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interval Angochitina longicollis Eisenack, Conochitina acuminata Eisenack, and Calpichitina (Densichitina) densa are strikingly new, easily recognized and quite cosmopolitan and can be traced throughout the North Chitinozoan Realm (see Text-figs. 29-31). Additionally Asselin et al.'s (1989) Angochitina sp. 1 is Lambdachitina bipedata sp. nov. in meim, providing further evidence for their Assemblage F belonging to this biozone. The occurrences of Calpichitina (Densichitina) densa, Conochitina cf. acuminata, and C. proboscifera in the lower unit of the Pitinga Formation and that of A. longicollis and Margachitina margaritana in the Nhamunda Formation of the Amazonas Basin, N. Brazil indicate that this biozone is continued into NE Gondwana.

9. The Conochitina visbyensis biozone

C. visbyensis, taken as the marker of the basal Wenlock, is widely recognized from Sweden (Laufeld 1974, 1979), Estonia (Nestor 1990), Czech (Dufka and Fatka 1993), Britain (Dornig 1981), the Yangtze Region (C. cf. visbyensis) and possible Canada (Asselin et al. 1989) and representative of shallow water facies assemblages. This biozone is replaced by the Margachitina margaritana biozone in the deeper water facies and correlated with the middle part of the latter biozone, of which the eponymous species has been recorded also from NW Gondwana and its adjacent area: Libya (Paris 1988), Brasil (Grahn and Paris 1992), Spain (Cramer 1967a), and Belgium (Verniers and Rickards 1978, Verniers 1981, 1982).

10. The Ancyrochitina anserviensis biozone

As stated above, this species is confined to deposits of riccartonensis-belophorus graptolite biozone age by means of its occurrence in Sweden. Therefore this species is useful in correlation, but less wide in distribution. Its occurrence in Podolia is not reliable because those specimens referable to this species have elongate appendices rather than short spines, characteristic of this species. Ancyrochitina grandicornis Tsegelnjuk, an important element of the A. anserviensis biozone in the Yangtze Region also occurs in the higher Furmanov and lower Ternav Formations of Podolia, assisting in delimiting the age.

11. The Cingulochitina cingulata biozone

This biozone spreads throughout the North Chitinozoan Realm and NW Gondwana (Verniers et al. 1995) and is one of the most important biozones of Early Wenlock age for correlation. However, in Podolia no C. cingulata biozone has yet been demonstrated, though C. cingulata occurs in an interval along with Conochitina pachycephala Laufeld. However, this record represents the upper range of the species C. cingulata.

12. The Lambdachitina tabernaculifera biozone

In Sweden, L. tabernaculifera (Laufeld) is limited to the higher part of the Sphaerchitina lycopteroides biozone and is a characteristic species for fixing the upper boundary of Wenlock. The name-giving species is recorded only from Sweden and China.

13. The Lambdachitina crassispina biozone

The newly proposed Angochitina elongata biozone is not introduced to the Yangtze Platform not only because most elements of that biozone are absent in this region, including Ancyrochitina desmea, Belonechitina latifrons, Cingulochitina convexa, Eisenackitina intermedia, Angochitina
echinata, and the other species (Verniers et al. 1995), but also because the L. crassispina biozone has its own distinctive fauna, including Eisenackitina cf. cyrtopleura, E. venusta, and E. rimoso and is a biostratigraphically useful entity in its own right. On the basis of the range of biozonal species in Sweden, this biozone equates the Angochitina elongata biozone.

14. The *Grahnichitina philipi* biozone

This biozone also is a widely traceable biozone in the North Chitinozoan Realm and may be recognized from Sweden (Laufeld 1974, Verniers et al. 1995), Estonia (Nestor 1990), and Britain (Dorning 1981, Sutherland 1994). It may extend across the realm boundary into Spain (Schweineberg 1987) and Libya (Jaglin and Massa 1985).

15. The *Angochitina sinica* biozone

This biozone is affirmed to be the correlative of the Eisenackitina barradei biozone on the basis of the presence of Ozarkodina crispa Walliser. Angochitina sinica is not an endemic species, and was discovered and illustrated by Cramer (1970) from the Lecthyalus-shale of Upper Ludlow age in the Racine Formation near Chicago, Illinois, indicating its widespread distribution. It also is present in Spain (Schweinebeg’s 1987 Angochitina aff. mourai = A. sinica herein). This species has not yet been discovered from other localities, partly because the publications right covering the interval are small in the literature, and partly because the light microscope photographs provided by Cramer (1970) hinder it from being recognized. The SEM photographs given by this monograph will help to rectify this situation.

