim and its collar and from *D. squamosa* by its shorter collar, thin vesicle wall and inconspicuous ornamentation. Twins or chains were not observed. Many specimens have a detached operculum in the vesicle.

Occurrence.—*D. hemsensis* occurs in units b and c of the Hemse limestones and all through the Hemse Marl and up to the middle-upper part of the Eke Beds. It has its peak of abundance at the Hemse—Eke boundary.

Desmochitina muldiensis n. sp.

Fig. 41.

Derivation of name.—Latin *Muldiensis*, from the Mulde area in which the type locality is located.

Holotype.—LO 4652 T.

Type stratum.—Mulde Beds, upper part (Sample G 71—37).

Type locality.—Bjärnes 1, Gotland.

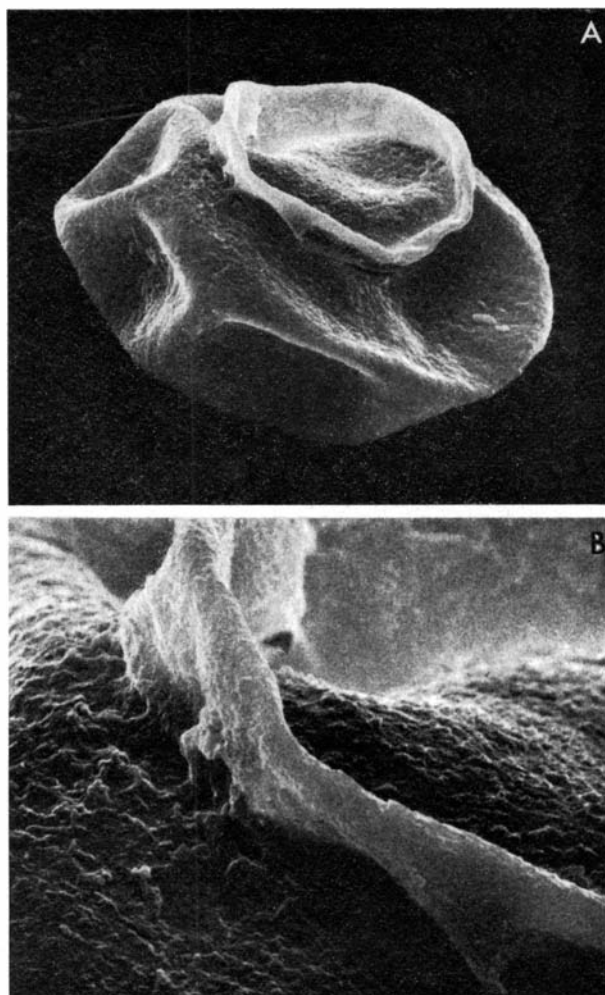


Fig. 41. *Desmochitina muldiensis* n. sp. Bjärnes 1, Mulde Beds, upper part (G 71—37). LO 4652T. A. Holotype in oblique oral view. $\times 800$. B. Holotype, detail of collar. Note the ornamentation of vesicle wall. $\times 3000$.

Diagnosis.—*Desmochitina* species where the width exceeds the length. The vesicle is provided with a very thick collar which is slightly widened from the aperture. The vesicle wall has a verrucate or finely rugose ornamentation.

Dimensions.—Population from the type stratum in microns: Length 50—70 (slightly deformed holotype 65), width 60—80 (holotype 80), interior width of aperture 30—40 (holotype 35), width of collar 40—55 (holotype 45).

Description.—*D. muldiensis* is characterized by its ornamentation and by its very thick collar. The operculum has granulate ornamentation on its outer surface and shows no concentric growth lines. The operculum is welded to the aperture tightly. No twins or chains were encountered.

Occurrence.—Uncharacteristic specimens of the species were encountered in the *Conchidium tenuistriatum* Beds but the main stratigraphical range is from the

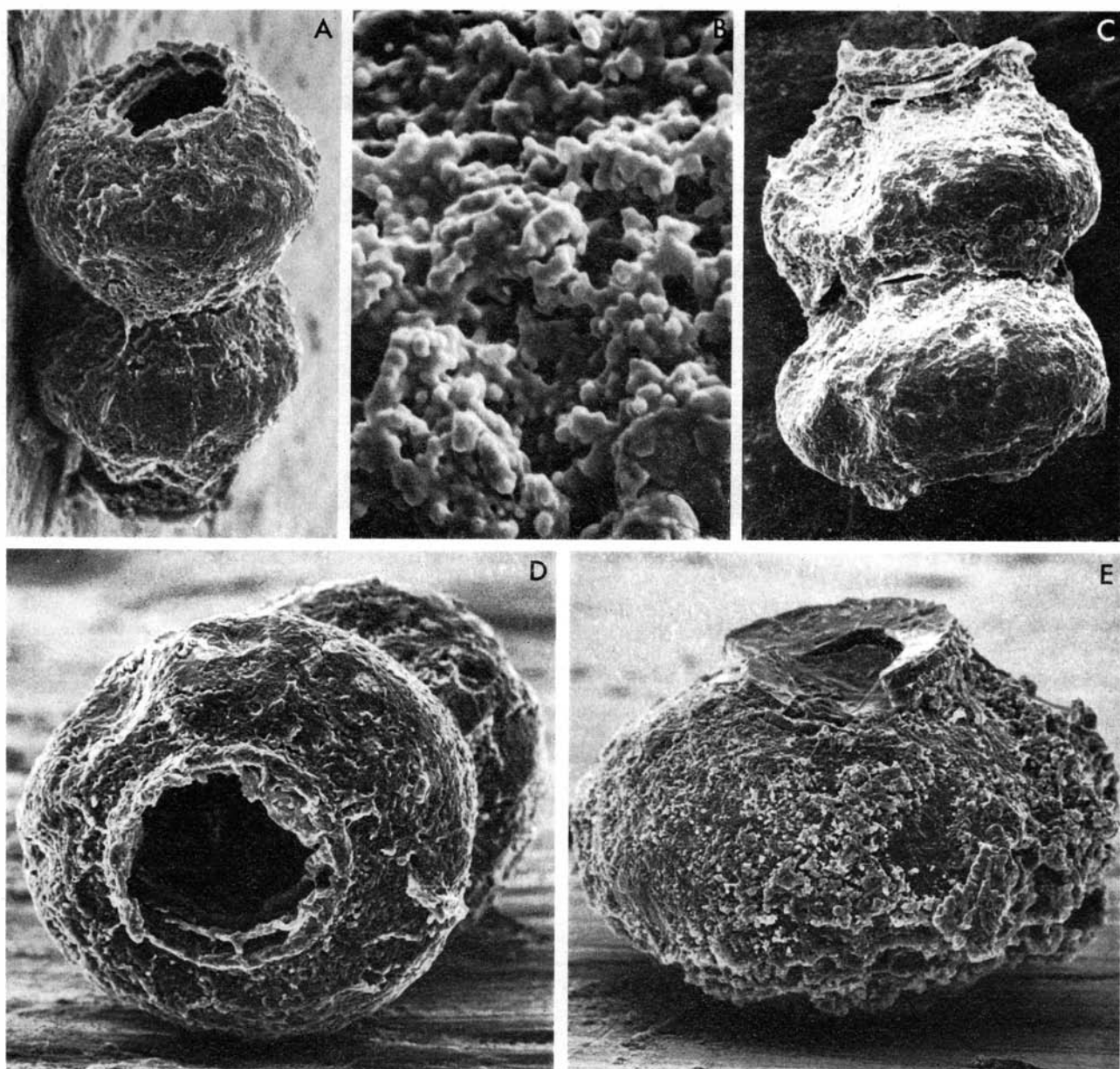


Fig. 42. *Desmochitina opaca* n. sp. Buske 1, Upper Visby Beds (G 66—380). A. Holotype in oblique aboral view. LO 4650T. $\times 600$. B. Ornamentation in the middle part of another specimen. LO 4650t. $\times 6000$. C. Twin in lateral

view. $\times 600$. D. Holotype in oral view. $\times 840$. E. Specimen in oblique aboral view with operculum of the following specimen attached to its base. LO 4650t. $\times 1020$.

Pentamerus gotlandicus Beds of Slite age to the top of the Mulde Beds. Its occurrence in the Halla Beds at Gandarve 1 is noteworthy.

Desmochitina opaca n. sp.

Fig. 42.

Derivation of name.—Latin *opacus*, dark, very shady, opaque, referring to the vesicle wall.

Holotype.—LO 4650 T.

Type stratum.—Upper Visby Beds (Sample G 66—380).

Type locality.—Buske 1, Gotland.

Diagnosis.—*Desmochitina* species where the width exceeds the length. The vesicle is provided with a very short collar parallel to the longitudinal axis and with a thick operculum. The vesicle wall is covered by a thick, spongy ornamentation.

Dimensions.—Population from the type stratum in microns: Length 45—60 (holotype, twin 56, 58), width 70—85 (holotype 75, 77), interior width of

aperture 30—45 (holotype 36, 38), width of collar 44—66 (holotype 47).

Description.—The connection between the vesicles is firm and twins and short chains are common. The operculum has a smooth inner surface and a granulate to spongy outer surface by which it is attached to the preceding vesicle. Commonly, the operculum sticks to the base of the preceding vesicle. The connection between vesicles is further strengthened by the short, subcylindrical collar. The heavy ornamentation covers the entire vesicle with the exception of the operculum and the part of base which is attached to the following vesicle. This ornamentation is very characteristic of the species and consists of a spongy substance which can have a thickness of 10 microns.

Occurrence.—*D. opaca* was encountered only in the Upper Visby Beds and in the uppermost part of the marly, southwestern facies of the Höglint Beds.

Desmochitina squamosa n. sp.

Fig. 43.

Derivation of name.—Latin *squamosus*, scaly, scaled, referring to the ornamentation of the vesicle wall.

Holotype.—LO 4647 T.

Type stratum.—Hemse Marl, top. (Sample G 72—140).

Type locality.—Bodudd 1, Gotland.

Diagnosis.—*Desmochitina* species where the width exceeds the length. The aperture is narrow and the short collar is widened. The ornamentation consists of a thick cover of scales turned on edge and of undulating membranous borders attached at an angle to the vesicle wall.

Dimensions.—Population from the type stratum in microns: length 45—60 (holotype 52), width 55—85 (holotype 74), interior width of aperture 20—35 (holotype 25), width of collar 30—50 (holotype 35).

Description.—The ornamentation covers the entire, lens-shaped vesicle but decreases in size in the central part of the base and in the oralmost part of the vesicle. The collar is thick but undulating. The species is distinguished from other *Desmochitina* species of the same over-all shape by its characteristic ornamentation which has a thickness of 5—10 microns.

Occurrence.—*D. squamosa* is restricted to the upper part of the Hemse Marl and to the Eke Beds, where its latest occurrence is in the middle-upper part.

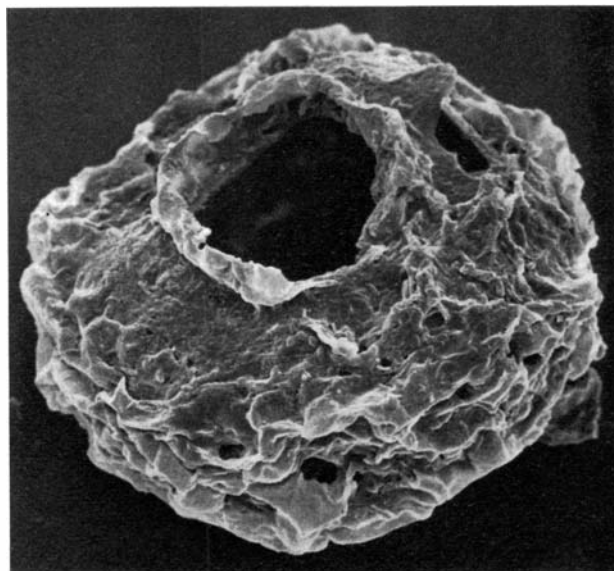


Fig. 43. *Desmochitina squamosa* n. sp. Bodudd 1, Hemse Marl, top (G 72—140). LO 4647T. Holotype in oblique oral view. Note the ornamentation and collar. $\times 1025$.

Genus *Eisenackitina* Jansonius, 1964

Type species.—*Eisenackitina castor* Jansonius, 1964.

Remarks.—Jansonius' (1964:912) remarks that the operculum shows concentric growth lines and carries a short, thin membrane are corroborated by this study. The same is true of his statement that the vesicle wall consists of more than one layer (cf. Eisenack 1968a: 140, 1972b: 119). The *Eisenackitina* species in the Silurian of Gotland are characterized by a short but conspicuous ornamentation.

Species in Gotland.—*E. lagenomorpha* (Eisenack, 1931); *E. oviformis* (Eisenack, 1972); *E. philipi* n. sp.

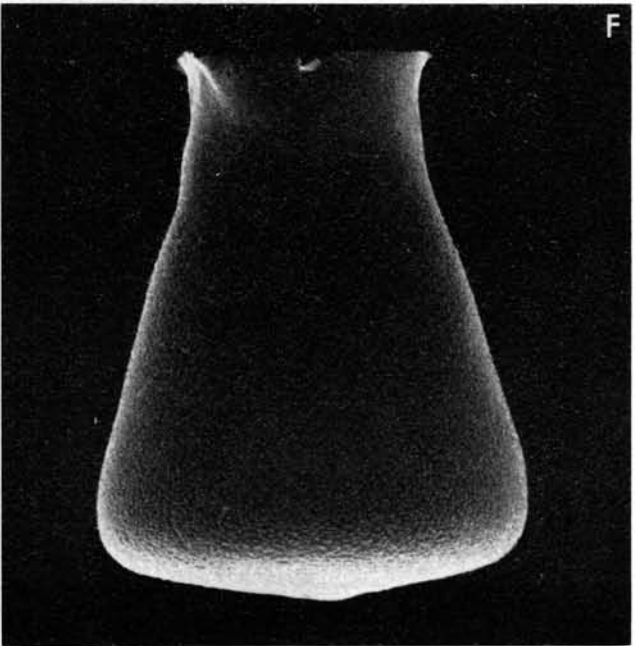
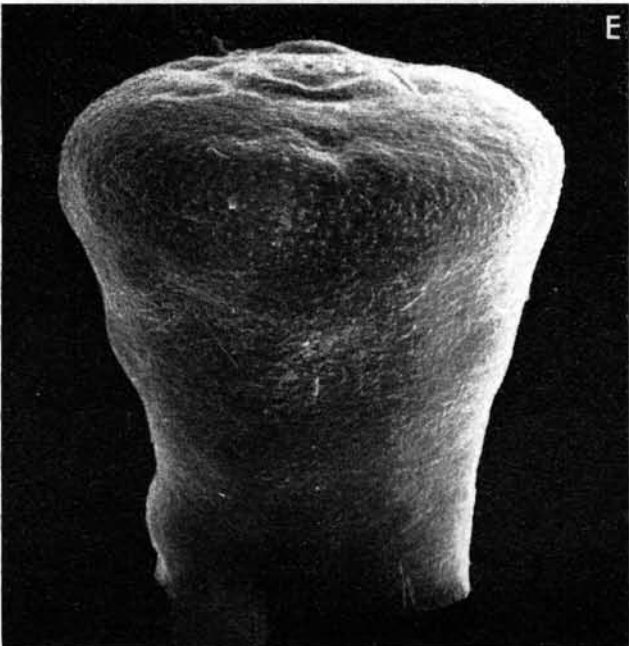
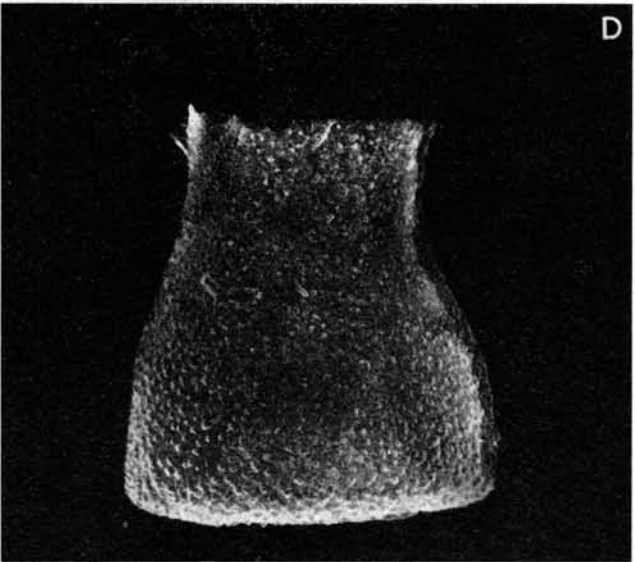
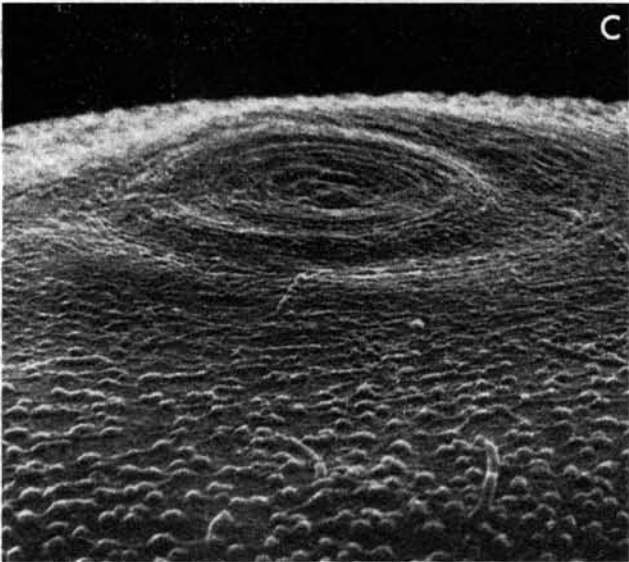
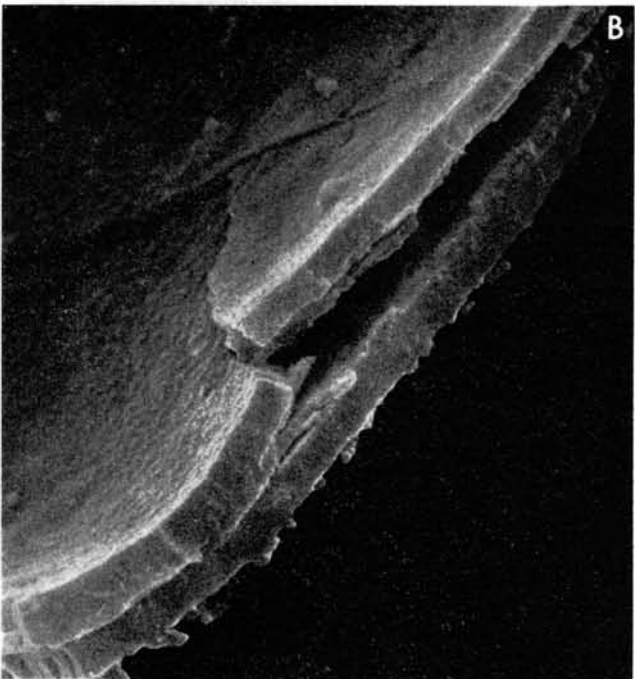
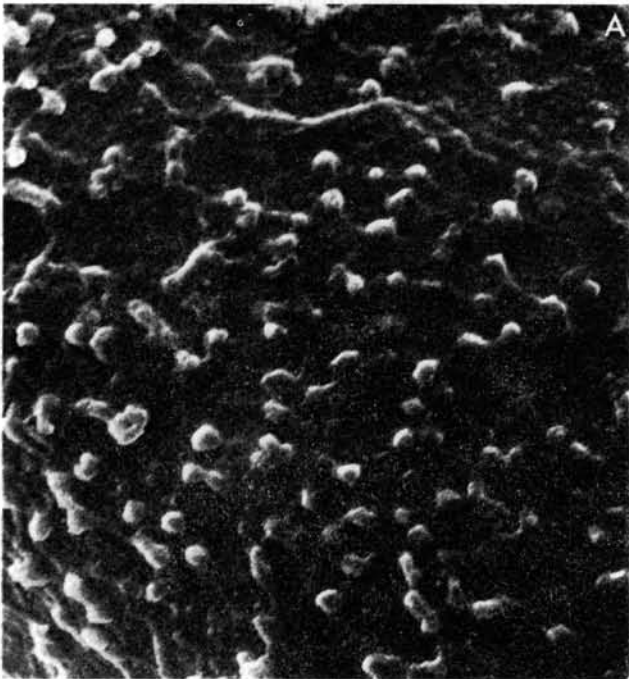
Eisenackitina lagenomorpha (Eisenack, 1931)

Fig. 44.

Synonymy □ *Conochitina lagenomorpha* n. sp.—Eisenack 1931: 85, Pl. 1: 12—13. □ *Conochitina lagenomorpha* Eisenack 1931—Eisenack 1955a: 160—161,

Fig. 44. A, C, E—F. *Eisenackitina lagenomorpha* (Eisenack, 1931). Bankvät 1, Hamra Beds, unit b (G 71—26). LO 4691t. B. *Eisenackitina* cf. *lagenomorpha*. Lau Backar 1, Eke Beds, *Rhizophyllum* Limestone (G 71—102). LO 4692t. D. *Eisenackitina lagenomorpha*. Ängvards 2, Hamra Beds, unit b (G 71—7). LO 4693t.

A. Ornamentation of vesicle wall in the aboral part of the body. $\times 5000$. B. Section of vesicle wall and interior ornamentation in the aboral part of vesicle. $\times 3000$. C. Basal callus of the specimen in F. Note the concentric striation. $\times 2000$. D. Specimen in lateral view. $\times 600$. E. Specimen in oblique aboral view. $\times 800$. F. Specimen in lateral view. $\times 500$.



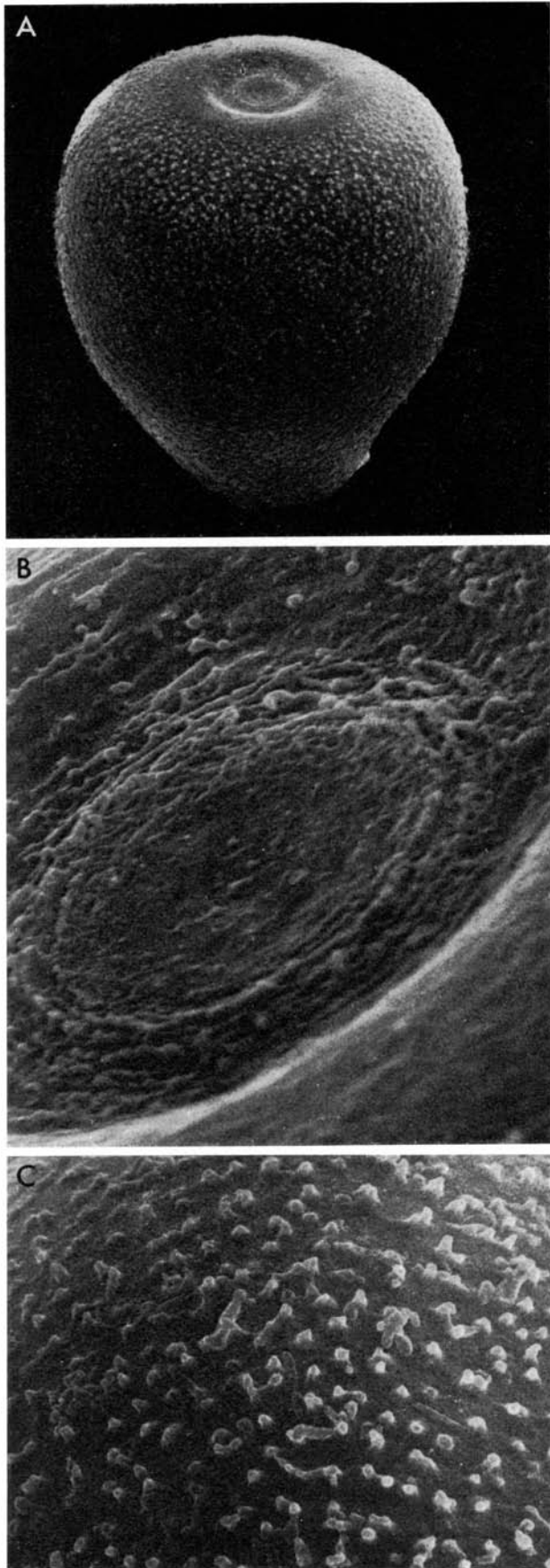


Fig. 45. *Eisenackitina oviformis* (Eisenack, 1972). Klehammarsård 1, Sundre Beds, lowermost part (G 69–11). LO 4694t. A. Specimen in oblique aboral view. $\times 750$. B. Same specimen, aboral pole. $\times 6000$. C. Same specimen, ornamentation in the aboral part. $\times 3000$.

Pl. 1: 1–2. □ *Conochitina lagenomorpha* Eisenack 1931—Eisenack 1964a: 318, Pl. 26: 16. □ *Bursachitina lagenomorpha* (Eis.)—Taugourdeau 1966a: 72. □ *Conochitina lagenomorpha* Eisenack, 1931—Eisenack 1968: 164, Pl. 25: 28–33. □ *Conochitina lagenomorpha* Eisenack 1931—Eisenack 1970: 306, Fig. 1: P–Q. □ *Bursachitina lagenomorpha* (Eisenack 1931)—Eisenack 1972a: 72.

Remarks.—The basal edge is rounded and the base flat or slightly convex. Flexure and shoulder are broadly rounded or lacking. The oralmost part of vesicle is widened. The vesicle wall is covered with a verrucate to granulate ornamentation decreasing in size at the aperture and from the basal edge towards the aboral pole. There is a basal callus protruding from the base. The callus which carries a narrow scar passes into the lateral part of the base through a low but wide furrow. The vesicle wall is composed of two layers of about the same thickness. The interior surface of the vesicle wall is ornamented by low but wide verrucae. The operculum has concentric growth lines and a short, thin membrane extending along the vesicle wall in aboral direction.

Occurrence.—In Gotland some uncharacteristic and scattered specimens occur in the Hemse Marl but characteristic specimens of *E. lagenomorpha* do not appear until in the lower part of the Eke Beds. The species ranges through the Sundre Beds.

The type stratum of the species is the submarine *Beyrichia* Limestone (Eisenack 1955a: 161) which crops out just south of Gotland (Martinsson 1965a: 333). Eisenack (1964a: 318) reported the species from the Öved—Ramsåsa Group in Scania, South Sweden. The same author established its occurrence also in the Whitcliffian-Pridolian Kaugatuma beds (the Kaugatumapank) and the Pridolian Ohesaarepank in Estonia (Eisenack 1955a: 161, 1970: 321). Kaljo (1970: 179) stated that *E. lagenomorpha* appears already in the upper third of the Paadla Stage in the same country.

There are at least 15 papers more that contain reports on the occurrence of this “species” from the early Caradocian to the Siegenian and from several parts of the world. In some of these reports there are no figures, in others the figures do not permit a safe identification and so these references are not discussed here. For stratigraphical reasons some of these reports need not be considered either.

Eisenackitina oviformis (Eisenack, 1972)

Fig. 45.

Synonymy □ *Bursachitina oviformis* n. sp.—Eisenack 1972a: 72–73, Pl. 18: 12–21, 28–32. □ *Eisenackitina oviformis* Eisenack 1972—Eisenack 1972b: 122, Pl. 33: 17–20.

Remarks.—The species is characterized by its globose vesicle which is widened at the aperture. The vesicle wall has a granulate ornamentation which decreases in size at the aperture and in the central part of the base. The middle part of vesicle also carries very short spines. In most specimens there is a sunken area in which a basal callus is located. A very conspicuous, concentric pattern is seen in the part of the vesicle wall in all specimens.

Occurrence.—*E. oviformis* makes its debut in the uppermost part of the Hamra Beds and then ranges through the Sundre Beds. It has not been encountered in the *Beyrichia* Limestone so far, but according to Eisenack (1972a: 83) it occurs in the Leba boring core (from northernmost Poland) from the very base at 1273 m and up to at least the 858 m-level. Specimens with a question mark referred to *E. oviformis* were recorded in the samples from 689, 745 and 743 m but not from the uppermost portion of that core. According to Jaeger (1962: 130) the latest Pridolian *M. transgrediens* zone is represented by the *bouceki* subzone in the samples from 714 and 746 m.

Eisenackitina philipi n. sp.

Fig. 46.

Derivation of name.—In honour of Arne Philip of Visby, architect, geologist, airman and authority on almost everything about Gotland.

Holotype.—LO 4637 T.

Type stratum.—Eke Beds, lowermost part (Sample G 72—54).

Type locality.—Nyan 2, Gotland.

Diagnosis.—The vesicle is subconical but with curved flanks and broadly rounded flexure and shoulder which can be lacking. The aperture is widened and the base convex with a wide, protruding central part. A granulate ornamentation covers the vesicle wall. The greatest vesicle width is at or immediately oral of the broadly rounded basal edge.

Dimensions.—Population from the type stratum in microns: length 115—190 (holotype 187), width 65—110 (holotype 96), width of aperture 35—60 (holotype 59).

Description.—The over-all shape of this species varies to a great extent both as to size, curvature of the flanks and ornamentation. The ratio length: width is 1.5—1.9. Some specimens lack a flexure, others have a most conspicuous one. Commonly, the shoulder is inconspicuous. The ornamentation can vary from almost

nothing in some specimens to others with short spines. For demonstrating the marked variation the specimens figured here were collected from one and the same sample. The ornamentation is best developed at the basal edge and decreases towards the aperture and towards the central part of the base which is concentrically striated. As seen in the figures the central, protruding part of the base varies considerably in width. The vesicle wall is very thin at the aperture but consists of three layers in the aboral part of the chamber. Two layers of about the same thickness are covered by an exterior, thin layer which carries the ornamentation. There is a basal callus with a scar.

Remarks.—The species is tentatively classified as to genus. The curved flanks do not fit very well with the diagnosis of *Eisenackitina*. However, a number of interesting details of the morphology are identical with those commented upon by Jansonius (1964: 912, 1967: 349, 1970: 795—796, Fig. 3 D—F) when discussing the type species. Before a safe generic designation can be made a reasonable amount of other critical species will have to be investigated by a SEM. The differentiations of the base will be of great importance in all revisions.

Occurrence.—*E. philipi* is a species very characteristic of the Eke Beds in Gotland. However, it makes its debut already in the upper part of the Hemse Marl and is encountered (rarely) in the lower part of the Burgsvik Beds. It is an excellent index fossil.

Gotlandochitina n. gen.