16. The *Fungochitina kosovensis* biozone

*F. kosovensis* is an excellent biozonal species not only because it has a short-range peculiar to the parultimus-ultimus and basal branikensis-lochkovensis biozones of Early Pridoli age, but also because its unique shape renders it easily identifiable. It is described, apart from the Yangtze, from Bohemia (Paris and Kriz 1984, Kriz et al. 1986) and recorded from Libya (Jaglin 1986) and Brasil (Grahn and Paris 1992). This biozone corresponds partly or wholly to that of Ancyrochitina fragilis of Nestor (1990) and the total-range of *F. kosovensis* is similar to that of Plectochitina carminae Cramer found from Spain (Cramer 1964, Cramer and Diez 1978), Algeria (Magloire 1967), and Libya (Al-Ameri 1983).

17. The *Margachitina* sp. A biozone

This biozone is correlated with the *M. elegans* biozone, with the presence of Grahnichitina lagenomorpha substantiating a wid-Pridoli age, because this species has a last occurrence in the chitinozoan biozone of *M. elegans* corresponding to the middle part of the Pridoli Series (Verniers et al. 1995). On conodont evidence, this interval is placed to the Late Pridoli Series, i.e. a slightly younger data than the age indicated by chitinozoans. It is not possible at this stage to comment on this discrepancy.

The correlation of the Yangtze Silurian chitinozoan biozones with those of other localities in the world is presented in Text-figs. 29-31.
<table>
<thead>
<tr>
<th>Stage</th>
<th>China</th>
<th>Sweden</th>
<th>Estonia</th>
<th>Belgium</th>
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<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
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<tr>
<td></td>
<td>M. sp. A.</td>
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<td><em>U. urna</em></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td><em>fusiformis-pustuliformis</em></td>
<td><em>fragilis</em></td>
</tr>
<tr>
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<td><em>E. internedia</em></td>
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<tr>
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<td><em>E. philipi</em></td>
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<td><em>L. crassispina</em></td>
<td><em>A. echinata</em></td>
<td><em>granosa</em></td>
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<tr>
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<td><em>indecora</em></td>
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<td><em>C. cingulata</em></td>
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<td><em>cf. namila</em></td>
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<tr>
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<td><em>C. visheensis</em></td>
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<td><em>A. longicollis</em></td>
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<td><em>E. dolioformis</em></td>
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<tr>
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<td><em>interzone 2</em></td>
<td><em>C. iklaensis-S. maennili</em></td>
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<td><em>convexa</em></td>
<td><em>electa</em></td>
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<td><em>P. pseudoaggl.</em></td>
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<td><em>B. postrobusta</em></td>
<td><em>postrobusta</em></td>
<td><em>B. postrobusta</em></td>
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</table>

Text-figs.29 (30-31). Correlation of Silurian Chitinozoan biozones employed herein for the Yangtze Region with those elsewhere of the world.

Note that the biozones of Sweden, Estonia, SE Europe, Belgium, England, and Libya have been fully or partly established and those of other areas have not yet been purposed or adequately defined (no basal and top boundaries or biozonal species designated). Therefore they are here compiled on data from each area only for the purpose of correlation. The ticks on the left-hand margin represent the boundaries of series or stages. 1, this paper 2, Eisenack 1971a, Lautfeld 1974, Grahn 1978, Verniers et al. 1995.3, Nestor 1990. 4, Martin 1973, Verniers 1982, Grootel 1986.
<table>
<thead>
<tr>
<th>Czech</th>
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<th>U. S. A.</th>
<th>Canada</th>
<th>Ukraine</th>
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<td>M. elegans</td>
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<td>C. alargata-Cyathochitina sp. B</td>
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<td>A. seurati-P. pseudoaggul.</td>
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<td>C. vitrea</td>
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</table>

CHITINOZOAN CLASSIFICATION

Chitinozoans are a group of organic-walled microfossils whose biological affinities are uncertain and enigmatic. Since Swedish Hinde (1882) first assigned a chitinozoan specimen (probable Conochitina) from the Silurian of Gotland to polychaete jaw, they have been alternately placed in various groups in the animal and plant kingdoms as follows (Table 1):

Table 1. Proposed chitinozoan affinities in the literature

<table>
<thead>
<tr>
<th>Animal</th>
<th>Kingdom</th>
</tr>
</thead>
<tbody>
<tr>
<td>1882</td>
<td>Hinde polychaete annelids</td>
</tr>
<tr>
<td>1931</td>
<td>Eisenack protozoans (Testaceae)</td>
</tr>
<tr>
<td>1942</td>
<td>Cooper hydrozoans</td>
</tr>
<tr>
<td>1956</td>
<td>Jones Foraminifera</td>
</tr>
<tr>
<td>1961</td>
<td>Staplin chrysomonads</td>
</tr>
<tr>
<td>1963</td>
<td>Kozlowski eggs or egg-capsules of some kind of metazoa (annelid worms and gastropods)</td>
</tr>
<tr>
<td>1970b</td>
<td>Jenkins pre-sicula stages of graptolites</td>
</tr>
<tr>
<td>1970</td>
<td>Jansonius extinct animals of unknown systematic position</td>
</tr>
<tr>
<td>1981</td>
<td>Reid and John tintinnids</td>
</tr>
<tr>
<td>1985</td>
<td>Bignot vermiiform metazoa</td>
</tr>
<tr>
<td>1990</td>
<td>Cashman Foraminifera (rhizopods)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Plant</th>
<th>Kingdom</th>
</tr>
</thead>
<tbody>
<tr>
<td>1932</td>
<td>Eisenack flagellates</td>
</tr>
<tr>
<td>1973</td>
<td>Obut unicellular plants closely related to dinoflagellates</td>
</tr>
<tr>
<td>1977, 1981</td>
<td>Locquin Fungi (chitinomycetes)</td>
</tr>
<tr>
<td>1981</td>
<td>Schalleuter Fungi</td>
</tr>
</tbody>
</table>

Wrona (1980) considered the fecundity of those pre-1980s hypotheses to be all grounded on the characters of a single chitinozoan group or even genus or species, and to extrapolated over all the chitinozoans regarded as a homogeneous natural taxon. Bocklie (1981) regarded chitinozoans as unknown groups and Laufer (1974) did them to be of polyphyletic origin.

The uncertainty as to biological affinities of chitinozoans has exerted an intense influence on their classification. For example, Locquin (1976,1977) substituted Chitinomycetes for Chitinozoa and grouped them into five orders: Pterochitininales, Clathrochitininales, Urochitininales, Rhabdochitininales, and Desmochitininales according to the floral nomenclature. Schalleuter (1981) proposed two genera, Arimigutta and Biconigutta, with gutta instead of chitina as their suffix. However, chitinozoans have been placed by most authors in the animal kingdom. The fresh evidence for understanding the affinities of chitinozoans appeared in 1990-1991 when Cashman found the “juveniles” attached to the vesicular surface of mature individuals in Bulbochitina sp. from Silurian-Devonian rocks of Forillon Peninsula at Anse Ste. According to Cashman’s interpretation, the mucron is dynamic features in active chitinozoans with functioning being an opening for the appearance of pseudopodia of foraminifera, and the holes on the vesicle surface of chitinozoans provide with facilities for communication of the pseudopodial cytoplasm (ectoplasm) with the endoplasm of the chitinozoan. However, in material from the Yangtze Region an opening on the base is observed only on ill-preserved specimens and the pores on many vesicles of chitinozoans have an overlapping nature, supporting an interpretation of these structures as borings and an origin of parasites.

We disagree with the hypothesis of Jenkins (1970b) who regarded chitinozoans as being early ontogenetic forms of graptolites on account of the following evidence from the Yangtze Silurian chitinozoans:

1. The basal Xiaoxiuyu Formation and the Late Silurian lithostratigraphic units barren of graptolites and their debris are rather rich in chitinozoans, reaching a maximum abundance of 30 specimens per gram.
Both are prominently incongruous in abundance.

2. The Early Telychian Nanjiang Formation with high diversity graptolites (totally 40 species and 14 genera) yields low diversity chitinozoans (4 species and 3 genera). Both are noticeably unmatchable in diversity.

The evidences presented here are in favour of Kozlowski’s (1963) theory:

1. The prosome of *Grahnchitina piriformis* comprises a ca. 33 μm long somewhat compact flag and a ca. 83 μm long annulate tube and chokes the inside of the neck. The annulate tube is made up of a series of disc-like laminae. Two laminae are close together (about 1.3 μm apart) (pl.20, figs.8-9, 12-13). It seems to us that the prosome is not likely to be a movable structure as previously suggested.

2. The prosome of *Nanochitina lagenicula* is composed of a ca. 24 μm long compact flag and a ca. 20 μm long aboral flange (pl.3, fig.3). From the figure it is clear that the vesicle wall narrows remarkably in the place where there is a prosome. Thus a conclusion can be reached that the prosome is attached to the inner side of the neck wall and it is, therefore, a fixed structure, as pointed out by Laufeld (1974).