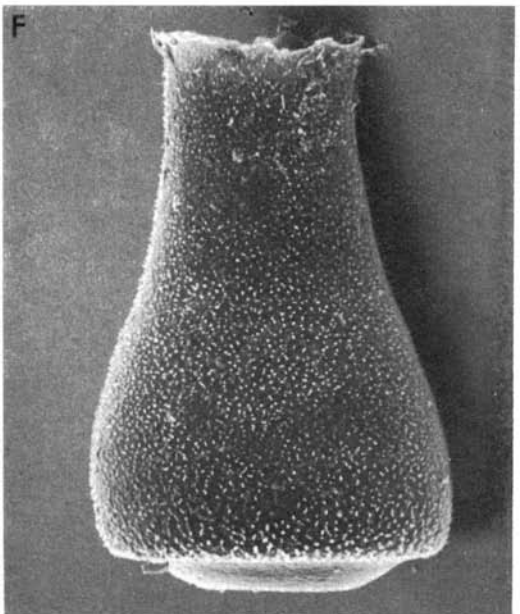
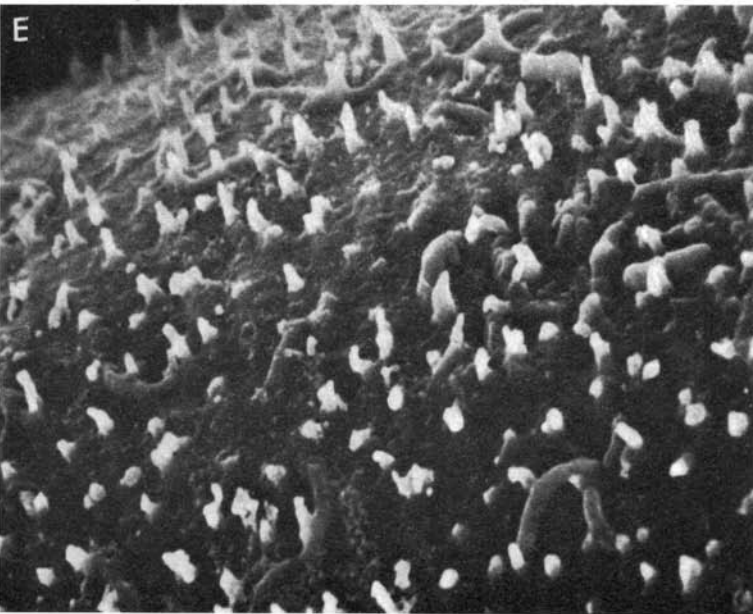
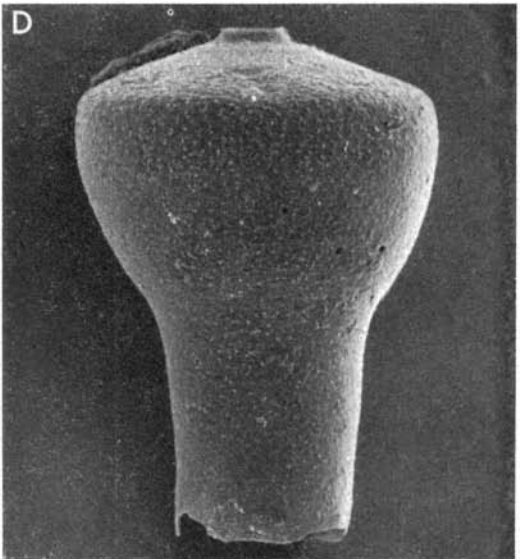
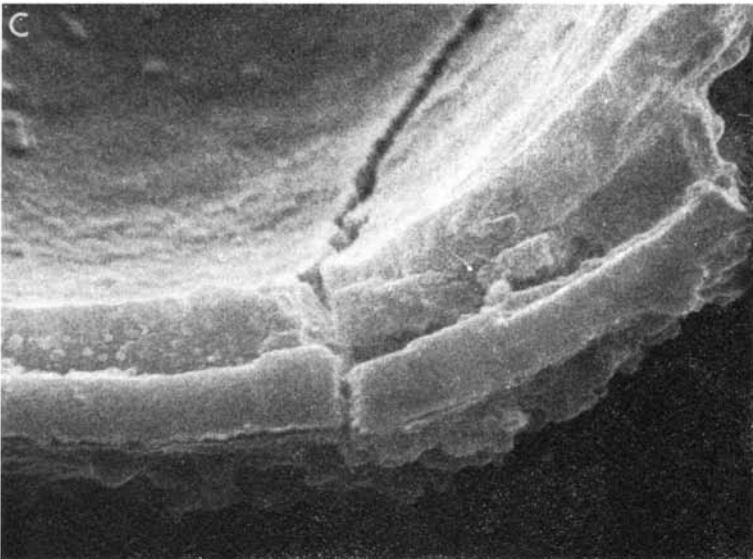
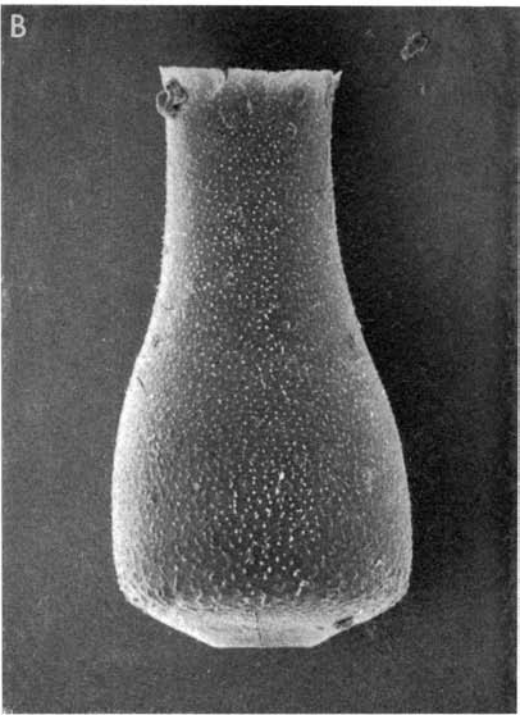
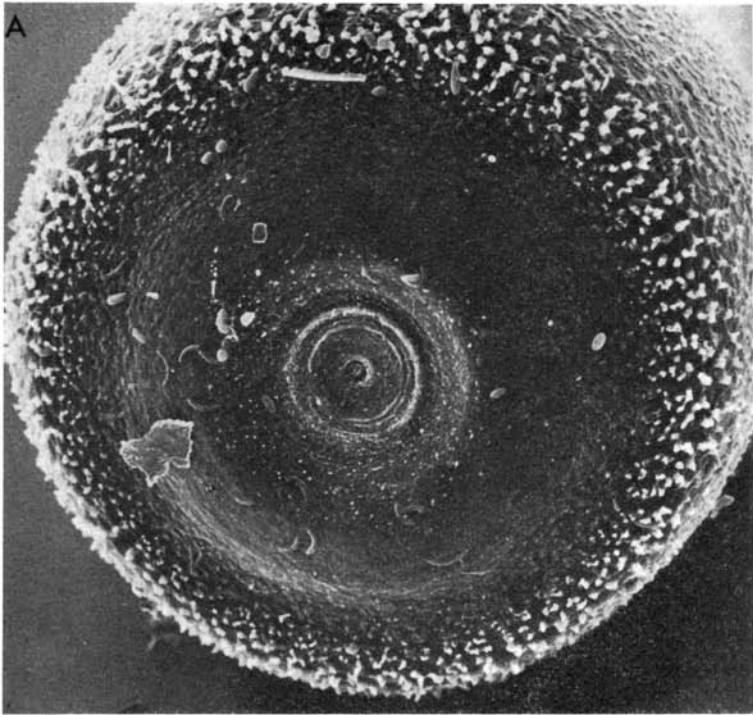
Derivation of name.—Swedish *Gotland*, where the type locality of the type species and type localities for several other species are located.

Type species.—*Gotlandochitina martinssoni* n. sp.

Species.—*Gotlandochitina martinssoni* n. sp.; *G. corniculata* n. sp.; *G. cornuta* n. sp.; *G. militaris* n. sp.; *G. tabernaculifera* n. sp.; *G. uncinata* n. sp.; *G. valbyttiensis* n. sp.; *G. villosa* n. sp.; *Ancyrochitina aequoris* Urban & Kline, 1970; *Angochitina callawayensis* Urban & Kline, 1970; *A. milanensis* Collinson & Scott, 1958; *Conochitina spinosa* Eisenack, 1932; *Sphaerochitina spinipes* Eisenack, 1964.

Diagnosis.—Chitinozoans with subcylindrical neck and conspicuous flexure, lacking shoulder and with a globose or subconical body characterized by an ornamentation of hollow spines attached to the vesicle in longitudinal rows.

Remarks.—The outline of the vesicle is similar to *Sphaerochitina* and *Ancyrochitina*, from which *Gotlandochitina* is extracted because of its peculiar orna-



mentation. There are reasons to believe that a closer study of the heavily ornamented, Silurian and Devonian species, referred to the genus *Sphaerochitina*, will reveal their affinity with *Gotlandochitina*. Several species with a heavy ornamentation all over the vesicle have earlier been referred to *Ancyrochitina*, although they lack the appendices characterizing the latter genus. It is probable that most of these latter species should also be referred to *Gotlandochitina*. The type species carries a prosome.

Gotlandochitina corniculata n. sp.

Fig. 47.

Derivation of name.—Latin *corniculatus*, with small horns, referring to the short but wide spines.

Holotype.—LO 4614 T.

Type stratum.—Höglint Beds, unit c, top (Sample G 69—110).

Type locality.—Strandakersviken 1, Gotland.

Diagnosis.—*Gotlandochitina* species with subconical body and broadly rounded basal edge and with a subcylindrical neck which is slightly widened at the finely-fringed aperture. The body is provided with short but wide and conical spines which are widely scattered but arranged in more or less conspicuous rows. The coalescent bases of the spines are elongated in longitudinal direction and some few spines branch once in lateral direction. The spines are most well-developed in the aboral part of the body and in the aboral part of the neck.

Dimensions.—Population from the type stratum in microns: length (excl.) 101—125 (holotype 105), width (excl.) 45—65 (holotype 50), maximum length of spines 15 (holotype 11), major part between 8 and 12.

Description.—In most specimens the base is convex but specimens with a flat or concave base do occur. The base is not provided with spines and the spines de-

crease in size in the oral part of the neck. Most spines are not attached perpendicularly to the vesicle wall but point in the oral or aboral direction and their lateral parts are curved in many specimens, thus having a hook-like appearance. The vesicle wall is smooth or finely verrucate between the spines. No observations of internal structures have been made.

Occurrence.—*G. corniculata* is a good index fossil which is restricted to parts of the Höglint Beds. It makes its appearance at Lauter 1 in the lower-middle part of the Höglint Beds. It appears that a middle Höglint age is more probable for this locality. The species was encountered also into the uppermost part of the Höglint Beds. It is interesting to note the local geographical extension of the species in the uppermost part of these beds, from Strandakersviken 1 in the Fårö island to the southwestern, marly facies at Ansarve 3.

Gotlandochitina cornuta n. sp.

Fig. 48.

Derivation of name.—Latin *cornutus*, provided with horns, referring to the horn-like ornamentation.

Holotype.—LO 4608 T.

Type stratum.—Mulde Beds, upper part (sample G 66—117).

Type locality.—Däpps 1, Gotland.

Diagnosis.—*Gotlandochitina* species with subconical body and broadly rounded basal edge and subcylindrical neck that comprises less than half of the total length and widens in its oral part. The aperture is fringed and the entire vesicle is covered by a conspicuous, granulate or verrucate ornamentation. The vesicle is provided with broad, coalescent and curved spines which are elongated longitudinally and most conspicuously developed at the basal edge. Most spines are fenestrate or have walls that are not entirely closed.

Dimensions.—Population from the type stratum in microns: length 135—165 (holotype 155), width (excl.) 60—80 (holotype 70), maximum length of spines 25 (holotype 16), commonly 12—20, maximum dimension of base of spine 25 × 75, commonly 10 × 15 (holotype 8 × 14).

Description.—The spines are often curved and when their walls do not close, they resemble a parrot's beak. The minor ornamentation of the vesicle wall is also developed in the same way under the spines. Hence, the spines were formed outside the vesicle by the

Fig. 46. *Eisenackitina philipi* n. sp. A, E—F. Burgen 4, Eke Beds, lowermost part (G 72—119). LO 4656t. B, D. Nyan 2, Eke Beds, lowermost part (G 72—54). C. Lau Backar 1, Eke Beds, *Rhizophyllum* Limestone (G 71—102). LO 4695t.

A. Specimen in F in oblique aboral view. Note the concentric structures in the base. ×1300. B. Holotype in lateral view. LO 4637T. ×410. C. Vesicle wall in transverse section. Note the finely verrucate ornamentation in the interior, aboral part of vesicle. ×5000. D. Specimen in lateral view. LO 4637t. ×600. E. Ornamentation in the middle part of the specimen in F. ×6000. F. Specimen in lateral view. ×600.

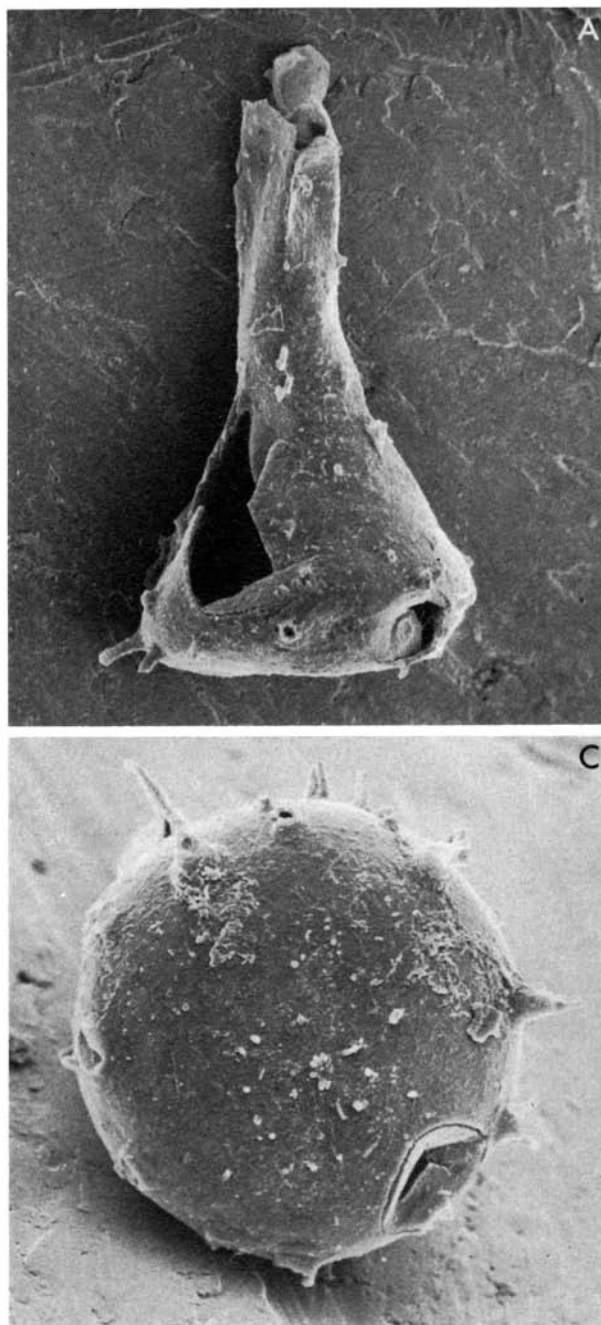
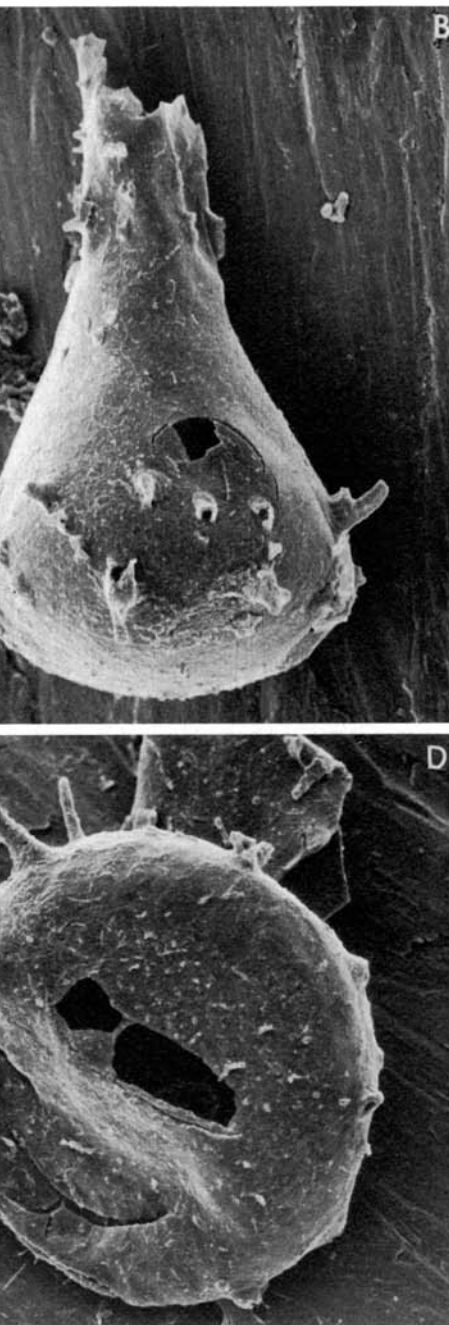


Fig. 47. *Gotlandochitina corniculata* n. sp. Strandakersviken 1, Högklint Beds, unit c, top (G 69—110). A. Specimen in lateral view. LO 4614t. $\times 750$. B. Holotype in lateral view. LO 4614T. $\times 930$. C. Holotype in aboral view. $\times 1200$. D. Specimen in aboral view. LO 4614t. $\times 930$.



Note the orientation of the hollow spines. LO 4614T. $\times 930$. C. Holotype in aboral view. $\times 1200$. D. Specimen in aboral view. LO 4614t. $\times 930$.

tissue that once secreted the entire vesicle. There is no pore through the vesicle wall under the spines and no differentiation of the interior surface of the vesicle wall reveals where the spines are attached outside. Some specimens have spines where the thin membrane, which forms the spine, is wrinkled and branched in a complex way.

Occurrence.—*G. cornuta* seems to be an excellent index fossil. It was encountered only in the Mulde Beds which represent a short time interval.

Gotlandochitina martinssoni n. sp.

Fig. 49.

Derivation of name.—Named in honour of Professor Anders Martinsson, Uppsala.

Holotype.—LO 4589 T.

Type stratum.—Slite Marl, *Conchidium tenuistriatum* Beds (Sample G 66—83).

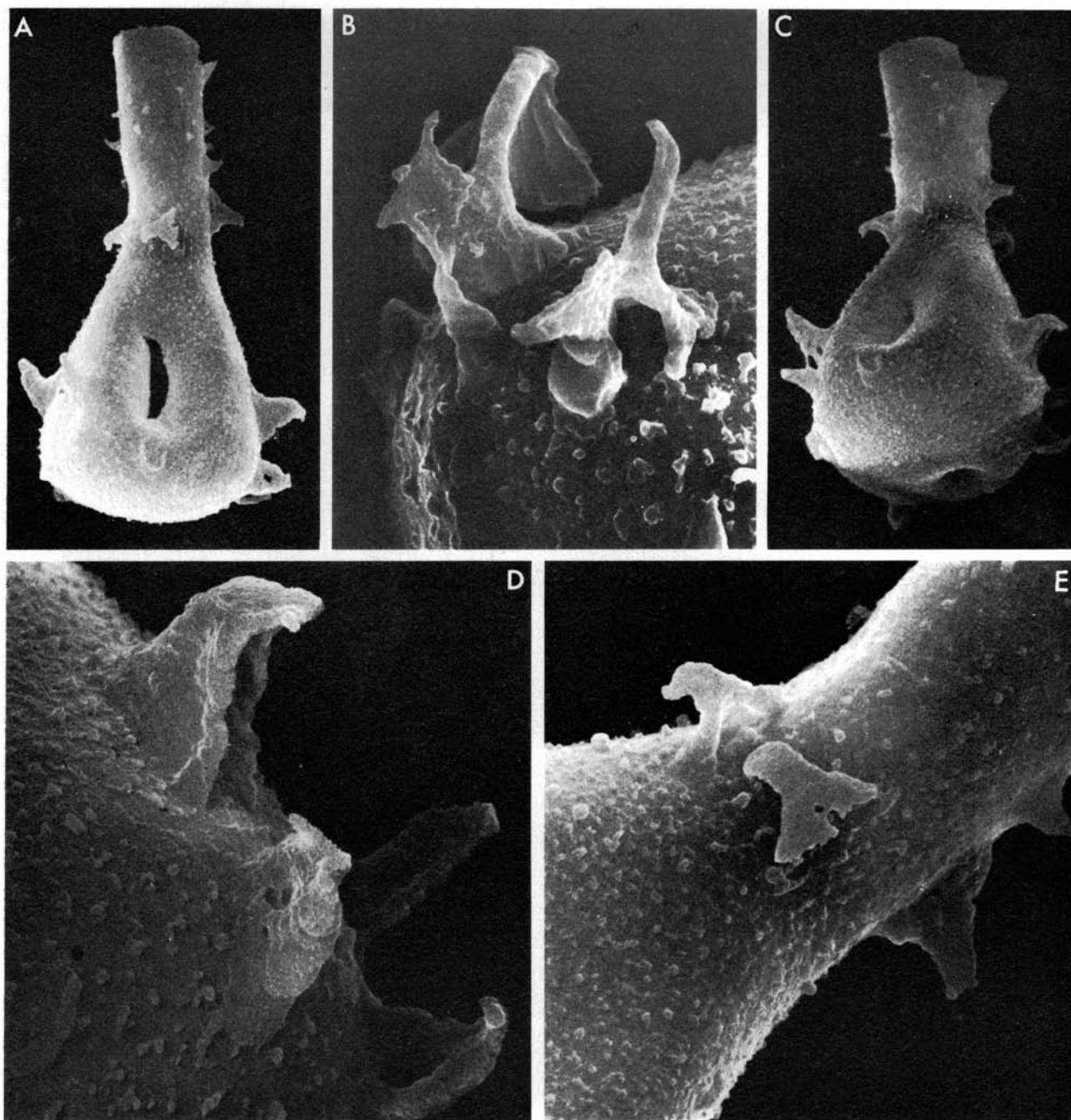


Fig. 48. *Gotlandochitina cornuta* n. sp. Däpps 1, Mulde Beds, upper part (G 66—117). A. Holotype in lateral view. LO 4608T. $\times 500$. B. Specimen in lateral view showing irregular spines in the aboral part of vesicle. Note the granulate orna-

mentation of vesicle wall inside the base of the hollow spine. LO 4608t. $\times 1500$. C. Holotype in oblique aboral view. $\times 500$. D. Spines in the aboral part of the holotype. $\times 2000$. E. Spines in the aboral part of neck of the holotype. $\times 1500$.

Type locality.—Sinnarve 1, Gotland.

Diagnosis.—*Gotlandochitina* species with globose body lacking basal edge. The neck comprises about half of the length of vesicle and is slightly widened in the oral part. The aperture is smooth to finely fringed. The smooth, to very finely verrucate, vesicle wall carries a great number of densely spaced, long and curved spines arranged in 10—18 longitudinal rows. The spines, which are coalescent and branching at the same time, decrease in size towards the aperture.

Dimensions.—Population from the type stratum in microns: length (excl.) 135—150 (holotype 141), width (excl.) 59—64 (holotype 64), maximum length of spines 27, minimum length (visible part) of prosome 27.

Description.—Most spines are long and irregularly curved and are coalescent in their innermost part, some of them branch once. The spines are strongly widened at the base by their coalescent roots and their bases are elongated along the longitudinal axis. Several

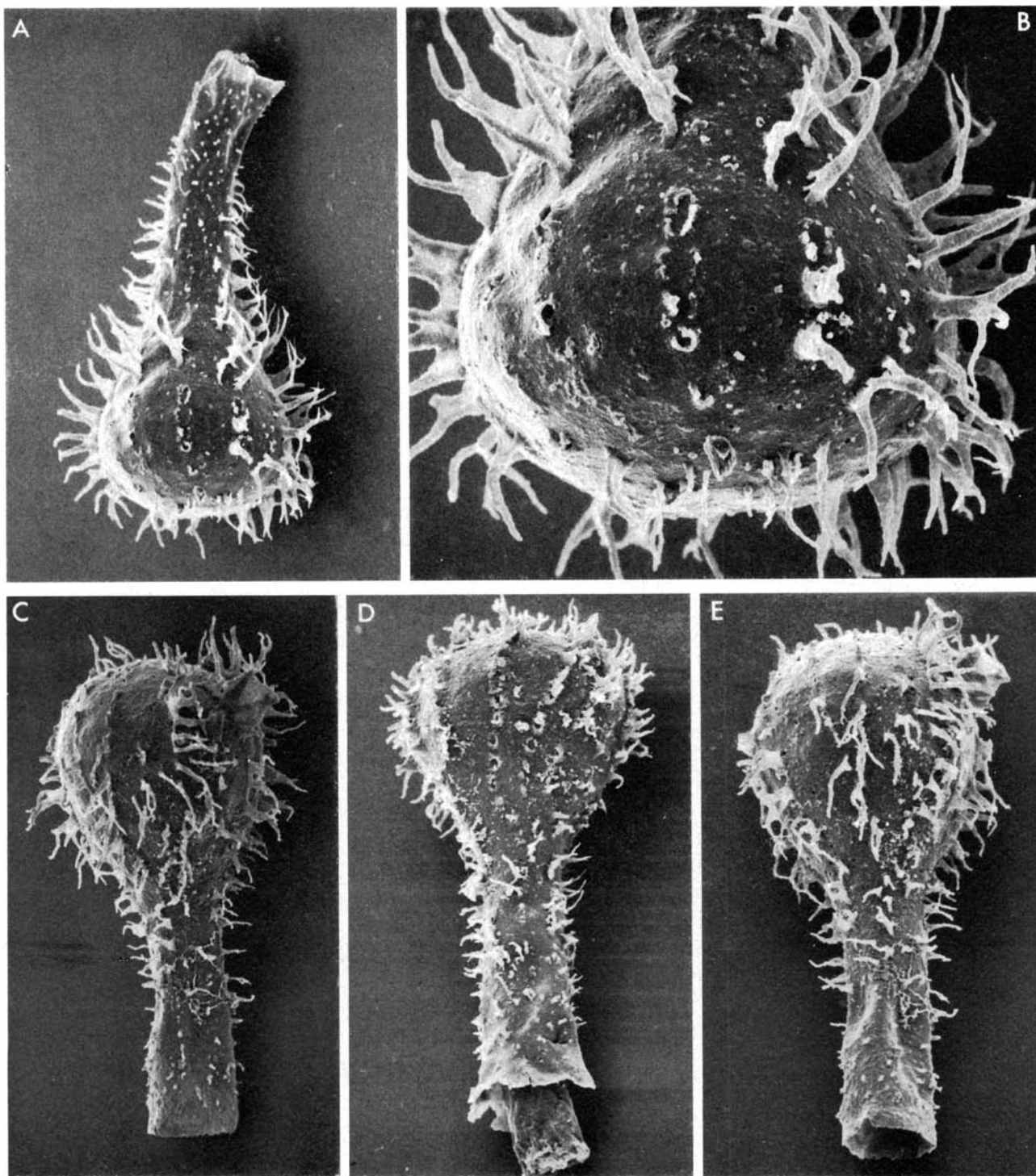


Fig. 49. *Gotlandochitina martinsoni* n. sp. Sinnarve 1, Slite Marl, *Conchidium tenuistriatum* Beds (G 66—83). A. Specimen in lateral view. Note the curved neck. LO 4589t. $\times 530$. B. Same specimen, lateral view. $\times 1320$. C. Specimen in

lateral view. LO 4589t. $\times 530$. D. Holotype in lateral view. Note the prosome (see also Fig. 71). LO 4589T. $\times 530$. E. Oblique lateral view of the specimen in C. $\times 600$.

spines on the body are flattened perpendicularly to the longitudinal axis and when the bases are extended in the opposite direction the spines resemble sails in lateral view. The decrease in size in oral direction is linked up with reduced branching and in the apertural part of the neck they are reduced to verrucae. The species is provided with a prosome, but other observations of internal structures have not been made. The

exterior part of the prosome shows no trace of a complicated structure and its rigid, tube-like exterior makes it improbable that the prosome was contractile earlier. Due to the similarity in the over-all appearance of the *Gotlandochitina* species it is reasonable to suppose that all species of this genus were provided with prosomes, but until this has been proved this character cannot be used in the generic description. The longi-

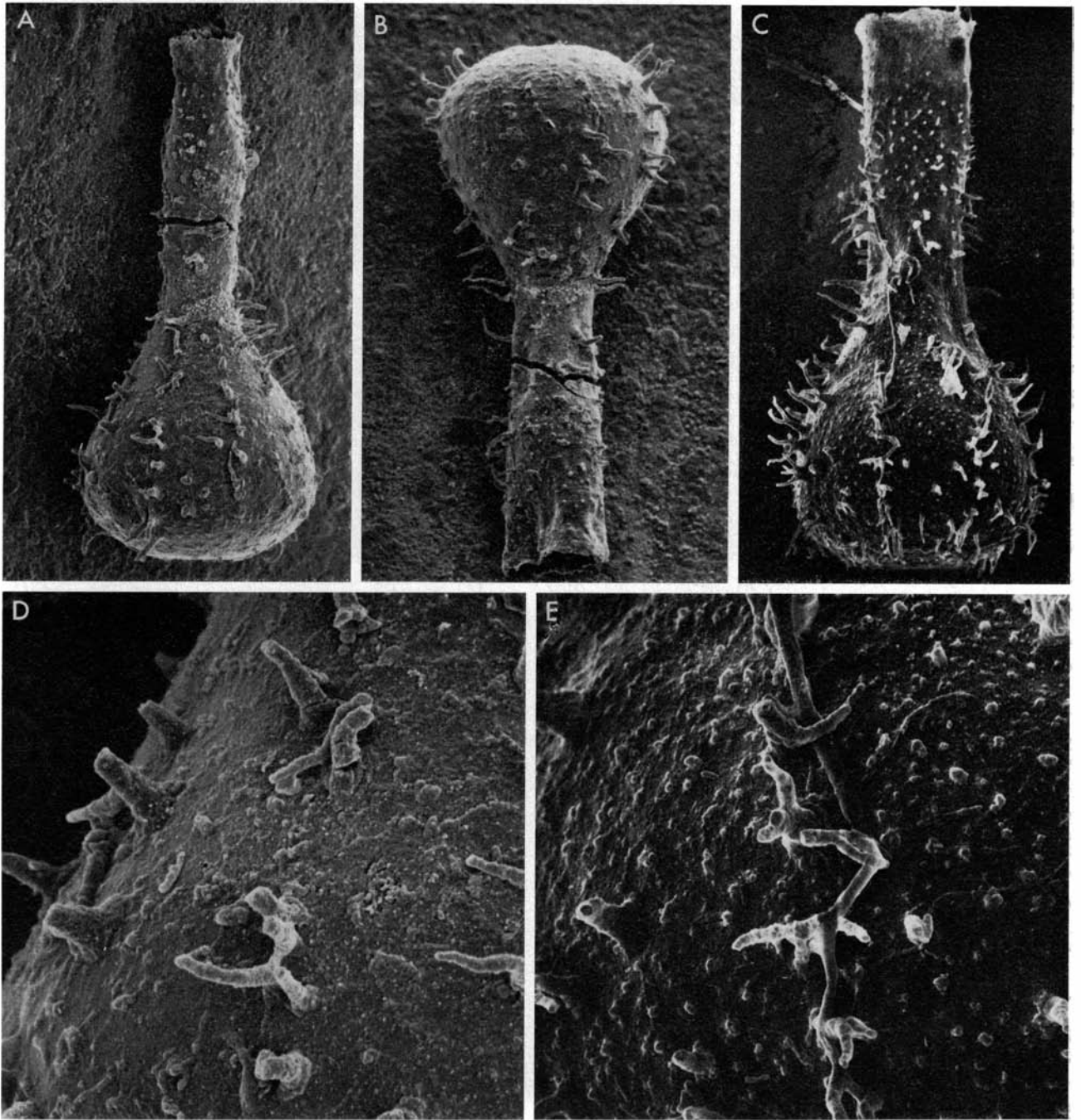


Fig. 50. *Gotlandochitina militaris* n. sp. Smiss 1, Klinteberg Marl, upper part (G 71—48). A. Specimen in lateral view. LO 4604t. $\times 600$. B. Same specimen, tilted, lateral view. $\times 600$. C. Holotype in lateral view. LO 4604T. $\times 600$.