3. Within the neck of *Angochitina heterotricha* sp. nov. there is a submerged “operculum” in the form of a more or less flat plate and an aborally widened prosome (pl.20, fig.3), different from the illustrated specimens on pl. 20, figs.1-2. Alternatively, they originally are an united prosome, but partitioned into two parts, an upper operculum-like flag and a lower flange. We prefer to the latter because many specimens of the species possess a long prosome, as shown on pl. 20, fig.3.

4. *Eisenackitina venusta* (pl.2, fig.1; pl.3, fig.7) and *Bursachitina rectangularis* (pl.6, figs.15-16; pl.20, figs.6-7) have an operculum tightly accreted to the inner wall of a basal collarette and differ in the morphology of opercula, flat in the former and vaulted at its center in the latter. The centrically vaulted operculum increases its surface area and its lateral expansion and contraction. Therefore its adhesion is greatly strengthened. As a result an in situ operculum is more often preserved in *B. rectangularis* than in *E. venusta*. It is hardly conceivable that the operculum of this type can be opened and closed once and again.

5. The operculum of the genus *Margachitina* is almost unexceptionally welted to the base of the supra-adjacent individual in the chain (pl.5, fig.3). The operculum possesses a quite wide aboral flange which makes the operculum easier to adhere to the inner wall of the aperture. It is a reasonable deduction that the operculum would have been opened once and for all only, as claimed by Wrona (1980).

The function of the operculum and prosome is interpreted conclusively to seal the vesicular contents hermetically. The closed nature of the Yangtze chitinozoan vesicle renders Kozlowski’s theory that advocates chitinozoans as eggs or cysts easier acceptable.

6. In specimens of *Eisenackitina daozenhensis* (pl.20, fig.11) a cluster, in the sense of Jenkins (1970), of two vesicles is found. Individuals in the cluster are smaller in size than single “mature” individuals. Those “immature” individuals are thought by Jenkins (1970) to be once packed tightly together and enveloped in an organic membrane (cocon), as documented by Kozlowsky (1963, figs.4-5) and Henry (1967, pl.13, figs.95-102). The clusters are considered to come out of the incomplete breakup of cocoons. If so, the creature (Grahn’s 1982 chitinozoophoran) giving birth to chitinozoans is soft-bodied metazoans rather than protozoans owing to the cocoon phenomena being exclusively metazoans.

Following Eisenack (1931), chitinozoans are considered group within the animal kingdom and classified into three families, the Lagenochitiniidae, Conochitiniidae, and Desmochitiniidae. Wilson and Dolly (1964) proposed the family Hoigichtiniidae. Jansonius (1964) defined the family Sphaerochitiniidae, but abolished the family Lagenochitiniidae. Taugourdeau (1964) described the new family Ancyrochitiniidae. Tappan (1966) thought that the family Sphaerochitiniidae was a subjective synonym of the family Lagenochitiniidae established by Eisenack (1931). Jansonius (1967) divided them into five tribes, the Ancyrochitina, Eremochitina, Euconochitina, Lagenochitina, and Desmochitina Tribes. However, in the 1970s Jenkins
(1970), Laufeld (1974) and Wrona (1980) stated that chitinozoan hierarchy did not reflect true phylogenetic relationships at the suprageneric level. A nascent interest in chitinozoan classification at the suprageneric level was seen and new phylogenetic classificatory schemes presented by Paris (1981), Achab et al. (1993), Wood (1994). From the 1980s onwards suprageneric chitinozoan classification is used and is, following Achab et al. (1993), but with an addition, shown in Table 2.

Table 2. Suprageneric chitinozoan classification

<table>
<thead>
<tr>
<th>Order</th>
<th>Family</th>
<th>Subfamily</th>
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<tbody>
<tr>
<td>Operculatifera</td>
<td>Desmochitiniidae</td>
<td>Cutichitininae</td>
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<td></td>
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<td>Eisenacktininae</td>
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<td></td>
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<td>Pterochitiniinae</td>
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<td></td>
<td>Conochitiniidae</td>
<td>Belonechitiniinae</td>
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<td>Retiachitiniinae</td>
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<td>Spinachitiniinae</td>
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<td>Prosomatifera</td>
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<td>Togachtiniinae</td>
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<td></td>
<td></td>
<td>Urnochitiniinae</td>
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</tbody>
</table>

**SYSTEMATIC DESCRIPTIONS**

Synonymies are as complete as the availability of literature allowed. Inevitably, there must be some omission. Comprehensive synonymy coverage was thought desirable as many of the taxa described in this paper were misidentified in the Chinese literature in the past. It is hoped also that the synonymies will be a source of information for authors wishing to plot palaeobiogeographic provinces.

The synonymies are annotated with the symbols proposed by Prof. Zhang Rong-huo (1983) who provided a very useful reference. For convenience, species are dealt with in alphabetical order throughout.

Morphological terminology for chitinozoans has not been standardized. The terms used in this paper are those recommended by the CIMP (Combaz et al. 1967) or introduced subsequently by Jansonius (1970), Jenkins (1970), Eisenack (1968, 1972), Laufeld (1974), Paris (1981), and Sutherland (1994).

Mattews (1973) recommended use of open nomenclature for certain specimens whose identity could not be exactly assigned. This practice is followed herein. Cf. is for specimens displaying comparison with the known species.

Below, the schematic drawings (Text-figs.32-33) are given for those morphological terms used in this study.

All specimens figured are housed in the Nanjing Institute of Geology and Palaeontology, Academia Sinica, in Nanjing, the People’s Republic of China.
Text-fig. 32. Chitinozoan morphology for: a. Desmochitinidae, b. Conochitinidae and c. Lagenochitinidae. Figs. d-k represent vesicle surface structure; d-g are classified as either textured, bald or ornamented; h-k are classified as ornamented (based on Paris 1981, p. 68, 70 and Sutherland 1994, p. 21).
Text-fig. 33. A. Vesicle dimension: L=length of vesicle, ln=length of neck, lb=length of body, D=maximum diameter of vesicle, d=minimum diameter of vesicle, da=diameter of aperture, lapp=length of appendices, dcol=width of collarette or rim. B. Descriptive terminology for vesicle form (after Sutherland 1994, p. 22).
Order Operculatifera Eisenack, 1972b
Family Desmochitinidae Eisenack, 1931
Subfamily Desmochitininae Paris, 1981
p.1982 Sclerochitina TsegeJnjk
p.1982 Eurychitina TsegeJnjk

Type species: Desmochitina bursa Taugourdeau et Jekhowsky, 1960 (1960, p.1225, pl.7, figs.8-9), by original designation.

Diagnosis: Vesicle small, thick walled, short, length greater than or equal to maximum diameter; body conical to piriform; collarette more or less developed, flaring or cylindrical; flexure generally undistinct; shoulder absent or weakly developed; aboral margin rounded; base flat to convex; vesicle non-spinose (no spine or pointed cone), probably smooth, feltly, microgranular or feltly on aboral margin only; mucron not developed, but usually present, functional in linkage between vesicles; operculum discodial, chain formation common (Paris 1981, p.136-137)

Remarks: When proposed this genus, Taugourdeau (1966) put emphasis on its purse-like vesicle for which the genus is named. The vesicle is short, squat and the flank is convex. However, he erroneously stated that its length is in general equal to, or less than, its width. Paris (1981) pointed out that the specimen of its type species, B. bursa is completely flattened. Flattening causes increase in the width of vesicles. By use of the correction factor of 0.7 which was suggested by Paris (1981), the length of B. bursa is not less than its width, as implies Paris’ (1981) emendation for the original diagnosis of this genus.

Since the establishment of Bursachitina whether it is an independent genus has not been unanimous in the literature. Jansonius (1970) placed Bursachitina in synonymy with Eisenackitina Jansonius, 1964, though he (1968) had been in agreement with the former being generically separate. Zaslavskaya (1986) also did not concur with Bursachitina being generically distinct from Eisenackitina. However, Eisenack (1972a), Paris (1981), Grahn (1992), Achab and Asselin (1993), and Sutherland (1994) deemed Bursachitina a valid genus.

We regard that inclusion of granular forms and smooth forms within Eisenackitina makes it a homeomorphologic grouping rather than natural one because the presence or absence of granular ornaments on the vesicle surface is, as now widely accepted, sufficient to warrant generic distinction. Following Paris (1981), we ascribe smooth form having a profile similar to that of Eisenackitina to Bursachitina.

Of numerous genera erected by TsegeJnjk (1982), smooth forms of Sclerochitina and Eurychitina are herein removed to Bursachitina. These forms have a somewhat purse-shaped outline and smooth vesicle, as in most Bursachitina species. A narrow collarette too is similar, and differences amount to matters of degree only.