D. Ornamentation in the oral part of the body of the specimen in A. $\times 2400$. E. Ornamentation of the middle part of the body of the holotype. $\times 2400$.

tudinal axis is somewhat curved in many specimens of *G. martinssoni*. It is probable that the specimens classified as *Sphaerochitina* sp. aff. *spinipes* and *Sphaerochitina spinipes* from the Slite Marl and figured by Eisenack (1964a, Pl. 28: 8 and 9) belong to *G. martinssoni*.

Occurrence.—*G. martinssoni* has a short stratigraphical range and is restricted only to the middle-upper part of the Slite Beds. It makes its debut in the *Conchidium tenuistriatum* Beds and the northwestern part

of the Slite Marl and then ranges up in the *Pentamerus gotlandicus*—*Atrypa reticularis* Beds but then disappears.

Gotlandochitina militaris n. sp.

Fig. 50.

Derivation of name.—Latin *militaris*, in military fashion, referring to the spinose ornamentation which is attached to the body in ranks.

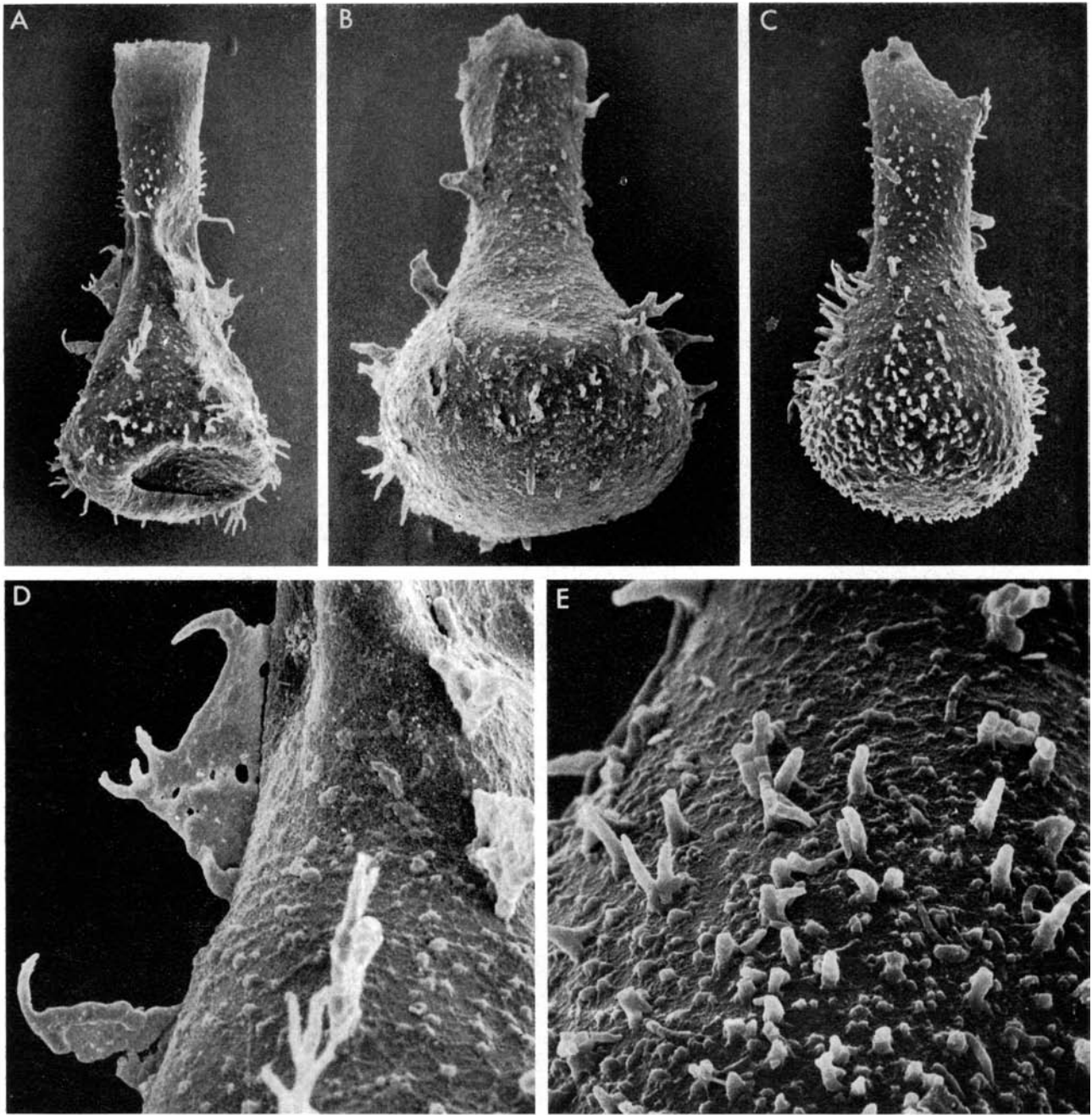


Fig. 51. *Gotlandochitina spinipes* (Eisenack, 1964). A, B, D. Snoder 1, Hemse Marl, northwestern part (G 66—97). LO 4612t. C, E. Gyle 1, Hemse Beds, unit b (G 72—76). LO 4624t.

A. Specimen in lateral view. $\times 600$. B. Specimen in oblique

aboral view. $\times 800$. C. Specimen in oblique lateral view. $\times 600$. D. Same specimen as in A. Ornamentation at the flexure. $\times 2400$. E. Specimen in oblique aboral view showing the ornamentation of the aboral part of neck. $\times 2400$.

Holotype.—LO 4604 T.

Type stratum.—Klinteberg Beds, Klinteberg Marl, upper part (Sample G 71—48).

Type locality.—Smiss 1, Gotland.

Diagnosis.—*Gotlandochitina* species with cylindrospheroidal vesicle and broadly rounded but conspicuous flexure and broadly rounded shoulder. The vesicle wall is ornamented by 6—12, commonly 8—10 longitudinal rows of spines. The spines are long and

slender but several are coalescent and/or branch. In between the spines the wall is coarsely verrucate.

Dimensions.—Population from the type stratum in microns: length (excl.) 140—155 (holotype 149), width (excl.) 60—70 (holotype 63), width (incl.) 70—80 (holotype 73), width of aperture 30—35 (holotype 32).

Description.—The species is characterized by the few rows of spines and by the coarsely verrucate vesicle wall. The ornamentation decreases in size towards the

finely fringed aperture and in the central part of the base. The spines are hollow in their proximal part only and most of them do not have longitudinally elongated bases. There is no pore through the vesicle wall connecting the interior of a spine to the interior of the vesicle. The spines are not branched more than once.

Occurrence.—*G. militaris* is characteristic of the uppermost part of the Klinteberg Marl which is the only unit in which the species occurs.

Gotlandochitina spinipes (Eisenack, 1964)

Fig. 51.

Synonymy □ *Sphaerochitina spinipes* n. sp.—Eisenack 1964a: 322, Pl. 29: 5–6, *non* Pl. 28: 8–9.

Emended diagnosis.—*Gotlandochitina* species with globose body lacking basal edge. The neck comprises half the length or more of the vesicle and is slightly widened towards the aperture which is finely fringed. The vesicle is provided with complex spines arranged in more or less conspicuous, longitudinal rows. The spines decrease in size and complexity in the oralmost part of the neck and in the basal part of the body. Most spines are coalescent with the base elongated in longitudinal direction and often the basal parts of some spines are fused, resulting in a fenestrate, sail-like ornamentation. The vesicle wall is provided with a verrucate ornamentation in between the spines. Some spines branch over in lateral direction.

Dimensions.—Population from Snoder 1 in microns: length (excl.) 127–145 (in good agreement with Eisenack's values: 124–152, holotype 138), width (excl.) 55–63.

Remarks.—In several specimens some spines from two different rows are fused in their distal ends, thus giving rise to hollow and fenestrate protuberances. Observations of internal structures have not been made.

The species has been transferred from *Sphaerochitina* because of the arrangement of spines in rows. Eisenack's original diagnosis of *Sphaerochitina* is very precise, especially as far as the ornamentation is concerned, stating that the vesicle wall is smooth or provided with very small verrucae and lacking spines (Eisenack 1955a: 162). In my opinion his diagnosis fits excellently a restricted group of species common in the Baltic Silurian. It is also of interest to note that many heavily ornamented forms referred to *Sphaerochitina* have an over-all vesicle shape that is slightly similar to either *Ancyrochitina* or *Angochitina*. To include these forms in *Sphaerochitina* will only cause confusion and the fact that heavily spined forms do not fit into the diagnosis of the latter genus will lead to an "emendation" of the diagnosis of *Sphaerochitina*.

Occurrence.—*G. spinipes* is restricted to the north-western part of the Hemse Marl and to units b and c of the Hemse Beds in limestone facies.

Gotlandochitina spinosa (Eisenack, 1932)

Fig. 52.

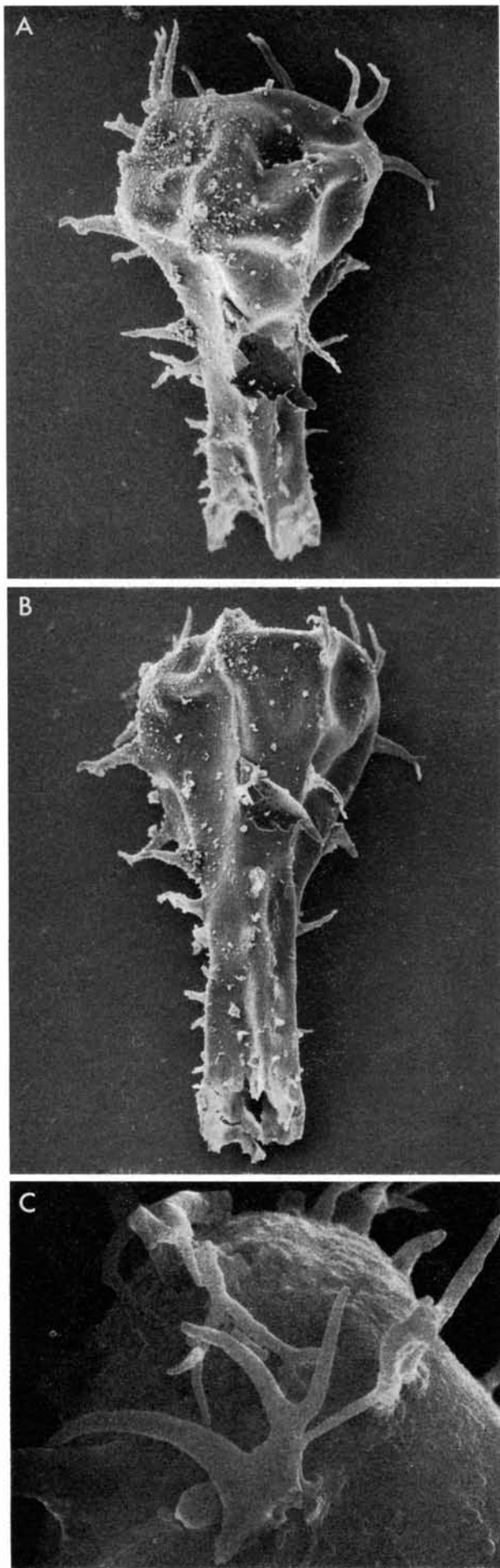
Synonymy □ *Conochitina spinosa* n. sp.—Eisenack 1932: 271–272, Pl. 12: 11–13. □ *Ancyrochitina spinosa* (Eisenack 1932)—Eisenack 1959a: 13–14, Fig. 2 c, Pl. 2: 1–2. □ *Ancyrochitina spinosa* (Eisenack 1932)—Eisenack 1964a: 325, Pl. 28: 10–11.

Emended diagnosis.—*Gotlandochitina* species with subconical body with rounded to broadly rounded basal edge. The flexure is broadly rounded and the subcylindrical neck, which comprises about half of the length of vesicle, is slightly widened towards the aperture, which is finely fringed. The spines are long, thick and rounded with coalescent bases and most branch once, or occasionally twice. The spinose ornamentation covers the entire vesicle but decreases in size and complexity in the base and in the oralmost part of the neck. The bases of some spines are elongated in longitudinal direction.

Dimensions.—Population from Sinnarve 1 in microns: length (excl.) 115–152 (in good agreement with Eisenack's values, 109–155, neotype 109), width (excl.) 55–73 (neotype 60), maximum length of ornamentation 26, the majority of spines are 12–20 long.

Remarks.—In most specimens the base is slightly convex as described in the original diagnosis (Eisenack 1932: 270), but specimens with a flat or slightly concave base do occur, as noticed already by Eisenack (1959a: 14). A characteristic feature is that many spines do not branch until their distal end and that the proximal part of a spine is cone-shaped. The bases of some spines are elongated in a longitudinal direction and fused with neighbouring spines. The vesicle wall is smooth or finely verrucate in between the spines.

Occurrence.—*G. spinosa* occurs only in the Slite Beds, where it is restricted to the *Conchidium tenuistriatum* Beds and unit g and to the northwestern and central parts of the Slite Marl. The species was erected on material extracted from an erratic boulder of crinoid limestone of Silurian age. Eisenack designated a neotype from the Middle Wenlockian of Gotland. In Gotland *G. spinosa* is restricted to rocks of this age. "*Ancyrochitina spinosa*" has been reported from the Solon Member of the Middle Devonian (Givetian) Cedar Valley Formation in Iowa (Dunn 1959: 1013–1014, Pl. 127: 19–23); from supposed Upper Devonian strata in the bore-hole Oum Doul 1 in south-



westernmost Morocco (Grignani & Mantovani 1964: 244, Pl. 1: 1—4); from supposed Early Silurian in the Amazonas Basin and supposed Early Devonian in the Paraná Basin, Brazil (Da Costa 1966: 20—22, Fig. 11, Pl. 4: 17, 1968a: 5, 1968b: 10, Pl. 3: 7, 1971a: 221, Fig. 9, 1972b: 57—58, Pl. 11: 1—2); under the name of *Angochitina spinosa* the taxon has been reported from the San Pedro Fm and the La Vide Shale Mb of northwestern Spain (Cramer 1964: 342, 1967a: 114). I have studied a lot of Devonian chitinozoans from several parts of the world, but I have never seen a single specimen of *G. spinosa* among them. The Devonian taxa referred to the latter species are homonyms for species occupying a similar habitat. Hence, the Devonian taxa are excluded here. The two specimens figured by Eisenack (1955a: 176, Pl. 1: 11—12) and classified as *Ancyrochitina* sp. aff. *spinosa* and probably of Pridolian age are not conspecific with *G. spinosa* and must be excluded as a supposed connecting link in efforts to construct a more or less uninterrupted stratigraphical range of "*G. spinosa*" from the Early Silurian into the Late Devonian.

Gotlandochitina tabernaculifera n. sp.

Fig. 53.

Derivation of name.—Latin *tabernaculum*, hut, cabin, and *ferre* to wear, referring to the characteristic arrangement of spines.

Holotype.—LO 4623 T.

Type stratum.—Klinteberg Beds, unit f (Sample G 71—97).

Type locality.—Sutarve 2, Gotland.

Diagnosis.—*Gotlandochitina* species with cylindrospheroidal vesicle and broadly rounded but conspicuous flexure and lacking or with broadly rounded, inconspicuous shoulder. The vesicle wall has a verrucate to granulate ornamentation and is provided with more or less conspicuous rows of coalescent spines which are unbranched.

Dimensions.—Population from the type stratum in microns: length (excl.) 105—135 (holotype 115),

Fig. 52. *Gotlandochitina spinosa* (Eisenack, 1932). A—B. Sinnarve 1, Slite Marl, *Conchidium tenuistriatum* Beds (G 66—83). LO 4590t. A. Specimen in oblique aboral view. $\times 780$. B. Same specimen in lateral view. $\times 780$. C. Valbytte 1, Slite Marl, slightly younger than the *Conchidium tenuistriatum* Beds (G 71—34). Specimen in lateral view showing ornamentation at the basal edge. LO 4601t. $\times 1650$.

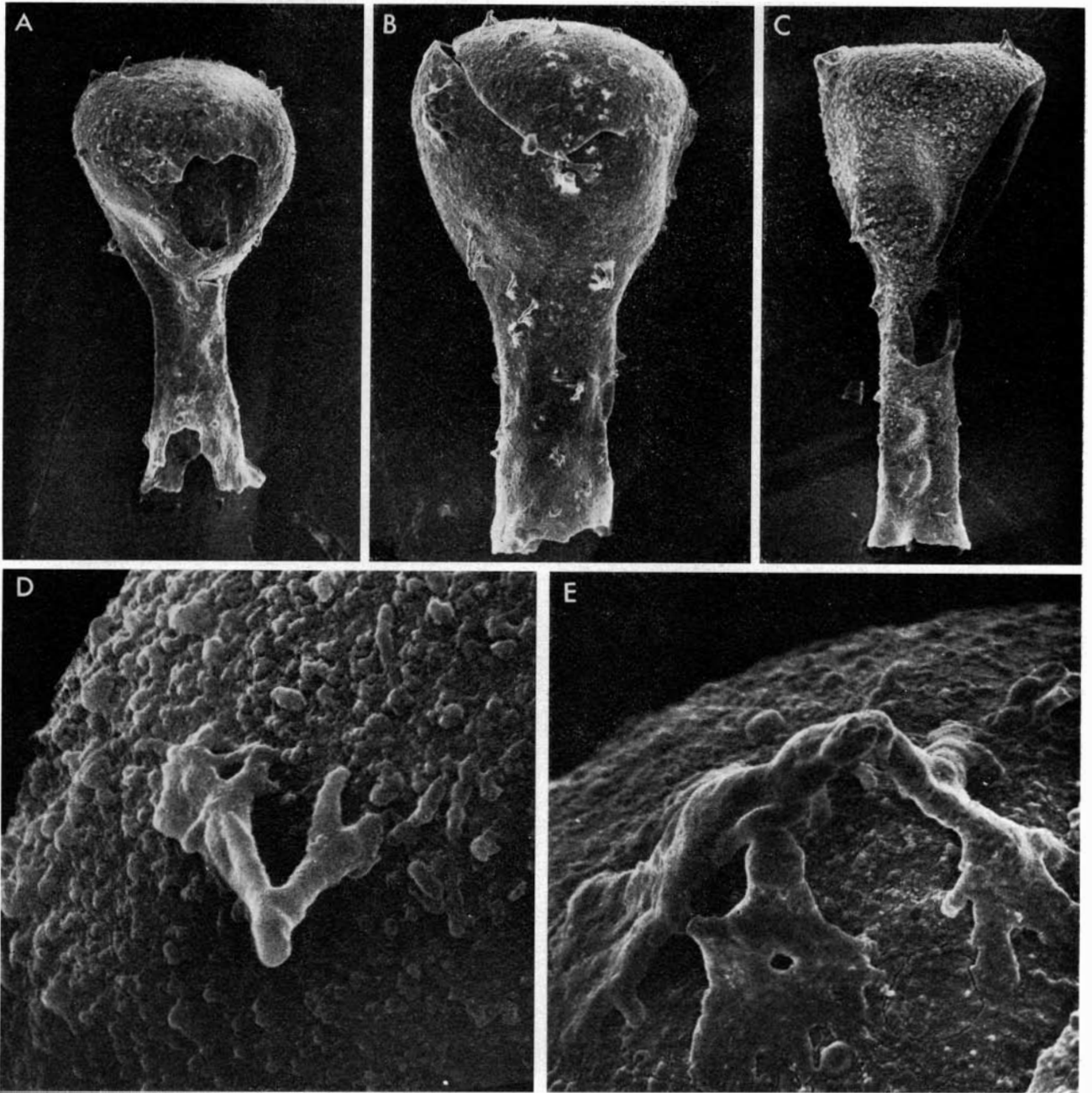


Fig. 53. *Gotlandochitina tabernaculifera* n. sp. Sutarve 2, Klinteberg Beds, unit f (G 71—97). A. Specimen in lateral view. LO 4623t. $\times 600$. B. Holotype in lateral view. LO 4623T. $\times 810$. C. Specimen in lateral view. LO 4623t. $\times 600$.

D. Same specimen, spine in the aboralmost part of the body. $\times 5000$. E. Holotype, spine in the aboral part of the body. $\times 6000$.

width (excl.) 50—65 (holotype 54), width of narrowest part of neck 18—25 (holotype 21), width of aperture 22—30 (holotype estimated at 25).

Description.—The narrowest part of the neck is just oral of the flexure and the neck is then widened in the oral direction, more abruptly at the finely fringed aperture. The neck comprises about half of the vesicle length. The spines are sparsely set on the vesicle but have a very characteristic shape. They have longitudinally elongated bases which are highly coalescent. It is not uncommon that a spine has more than ten

widely spaced “roots” which are coalescent far away from the vesicle wall. There are no pores through the vesicle wall under the spines. The vesicle wall is granulate or verrucate in its entirety but less so at the aperture and in the central part of the base. By its peculiar ornamentation the species is easily distinguished from other *Gotlandochitina* species.

Occurrence.—*G. tabernaculifera* was encountered only in units d and f of the Klinteberg Beds and in the undifferentiated lower-middle-upper part of these beds.

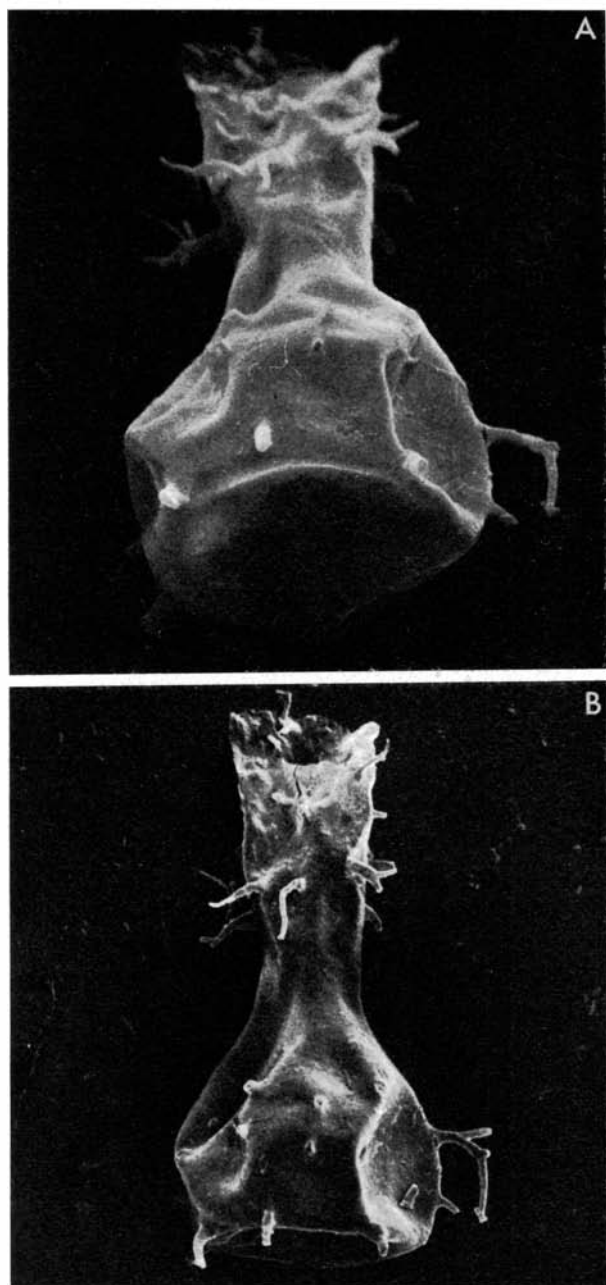


Fig. 54. *Gotlandochitina uncinata* n. sp. Munkebos 1, Slite Marl, *Pentamerus gotlandicus* Beds or slightly younger (G 71—79). LO 4593T. A. Holotype in oblique aboral view. $\times 750$. B. Holotype in lateral view. $\times 600$.

Gotlandochitina uncinata n. sp.

Fig. 54.

Derivation of name.—Latin *uncinatus*, provided with a small hook, referring to the shape of some of the spines.

Holotype.—LO 4593 T.

Type stratum.—Slite Marl, *Pentamerus gotlandicus* Beds or slightly younger (sample G 71—79).

Type locality.—Munkebos 1, Gotland.

Diagnosis.—*Gotlandochitina* species with cylindrospheroidal vesicle and broadly to bluntly rounded flexure and broadly rounded shoulder. The subcylindrical neck is widened in oral direction. The body is provided with 9—13 longitudinal rows of long but slender spines, which commonly branch 1—3 times. The oral part of the body and the aboral part of the neck lack ornamentation, but the oral part of the neck carries longitudinal rows of long, slender spines that branch 1—3 times.

Dimensions.—Population from the type stratum in microns: length (excl.) 110—135 (holotype, slightly deformed 122), width (excl.) 50—70 (holotype 58), width of aperture 25—35 (holotype, estimated at 28).

Description.—The basal edge is broadly rounded and the base convex and lacking ornamentation. The smallest width of the neck is at the flexure. The vesicle wall is finely granulate. *G. uncinata* has characteristic hollow spines with narrow, circular bases lacking connection with the interior of the vesicle. The spines taper gently and when branched the distal end is abruptly curved and renders the spines a hook-like shape. The aperture is widened and finely fringed. The length of spines is commonly between 10 and 30 microns.

Occurrence.—The species occurs from the north-western part of the Slite Marl and from the *Conchidium tenuistriatum* Beds through the Slite Siltstone. With the exception of some uncharacteristic specimens classified as *G. cf. uncinata* in the upper part of the Mulde Beds, the species is restricted to the upper part of the Slite Beds and to the Halla Beds.

Gotlandochitina valbyttiensis n. sp.

Fig. 55.

Derivation of name.—Latin *Valbyttiensis*, from Valbytte, the type locality close to the old fishing village with that name.

Holotype.—LO 4598 T.

Type stratum.—Slite Marl, slightly younger than the *Conchidium tenuistriatum* Beds (Sample G 71—34).

Type locality.—Valbytte 1, Gotland.

Diagnosis.—*Gotlandochitina* species with cylindrospheroidal vesicle and broadly to bluntly rounded flexure and lacking or with a broadly rounded shoulder. The neck is widened in oral direction. The ornamentation consists of longitudinal rows of very wide but short protuberances or spines which have

their bases elongated in longitudinal direction. The ornamentation is best developed at the basal edge and in the middle part of the neck.

Dimensions.—Population from the type stratum in microns: length (excl.) 135–165 (holotype 145), width (excl.) 65–80 (holotype 74), width (incl.) 75–90 (holotype 83), width of aperture 25–38 (holotype 30).

Description.—The neck has its smallest width at the conspicuous flexure. The aperture is finely fringed. The vesicle wall has a verrucate ornamentation and longitudinal series of spinose ornamentation. The latter is mainly confined to the aboral part of the body and to the neck, but scattered spines do occur in the oral part of the body. The spinose ornamentation characterizes the species and consists of irregularly formed protuberances. Several are open in their distal end and their wide bases have an irregular outline but are longitudinally elongated. These protuberances were welded to the vesicle wall by the tissue that once surrounded and formed the vesicle. The interior of the vesicle wall shows no sign of the attachment of the spines outside. In some specimens the protuberances are so densely spaced that veritable palisades consisting of their wrinkled, membranous outer ends are formed. The spines on the neck are less complicated but have longitudinally elongated bases. The length of the ornamentation is 8–20 microns.

Occurrence.—*G. valbyttiensis* ranges from unit d of the Slite Beds to the upper part of the Mulde Beds. It has a peak of abundance in the *Conchidium tenuistriatum* Beds and *Pentamerus gotlandicus* Beds.

Gotlandochitina villosa n. sp.

Fig. 56.

Synonymy □ *Angochitina echinata* pars—Eisenack 1968a, Pl. 28: 29.

Derivation of name.—Latin *villosus*, hairy, shaggy, hirsute, referring to the ornamentation of long, fairly dense and curved spines.

Holotype.—LO 4587 T.

Type stratum.—Sundre Beds (sample G 69–7).

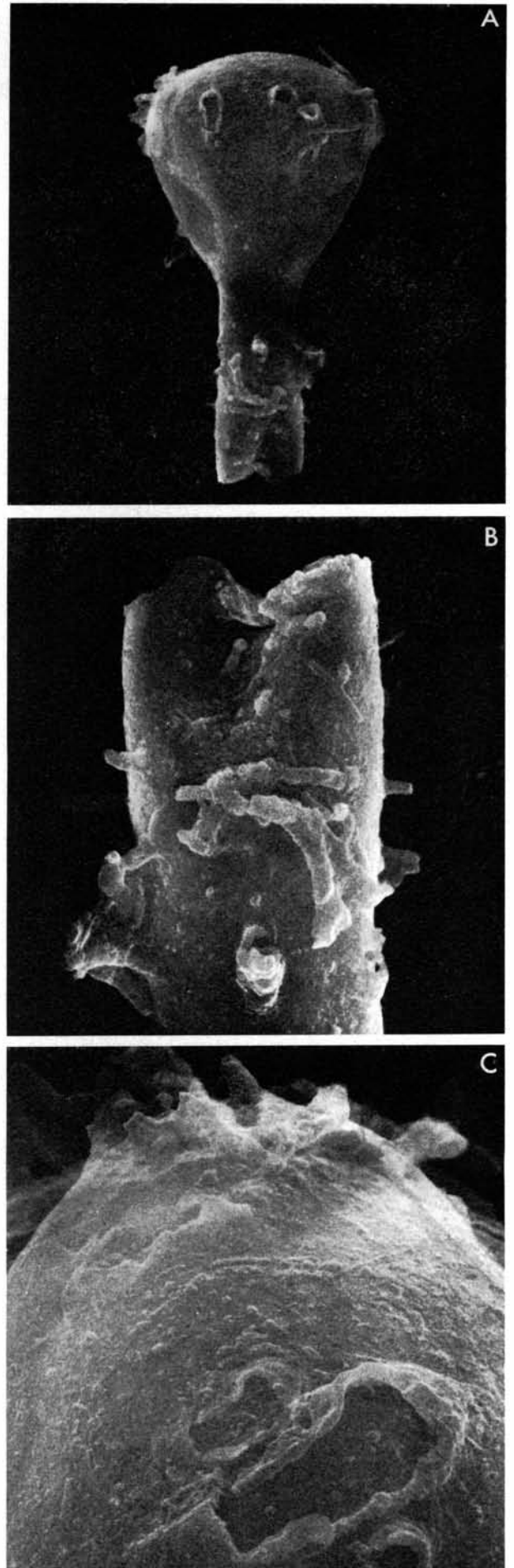


Fig. 55. *Gotlandochitina valbyttiensis* n. sp. Valbytte 1, Slite Marl, slightly younger than the *Conchidium tenuistriatum* Beds (G 71–34). LO 4598T. A. Holotype in lateral view. $\times 500$. B. Holotype, ornamentation of the neck. $\times 1500$. C. Holotype, lateral view of ornamentation at the basal edge. Note the homogeneous texture of the vesicle wall inside and outside the appendix. $\times 3000$.

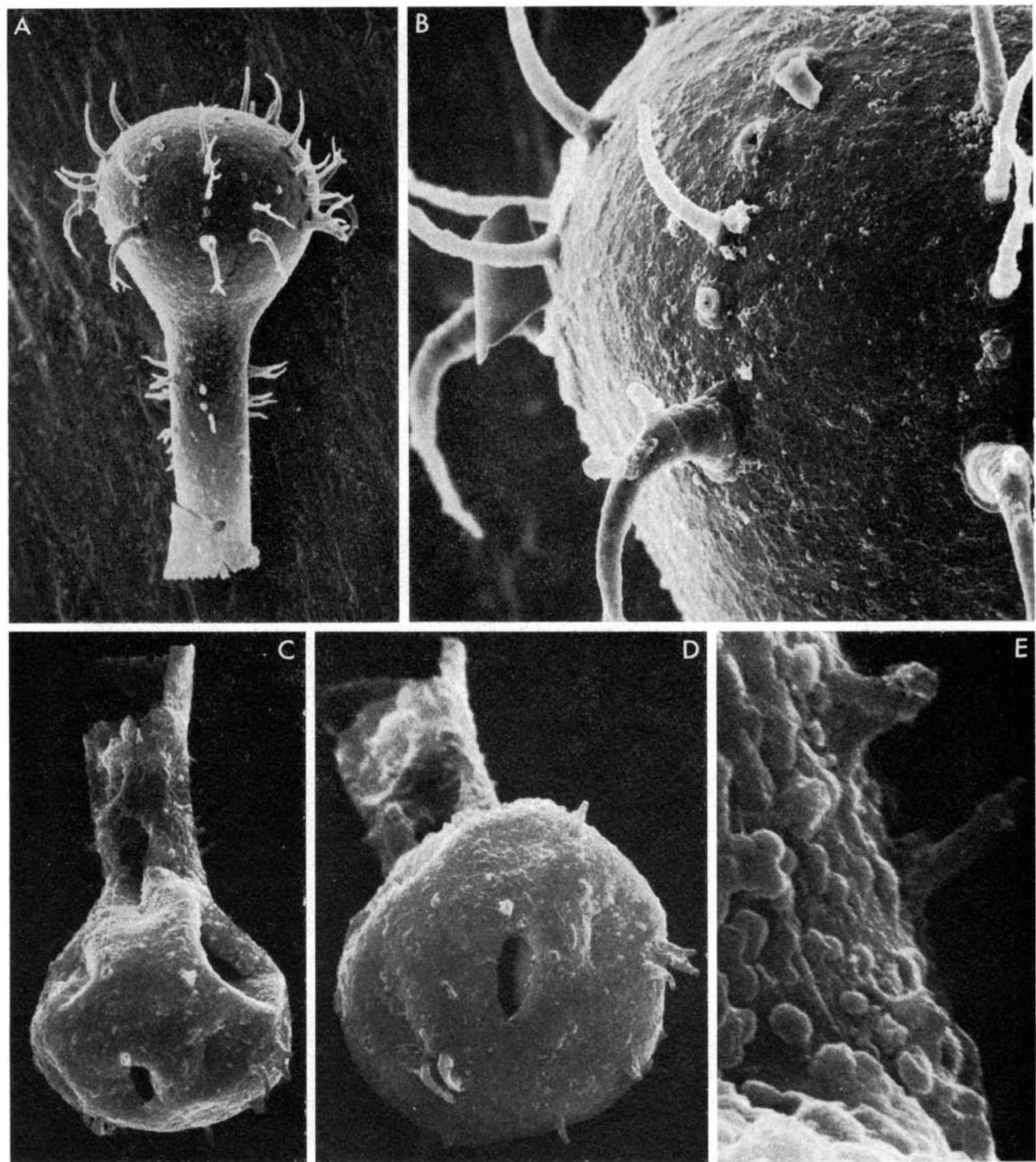


Fig. 56. *Gotlandochitina villosa* n. sp. A—B. Suders 1, Sundre Beds, middle part (G 69—7). LO 4587T. A. Holotype in lateral view. $\times 600$. B. Holotype, spines in the middle and aboral part of the body. $\times 2400$. C—E. Faludden 2,

Hamra Beds, unit c (G 71—16). LO 4662t. C. Specimen in lateral view. $\times 600$. D. Same specimen in oblique aboral view. $\times 800$. E. Same specimen, ornamentation of vesicle wall in the aboral part of the neck. $\times 5000$.

Type locality.—Suders 1, Gotland.

Diagnosis.—*Gotlandochitina* species with cylindrospheroidal vesicle and bluntly to broadly rounded but conspicuous flexure. The body is globose, lacking basal edge. The subcylindrical neck, which comprises half of the vesicle length or more, is widened at the fringed aperture. The ornamentation consists of 10—14 longi-

tudinal rows of long and slender, smoothly curved spines. The spines are restricted to the aboral parts of the body and neck.

Dimensions.—Population from the type stratum in microns: length (excl.) 125—140 (holotype 130), length (incl.) 135—150 (holotype 142), width (excl.) 55—75 (holotype 62), width (incl.) 70—95 (holotype

82), width of neck of the holotype 22, width of aperture of the holotype 27, maximum length of spine 22, commonly 5—15.

Description.—Most spines are simple but some branch once or occasionally twice. The spines of the aboral part of the body are curved in aboral direction and those of the oral part of the body in the opposite direction. This is true of all well-preserved populations and is not any effect of the diagenesis of the rocks. The spines, which have narrow bases, are hollow but their central cavity is narrow and has no connection with the interior of the vesicle. The vesicle wall is finely verrucate or granulate, between the spines. However, that ornamentation can be observed only at very high magnifications. The spines of the neck decrease in size towards the aperture, but those of the body are of the same size almost to the aboral pole.

Occurrence.—*G. villosa* makes its debut in the upper part of the Hamra Beds and then ranges through the lower and middle part of the Sundre Beds. Future studies will reveal if this apparently excellent index fossil ranges into the *Beyrichia* Limestone.

Genus *Linochitina* Eisenack, 1968

Type species.—*Conochitina erratica* Eisenack, 1931.

Remarks.—Eisenack's diagnosis (1968: 170) is strictly adhered to here. An important character of the species is that they occur not only as isolated specimens but also as twins and chains.

Species in Gotland.—*L. cingulata* (Eisenack, 1937); *L. convexa* n. sp., *L. erratica* (Eisenack, 1931); *L. hedei* n. sp.; *L. odiosa* n. sp.

Linochitina cingulata (Eisenack, 1937)

Fig. 57.

Synonymy □ *Desmochitina cingulata* n. sp.—Eisenack 1937: 220, Pl. 15: 6—7. □ *Eremochitina? cingulata* (Eis.)—Taugourdeau 1966a: 38, non Pl. 1: 4. □ *Linochitina cingulata* (Eisenack, 1937)—Eisenack 1968a: 170—171, Pl. 24: 12, 16, Pl. 29: 29—32, Pl. 31: 18.

Remarks.—*L. cingulata* is easily distinguished from other *Linochitina* species by its well-developed but very thin cingulum, thickness of vesicle wall and by the constriction of the body orally of the cingulum. However, the cingulum is very fragile and when detached *L. cingulata* may be confused with other superficially similar species. The wide cingulum is very thin and transparent and is not provided with any reinforcement structures, neither longitudinally, nor

transversally. The base is striated concentrically, but the remaining part of vesicle is very smooth. However, a verrucate ornamentation is observed at very high magnifications. The vesicle wall is very dark and opaque, but orally of the prosome it is thin and semi-transparent. Twins and chains are very common.

Occurrence.—The species makes its appearance in the *Conchidium tenuistriatum* Beds and the northwestern part of the Slite Marl and ranges through the Halla Beds to the top of the Mulde Beds. It has its peak of abundance in the *Pentamerus gotlandicus* Beds through the Slite Siltstone. In Scania, southernmost Sweden, it shows its peak of abundance in the upper part of the *testis-lundgreni* zone.

L. cingulata is an excellent index fossil. However, there are similar *Linochitina* species at restricted levels higher up in the Silurian and Devonian. Hence, the stratigraphical range of *L. cingulata* has been recorded as Caradocian—Devonian. Unfortunately, very few records of the species have been included under Synonymy. The reason is that several reports did not include any illustrations or contained figures by which it is impossible to establish synonymy. Hence, it is possible that some of the following papers include *L. cingulata*: Taugourdeau & Jekhowsky 1960: 1226, Pl. 6: 76—80, non 81; Taugourdeau 1961: 144—146, 1962a: 233, 1962b: 806—808, 1967a: 260; Taugourdeau & Abdusselamoglu 1962: 238—239; Cramer 1964a: 348, Pl. 22: 17, 1967a: 93, Pl. 3: 71—72, 1973: 282—283, Pl. 2: 16, 25—26; Cramer & Diez de Cramer 1972: 2272; Graindor et al. 1966: 341; Da Costa 1967: 108, 1971a: 247, 249, Figs. 60—61, 1971b: 88—90, Pl. 18: 3—7; Rauscher & Doubinger 1967: 319, Pl. 3: 7; Jardiné & Yapaudjian 1968, Pl. 6: 17; Goldstein et al. 1969: 378—379; Lister 1970: 17—18, 21—22; Lefort & Deunff 1971: 18, Deunff et al. 1971: 19—20, Pl. 4: 14—16, 23, 29; Deunff & Paris 1972, Figs. 21, 26, 30, 31.

Linochitina convexa n. sp.

Fig. 58.

Derivation of name.—Latin *convexus*, domed, convex, referring to the base and the body.

Holotype.—LO 4655 T.

Type stratum.—Eke Beds, lowermost part (Sample G 72—119).

Type locality.—Borgen 4, Gotland.

Diagnosis.—*Linochitina* species with highly convex flanks and base. The flexure is broadly rounded but conspicuous and the shoulder broadly rounded. The neck is widened towards the finely fringed aperture.

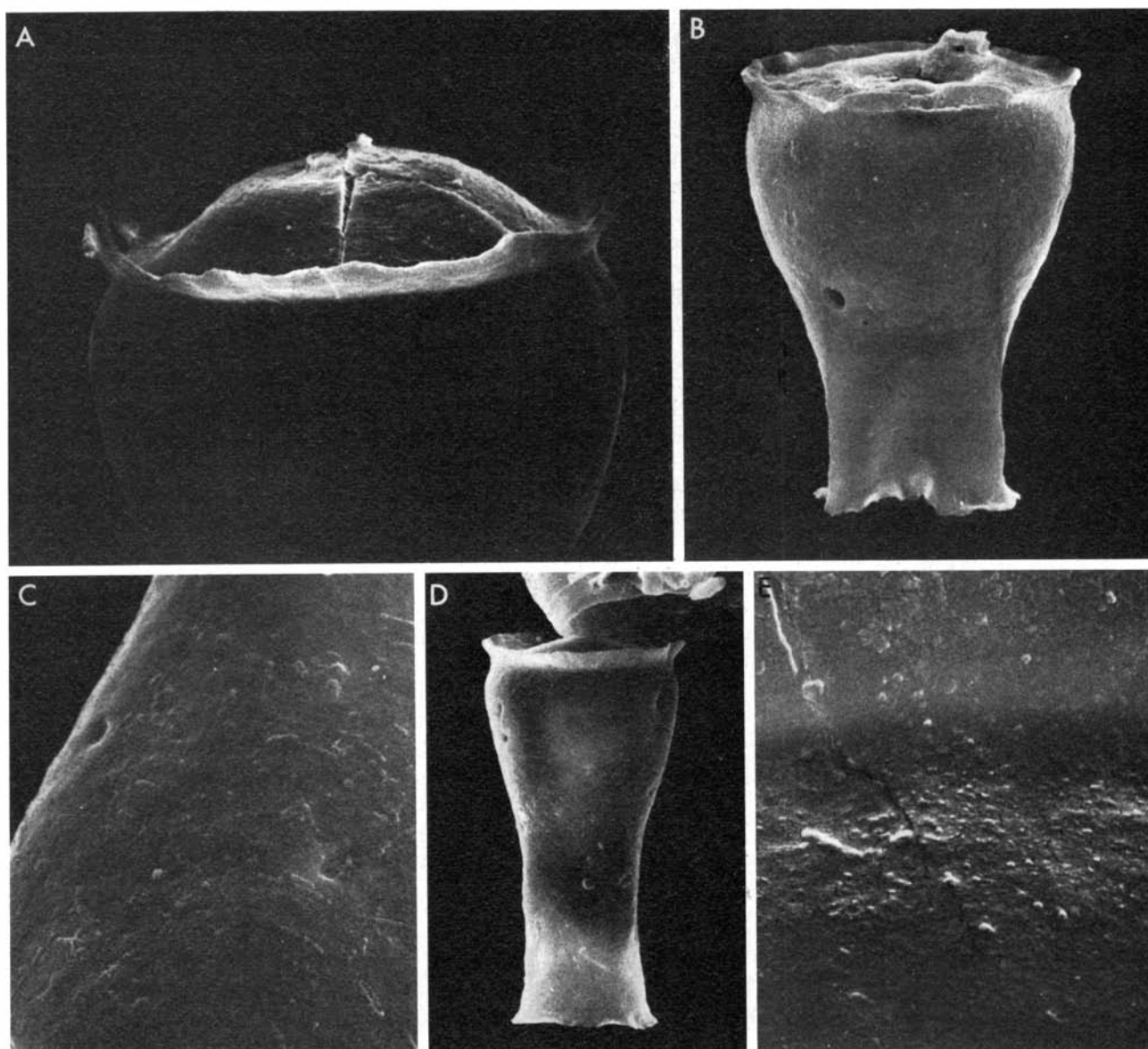


Fig. 57. *Linochitina cingulata* (Eisenack, 1937). Valbytte 1, Slite Marl, slightly younger than the *Conchidium tenuistriatum* Beds (G 71—34). LO 4602t. A. Aboral part of specimen in oblique lateral view showing the convex base and the cingulum. $\times 1000$. B. Specimen in oblique lateral view. $\times 800$. C. Texture of vesicle wall of the specimen in D.

Note perforations caused by parasites. $\times 2000$. D. Specimen in lateral view. Note the whitish lustre of neck and aperture which is caused by electrons penetrating the vesicle wall, where it is very thin. E. Same specimen, detail of the transition between the body (lower part of the picture) and the transparent cingulum. $\times 5000$.

The vesicle wall is thin and semi-transparent, particularly in the oral part of the vesicle. A very short but wide edging is attached at the basal edge.

Dimensions.—Population from the type stratum in microns: length 80—114 (holotype, with a somewhat fragmented aperture 80), width 35—55 (holotype 37), smallest width of neck 25—35 (holotype 27), width of aperture 25—45 (holotype 35), length of base 5—15 (holotype 7).

Description.—The highly concave base is striated concentrically and is provided with a sunken area with a basal scar. The vesicle wall is smooth to very finely

granulate (observed at magnifications of $3000\times$ and more). *L. convexa* is distinguished from *L. cingulata* by its short and wide edging at the basal edge and from *L. erratica* by its more convex flanks and base, shorter but wider vesicle and in lacking a basal process. *L. odiosa* also is provided with a basal process and has a very small and inconspicuous edging at the basal edge. *L. hedei* has less curved flanks and a cingulum-like edging extending perpendicularly to the longitudinal axis. Twins and chains are uncommon.

Occurrence.—*L. convexa* ranges stratigraphically from unit c of the Hemse Beds and the northwestern part of the Hemse Marl through the Eke Beds. It has a

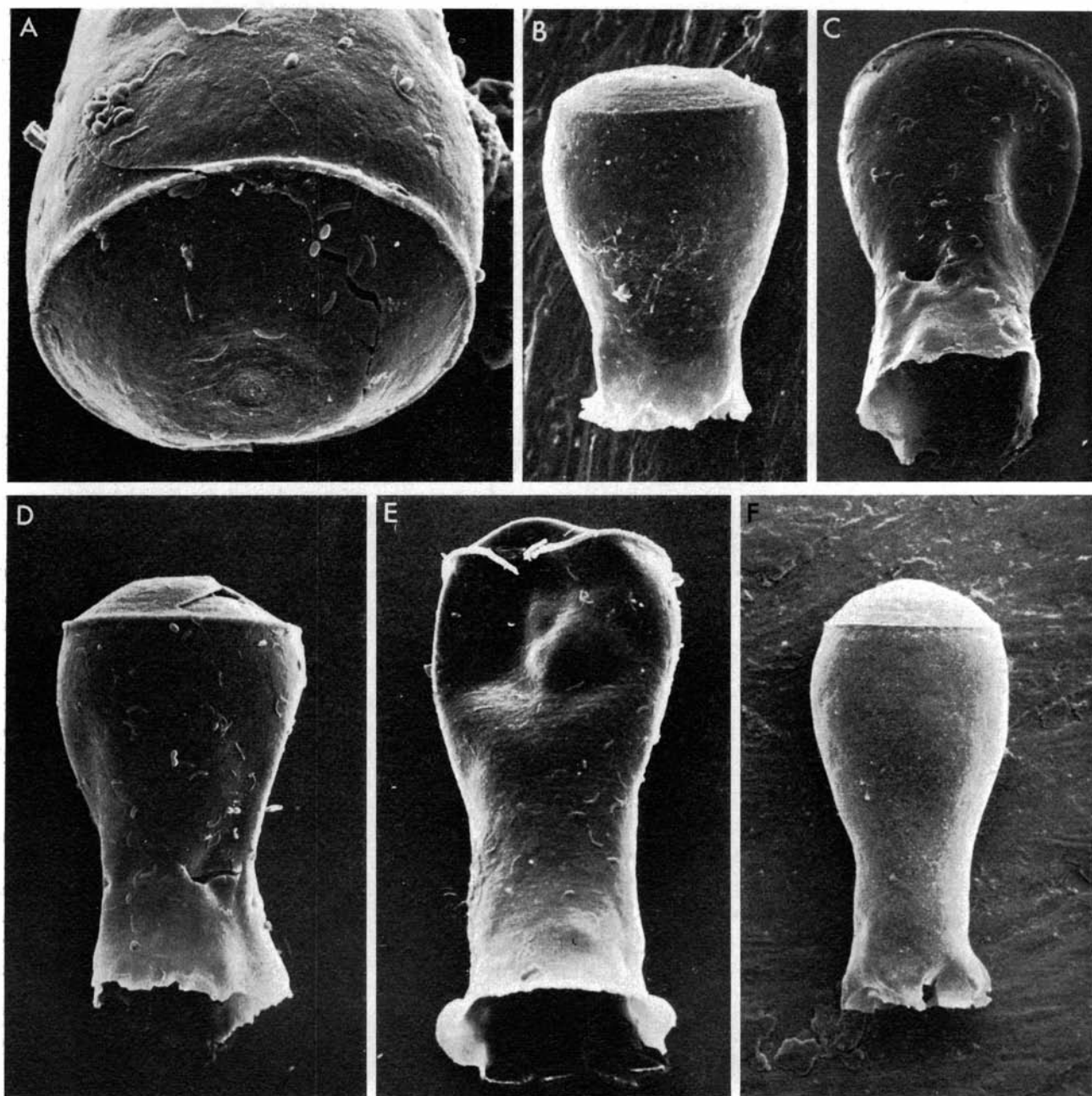


Fig. 58. *Linochitina convexa* n. sp. A, C—E. Burgen 4, Eke Beds, lower part (G 72—119). B. Drakarve 1, Hemse Marl, uppermost part (G 72—131). LO 4696t. F. Snoder 2, Hemse Marl, northwestern part (G 66—205). LO 4659t.

A. Oblique aboral view of specimen showing the base.

Note the short and thick edging at the basal edge. LO 4655t. ×1800. B. Specimen in lateral view. ×720. C. Holotype in oblique oral view. LO 4655T. ×900. D. Holotype in lateral view. ×900. E. Specimen in oblique lateral view. LO 4655t. ×900. F. Specimen in lateral view. ×600.

peak in its abundance in the lowermost part of the Eke Beds.

Linochitina erratica (Eisenack, 1931)

Fig. 59.

Synonymy □ *Desmochitina erratica* n. sp.—Eisenack 1931: 92, Pl. 3: 6—8. □ *Desmochitina erratica* Eisenack 1931—Eisenack 1962a: 307, Pl. 17: 10—11. □

Eremochitina? erratica (Eis.)—Taugourdeau 1966a: 38. □ *Linochitina erratica* (Eisenack, 1931)—Eisenack 1968a: 170, Pl. 31: 17.

Remarks.—This slender species has gently curved flanks with inconspicuous flexure and shoulder. The vesicle has a faint striation perpendicularly to the longitudinal axis. This concentric pattern is most well-developed on the base which is concave. The basal edge is bluntly to broadly rounded and provided with a short and narrow edging. There is a basal process

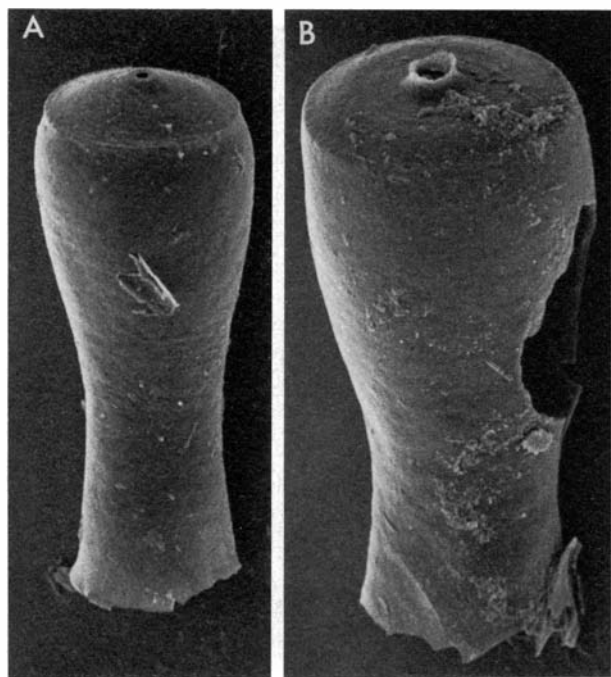


Fig. 59. *Linochitina erratica* (Eisenack, 1931). Nyan 2, Eke Beds, basalmost part (G 72—54). LO 4638t. A. Specimen in oblique lateral view. Note the basal process. $\times 690$. B. Specimen in oblique aboral view. $\times 690$.

which is wide and tube-like. It is formed by the outer wall layer and the hole of the process is sealed from the interior of the vesicle by the interior wall layer. The vesicle wall is smooth and thin. Twins and chains are uncommon. *L. erratica* is distinguished from the other *Linochitina* species by its slender shape and inconspicuous edging at the basal edge.

Occurrence.—*L. erratica* was encountered in the Halla, Klinteberg, Hemse and Eke Beds. Eisenack (1964a: 327) earlier recorded its occurrence in Gotland in the lower, northwestern part of the Hemse Marl. The species was reported in almost all of the references mentioned in connection with the present report on the occurrence of *L. cingulata* to which reference is made. Further, Correia (1964: 105) reported the species from black shales of supposedly Middle and Late Llandovery age in northern Morocco. The species was stated to occur with “*Desmochitina bohémica* Eisenack, 1934”. The latter is an early Gedinian species. Kaljo (1970: 179) reported the occurrence of *L. erratica* in the middle and upper part of the Jaani beds in Estonia.

Linochitina hedei n. sp.

Fig. 60.

Derivation of name.—In honour of Dr. J. Ernhold Hede of Lund, forever the expert on the Silurian of Gotland.

Holotype.—LO 4654 T.

Type stratum.—Hamra Beds, unit c (Sample G 66—115).

Type locality.—Barshageudd 1, Gotland.

Diagnosis.—*Linochitina* species with almost straight flanks and bluntly rounded to sharp basal edge. The vesicle is slightly widened at the aperture and slightly constricted just orally of the basal edge which is provided with a short cingulum extending almost perpendicularly to the longitudinal axis. The base is flat, concentrically striated and commonly carries a very short but wide basal process.

Dimensions.—Population from the type stratum in microns: length 90—105 (holotype 96), width 50—60 (holotype 55), smallest width of neck 35—40 (holotype 37), width of aperture 37—45 (holotype 37).

Description.—*L. hedei* lacks flexure and shoulder. The vesicle wall consists of two layers, the exterior of which forms the cingulum. The interior wall layer seals the hole of the basal process from the interior of the vesicle. The vesicle surface is smooth to very finely granulate. The cingulum is 1—3 microns wide. *L. hedei* is distinguished from the other *Linochitina* species by its sharp basal edge, straight flanks and characteristic cingulum. Twins and chains are rare.

Occurrence.—The species makes its debut in the upper part of the Hamra Beds, where it is common and was encountered also in the lower part of the Sundre Beds. It seems probable that the *L. hedei* ranges into the submarine *Beyrichia* Limestone (see Pl. 1: 9—10 in Eisenack 1955a; the two specimens are probably to be classified as *L. hedei*).

Linochitina odiosa n. sp.

Fig. 61.

Derivation of name.—Latin *odiosus*, hateful, obnoxious, referring to the absence of conspicuous characters.

Holotype.—LO 4596 T.

Type stratum.—Slite Marl, *Pentamerus gotlandicus* Beds or slightly younger (Sample G 71—79).

Type locality.—Munkebos 1, Gotland.

Diagnosis.—*Linochitina* species with gently curved flanks and lacking flexure and shoulder. The neck is widened towards the aperture and the basal edge broadly rounded and inconspicuous or lacking. The base is highly convex and provided with a tube-like

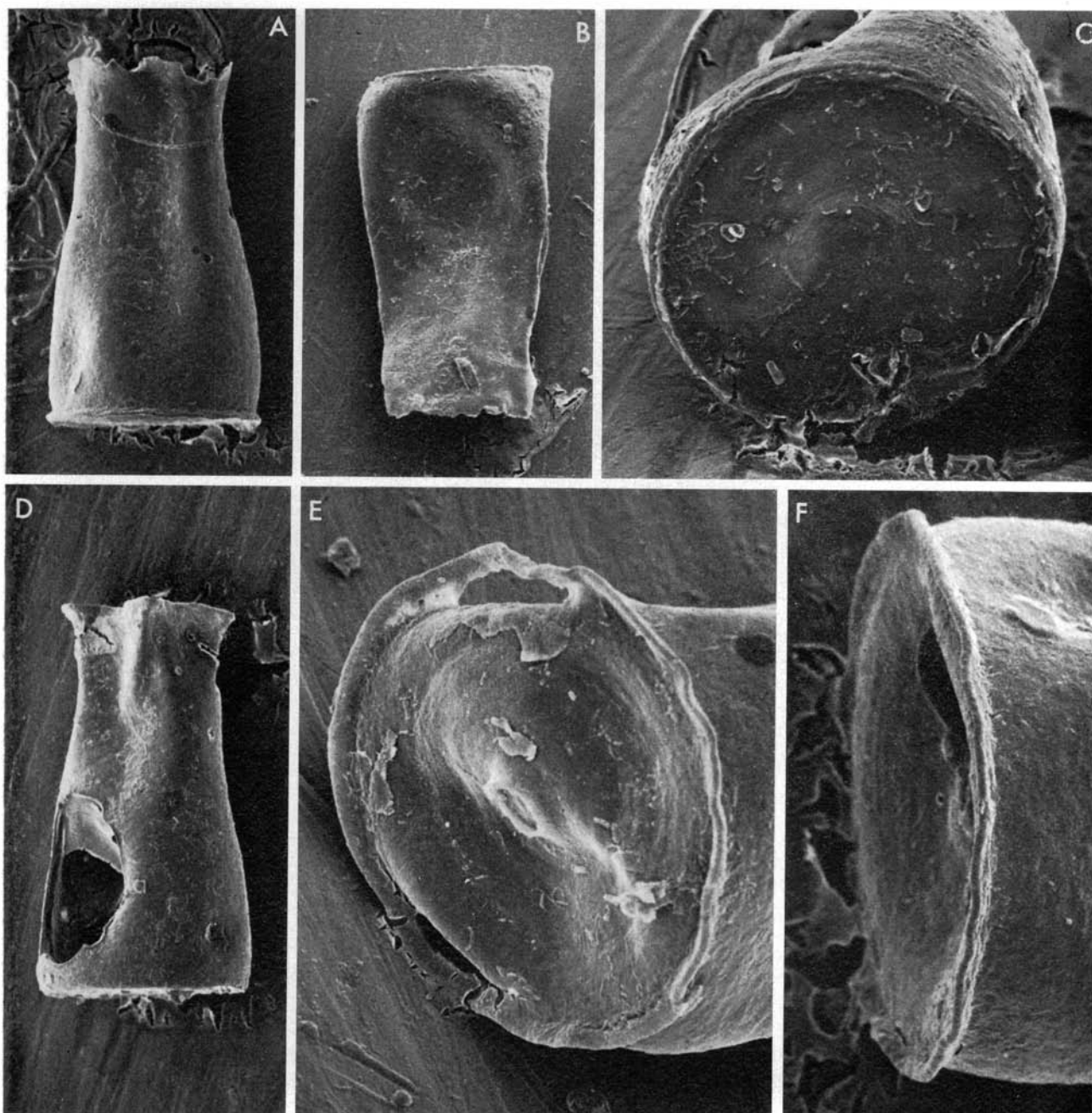


Fig. 60. *Linochitina hedei* n. sp. Barshageudd 1, Hamra Beds, unit c (G 66—115). A. Holotype in lateral view. LO 4654t. $\times 600$. B. Specimen in lateral view. LO 4654t. $\times 600$. C. Specimen in oblique aboral view. LO 4654t. $\times 1140$.

D. Specimen in lateral view. LO 4654t. $\times 600$. E. Specimen in oblique aboral view. LO 4654t. $\times 1380$. F. Holotype in oblique aboral view. $\times 1500$.

short and wide basal process. The vesicle lacks cin- gulum and edging.

Dimensions.—Population from the type stratum in microns: length 115—125 (holotype 117), width 35—45 (holotype 42), smallest width of neck 28—40 (holo- type 32), width of aperture 42—50 (holotype 43).

Description.—The aperture is abruptly widened and coarsely fringed. In twins and chains it can be observed that the aperture is attached very tightly to the base of the neighbouring vesicle. There is no edging at the

junction between the vesicles but in the distal part of the base there is a small bevel in which the aperture of the neighbouring vesicle fits. The highly convex base is concentrically striated. The vesicle wall consists of two layers and its exterior surface is smooth to very finely granulated. Twins and chains are common.