Bursachitina rectangularis (Zaslavskaya, 1983)
(pl.6, figs.8-11,15-16; pl.20, figs.6-7)

1983 Conochitina intermedia Eisenack; Zaslavskaya, p.61, pl.4, fig.8.
1983 Linochitina reetangularis sp. nov.; Zaslavskaya, p.69, figs.5-7.
1984 Linochitina rectangularis Zaslavskaya; Obut and Zaslavskaya, pl.7, figs.4-5.
v1990 Conochitina leiijiatunensis sp. nov.; Geng, p.632, 635, pl.1, fig.5.
Material: More than one hundred flattened specimens from Locs.2, 5, 10, 13, and 22.

Description: The small vesicle is originally purse-shaped and when flattened, subquadrangular. The neck is reduced to form a ca. 3-7 µm wide membranous collarette. When fully flattened, the length of the vesicle is equal to or slightly less than its width. After effects of flattening have been removed, it alway exceeds the width, with the L/D ratio of 2. The operculum has a central vault which emerges often out of the aperture, as observed in many specimens (pl.6, fig.15; pl.20, figs. 6-7). In one broken specimen a 1.5 µm thick lamella adhering to the inner wall is seen of the collarette (pl.6, fig.16), indicating the former presence of an operculum. There is no flexure, nor shoulder. The flank is straight and meets at a right or obtuse angle with the flat or somewhat convex base. The surface wall is smooth.

Dimensions: The means calculated from fifteen flattened specimens from Loc.10 (in µm).

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<th>L</th>
<th>D</th>
<th>L/D</th>
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<tbody>
<tr>
<td>Mean (flattened specimens)</td>
<td>128</td>
<td>99</td>
<td>1.3</td>
</tr>
<tr>
<td>After restoration of the flattening (coeff.0.7)</td>
<td>mean</td>
<td>128</td>
<td>72</td>
</tr>
<tr>
<td></td>
<td>range</td>
<td>93-167</td>
<td>62-80</td>
</tr>
</tbody>
</table>

Remarks: In this monograph Zaslavskaya’s (1983) species *rectangularis* from the Siberian Platform Llandovery is removed from *Linichitina* to *Bursachitina* because of its absence of a copula at the base and occurrence in isolation rather than in chain. These features are sufficient to warrant exclusion from *Linichitina*. Geng (1990) illustrated one specimen of *B. rectangularis* under his new specific name of *Conochitina leijiatunensis*. His specimen which is fully flattened has a sub-rectangular guise and is very similar to, but differentiates from Zaslavskaya’s material in its smaller size [79 µm long and 49 µm wide for *C. leijiatunensis*; 120-161 µm long and 70-78 µm wide for Zaslavskaya’s (1983) *L. rectangularis* after restoration of the flattening (coeff. 0.7)]. Since that time we have obtained many specimens which are *leijiatunensis*-like in shape and range in length from 87-167 µm. Therefore, a length of 79-167 µm comprises complete spectrum of size variation for *C. leijiatunensis*. It is clearly that the size of the Siberian species falls within the range. Considering the conformity of shape and the continuity of size variation, *C. leijiatunensis* is thought herein as being synonymous with *B. rectangularis* and the type specimen of *C. leijiatunensis* as the extreme end of *B. rectangularis*.


Genus *Calpichitina* Wilson et Hedlund, 1964

Type species: *Calpichitina scabiosa* Wilson et Hedlund, 1964 (p.164, pl.1, fig.1), by original designation.

Diagnosis:“Tests single, subspherical, urn-shaped, slightly broader than high; oral opening operculate, approximately one-half diameter of test, with flaring membranous collar which arises from a thickened annulus at neck; operculum circular, bordered by a narrow membranous flange; aboral end rounded, cupola (sic, copula) none; . . . wall approximately two microns thick, outer part opaque, appears to be composed of a vermiculate network, inner part translucent, smooth, appears structureless” (After Wilson and Hedlund 1964, p.161).