Occurrence.—*L. odiosa* ranges stratigraphically from the *Conchidium tenuistriatum* Beds and the north- western part of the Slite Marl through the Slite Silt- stone. Scattered, atypical specimens were encountered in the Mulde Beds. It seems apparent that *L. odiosa*

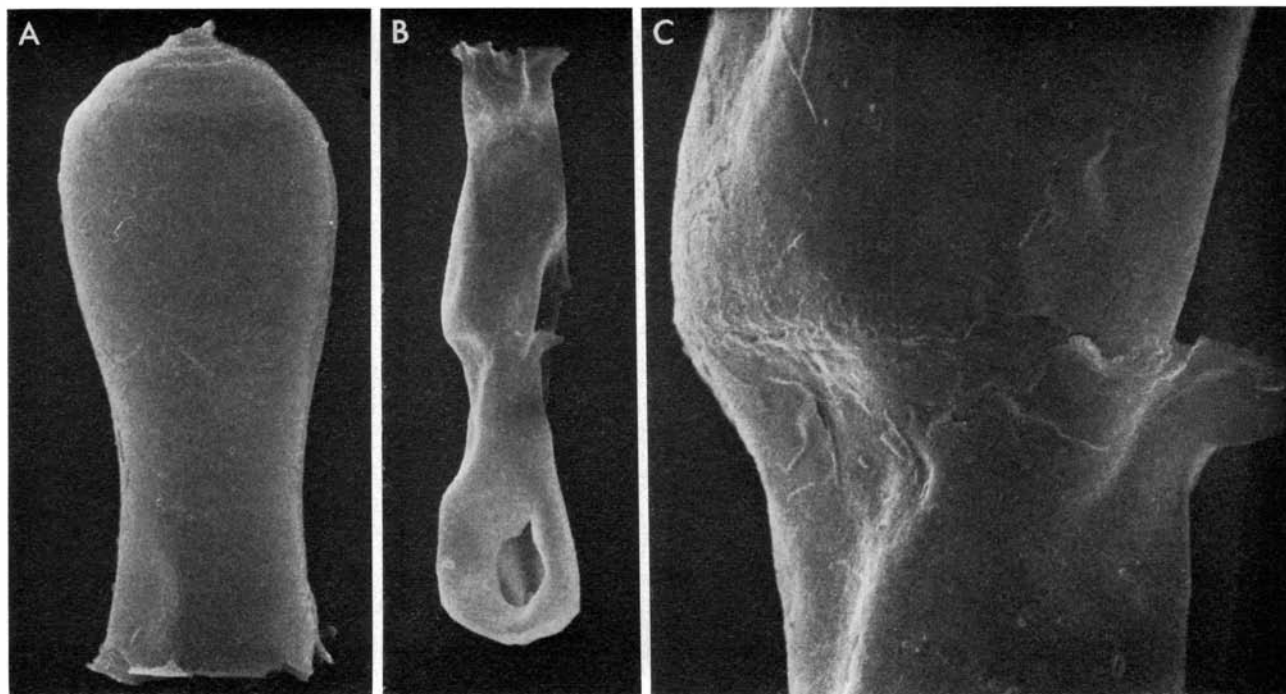


Fig. 61. *Linochitina odiosa* n. sp. Munkebos 1, Slite Marl, *Pentamerus gotlandicus* Beds or slightly younger. A. Holotype in lateral view. LO 4596T. $\times 750$. B. Twin in lateral view.

LO 4596t. $\times 350$. C. Same twin, detail of connection of the vesicles. LO 4596t. $\times 2000$.

was classified as *L. erratica* if encountered by earlier students.

Genus *Margachitina* Eisenack, 1968

Type species.—*Desmochitina margaritana* Eisenack, 1937.

Remarks.—The erection of the genus *Margachitina* by Eisenack (1968: 182) was most justified. The type species has an over-all shape which highly deviates from that of other type species. Furthermore, the mode of connection between the specimens in the chains of this species is unique. The occurrence of very long, helical chains of *M. margaritana* is another important biological character which is shared only by a few other taxa.

Species in Gotland.—*Margachitina margaritana* (Eisenack, 1937).

Margachitina margaritana (Eisenack, 1937)

Fig. 62.

Synonymy □ *Desmochitina margaritana* n. sp.—Eisenack 1937: 221, Pl. 15: 9—11. □ *Desmochitina margaritana* Eisenack 1937—Eisenack 1962a: 306, Pl. 17: 12—13. □ *Desmochitina margaritana* Eisenack,

1937—Kozłowski 1963: 434—435, Fig. 7. □ *Margachitina margaritana* (Eisenack, 1937)—Eisenack 1968a: 182, Pl. 24: 17—18. □ *Margachitina margaritana* (Eis. 1937)—Laufeld 1971: 296, Pl. 2: N. □ *Margachitina margaritana margaritana* Eis.—Obut 1973, Pl. 15: 12—13.

Remarks.—The vesicle wall of *M. margaritana* is very thick, opaque and almost black. It is composed of a single, massive layer, but in the aboral part of the vesicle and in the operculum, which is very thick-walled, there are two layers. The two layers are similar to each other, and the contact between them is only recognizable as a zone of weakness along which the wall splits. In the basal callus, to which the protruding part of the operculum of the following vesicle is attached, the wall has a lamellar structure. The vesicle is smooth or very finely granulate but its aboral part and operculum have an annulate structure perpendicular to the longitudinal axis. The operculum is attached very strongly to the aperture and when a chain is subjected to strain the aboral part of a vesicle is ruptured before this connection breaks.

Occurrence.—The species ranges through the lower part of the Gotlandian sequence of strata. Its last occurrence is in the uppermost part of the Slite Beds, where *M. margaritana* is fairly common, to the top of *Pentamerus gotlandicus*—*Atrypa reticularis* Beds. The species does not range into the Slite Siltstone or, where that is lacking, the Halla Beds.

Very few references have been included under Synonymy here, despite the fact that “*M. margari-*

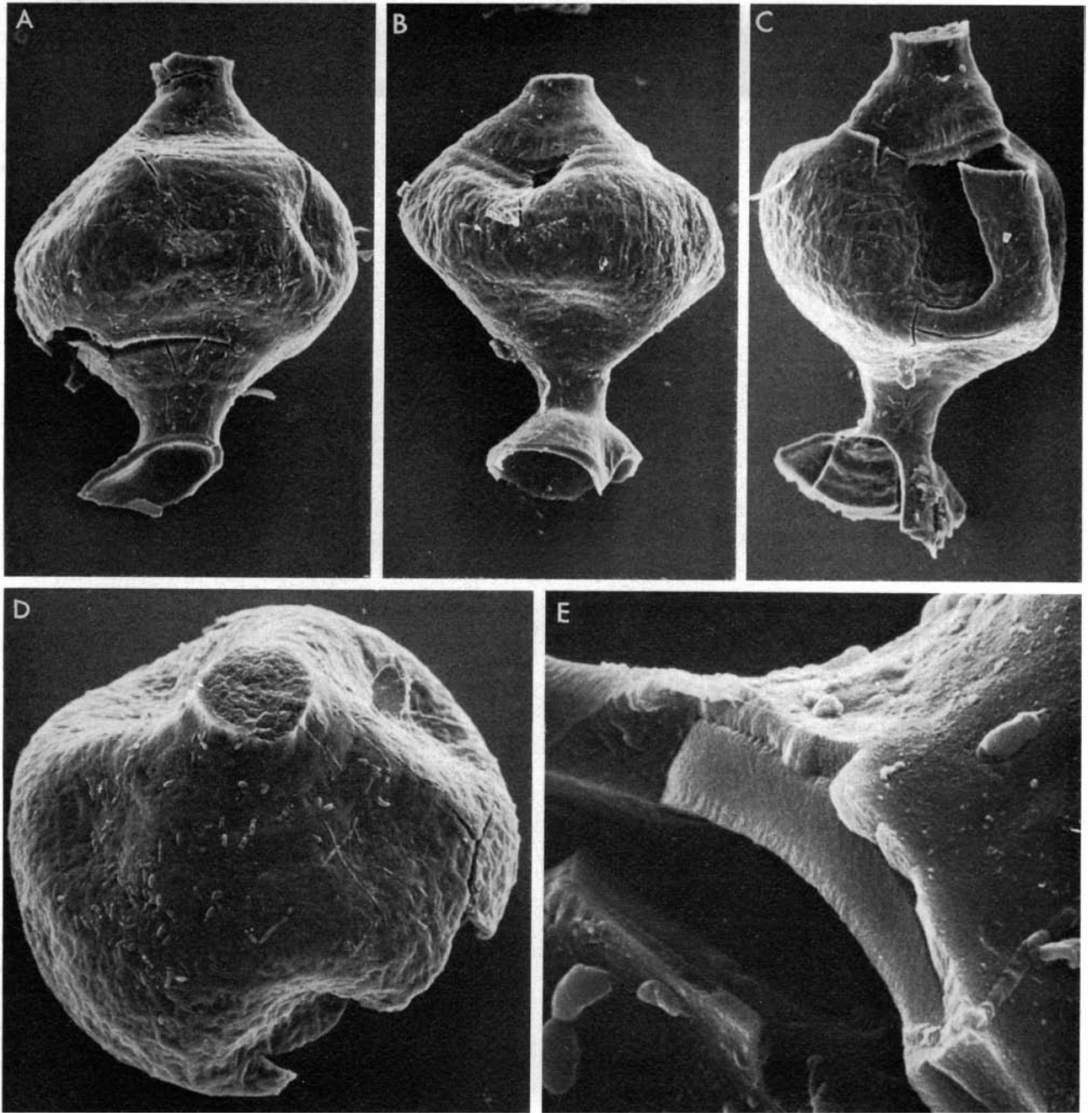


Fig. 62. *Margachitina margaritana* (Eisenack, 1937). Snäckgårdsbaden 1, Upper Visby Beds, upper part (G 66—407). LO 4594t. A. Specimen in lateral view. Note that the aperture points downwards. $\times 720$. B. Specimen in lateral

view. $\times 720$. C. Specimen in lateral view. Note the widened peripheral part of the opercula. $\times 720$. D. Specimen in oblique aboral view. $\times 1200$. E. Transversal section through the vesicle wall in the middle part of the operculum. $\times 7200$.

tana” is a species often encountered in the literature. The restriction has two causes. Firstly, several figures of supposed *M. margaritana* do not permit a critical evaluation. Secondly, *M. margaritana* is commonly misidentified with similar *Margachitina* species in the Pridolian and Devonian. However, it is most probable that *M. margaritana* occurs in Llandoveryan—Wenlockian strata of several areas outside those reported under the headline Synonymy here. Taugourdeau & Jekhowsky (1960: 1226—1227) reported the species from Wenlockian to Lower-Middle Devonian rocks of several bore-holes in Sahara. The figured specimens

all belong to another, Devonian species, but it is probable that *M. margaritana* does occur in the Sahara material since its peak of abundance was reported to be in “zone 4” (Taugourdeau & Jekhowsky 1960, Fig. 2). Apparently this zone is of middle-late Wenlockian age. Eisenack (1962b: 219, 1964: 335) and Taugourdeau & Jekhowsky (1964: 861) earlier established the occurrence of *M. margaritana* in the late Llandoveryan and Wenlockian of Gotland. Cramer (1967: 97—98) reported it from a part (probably Wenlockian) of the Formigioso Fm of the Cantabrian Mountains in Spain. In the same year Lange (1967a:

Pl. 5: 64) and Da Costa (1967: 109, Pl. 3: 29; cf. 1971a: 249—250, Fig. 63) reported the species from the Amazonas Basin of Brazil. The occurrence of *M. margaritana* in the Trombetas Formation of Brazil is noteworthy since that formation is referred to as early Llandovery in age, mainly on the basis of reports of *Climacograptus innotatus brasiliensis* Ruedemann, 1929 (Lange in Berry & Boucot 1972: 37). The chitinozoans from the Pitinga Member of that formation described by Lange (1967a), in my opinion, rather indicate a middle-upper Wenlockian age, even though some of them are endemic and therefore of little use in correlation.

It seems possible that *M. margaritana* occurs in the subsurface Silurian of Florida (Goldstein et al. 1969: 378—379; Cramer 1973: 283). Kaljo (1970: 149) established its occurrence in the lower part of the Jaani Beds in Estonia, and Laufeld (1971: 296, Pl. 2: N) reported the species from the Restevo Beds in Podolia. Deunff et al. (1971: 20, Pl. 2: 5) described the occurrence of supposed *M. margaritana* in submarine Silurian rocks west of Brittany, but it remains in doubt whether it is *M. margaritana* or a Pridolian *Margaritana* species. Cramer (1970: 746) established its occurrence (together with e.g. *Desmochitina densa*) in the Ross Brook Formation, Nova Scotia, and his conclusions regarding the age of the isolated slabs from the formation mentioned are fully corroborated by this study.

Genus *Pterochitina* Eisenack, 1955 restr. 1968

Type species.—*Bion perivelatum* Eisenack, 1937.

Remarks.—Taugourdeau's (1966a: 42) statement that the vesicle wall consists of two layers is corroborated by the present study. The flange-like velum, which has a lamellar structure, is formed as a prolongation of the thin outer wall layer (cf. Eisenack 1968a: 183). The inner wall layer is thick and homogeneous.

Species in Gotland.—*Pterochitina perivelata* (Eisenack, 1937) and, according to Eisenack (1959a: 17, 1964a: 327), *Pterochitina makroptera* Eisenack, 1959 (not recorded here).

Pterochitina perivelata (Eisenack, 1937)

Fig. 63.

Synonymy □ *Bion perivelatum* n. sp.—Eisenack 1937: 229—230, Fig. 7, Pl. 16: 4. □ *Pterochitina perivelata* (Eisenack 1937)—Eisenack 1955a: 177, Pl. 3: 9—11. □ *Pterochitina perivelata* (Eisenack, 1937)—Eisenack 1968a: 183, Pl. 31: 29—30. □ *Pterochitina perivelata* (Eisenack 1937)—Eisenack 1972a: 74, Fig. 1, Pl. 17: 29—30.

Remarks.—The medusa-like vesicle consists of two wall layers, an inner, thick and homogeneous and an outer, thin one which is ornamented. The velum, which is curved in oral direction, is lamellar and is formed by extensions of the outer wall layer. The velum and the part of the vesicle wall aboral of the velum are wrinkled in most specimens. The disc-like operculum and the vesicle wall between the operculum and the velum have a granulate to rugose, sometimes spongy ornamentation. The vesicle wall aboral of the velum has a coarsely rugose ornamentation. In some specimens there are circular to elliptical marks of some bladder-like structure in the part of the vesicle. There is no trace of any basal callus, process or scar and there is no protruding structure in the central part of the operculum. Hence, it is not improbable that *P. perivelata* can occur in aggregations of the same kind as that described by Legault (1973a, 1973b: 40—41, Pl. 7: 8, 10) for a Middle Devonian species, *Hoegishaera* cf. *H. glabra* Staplin, 1961. On judging from Legault's figures it seems possible that *H.* cf. *H. glabra* belongs to the genus *Pterochitina*. A reinvestigation of the type species, *H. glabra* Staplin, 1961, of the genus *Hoegisphaera* Staplin, 1961 is needed. *Hoegisphaera* may well be a junior synonym of *Pterochitina*.

Occurrence.—*P. perivelata* makes its debut in the upper part of the Hamra Beds and was also encountered in the lower part of the Sundre Beds. Eisenack (1937: 218, 229, 1955a: 177) established its occurrence in the slightly younger *Beyrichia* Limestone. Later Eisenack (1972a: 74) reported *P. perivelata* from the Leba boring in northernmost Poland. It was encountered at a depth of 1273 m and in five other samples the uppermost of which was taken at 686 m. It is therefore safely established that the species ranges at least into and probably above the *bouceki* subzone of the *transgrediens* zone.

Schultz (1967: 176) described a single vesicle from the Llandoveryan of Dalarna, central Sweden, under the name of *?Pterochitina perivelata* (Eisenack 1937), but as remarked by himself the reference is most uncertain.

Genus *Sphaerochitina* Eisenack, 1955

Type species.—*Lagenochitina sphaerocephala* Eisenack, 1932.

Remarks.—The definition of the genus used in this paper is Eisenack's original one (1955a: 162). Later Eisenack (1968a: 174) widened his original diagnosis to include a species, *Sphaerochitina spinipes* Eisenack, 1964, with an ornamentation consisting of fairly long spines. In the present paper *S. spinipes* is referred to the new genus *Gotlandochitina*, which embraces chitinozoans with a spinose ornamentation that is arranged in longitudinal rows. Hence, there is no reason to

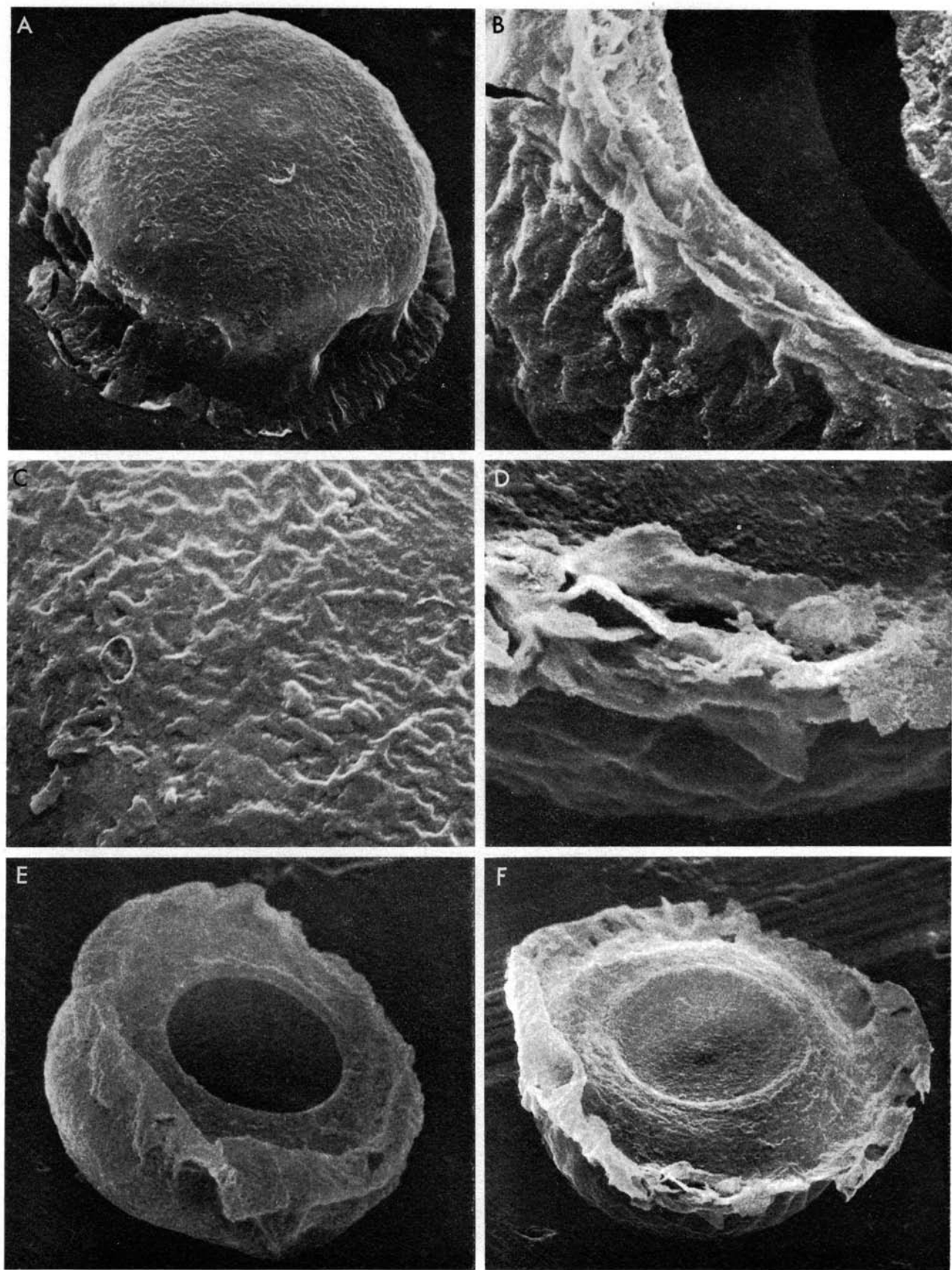


Fig. 63. *Pterochitina perivelata* (Eisenack, 1937). Faludden 2, Hamra Beds, unit c (G 71—16). LO 4661t. A. Specimen in oblique aboral view. $\times 800$. B. Transverse section of wall in aboral part of the vesicle. Note the edge of aperture in the background. $\times 3000$. C. Ornamentation on the base of the

specimen in A. $\times 3000$. D. Oblique oral view of the velum of the specimen in F. Note the lamellar structure. $\times 3000$. E. Oblique oral view of the specimen lacking operculum. $\times 750$. F. Oblique oral view of specimen with operculum *in situ*. $\times 800$.

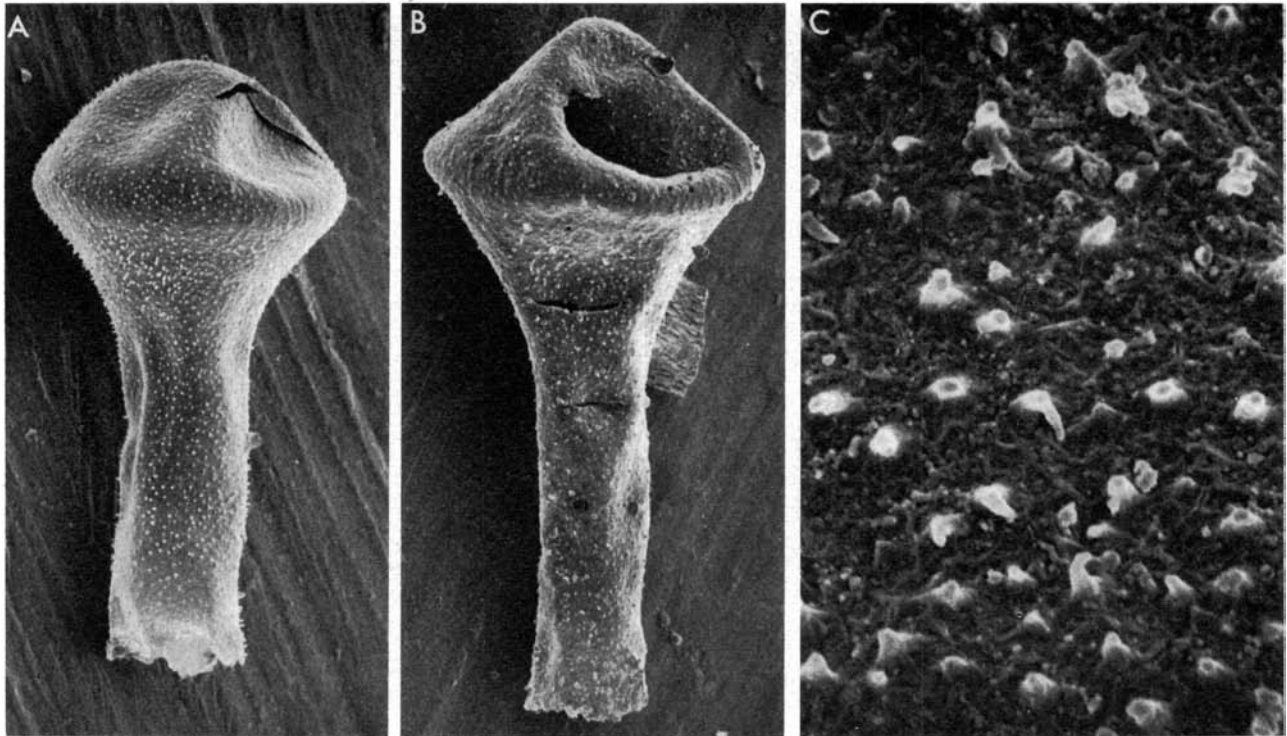


Fig. 64. *Sphaerochitina acanthifera* Eisenack, 1955, Stora Hagslunds 1, Eke Beds, lowermost part (G 72—130). LO 4646t. A. Specimen in lateral view. $\times 600$. B. Specimen in

lateral view. $\times 600$. C. Specimen showing ornamentation of middle part of the body. $\times 6000$.

widen the original diagnosis of *Sphaerochitina* to embrace forms with long spines.

Species in Gotland.—*Sphaerochitina acanthifera* Eisenack, 1955; *S. concava* n. sp.; *S. dubia* Eisenack, 1968; *S. impia* n. sp.; *S. lycoperdoides* n. sp.; *S. sphaerocephala* (Eisenack, 1932).

Sphaerochitina acanthifera Eisenack, 1955

Fig. 64.

Synonymy □ *Sphaerochitina acanthifera* n. sp.—Eisenack 1955b: 314, 317, Pl. 1: 14—15. □ *Sphaerochitina acanthifera* Eisenack 1955—Eisenack 1964a: 322. □ *Sphaerochitina acanthifera* (Eis.)—Taugourdeau 1966a, Pl. 2: 36. □ *Sphaerochitina acanthifera* Eisenack, 1955—Eisenack 1968a: 175, Pl. 28: 23—26. □ *Sphaerochitina acanthifera* Eisenack 1955—Eisenack 1972b: 124, Pl. 34: 17—18.

Remarks.—In several but not all populations most specimens have a bluntly rounded “basal edge”. In these specimens the middle part of the body is drawn out in lateral direction which renders the body a rhombic outline in lateral view. This “basal edge” looks like it was formed by compression along the longitudinal axis of the vesicle. However, studies of

continuously etched, oriented slabs disproved this supposition. The populations which do not include this characteristic feature have been classified as *S. cf. acanthifera* in the present study. The ornamentation of the vesicle wall is most characteristic in both types of the populations. It consists of very short spines which commonly decrease in length at the aperture. This ornamentation is most conspicuous in the middle part of the body where the longer spines are hollow at the base. There is no connection with the interior of the vesicle. The vesicle wall between the spines is finely rugose. When studied under an ordinary microscope in reflected light the vesicle is dark and dull despite a very thin vesicle wall. The wall is composed of two layers.

Occurrence.—*S. acanthifera* ranges stratigraphically from the base of the Eke Beds to the lower part of unit b of the Hamra Beds.

Sphaerochitina concava n. sp.

Fig. 65.

Derivation of name.—Latin *concavus*, concave. referring to the base.

Holotype.—LO 4627 T.

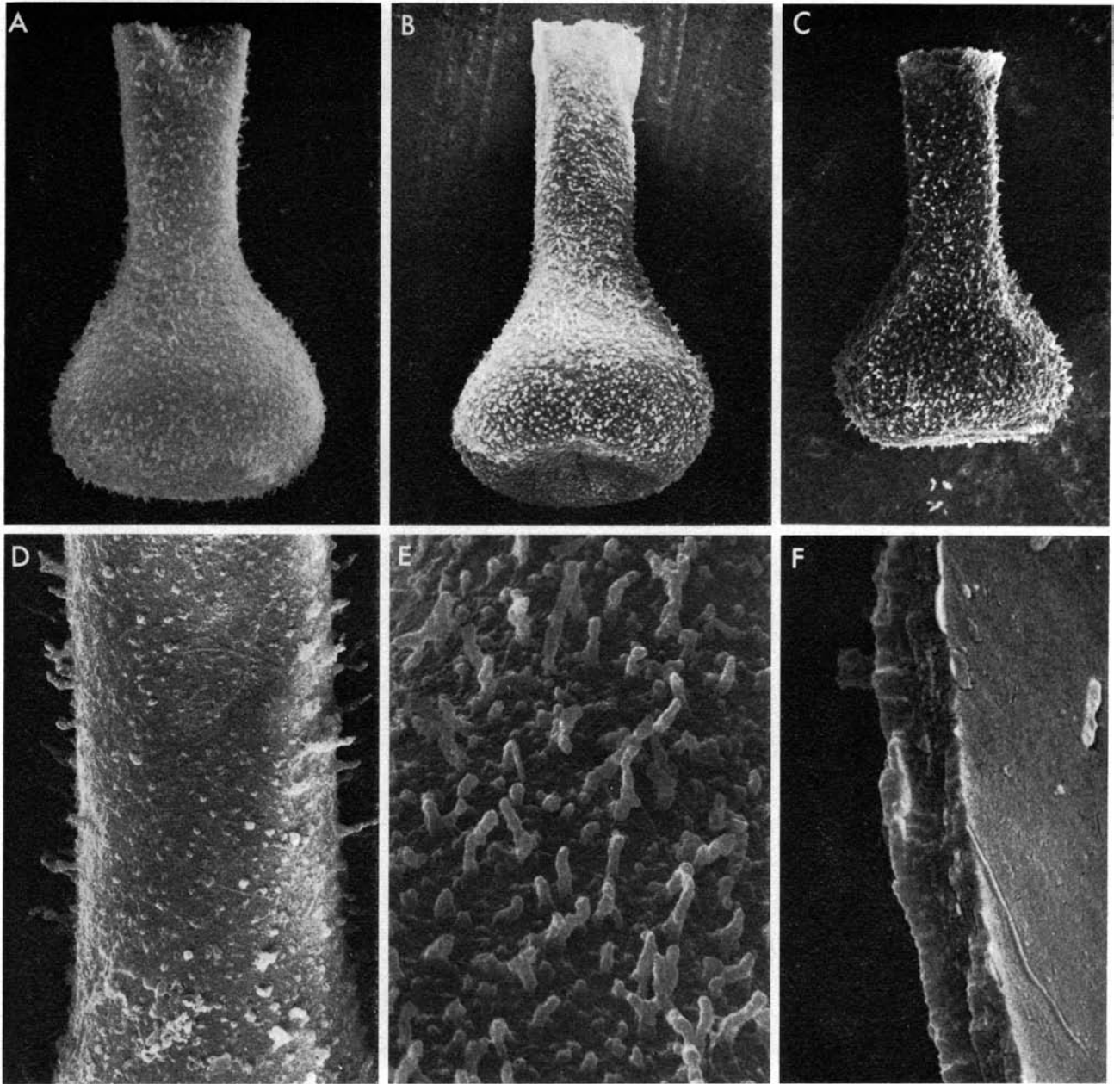


Fig. 65. *Sphaerochitina concava* n. sp. Gothemshammar 2, Klinteberg Beds, unit a (G 71—63). A. Specimen in lateral view. LO 4627t. ×600. B. Specimen in oblique lateral view. LO 4627t. ×600. C. Holotype in lateral view. LO 4627T. ×600. D. Specimen in lateral view showing the ornamenta-

tion in the aboral part of the neck. LO 4627t. ×1500. E. Ornamentation at the flexure of the specimen in B. ×3000. F. Transverse section of wall in the middle part of the vesicle. LO 4627t. ×6000.

Type stratum.—Klinteberg Beds, unit a, base (Sample G 71—63).

Type locality.—Gothemshammar 2, Gotland.

Diagnosis.—*Sphaerochitina* species with broadly rounded but conspicuous flexure and lacking or with broadly rounded and inconspicuous shoulder. The flanks of the body are broadly rounded and a basal edge is lacking. The base is concave. The vesicle wall is provided with densely spaced granules and short, irregularly curved spines with blunt tips. Each individual spine varies unevenly in its thickness from base to tip.

Dimensions.—Population from the type stratum in microns: all incl. ornamentation, length 100—125 (holotype 105), width 60—75 (holotype 60), smallest width of neck 15—25 (holotype 16), width of aperture 20—30 (holotype 20).

Description.—The neck has its smallest width at the flexure and is widened towards the aperture which is fringed. The base is always concave and this has not been caused during the diagenesis of the sediments. The ornamentation is very densely spaced all over the vesicle but decreases in size at the aperture and towards the aboral pole. Some spines branch once and

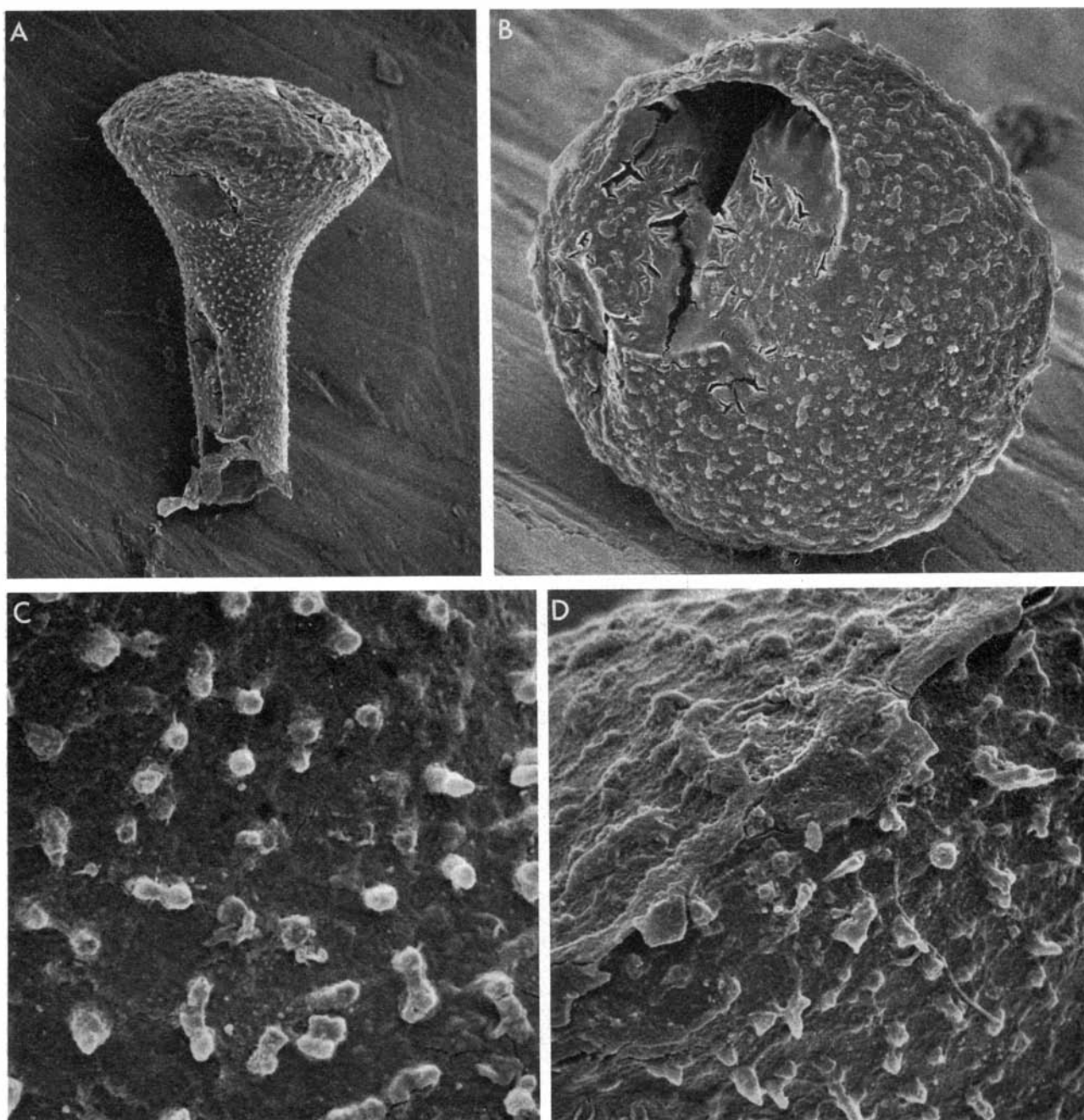


Fig. 66. *Sphaerochitina dubia* Eisenack, 1968. Hammarudden 1, Hemse Beds, unit c (G 66—280). LO 4611t. A. Specimen in lateral view. $\times 600$. B. Same specimen in aboral view.

$\times 1080$. C. Same specimen, ornamentation in the aboral part of the neck. $\times 6000$. D. Same specimen, lateral view of basal edge. $\times 3120$.

some are coalescent. The spines are massive. The vesicle wall is composed of two layers of which at least the inner layer has a lamellar structure. *S. concava* is distinguished from other *Sphaerochitina* species by its concave base and by its characteristic, very dense ornamentation. The maximum length of ornamentation is about 5 microns.

Occurrence.—*S. concava* occurs in the upper parts of the Halla and Mulde Beds and in units a, b and c of the Klinteberg Beds and in undifferentiated but early parts of the latter beds.

Sphaerochitina dubia Eisenack, 1968

Fig. 66.

Synonymy □ *Sphaerochitina dubia* n. sp.—Eisenack 1968a: 176, Fig. 10, Pl. 28: 10—11.

Remarks.—The species has a subcylindrical neck, a broadly rounded conspicuous flexure but lacks a shoulder. The body expands very rapidly and the basal edge is either bluntly rounded or pointed. The base is convex. The vesicle is mushroom-shaped and is further

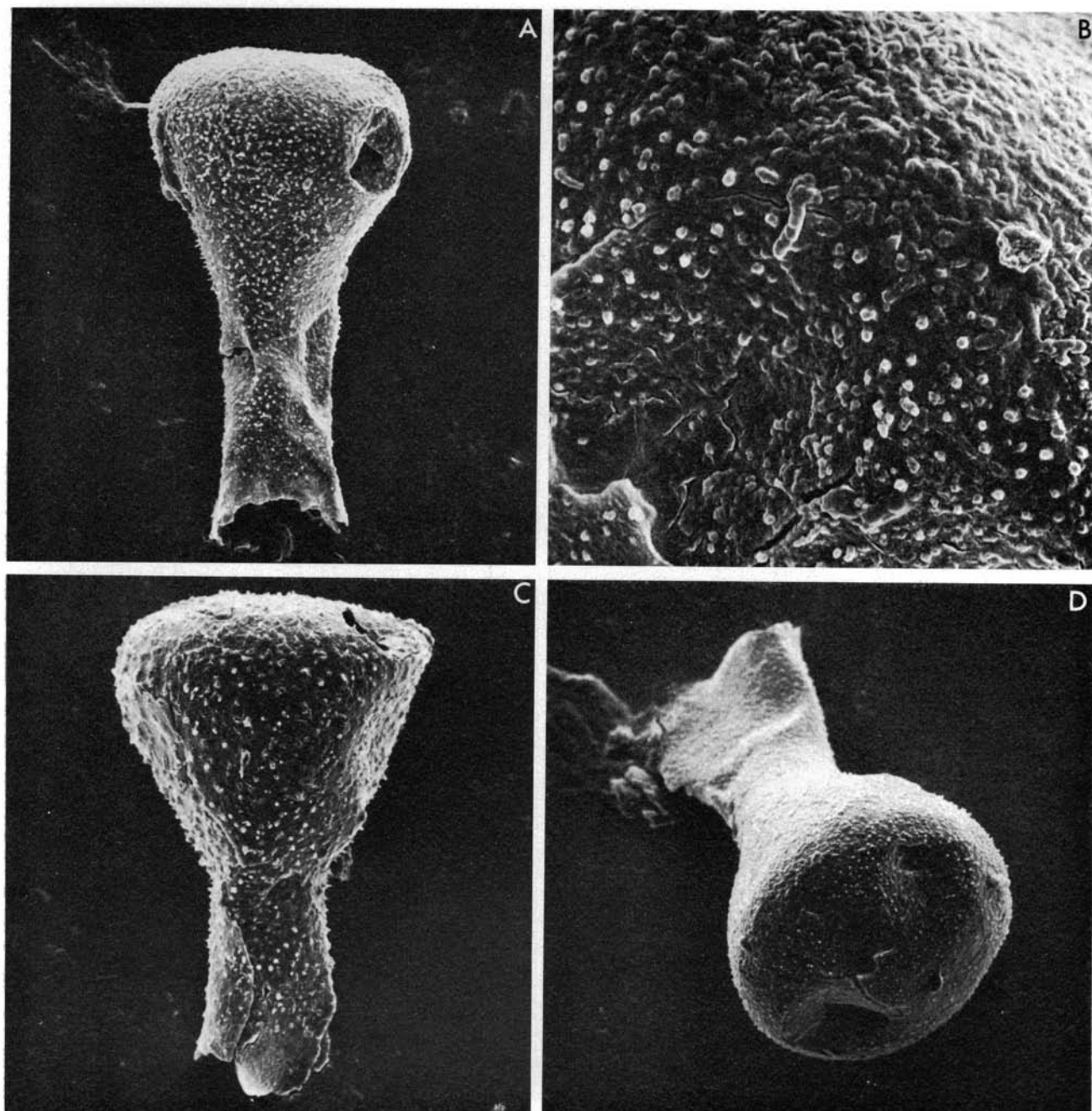


Fig. 67. *Sphaerochitina impia* n. sp. Grogarnshuvud 1, Hemse Beds, unit c (G 71—103). A. Specimen in lateral view. LO 4625t. ×780. B. Aboral view of the specimen in D.

LO 4625t. ×3350. C. Holotype in lateral view. LO 4625t. ×900. D. Specimen in oblique aboral view. LO 4625t. ×840.

characterized by a pronounced basal edge and an ornamentation consisting of wide verrucae and very short spines. The spines are restricted to the neck and oral part of the vesicle and decrease in size towards the widened aperture and the basal edge. The vesicle wall consists of two, equally thick layers.

Occurrence.—*S. dubia* is an excellent index fossil which occurs in units a and c of the Hemse Beds and in undifferentiated lower-middle parts of these beds. It was encountered as atypical specimens also in unit f of the uppermost part of the Klinteberg Beds.

Sphaerochitina impia n. sp.

Fig. 67.

Derivation of name.—Latin *impius*, the criminal, the traitor, referring to the subconical body which should have been spheroidal to fit the name of the genus perfectly.

Holotype.—LO 4626 T.

Type stratum.—Hemse Beds, unit c, base (Sample G 71—103).

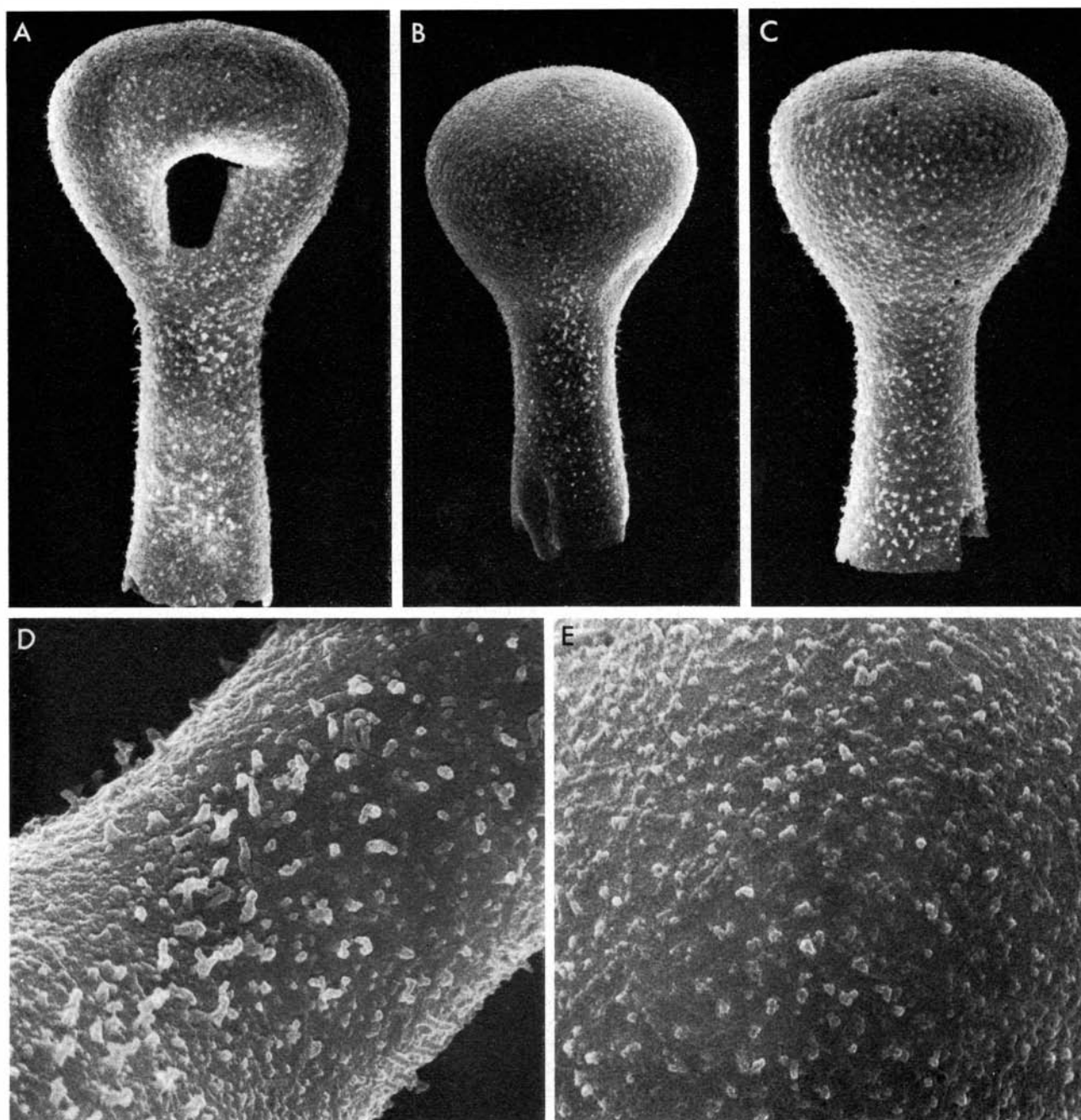


Fig. 68. *Sphaerochitina lycoperdoides* n. sp. Fjärdinge 1, Klinteberg Beds, unit b (G 69—144). A. Specimen in lateral view. LO 4629t. $\times 750$. B. Holotype in lateral view. LO 4629T. $\times 750$. C. Specimen in lateral view. LO 4629t.

$\times 750$. D. Holotype, ornamentation in the aboral part of neck. $\times 3000$. E. Holotype, ornamentation in the middle part of the body. $\times 3000$.

Type locality.—Grogarnshuvud 1, Gotland.

Diagnosis.—Small *Sphaerochitina* species with cylindro-conical vesicle and with broadly to bluntly rounded flexure but lacking a shoulder. The basal edge is broadly rounded and the base is flat or slightly convex. The vesicle has a verrucate and granulate ornamentation but short spines do occur. The ornamentation is dense and decreases in size towards the fringed aperture.

Dimensions.—Population from the type stratum in microns: measurements including ornamentation, length 80—105 (holotype 86), width 50—60 (holotype 57), smallest width of neck 15—22 (holotype 22), width of aperture 20—28 (holotype 26), maximum height of ornamentation 1.5—2.

Description.—The neck has its smallest width at the flexure and is widened towards the aperture. The ornamentation covers the entire vesicle but decreases

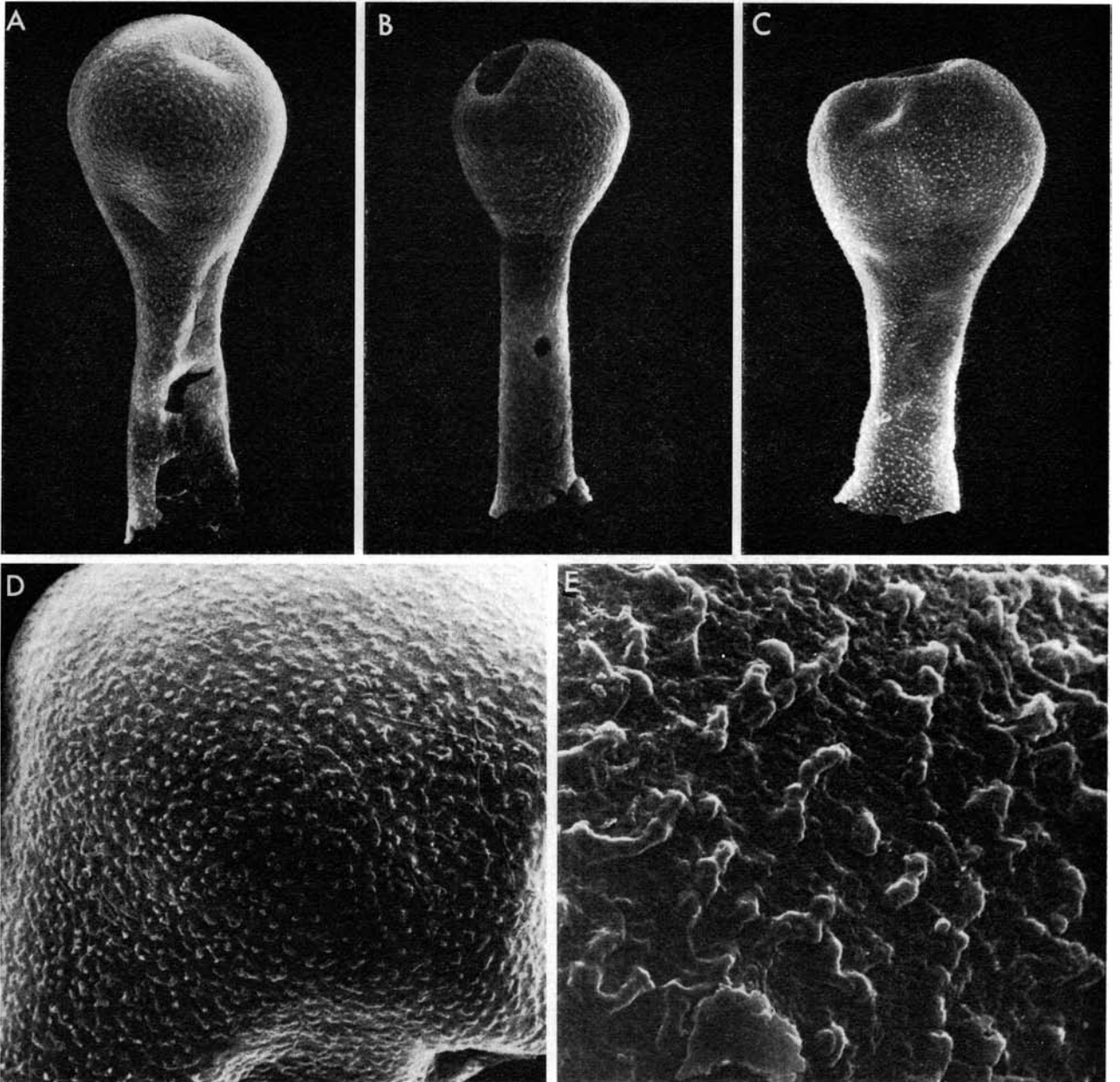


Fig. 69. *Sphaerochitina sphaerocephala* (Eisenack, 1932). A. Bankvät 1, Hamra Beds, unit b (G 71—29). Specimen in lateral view. LO 4603t. $\times 400$. B. Same data but sample G 71—28. Specimen in lateral view. LO 4680t. $\times 300$. C. Same data but sample G 71—26. Specimen in lateral

view. LO 4607t. $\times 500$. D. Same data as A. Specimen in lateral view showing ornamentation in the middle part of vesicle. LO 4603t. $\times 1320$. E. Same specimen as in B. Ornamentation in the middle part of the vesicle. $\times 3000$.

in size and density towards the aperture and the aboral pole. It is most well-developed at the flexure. *S. impia* is distinguished from similar *Sphaerochitina* species by its small size (which is not a very important character), by its verrucate and granulate ornamentation, but primarily by the over-all shape of its vesicle. The flat or slightly convex base renders the body a subconical form.

Occurrence.—With the exception of some populations in units b and c of the Klinteberg Beds *S. impia* is restricted to the lower and middle part of the Hemse Beds. In these beds the species occurs in units a—d

but not in the Millklint Limestone. It was also encountered in the lower, northwestern part of the Hemse Marl and in limestones of early-middle Hemse age.

Sphaerochitina lycoperdoides n. sp.

Fig. 68.

Derivation of name.—From the generic name *Lycoperdon*, puff-balls, and the latinized Greek suffix *-oides*, similar to.

Holotype.—LO 4629 T.

Type stratum.—Klinteberg Beds, unit b (Sample G 69—144).

Type locality.—Fjärdinge 1, Gotland.

Diagnosis.—*Sphaerochitina* species with cylindro-spheroidal vesicle and broadly rounded flexure and broadly rounded, inconspicuous shoulder. The base is convex and a basal edge is lacking. The subcylindrical neck is widened towards the coarsely fringed aperture. A verrucate and granulate ornamentation covers the entire vesicle, and short spines occur in the aboral part of the neck.

Dimensions.—Population from the type stratum in microns: measurements including ornamentation, length 95—125 (holotype 97), width 55—65 (holotype 57), smallest width of neck 15—27 (holotype 16), width of aperture 24—32 (holotype estimated at 25), maximum length of ornamentation 2.5—3, commonly 1—2.

Description.—The ornamentation is most well-developed in the oral part of the chamber and aboral part of the neck. It decreases in size towards the aperture and in the aboral part of the chamber towards the aboral pole. The short spines are irregular in shape. Some are coalescent, some branched, and others are clavate or irregularly curved. *S. lycoperdoides* is distinguished from *S. impia*, *S. dubia* and *S. concava* mainly by its globose body and from other *Sphaerochitina* species also by its ornamentation.

Occurrence.—*S. lycoperdoides* occurs in the upper part of the Mulde Beds and in units a and b and undifferentiated lower-middle parts of the Klinteberg Beds.

Sphaerochitina sphaerocephala (Eisenack, 1932)

Fig. 69.

Synonymy □ *Lagenochitina sphaerocephala* n. sp.—Eisenack 1932: 271—272, Pl. 12: 14—15. □ *Sphaerochitina sphaerocephala* (Eisenack 1932)—Eisenack 1955a: 162, Pl. 1: 5—6. □ *Sphaerochitina sphaerocephala* (Eisenack 1932)—Eisenack 1964a: 321, Pl. 30: 5. □ *Sphaerochitina sphaerocephala* (Eisenack, 1932)—Eisenack 1968a: 175, Pl. 28: 14—22, Pl. 29: 33, Pl. 34: 20. □ *Sphaerochitina sphaerocephala* (Eisenack 1932)—Eisenack 1970: 306, Fig. 1: R, *non* 1: E, F.

Remarks.—The populations of *S. sphaerocephala* in Gotland are all characterized by specimens with a verrucate ornamentation with transitions to rugae. The ornamentation covers the entire vesicle but decreases

in size towards the aperture and around the aboral pole. The specimens have a cylindro-spheroidal vesicle with a neck that is gently widened in oral direction but abruptly widened at the aperture. The vesicle wall consists of two layers of equal thickness. *S. sphaerocephala* is distinguished from the other *Sphaerochitina* species by its globose body and low ornamentation which is hardly visible at low magnifications.

Occurrence.—Atypical specimens were encountered in unit a of the Hamra Beds but typical populations appear in unit b of these beds and occur also in the lower part of the Sundre Beds. The submarine *Beyrichia* Limestone is the type stratum of *S. sphaerocephala*, but how high up in the Pridolian the species ranges is uncertain. Eisenack (1972a: 69—70, see Pl. 16: 1—25, Pl. 19: 1—16, 18—26) described and figured a great number of specimens classified as *S. sphaerocephala* from the Leba boring in northernmost Poland. However, it is difficult to draw any conclusions about the morphology of the populations at different levels in that core. Evidently, Eisenack intended to show series of the morphological variation by specimens picked out from the various levels rather than to show characteristic specimens from successively younger populations. Hence, this reference was not included under Synonymy, even though some of the figured specimens can be classified as *S. sphaerocephala* as originally defined by Eisenack. Eisenack (1970: 321, Fig. 1: R) earlier reported its occurrence in the Pridolian Ohesaarepank in Estonia.

S. sphaerocephala has been reported extensively in the literature (see Eisenack 1972a: 69), but due to lack of useful illustrations in several reports, combined with the fact that the species has a generalized morphology, it serves no useful purpose to discuss these occurrences. It is hard to escape the conclusion that *S. sphaerocephala* has become a waste-basket taxon.

State of preservation and orientation of vesicles in the sediment

State of preservation.—The chitinozoans are no exception to the rule that the Silurian of Gotland yields fossils of an outstanding state of preservation. Most chitinozoan populations are preserved more or less in full relief. Flattened chitinozoans are very scarce and occur only in some of the silty and marly units. However, it should be kept in mind that the specimens used for illustrations here were especially selected among more than a million specimens and that most specimens have minor imperfections which are never revealed under a light microscope.

Another character in common with all chitinozoans in Gotland is the absence of a metamorphic influence. In Correia's scale (e.g. 1967: 1291, Fig. 9) they can be referred to stage N 1 which means that the microfossils have never been subjected to temperatures exceeding 100°C. On common geological grounds

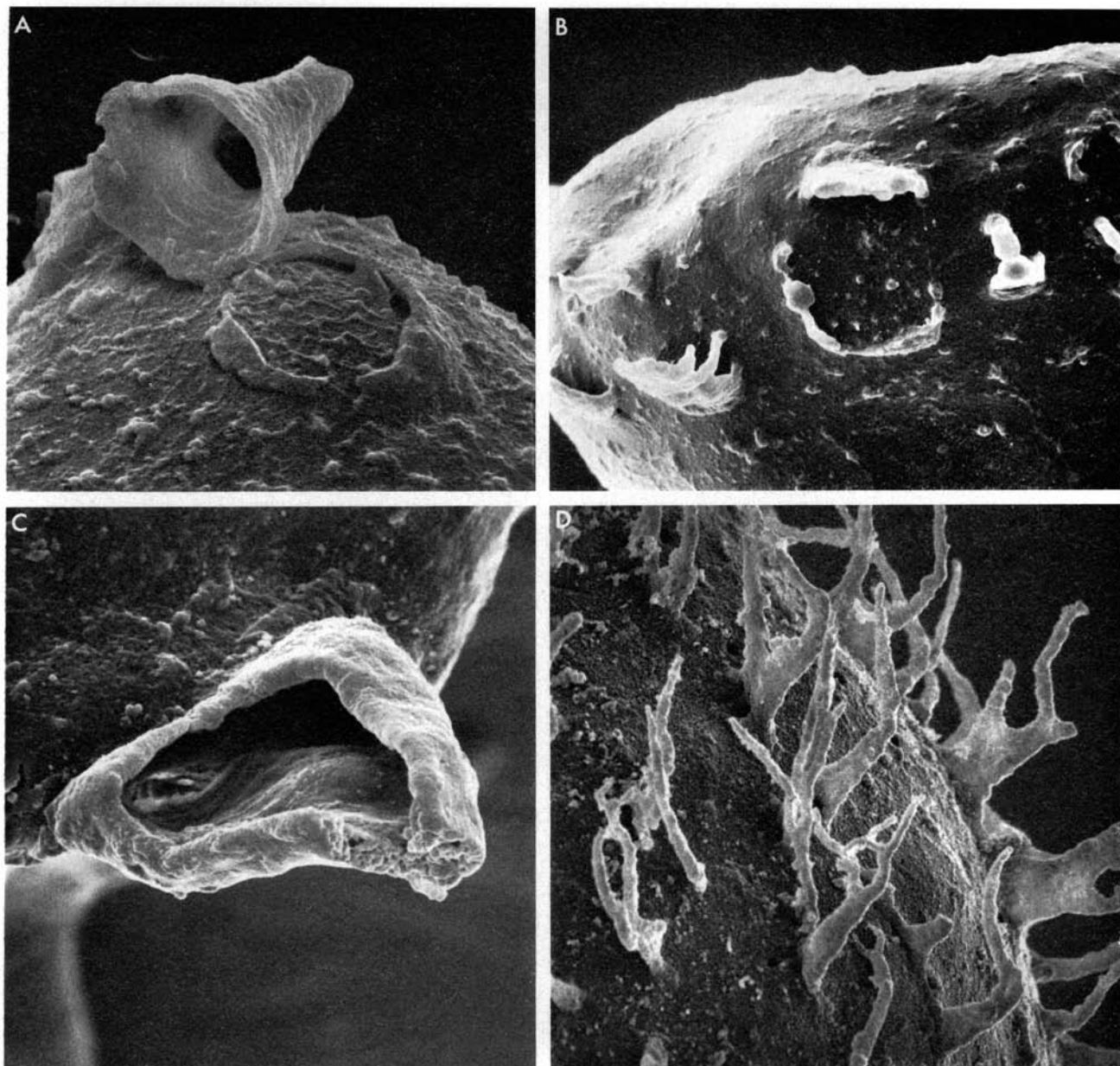


Fig. 70. Appendices and ornamentation. *A. Gotlandochitina cornuta* n. sp. (Däpps 1, Mulde Beds, upper part, G 66—117, LO 4608t). Oblique oral view of detached spine at the basal edge. $\times 3000$. The spine was cracked from its place by focussing the electron beam on the tip of the spine and increasing the kilovoltage until the spine started to break at its base. With some training the kilovoltage can be rapidly decreased the moment just before the spine is detached and thrown out in the specimen chamber. The figure shows clearly that there is no connection between the hollow spine and the interior of the vesicle. The vesicle wall shows no differentiation under the spine. Hence, the spine was attached to the vesicle wall from outside by a tissue which first secreted the vesicle wall.

B. Ancyrochitina cf. primitiva Eisenack, 1964 (Mulde 1, Slite Siltstone, G 72—151, LO 4670t, same specimen as in Fig. 13:D). Lateral view of detached appendices at the

basal edge. $\times 2400$. In similarity with the *Gotlandochitina* species there is no pore (lumen) through the vesicle wall.

C. Ancyrochitina pachyderma n. sp. (Ansarve 2, Höglint Beds, southwestern facies, G 72—98, LO 4616t, same specimen as in Fig. 10:C). Oblique aboral view of appendix. $\times 6000$. There is no connection between the hollow spine and the interior of the vesicle. Note the spongy material in the wall of the spine. There are faint terraces where the spine is attached to the vesicle wall.

D. Gotlandochitina martinsoni n. sp. (Sinnarve 1, Slite Marl, *Conchidium tenuistriatum* Beds, G 66—83, LO 4589t, same specimen as in Fig. 49:C). Lateral view of spines just oral of the middle of the body. $\times 2650$. The spines have no connection with the interior of the vesicle. Note the irregular outline and finely granulate surface of the spines. The perforations were caused by parasites.

there are also other reasons indicating that the burial of the Silurian strata of Gotland was a shallow one.