Remarks: The genus *Calpichitina* was established, with *C. scabiosa* as type species, by Wilson and
Hedlund (1964) based on the material from the Upper Ordovician Sylvan Shale of Oklahoma. Very shortly after the erection of *Calpichitina*, Wilson and Dolly (1964) re-evaluated its validity and dethroned it by the transfer of the type species to *Hoegisphaera* sensu Wilson and Dolly, 1964. Several years later Eisenack (1968), Jenkins (1970), and Jansonius (1970) placed *Hoegisphaera* in synonymy with *Desmochitina* Eisenack 1931. In view of these, the systematic position of *Calpichitina* is a problem worthy to be considered. Indeed, some species of *Calpichitina* seemingly conform in their light microscopy characteristics to those of *Hoegisphaera*. So it is more or less difficult using light microscopy to distinguish these two genera. However, using scanning electron microscopy, it is clear that they in fact are different in aperture features, the aperture being bordered by a low rim in *Hoegisphaera* Staplin (Urban and Newport 1973, pl.1, figs. 6, 10; Wright 1980, pl.4, figs. 7-8; Paris et al. 1988, pl. 19, figs. 5a-b), while the aperture by a membranous collarette, for example, in *Calpichitina lenticularis* (Bouche 1965) (Molyneux and Paris 1985, pl. 7, fig. 10). During the last twenty years, considerable controversy has surrounded the issue of whether the presence or absence of a collarette may be a valid criterion for the introduction of a new genus. Some writers take a definite collarette as a generic characteristic, e.g. Eisenack who in 1968 commanded the presence of a collarette as a diagnostic attribute of *Halochitina* Eisenack 1968 to separate *Pterochitina* Eisenack 1955. As far as *Calpichitina* Eisenack 1968 is concerned, it may be maintained, in our opinion, as a discrete genus following the same taxonomic tenets. However similar *Calpichitina* and *Hoegisphaera* look in shape, the evidences shown by the SEM convince us that inclusion of *Calpichitina* to *Hoegisphaera* is unacceptable. This long-standing quarrels of opinion in a generic nomenclature are complicated by the fact that in his emended description, Urban (1972, p.24) noted that there exists a carina around the basal edge in the species *Hoegisphaera glabra* Staplin, 1961 emend. Urban, 1972 and put forth such a view that the dark ring parallel to and just inside the chamber outline shown on the paratype of Staplin (1961, pl. 50, fig. 6) evidently is a reduced carina (p.22-24). If so then *Hoegisphaera* in the sense of Urban (1972) is sure enough, in our opinion, a junior synonymy of *Pterochitina* Eisenack 1955. Alternative explanation is that those dark rings are the result of foldings of the vesicle wall. The type species of *Hoegisphaera* Staplin 1961, *H. glabra* Staplin 1961, is in either event in need of re-investigation to reassess the validity of the genus.

On the other hand, it seems to us that the transfer of the species of *Calpichitina* to *Desmochitina* which is used in the strict sense of Paris (1981, p.116) is not appropriate because the latter genus has a body-diameter always less than body-length.

Subgenus *Calpichitina* (*Densichitina*) Paris, 1981

Type species: *Desmochitina densa* Eisenack, 1962a (p. 311-312, pl.17, fig.14), by original designation.

Diagnosis: Vesicle lenticular to more or less spherical, neck reduced to a narrow collarette or rim, base with mucron. Operculum discoid, generally with membranous flange, enveloping base of superjacent individual, colonial forms.

Remarks: Paris (1981) divided the genus *Calpichitina* into two subgenera: C. (*Densichitina*) and C. (*Calpichitina*). A wide mucron and a chain-occurrence have been invoked to distinguish the former from its sister subgenus (Paris 1981).

* Combaz and Peniguel's (1972) proposed replacement of *Hoegichitina* for *Hoegisphaera* is an unjustified emendation according to ICZN Article 33 (Ride et al. 1985).
Calpichitina (Densichitina) densa (Eisenack, 1962a) Paris, 1981
(pl.1, fig.1)

1962 Desmochitina densa n. sp.; Eisenack, p.311-312, pl.17, fig.14; text-fig.8.
1964 Desmochitina densa Eisenack; Eisenack, p.326.
1964 Desmochitina densa Eisenack; Cramer, p.348, pl.22, figs.1-3.
1966 Desmochitina densa Eisenack; Taugourdeau, pl.2, figs.34-35.
1967 Desmochitina densa Eisenack; Cramer, p.95, pl.3, fig.69.
1967 Desmochitina densa Eisenack; Rauscher et Doubinger, p.319, pl.3, fig.4.
1970 Desmochitina densa Eisenack; Cramer, p.746.
1971 Desmochitina densa Eisenack; Laufeld, p.295, pl.1, fig.4-A.
1974 Desmochitina densa Eisenack; Laufeld, p.77-78, fig.39.
1981 Desmochitina densa Eisenack; Dorning, p.206.
1981 Calpichitina (Densichitina) densa Eisenack; Paris, p.133.
1982 Desmochitina densa Eisenack; Nestor, p.91.
1985 Desmochitina densa Eisenack; Grahn, p.161, pl.2, figs.10-11.
1989 Calpichitina (Densichitina) densa (Eisenack); Paris, fig.175c.
1992 Densichitina densa (Eisenack); Grahn and Paris, pl.2, fig.4.
1993 Calpichitina (Densichitina) densa (Eisenack); Swire, p.100,105.