Orientation of chitinozoan vesicles in the sediment.—

A number of oriented limestone slabs were collected for special purposes, e.g. for studying the way in which chitinozoans and other organic-walled microfossils are embedded in the rocks. Cubes were cut from

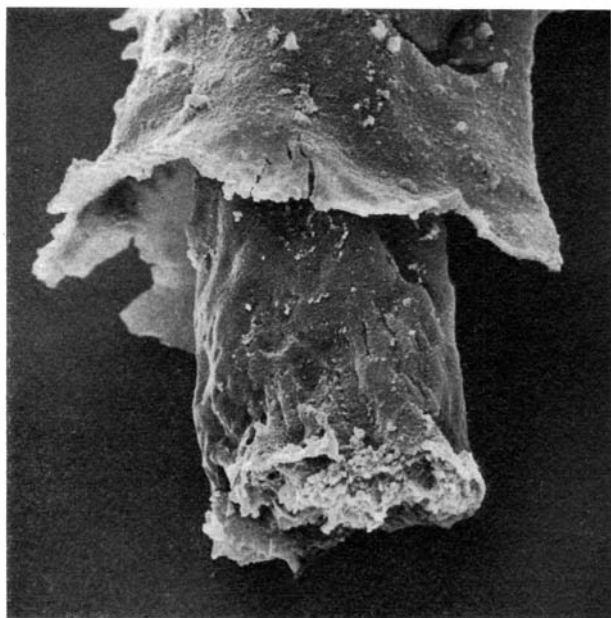


Fig. 71. Prosome in the holotype of *Gotlandochitina martinssoni* n. sp. (For data, see Fig. 49: D). Oblique oral view. $\times 2250$. The surface of the prosome has the same granulation as the exterior of the vesicle wall. The prosome consists of a tube which is provided with very thin, transverse lamellae inside. The tube is rigid and it seems improbable that the prosome once was contractile like a concertina. Hence, its function was probably only to seal the organism inside from the surrounding medium. The vesicles are very tight, and the slightest pressure on the exterior of the vesicle caused extrusion of the prosome.

the slabs by a cut-saw. The limestone cubes were etched with diluted hydrochloric acid and after rinsing the surfaces were scrutinized under a binocular microscope. The orientation of the chitinozoans lying on a bedding plane was noted and the surface was etched again. By repeating this procedure it was possible to get information on the orientation of the microfossils through a thin bed of limestone in some hours. The disadvantage of the method is the difficulty of making continuous observations. It is also difficult to apply the above-mentioned procedure to rocks composed of or containing fragments of fossils consisting of calcium carbonate, since the acid etches some parts of the bedding-plane more than others. To overcome these difficulties two methods developed by Groth (1957) have been used. In these the dissolution of calcium carbonate is performed by the use of an ion exchanger or a chelating agent, EDTA. The processes are slow and therefore cannot be applied in routine investigations but take place without effervescence, thus permitting continuous observation. The method applying EDTA has proved the most satisfactory one. The four sides perpendicular to the upper bedding-plane of the limestone cube were equipped with plates of plasticine. The plates should extend 2–3 cm above the bedding plane which will form the bottom of a small “aquarium” into which the chelating agent is poured.

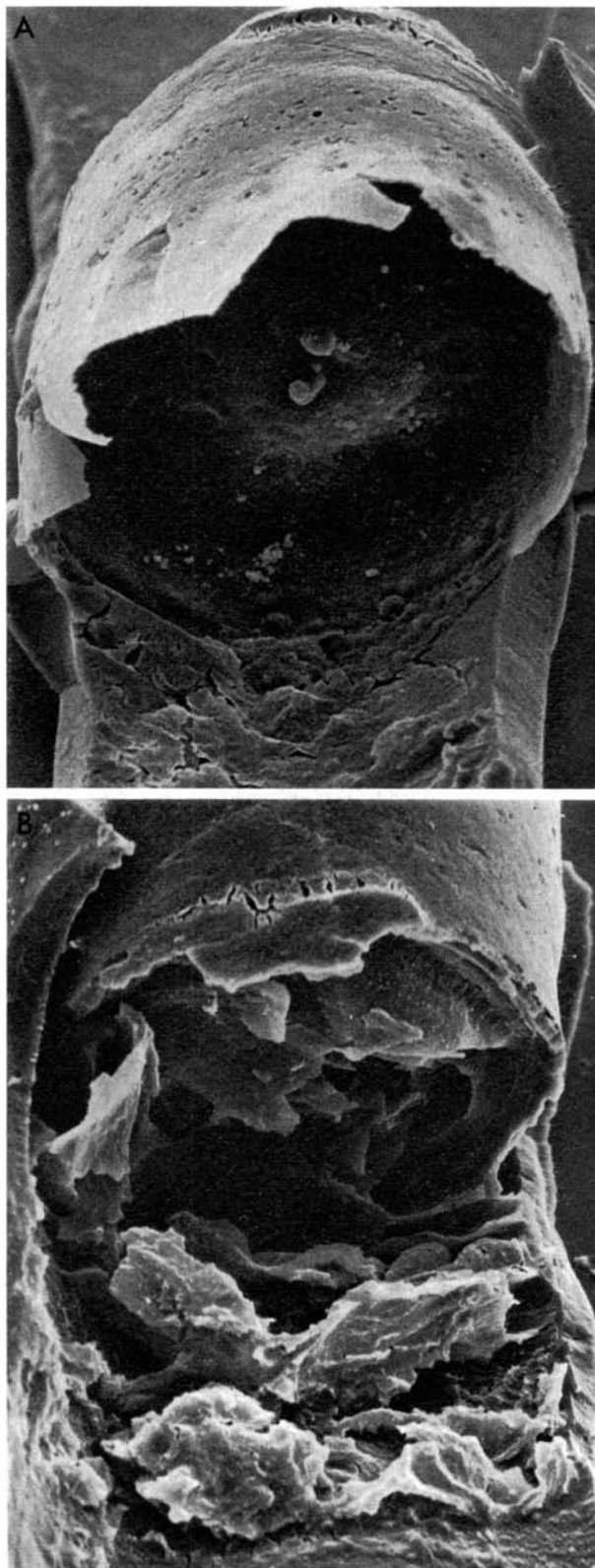


Fig. 72. Prosome in *Conochitina proboscifera* Eisenack, 1937. (For data, see Fig. 33.) A. Aboral view. $\times 1200$. The prosome has its greatest width in its aboral part. The tube-like lateral part extends in aboralward direction as a flange. Note the scars in the concave central part of the prosome. It is not possible to state if these scars acted as points of attachment for some kind of tissue or filaments of cytoplasm, since scars were encountered in one specimen only. It is not self-evident that the scars are connected with the animal itself because a similar morphology may be caused by a disintegration of the wall by the action of sulfate-reducing bacteria (cf. Laufeld 1973: 139–140). B. Oral view. $\times 1200$. The transverse

The studies of the oriented limestone slabs may be concluded as follows.

(1) The chitinozoans in the ten samples investigated have not proved to wear a more delicate ornamentation than that preserved after the standard acid digestion of samples. Unfortunately, external tissue has not been encountered in the samples studied.

(2) The orientation of the chitinozoans within the rock has proved to be three-dimensionally random in most samples. My suspicion that the marked "keel" at the widest part of the vesicles of "typical" population of *Sphaerolithina acanthifera* should be a special effect of compaction of some types of sediment has therefore proved incorrect.

(3) When chitinozoans show preferred orientation it has always been in a horizontal, i.e. bedding, plane. If some chitinozoans were members of the infauna it should be expected that they would show random orientation or a preferred orientation perpendicular to the bedding planes. The morphology of even chitinozoans wearing appendices (e.g., *Ancyrochitina primitiva*) does not *per se* exclude a life as interstitial organism as may be experienced by a comparison with the solitary bryozoan *Monobryozoon ambulans* (see, e.g., Ax 1960, Fig. 52).

(4) Chitinozoans in strata deposited in sedimentary regimes where currents played an important part have proved to show preferred orientation. In, e.g., the Slite Siltstone *Linolithina cingulata* shows a remarkable uniformity in this respect.

(5) It is evident that organic-walled microfossils with elongated form can be used as indicators of direction of currents. The study of preferred orientation of these fossils holds good promise as a standard tool, because of their extreme abundance as compared to macrofossils and because of the ease and promptness by which they can be exposed on the bedding-planes by the use of weak acids.

Morphology

Observations of the micromorphology of Chitinozoa are scattered in the literature and occur mainly in connection with systematic descriptions. There are some notable exceptions, e.g., Combaz & Poumot 1962 and Taugourdeau & Magloire 1965a. Few papers have been devoted solely to morphological analyses. All information published prior to 1965 was synthesized in a publication by Taugourdeau and coworkers

(Taugourdeau et al. 1967) to which reference is made. As the scope of the present paper is restricted only to a description and discussion of the chitinozoans of the Silurian of Gotland, I have no intentions to survey even the literature after 1965 in that respect. A modern, balanced and well-illustrated study by Jenkins (1970) fills a part of this gap. Eisenack's papers, notably 1968a, 1972a and 1972b, are valuable sources of information. Reference should be made also to Jansonius (1970) and Legault (1972a, 1972b).

Ornamentation and appendices

Among the chitinozoans of the Silurian of Gotland there are several species which are provided with well developed appendices or an elaborate spinose ornamentation. The appendices of a great number of specimens of all *Ancyrochitina* species in Gotland were scrutinized under a SEM. Hence, it can be safely concluded that all these species have hollow appendices. Hundreds of appendices were broken off in order to permit a study on how the appendices were formed (e.g. Fig. 70: A—C). In several papers it is stated that there is a pore (lumen) through the vesicle wall under the hollow appendices connecting the central canal of an appendix with the interior of the vesicle. A thorough search for specimens displaying such pores was made in the Gotland species because of the importance of such a character for the interpretation of the biology of the group. However, not even a single specimen provided with pores was discovered in the present material.

Interestingly enough, the exterior surface of the vesicle wall shows no modification in those parts which are concealed by the hollow appendices. The ornamentation of these parts is perfectly similar to the parts where no appendices are attached (Fig. 70: A—B). The interior surface of the vesicle wall shows no modification under the spot where the appendices are attached and when studying the interior of a vesicle it is not possible to say where the appendices are attached to the wall outside.

The spines have the same principal structure as the appendices. In species provided with very short spines most spines are more or less massive. But as soon as the spines are longer and thicker they have a spongy or hollow interior.

These observations lead to the conclusion that the appendices and the spinose ornamentation were built from outside by a soft tissue. The ectoplasma of a protozoan could do the same but, as pointed out later on, this is a less probable explanation. It seems evident that the vesicle wall was secreted before the appendices or spines were attached to it from outside.

There are several explanations of the function of appendices and spines but only three need serious consideration. Firstly, the spines and appendices can be interpreted as a mechanism of defence. They increased the size of the vesicle, so that the chitinozoan was not very easy to swallow or digest by animals

interior lamellae seem to be firmly attached to the vesicle wall orally of the main prosome tube.

higher up in the food webs. Secondly, the processes could have acted as an anchoring device, by which the chitinozoan was attached either to the sea bottom or to floating or swimming organisms. This explanation implies a benthic or a pseudoplanktic mode of life. Thirdly, the appendices and spines can be interpreted as a buoyancy apparatus, which leads to the conclusion that the species provided with long processes were members of the plankton.

The appendices by definition is confined to the basal edge of the vesicle. In my opinion, it seems improbable that an anchoring apparatus serving the purpose of fixing the base of the chitinozoan to the sea-bottom was built as a hollow spine. The vesicle is composed of a fairly heavy organic material, and it is reasonable that the part which was directed towards the sea-bottom was the heaviest part of the vesicle. Should the appendices and spines have been of that function it is probable that the spines were massive and heavy. Hence, the basal part of the vesicle was oriented in the opposite direction and a benthic mode of life is excluded for these taxa.

Prosome and operculum

All chitinozoans were provided with an operculum or a prosome by which the neck or aperture was closed. This is a primary feature and when the prosome or operculum are lacking, there is always a trace of their former existence. In the Gotlandian material the characteristics of prosomes and opercula reveal the efficiency by which they seal the interior of the vesicle. Two different types of prosomes are illustrated here (Figs. 71–72). The main difference between them is the length but both consist of a rigid tube, the interior of which is divided by a great number of very thin, transverse lamellae. The effective manner by which they are welded to the neck, commonly in connection with a slight constriction of the vesicle wall, excludes the possibility that they were movable structures. This is even more true of the opercula (see Figs. 39: A–B, D–E, 62: C). Hence, it can be concluded that the operculum and prosome were fixed structures. In the Gotlandian material their function was solely to seal permanently the connection between the living organism in the vesicle and the sea-water outside. In my opinion this kind of structure can be interpreted in two ways only. The chitinozoans were either encystment cases or early embryonal stages of invertebrates of some kind.

Vesicle wall

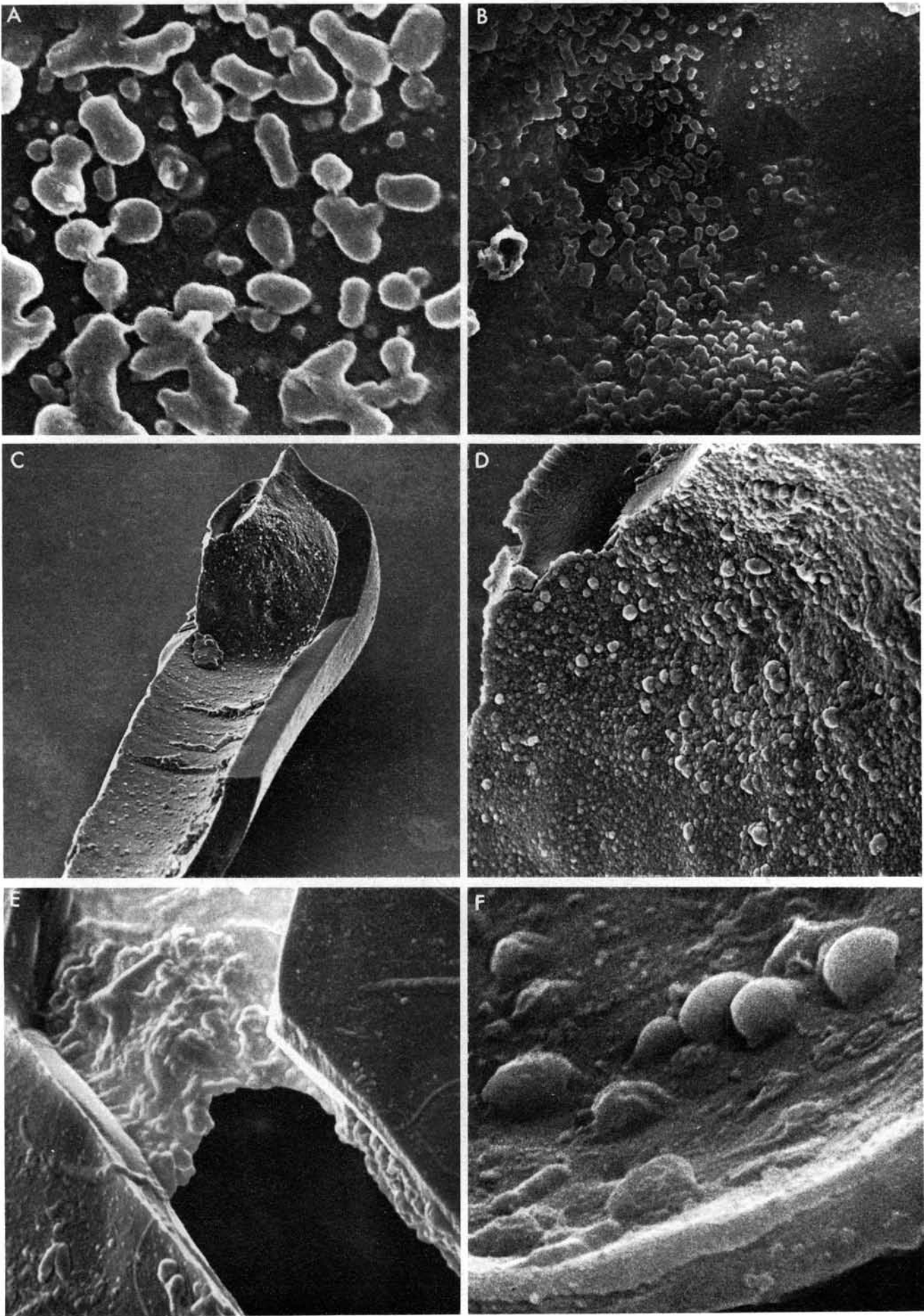
The structure of the vesicle wall has been a matter of dispute in several years. Some authors have stated that the vesicle wall is composed of one, two or three layers, others have refused to accept these observations. It is not my intention to make generalizations applicable to all chitinozoans but to make some generalizations within the Gotlandian material.

(1) As shown in some of the figures in connection with the descriptions of species chitinozoans with one, two or three wall layers do occur in the material. Most species have vesicles composed of two wall layers. The two layers can be of equal thickness, e.g. *Eisenackitina lagenomorpha* (Fig. 44: B), but in most species (cf. Fig. 28: B) the inner wall layer is very thin and the outer layer homogeneous, massive and thick (Fig. 29: E, 73: C–E).

(2) Among the chitinozoans with two wall layers it is more or less a rule that species with long and big vesicles and lacking a spinose ornamentation have a very thick, massive (and heavy) outer wall layer and a thin, membranous inner layer. In, e.g. Fig. 73: C–E it can be observed that the inner layer has a conspicuous ornamentation towards the cavity. This inner layer seals the oral part of the basal process and when the prosome was *in situ* the vesicle cavity was perfectly isolated from the sea-water.

(3) Several, possibly all, chitinozoans have an ornamentation of the interior of the vesicle wall. *Conochitina acuminata* and *Ancyrochitina* cf. *diabolus* have been studied more accurately in this respect because the ornamentation was discovered in these species. In the former species (Fig. 73: A–B) it consists of granules or low irregular ridges occasionally formed as pieces in a jig-saw puzzle. This ornamentation is restricted to a fairly narrow zone around the neck and aboral of the prosome. In *Ancyrochitina* cf. *diabolus* the ornamentation is restricted to the aboral part of the vesicle (Fig. 73: F) and consists of smoothly rounded verrucae. This kind of interior ornamentation was observed in several species (cf. *Eisenackitina lagenomorpha*, Fig. 44: B), but less conspicuously developed. A special study is needed in order to reveal the significance of this ornamentation. Nevertheless, it is tempting to suggest that the soft tissue of the chitinozoan was anchored to the vesicle at the basal verrucae. Further, it is possible that the granules in the neck were points of attachment for soft threads which served to keep the prosome in a fixed position.

Fig. 73. Interior parts of vesicle. *A.* *Conochitina* cf. *acuminata* Eisenack, 1959. Buske 1, Upper Visby Beds, G 66–378, LO 4606t. Ornamentation of the interior part of the vesicle wall aboral of the prosome. $\times 10,000$. *B.* Same as *A* but in smaller magnification. $\times 3000$. *C.* *Conochitina proboscifera* Eisenack, 1937. (For data, see Fig. 33.) Oral view of the basal interior of vesicle. $\times 600$. Note the transverse ridges in the vesicle wall and the granulate structure of the inner wall layer which seals the interior from the basal process. *D.* Detail of *B.* $\times 2400$. *E.* *Conochitina proboscifera* Eisenack, 1937. Buske 1, Upper Visby Beds, G 66–380, LO 4651t. Aboral part of specimen in which the thick exterior wall layer was cracked, but the thin interior wall layer remained partly undamaged. $\times 6000$. *F.* *Ancyrochitina* cf. *diabolus* Eisenack, 1937. Gerumskanalen 1, Hemse Marl, northwestern part, G 71–45, LO 4663t. Verrucate ornamentation of the interior, basal part of the vesicle wall. It seems probable that the soft parts of the organism inside the vesicle were anchored to the vesicle wall at these protrusions. $\times 10,000$.



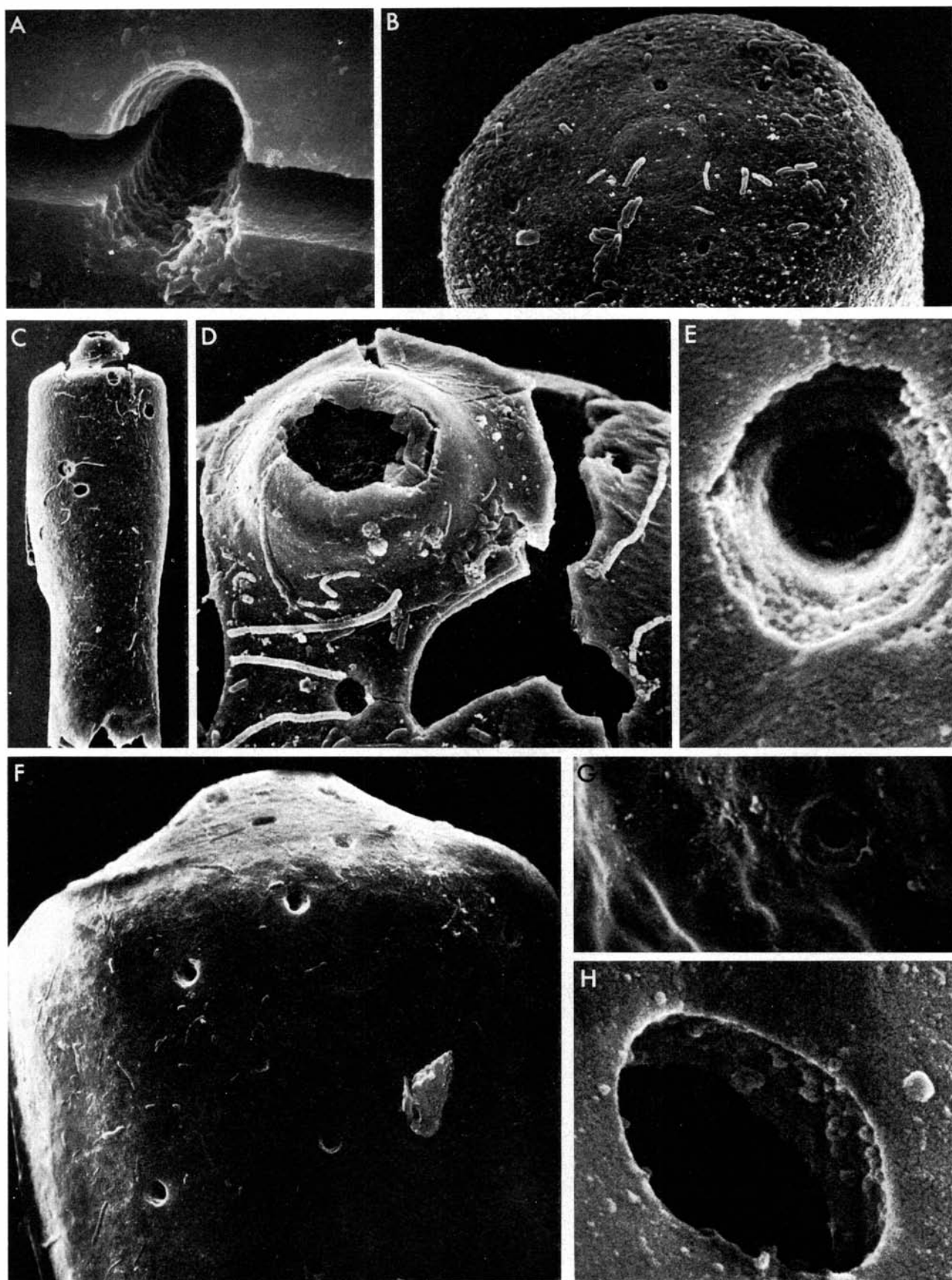


Fig. 74. Traces of parasites? *A. Conochitina proboscifera* Eisenack 1937. Rosendal core, 84 m, Early Wenlockian, LO 4610t. Cylindrical penetration of aboral part of the vesicle wall which has been cracked. $\times 3565$. *B. Conochitina intermedia* Eisenack, 1955. Digrans 1, Hamra Beds, lower part, G 71—11, LO 4678t. Oblique aboral view of specimen with cylindrical penetrations. $\times 1200$. *C. Conochitina cf. acuminata*

Eisenack, 1959. Ireviken 3, Lower Visby Beds, G 66—357, LO 4676t. Lateral view of specimen with large cylindrical penetrations in the aboral part of vesicle. $\times 385$. *C.* The same specimen in oblique aboral view. The disintegration of the vesicle took place where most penetrations are located. Note also that the basal process is sealed at its interior end. $\times 2400$. *E. Conochitina gutta* n. sp. Munkebos 1, Slite Marl,

Parasites

Already in 1931 Eisenack reported that the vesicle wall of some chitinozoans was perforated by some other microorganism, probably bacteria or fungi (Eisenack 1931: 86). Perforations of this kind have been reported also by e.g. Jenkins (1967: 458) and Laufeld (1967: 316) who supported Eisenack's opinion that the perforations were caused by parasites. Several other authors have figured specimens with this kind of perforations, and Eisenack has discussed their possible origin in some detail (e.g., 1968: 143). In an outstanding paper Martin (1971: 11–12) showed that some of these perforations were caused by the disintegration of framboidal pyrite. Martin's explanation is applicable only to some types of penetrations, notably those related to specimens from shales. In the Gotland material there are two types of perforations of the vesicle wall which cannot be attributed to "inorganic" causes.

In the first type of perforation (Fig. 74: A–D, H) the holes are cylindrical with the same diameter all through the vesicle wall. In most specimens these perforations are scattered all over the vesicle, but the exceptions indicate that parasitic organisms can be held responsible for them, since they are concentrated in the aboral part of the vesicle only. Commonly, the second type of perforation shows a preference for the aboral part of the vesicle, where the main part of the soft tissue of the chitinozoan was located. The latter perforations are conical but step-formed with the largest diameter at the exterior surface of the vesicle wall (Fig. 74: E–G). The two types do not occur in the same vesicle. It deserves mentioning that the big *Conochitina* species are more often perforated than other taxa in the Silurian of Gotland, in that respect playing the role of the *Cyathochitina* species in the Ordovician (Laufeld 1973: 140).

Abundance

For several reasons, one being the possibility for drawing ecological conclusions, I have aimed at a quantification of the data collected in the present study. In this paper it is possible to discuss only two of all these parameters, viz., abundance and diversity. As explained in connection with Fig. 1 the abundance of chitinozoans in each sample was calculated as the number of specimens per gram of rock. This is the

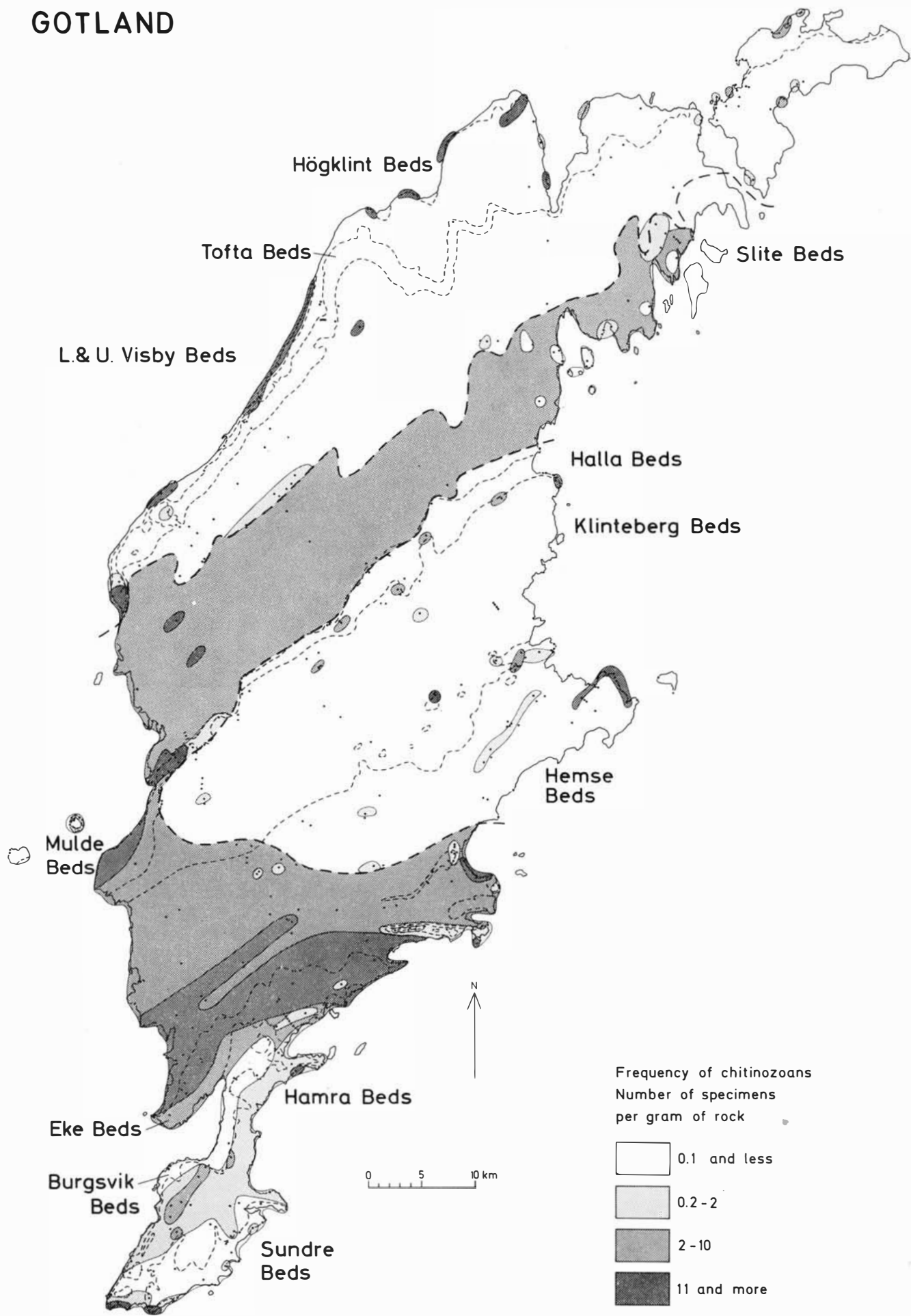
only "quick" method to get an idea on whether the chitinozoans, taken as a unit (which is an oversimplification, indeed), showed preference for certain biotopes. The values of the abundance at each locality were plotted in a map and iso-lines constructed. A generalized picture of the result is shown in Fig. 75. The broken line in the northwest marks the transition between the limestones of Slite age and the Slite Marl. The subparallel broken line towards the southeast marks the boundary between the Slite Marl and the central limestone area of Halla, Klinteberg and Hemse age. The broken line in the south which runs roughly in east–west marks the boundary between the central limestone area and the Hemse and Klinteberg marls immediately south of that line.

Without going into detail, it is immediately apparent that the chitinozoans showed preference for certain biotopes. On the northwest coast of the island there is a more or less coast-parallel zone showing a great abundance. It represents the Visby marls and the marly, lower part of the Högklint Beds. The northern area of biohermal and bedded limestones southeast of the first zone shows a very low abundance of chitinozoans. Towards the southeast the next zone of great abundance is again an area of marly sediments deposited at greater depths of water than the limestones towards the northwest. In the northeastern part of the Slite Marl area there are several small islands of low abundance. These areas are the outliers of unit g of the Slite limestone area. Towards the southeast a new area with low abundance is encountered, again in an area of biohermal and bedded limestone. The curved area of high abundance far in the east represent the samples from the marly unit c of the Hemse Beds. The central limestone area does not reach the west coast and the great abundances at its southwestern tip represent the Mulde Marl. The Hemse Marl area shows a great abundance which increases in its southeastern, uppermost part. The latter area is a time-equivalent to the barren area in the southern part of the central limestone area. The marly Eke Beds show a great abundance whereas the Burgsvik Beds have a low abundance, especially in their southwestern part. The main pattern in the southern peninsula, which mainly consists of limestones, is one of low abundance interrupted here and there by areas of great abundance where the marly parts of the Hamra Beds occur, notably in the southernmost points of Gotland.

It can be safely concluded that in Gotland the abundance of chitinozoans is almost directly proportionate with the contents of calcium carbonate in the rocks. A decrease in the percentage of calcium carbonate is coupled with an increased abundance of chitinozoans. The biohermal limestones, which commonly contain more than 90 % CaCO_3 , entirely lack chitinozoans and the coarse detrital limestones surrounding the bioherms contain very few. In the back-reef sediments the abundance of chitinozoans is very low. In fore-reef positions there is a constant increase in abundance connected with a decrease in the calcium carbonate contents, an increase in the depth of water

Pentamerus gotlandicus Beds or slightly younger, G 71–79, LO 4609t. Conical penetration of the specimen in F. $\times 10,000$. F. Same as E but in smaller magnification. $\times 1000$. G. *Desmochitina acollaris* Eisenack, 1959. Vike 1, Slite Marl, *Pentamerus gotlandicus* Beds or slightly older, G 66–304, LO 4688t. Conical penetration in the middle part of vesicle. $\times 6000$. H. *Linochitina cingulata* (Eisenack, 1937). Same specimen as in Fig. 57: B. Cylindrical penetration at the flexure. $\times 10,000$.

GOTLAND



and an increased amount of terrigenous, clastic material.

The lack of chitinozoans in the biohermal limestones possibly could be explained by the oxidized environment in which the bioherms thrived and in which organic material was rapidly destroyed. However, several microhabitats favourable for the preservation of organic-walled microfossils within the bioherms have been studied and several of these samples yielded a fair amount of organic-walled microfossils but no chitinozoans. The same is true of the back-reef sediments which commonly abound in organic-walled fossils but contain very few chitinozoans. We have no reason to believe that the chitinozoans were selectively destroyed by inorganic processes. Instead, all facts point at a non-occurrence or very sparse colonization of these environments. Unfortunately, the possibility that the chitinozoans dwelled in these environments but were effectively destroyed by some other organisms can not be ruled out, even though such an explanation is highly improbable.

The increase of abundance in the seaward direction from the bioherms is due to better living-conditions for the chitinozoans in that direction and not to a slower rate of sedimentation. However, it is interesting to note that the peaks of abundance are connected with an increased amount of terrigenous material in the shelf area seaward of the bioherms. The highest values (not uncommonly exceeding 100 specimens per gram of rock and in the richest sample so far encountered in the world 984, at Askryggen 1 in Lilla Karlsö) are encountered 30–50 km seaward of the closest bioherms. The highest values are encountered in time intervals when the Silurian shelf of Gotland shallowed up in connection with movements in the Fennoscandian Shield and an increased transport of terrigenous material to the sea. Most notable examples are the high values of abundance in late Slite time, just before an almost complete shallowing up of the shelf by the deposition of the Slite Silt followed by shallow-water oolitic limestones and a marked decrease of abundance. Similarly, the great abundance in late Hemse time just before the shallowing up by the deposition of the Hemse silt was followed by shallow-water algal limestones and the Burgsvik Sandstone and Oolite and a marked decrease of abundance.

These time intervals of rapid sedimentation in the Silurian of Gotland have attracted my interest, since they hold promise of providing us with keys for the understanding of interrelationships between time and life. Männil's (1968 pers. comm., 1972) discovery of very thin repetitive zones (zonules) of one and the same chitinozoan species in the Ordovician of Estonia stimulated the search for a similar pattern in Gotland. When studying the rhythmically deposited Upper Visby Marl it soon became evident that the chitinozoans

of these beds showed a more complicated but similar occurrence. There is a marked difference not only in the abundance of chitinozoans in the thin limestone beds as compared to the intercalated marl beds but also in diversity and composition of chitinozoan taxa. In order to understand these differences it is of paramount importance to know the length of time represented by these "zonules". Among the many groups of fossils in Gotland showing a rhythmical pattern of growth the solitary rugose corals were therefore used as time markers. They have the advantage of occurring in growth position in the Visby and Mulde Beds and in the Slite Beds, where they reach considerable dimensions in the *Pentamerus gotlandicus* Beds and slightly younger rocks. These solitary corals show diurnal growth lines, but more important in this connection they display very conspicuous markings in the corallum about each 30th day. Most of them lived between 12 and 18 months in Gotland. The growth was not constant during the life of an individual but increased during some of the months of the year. That part of the corallum has tentatively been interpreted as representing the summer months. By following the monthly markings of the corallum out in the surrounding rocks and by correlating the monthly rings of a series of closely located specimens it was possible to establish a chronology of the rocks for a period of about five years. The results obtained so far from these studies are tentative only, mainly because solely a small area of a single section has been investigated. Nevertheless, it seems evident that the chitinozoans of the Slite sea did not occur in constant abundance throughout a year. There is a peak of abundance in "late autumn" but more important, the different taxa of chitinozoans have their peaks of abundance fairly well separated from each other during the year.

The greatest importance of the method used is that it provides a tool for measuring the productivity in ocean water in earlier time intervals. However, the values obtained so far are much too high when compared to the productivity in present-day seas.

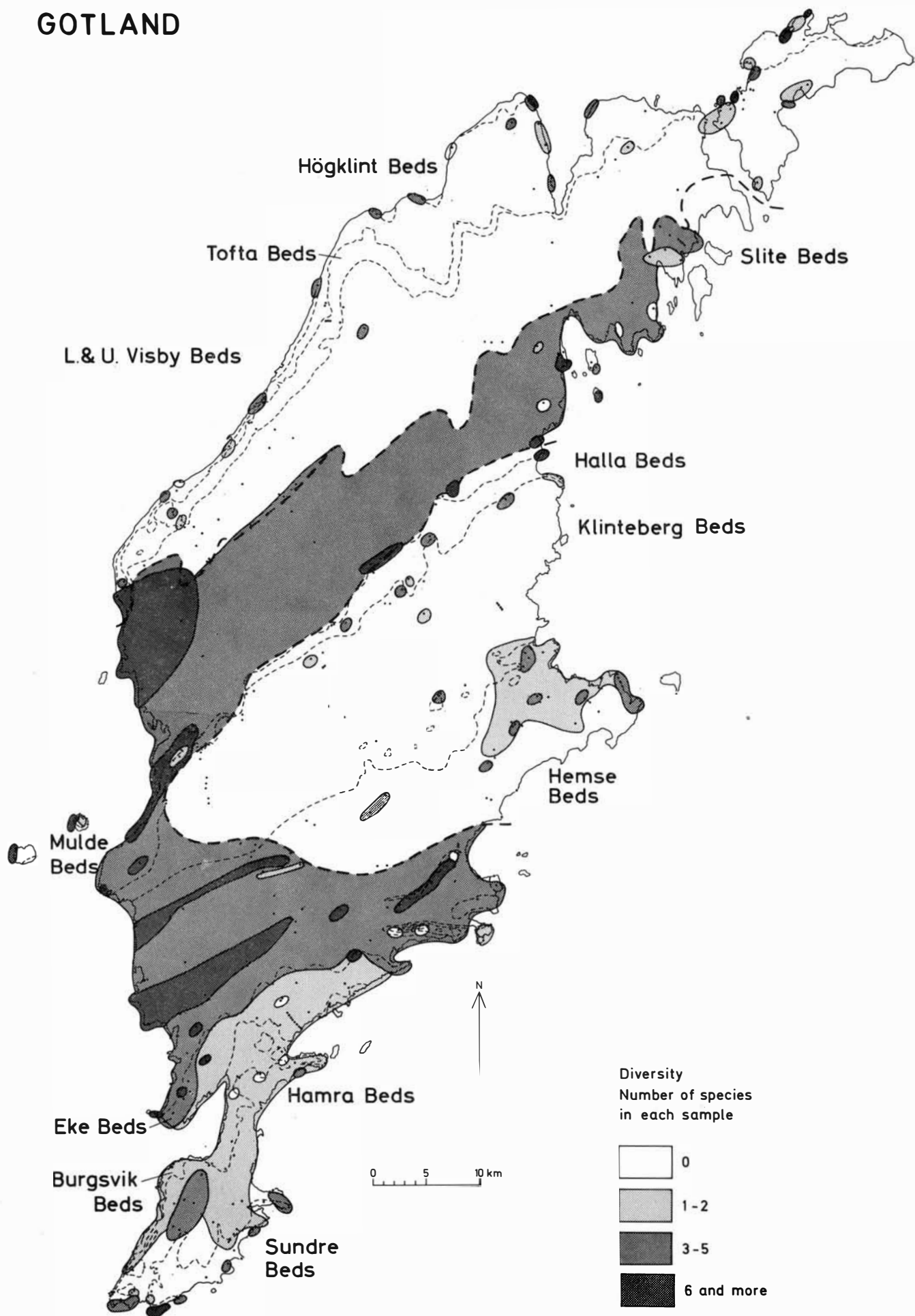
In summing up the evidence from the study of abundance it can be stated that the Chitinozoa as a (heterogeneous) group are facies-controlled. The optimum living-conditions in the Silurian sea in the Gotland area were 30–50 km outside the bioherms. The abundance increased when increased amounts of terrigenous material of the clay-silt fractions were deposited in the shelf. The abundance was not constant throughout a Silurian year but showed a peak in "late autumn", however individual taxa showed separate peaks in different parts of the year. The latter mode of occurrence is characteristic for zooplankton in tropical waters of today (Raymont 1972: 401).

Diversity

The number of species of chitinozoans in each sample is fairly restricted. Few samples contain more than 8 species and the maximum number encountered is 13

Fig. 75. Schematic map of abundance of chitinozoans in Gotland. The abundance is expressed as the number of specimens per gram of rock.

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(Valbytte 1). In Fig. 76 the diversity has been expressed as the number of species in each sample. On comparing Fig. 76 with Fig. 75 it is immediately apparent that the main pattern of diversity is very similar to that of the abundance. Hence, it is evident that the ecological conclusions reached at in the discussion of abundance are further strengthened by the diversity data. The diversity is greatest in the upper part of the Slite Marl (*Conchidium tenuistriatum* Beds—*Pentamerus gotlandicus* Beds) and in the upper part of the Hemse Marl. There are several similarities in the details of the two maps but the dissimilarities are of greater ecological interest and one of these deserves further comments. The marly parts of the Eke Beds show a great abundance of chitinozoans but a low diversity. The only reasonable explanation to this is that the species concerned showed a pronounced preference to a shallow, agitated water or to the fairly coarse-grained substratum connected with this environment. Of the species involved *Sphaerochitina acanthifera* can be singled out as responsible for the differences in abundance and diversity. It remains to be tested by subsurface material if the ecological valence of *S. acanthifera* was as low as suggested by the present data. The species dominates among the few species of the extreme shallow-water sediments of the Burgsvik Beds.

Systematic position

Earlier discussions on the systematic position of the chitinozoans have lately been reviewed by Jenkins (1970: 13–16) who suggested that they could be pre-sicula stages of the graptolites. Reference should also be made to a stimulating paper by Obut (1973: 80–81; the paper was kindly translated for me by Dr. Stefan Bengtson, Uppsala) who, after a review of earlier opinions, suggested that the chitinozoans are an Order of one-celled plants closely related to the dinoflagellates.

With a reference to the above-mentioned papers the discussion here is restricted to the evidence of the material dealt with in this paper.

(1) Studies of orientation of the vesicles in the sediments exclude the possibility that the chitinozoans were members of the infauna. Some of them show a preferred orientation and since they lack structures anchoring them to the substratum these vesicles must have sedimented like clastic particles.

(2) The appendices and spines of several taxa were attached to the vesicle from outside in a mode suggesting that the tissue of a metazoan was responsible for it.

The hollow spines and appendices indicate a planktic or, less probably, a pseudoplanktic way of life for these species.

(3) The fairly thick vesicle wall of the big *Conochitina* species makes it improbable that they were planktic.

(4) The prosome and operculum were not movable structures but permanently fixed in a way suggesting that the chitinozoans were encystment cases or embryonal stages of some metazoans.

(5) The abundance of chitinozoans in the Silurian of Gotland shows that they had preference for some biotopes and that the group as a whole had optimum living conditions some 30–50 km outside the Silurian reefs and in fairly deep waters on the shelf. Different species had peaks of abundance in different parts of the year in similarity with recent zooplankton in tropical waters.

(6) The diversity of species further support the conclusion that the chitinozoans showed a preference for some biotopes. At least one species shows preference to very shallow water.

In my opinion the above-mentioned data make it evident that the chitinozoans were eggs of some metazoans that were very abundant during the time interval concerned. This should rule out the graptolites, which can not be said to be very common in, e.g., Middle and Upper Devonian rocks abundant in chitinozoans. Several of the taxa were planktic (meroplankton) as mentioned above and some thick-walled forms certainly benthic. In a brilliant paper Kozłowski (1963: 442–444) put forward several arguments for a systematic relationship between chitinozoans and annelids or gastropods. In my opinion the conclusions drawn above further strengthen Kozłowski's arguments. It should be added that some chitinozoan taxa occur as helical chains of vesicles (see, e.g., Jenkins 1970, Fig. 9: C, Pl. 6: 4, 6). It seems probable that the helical chains were laid by some spirally coiled animal. Hence, there are reasons to suppose that the chitinozoans are of polyphyletic origin and that at least polychaetes and gastropods were involved. Finally, it deserves mentioning that the chitinozoans are excellent index fossils. However, this is obscured by the fact that the species of an assemblage of a certain age have their morphological counter-parts in similar environments in the same or another geological system. That is one of the explanations of why so many species are recorded in the literature as ranging from the early Ordovician through the Devonian.

Stratigraphy and correlation

The chitinozoan taxa described in the present study have been plotted as to stratigraphical occurrences in

Fig. 76. Schematic map of diversity of chitinozoans in Gotland. The diversity is expressed as the number of species in each sample.

[illegible]

Fig. 77. The species of some importance for the stratigraphy have been recorded in Fig. 78, in which the taxa have been stratigraphically ordered as local range zones. In the following the discussion will be restricted to the species recorded in Fig. 78.

Lower Visby Beds.—There is no chitinozoan species restricted solely to the Lower Visby Beds, since all six species range into the Upper Visby Beds. The delimitation of the Lower Visby Beds downwards will be made on core material by a team of palaeontologists in the near future. It can be mentioned that there are several zones of chitinozoans between the sea level and the red *Arachnophyllum* Marl.

Upper Visby Beds.—In agreement with the Lower Visby Beds these strata are not characterized by any chitinozoan species exclusively occurring in them. However, the Upper Visby Beds are characterized by the concurrent range zone of *Conochitina acuminata*, *C. visbyensis*, *C. proboscifera* f. *gracilis*, f. *truncata*, and *Desmochitina opaca*. All but the first taxon appear in the Upper Visby Beds. The range of *Angochitina longicollis* in the Visby Beds deserves some remarks. The species ranges from the submarine Silurian into the Upper Visby Beds, where it makes an abrupt decrease of abundance 2–3 m above the base. However, scattered specimens are found up to some few metres below top of the Upper Visby Beds. At Röstånga in Scania, southernmost Sweden, there are rich populations of the species in dark shales of *M. spiralis* age (*spiralis* occurs abundantly), but it has not been encountered in younger strata as yet. The species is lacking in the Adavere Stage in Estonia (Kaljo 1970: 178) which is remarkable. However, *A. longicollis* characterizes the lowermost 7–8 m of the Jaani Stage. According to Kaljo this part is of *C. purchisoni* age and thus Wenlockian. As pointed out by Martinsson (1967: 359) it seems probable that the Lower-Upper Visby boundary and the Adavere-Jaani boundary are not synchronous. A detailed study of the occurrence and abundance of *A. longicollis* in the Ohesaare core is under way, but before completed it can not be stated with certainty whether the chitinozoans support a correlation between a level 7–8 m above base of the Jaani beds and a level some few metres below the top or a level 2–3 m above the base of the Upper Visby Beds. Unfortunately, this stratigraphical interval is not exposed in Scania any longer and detailed studies of the range of the critical graptolites will have to rely on core material.

Högklint Beds.—The Högklint Beds are characterized by the exclusive occurrence of five species of chitinozoa. However, these species are new and cannot be used in the correlation with the East Baltic area until a detailed study of the chitinozoans of the Jaani Stage has been undertaken. The lower part of the Högklint Beds are distinguished by the concurrent range zone of *Desmochitina densa*—*Conochitina visbyensis* and *C. leptosoma*—*C. flamma*. Evidently, this zone corresponds to Martinsson's ostracode fauna with *Apatobolbina gutnica*. Unit b of the Högklint Beds cannot be distinguished by chitinozoans. It contains transient species only. Unit c is enclosed in the concurrent range zone of *Ancyrochitina ansarviensis* and *Conochitina mamilla*. The former species holds good promise as an excellent index fossil. It is restricted to unit c and the marly, southwestern facies of late Högklint age and it is easy to identify. One new element enters the chitinozoan succession in the uppermost part of the Högklint Beds, *Desmochitina acollaris* with a range zone to the top of the Slite Beds.

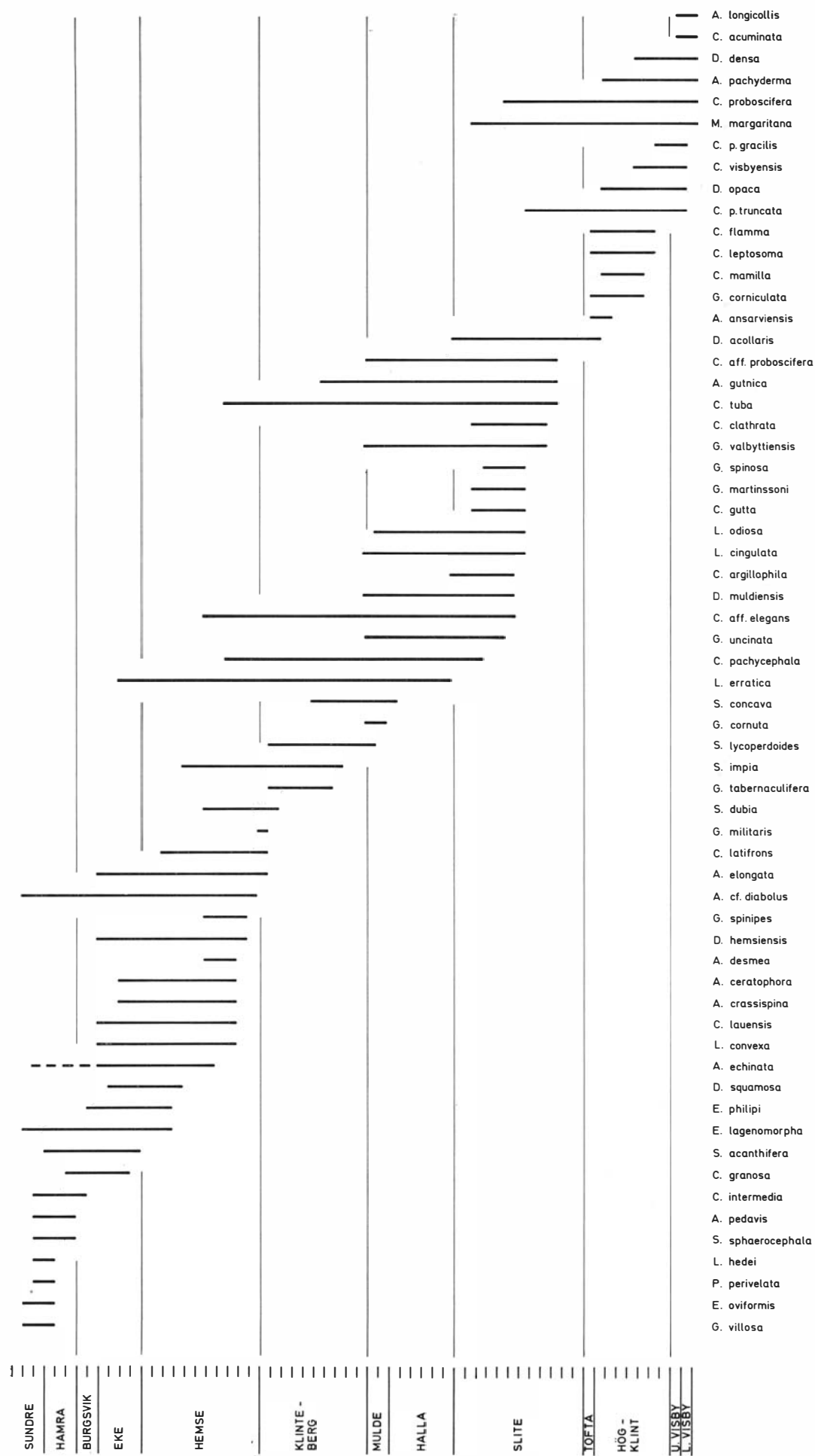
Tofta Beds.—A fairly great number of samples from this stratigraphical unit have been processed, some of them weighing about 1 kg. Nevertheless, the unit was found barren as far as chitinozoans are concerned. The Tofta Beds were deposited under extreme shallow-water conditions and the fossils occurring in them are of a very specialized kind not very useful in correlation. A few long-ranging chitinozoan species occur both below and above the Tofta Beds.

Slite Beds.—There are at least five important events in the chitinozoan succession of the Slite Beds. The first one is at the transition between unit b and the Katrinelund Limestone with the incoming of new species. Units a and b contain only transient species almost lacking stratigraphical importance, but in the Katrinelund Limestone three species make their appearance, viz., *Conochitina* aff. *proboscifera*, *C. tuba* and *Ancyrochitina gutnica* and from that time they are common well up in the Silurian.

The next event takes place at the transition between the Katrinelund Limestone and unit d, where two other species, *Clathrochitina clathrata* and *Gotlandochitina valbyttiensis* appear in the succession. Another important event is associated with the *Conchidium tenuistriatum* Beds, where three species make their appearance and after which *Conochitina proboscifera* disappears and *Gotlandochitina uncinata* appears. The last event takes place at the transition between the *Pentamerus gotlandicus* Beds and the youngest part of the Slite Beds, where five species disappear from the Gotlandian succession of chitinozoa.

The fifth event is connected mainly with a major change of facies at the transition between the limestone area in the northwest and the Slite Marl in the southeast. This transition is most conspicuous in the change of abundance but also in diversity. It is possible to make a fairly refined zonation of the Slite Beds by means of the chitinozoans but a zonal scheme must

Fig. 77. Occurrence of chitinozoans of the different topostratigraphical units in Gotland. Crosses represent occurrences of forms referred to as cf. and dots represent more or less typical populations. The stratigraphical units and subunits are described under Outline of the stratigraphy of Gotland. Unfortunately, the occurrence of *Ancyrochitina* cf. *primitiva* in the Slite Siltstone is omitted in the diagram.



await the graptolite zonation of the subsurface succession of the När core.

Halla Beds.—At the boundary between the Slite and Halla Beds two species disappear and one appears but the main aspect of the Halla chitinozoans is that of a late Slite fauna lacking the forms characteristic of muddy environments. The appearance of *Sphaerochitina concava* is noteworthy.

Mulde Beds.—*Gotlandochitina cornuta* is restricted to the Mulde Beds in which the chitinozoans have a Slite aspect. However, the disappearance of *Linochitina odiosa* and appearance of *Sphaerochitina lycoperdoides* in the upper part of these strata is an important stratigraphical event. Even more so is the boundary between the Mulde and Klinteberg Beds, where several species disappear. A fairly detailed study of the chitinozoans at this transition has revealed that the *G. nassa*-zone chitinozoans disappear not exactly at the Mulde—Klinteberg boundary in all places but between 0 and 5 m below. *Sphaerochitina lycoperdoides* is a species which appears very close to the base of the *P. ludensis* zone. The *nassa-ludensis* zone transition is a very conspicuous event in the chitinozoan succession as pointed out by Laufeld, Bergström and Warren (1974, in press) in connection with the establishment of a *ludensis*-zone fauna at the base of the *Colonus* Shale in west central Scania, southernmost Sweden. It deserves mentioning that this change of the chitinozoan fauna takes place between 203 and 204 m in the När core. According to Skoglund (1973, in litt.) *Pristiograptus ludensis* has its lowermost occurrence at 202.80–202.88 m.

Klinteberg Beds.—The lowermost part of the Klinteberg Beds contains a number of chitinozoans ranging from earlier strata. Two of them disappear in units b and c and are replaced by two species forming a concurrent range zone with the older ones. The next important event in the Klinteberg Beds takes place at the transition between unit f and the Klinteberg Marl, where two species disappear but 3–4 appear. The Klinteberg Marl has a definite aspect of the early, northwestern part of the Hemse Marl as far as chitinozoans are concerned. Nevertheless, the units mentioned are easily distinguished by chitinozoa as apparent in Fig. 77.

Unfortunately, we have no detailed logging of chitinozoans across the Wenlock—Ludlow boundary. Hence, these fossils cannot be used in the precise correlation of this interval as yet.

Kaljo (1970: 179) reported *Conochitina latifrons* as a species characteristic of the early part of the Paadla Stage, the lower boundary of which was correlated with the middle part of the *nilsoni* zone.

C. latifrons appears in the Klinteberg Marl in Gotland. Even though the evidence is scanty it is possible that the Wenlock—Ludlow boundary cuts across the upper part of the Klinteberg Beds. If this is correct the Klinteberg Beds were deposited in a very short time interval, embracing slightly more than one graptolite zone only. If this proves correct it will have far-reaching resulting effects as to palaeogeography. However, Martinsson (1967, Fig. 2) established the length of Klinteberg time to between two and three graptolite zones.

Hemse Beds.—*Ancyrochitina* cf. *diabolus* makes its debut in unit a of the Hemse Beds and in unit b two species appear, *Gotlandochitina spinipes* and *Desmochitina hemsiensis*, the former of which is a good index species. The northwestern part of the Hemse Marl has its chitinozoan fauna in common with units b and c of the limestone facies. *Gotlandochitina spinipes*, *Sphaerochitina dubia* and *Ancyrochitina desmea* disappear before the transition between units c and d. The southeastern, younger part of the Hemse Marl is easily distinguished from the northwestern part, e.g., by the appearance of *E. lagenomorpha* and *E. philipi*. It is interesting to note that the changes of chitinozoan faunas are more conspicuous within the Hemse Beds than the change at the Hemse—Eke boundary. Unfortunately, it is not possible to do any correlations with the Estonian chitinozoan faunas for the present.

Eke Beds.—*Sphaerochitina acanthifera* and *Conochitina granosa* are newcomers in the lower part of the Eke Beds but they are not very abundant. All chitinozoan species in the uppermost part of the Hemse Marl range into the lower part of the Eke Beds. However, some of them disappear in the middle part of the Eke Beds. This is a part of the very conspicuous decrease in diversity which continues to a level close to the top of the Burgsvik Beds.

Burgsvik Beds.—The only species occurring abundantly in these beds is *Sphaerochitina acanthifera* which also occurs in the Eke and Hamra Beds. Furthermore, it proved to be controlled by facies to a very great extent. However, the Burgsvik Beds represent a short time interval with very rapid sedimentation and probably all fossils occurring in these strata were dependent of facies to such an extent that they will never provide a means for a biostratigraphic subdivision.

Hamra Beds.—The lowermost unit of the Hamra Beds is hard to distinguish from the Burgsvik Beds unless *Ancyrochitina pedavis* occurs in the sample. However, there is very marked event in the chitinozoan succession between the middle and upper part of the Hamra Beds where four species make their appearance. Unfortunately, it is not very easy to distinguish unit b from unit c in the field. Hence, this very marked invasion of species can only tentatively

Fig. 78. Stratigraphical range of selected species of chitinozoa in the Silurian of Gotland. The stratigraphical subunits are the same as in Fig. 77.

be established as occurring at the transition between units b and c. According to Kaljo's (1970: 179) preliminary study of the Silurian chitinozoans of Estonia the Kaugatuma beds do not hold promise for providing a key to this problem. However, the Öved-Ramsåsa Group of Scania, southernmost Sweden, will be of help in this respect.

Sundre Beds.—The Sundre chitinozoans are all species transient from the Hamra Beds but several of them disappear a few metres above the Hamra—Sundre boundary. This is probably caused by extreme depositional conditions. The next sudden appearance of chitinozoan species takes place in the submarine sequence and is therefore beyond the scope of this paper.

Summary

About 475 geological localities in the Silurian of Gotland have been studied as to the occurrence of Chitinozoa. The processing of samples included digestion in hydrochloric, nitric and hydrofluoric acids and sifting. The sample residues (particle diameter >45 microns) were studied under a binocular microscope. More than one million specimens have been classified and counted. Several hundred specimens of a good state of preservation were studied and photographed on a SEM. Sixty-four taxa were described. One new genus, *Gotlandochitina*, has been erected with *G. martinssoni* n.sp. as type species and with the following new species *G. corniculata*, *G. cornuta*, *G. militaris*, *G. tabernaculifera*, *G. valbyttiensis*, and *G. villosa*.

Further, the following new species have been erected: *Ancyrochitina ansarviensis*, *A. gutnica*, *A. pachyderma*, *A. pedavis*, *Conochitina argillophila*, *C. flamma*, *C. granosa*, *C. gutta*, *C. lauensis*, *C. leptosoma*, *C. mamilla*, *C. visbyensis*, *Desmochitina hemsiensis*, *D. muldiensis*, *D. opaca*, *D. squamosa*, *Eisenackitina philipi*, *Linochitina convexa*, *L. hedei*, *L. odiosa*, *Sphaerochitina concava*, *S. impia*, and *S. lycoperdoides*.

The state of preservation is excellent and the chitinozoans have never been subjected to temperatures exceeding 100°C.

Studies of the orientation of the chitinozoan vesicles in the sediments have been undertaken and have proved that the species studied have no ornamentation which is lost in the processing of samples. Some populations of chitinozoa showed a preferred orientation and it has been pointed out that microfossils are underestimated as indicators of currents, etc. The studies of orientation have indicated that an interstitial mode of life can be excluded for the chitinozoans.

The micromorphology of the ornamentation, appendices, vesicle wall, prosome, operculum, and perforations caused by parasites have been studied in some detail and the palaeobiological significance of these observations have been briefly discussed.

The abundance of chitinozoans has been discussed

and it was concluded that the chitinozoa had optimum living conditions some 30—50 km seaward of the bioherms.

A method for measuring the productivity in ocean water of earlier geological periods has been discussed in connection with seasonal variations of abundance of chitinozoans.

It has been shown that the diversity of species follows a pattern similar to that of abundance.

The systematic position of the chitinozoans has been discussed in the light of the results obtained here and it has been pointed out that the group consists of eggs of metazoans, most probably gastropods and polychaetes but possibly also other groups.

Awaiting the graptolite zonation a formal chitinozoan zonation of the Silurian of Gotland has not been introduced but local range zones for the different species have been established.

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