Material: Two specimens occurring in twins from Loc.21.

Description: The vesicle is more or less discoid with the maximum diameter exceeding its total length. The apertural diameter comprises three-quarters of the total length. The maximum diameter lies medially. No rugose ornaments are observed. At the base of the lower individual of twins there is an up to 2.5 μm high, subcircular rim which is the scar of an original operculum-base adhesion.

Dimensions: Two specimens preserved in low relief are measured. The maximum diameter is 90 μm and the total length is 63 μm with a restoration coefficient of 0.7.

Remarks: The vesicle diameter of our specimens is slightly smaller than those recorded by Eisenack (1962, 100-105 μm long), but larger than those recorded by Laufeld (1974, 70-86 μm long). The Yangtze specimens otherwise agree with Eisenack’s (1962a) and Laufeld’s (1974) descriptions.

Occurrence: Daluzhai Formation of Daguan, NE Yunnan.

Subfamily Eisenackitiniiae Paris, 1981


1967b Simplochitina Cramer (invalid, nom. nud.)
1982 Eurychitina Tsegelnjuk
p 1982 Sclerochitina Tsegelnjuk

Type species: Eisenackitina castor Jansonius 1964 (p. 912, pl. 2, fig.16), by original designation.

Diagnosis: Body cylindrical, ovoid or more or less conical; neck inconspicuous, collarette often present, basal margin rounded; maximum diameter at basal margin; base shallow convex or rounded; mucron present, short; operculum disc-shaped; vesicle wholly or partly ornamented with spines, cones or tubercules, distributed in disorder; chain formation rare.

Remarks: The original diagnosis of the genus given by Jansonius (1964) is so loose that some species of Desmochitina and Bursachitina could be placed within the genus. Therefore, Paris (1981)
reappraised the genus and presented a revised diagnosis, which emphasizes the presence of spines, cones or tubercles serving to separate it from the closely related genera Desmochnitina and Bursachitina. Zaslavskaya (1986) synonymized Bursachitina and Eurychitina, a genus proposed by Tsegelnjuk in 1982, with Eisenackitina. The synonymy of Bursachitina and Eisenackitina is not acceptable since Bursachitina lacks a coarser verrucose or tuberculate surface wall. Eurychitina contains two forms, one having a smooth vesicle wall and the other covered with short spines or verrucae on the vesicle wall. The latter form is transferred, by definition, to Eisenackitina herein. Actually, the type species designated by Tsegelnjuk (1982) for Eurychitina, Bursachitina oviformis Eisenack 1972a, was removed by Eisenack himself in 1972b to Eisenackitina. Eisenack’s (1972b) transfer has not been disputed by previous authors (Laufeld 1974, Wrona 1980, Paris 1989). Then Eurychitina should be abandoned owing to the loss of its type species.

Sclerochitina is another genus proposed by Tsegelnjuk (1982), with Conochitina intermedia Eisenack 1955 as type species. Two species groups are encompassed within this genus, one being smooth and the other verrucose on the wall surface. Those species with the verrucose wall surface, for example, Tsegelnjuk’s (1982) S. intermedia (Eisenack, 1955) are removed by Laufeld to Eisenackitina as early as 1974. Therefore, the generic name Sclerochitina should be discarded also due to the transferrance of its type species, although Schallreuter (1986) persisted in using Sclerochitina as a valid generic name. In dating the Formigoso Formation by relying upon chitinozoans Cramer (1966, p.231-232) provided the generic name Simplochitina together with two known species, Simplochitina intermedia (Eisenack, 1955) and S. brevis (Taugourdeau et Jekhowsky, 1960). Cramer gives generic and specific names only without diagnoses and designation of a type species. Consequently, Simplochitina must be suppressed as a nomen nudum by ICZN Article 13 (Ride et al. 1985).

Swire (1990) described and illustrated two new species E. variireticulata and E. spongiosa. Inclusion of those two species signifies that the scope of Eisenackitina is expanded to embrace those Eisenackitina-like forms in shape but accompanying spongy reticular ornaments on the body. In this monograph we abide strictly by Jansonius’ (1964) original definition for Eisenackitina whose ornamentation includes spines, cones or tubercules. Therefore, Swire’s (1990) species are not retained in the genus.

**Eisenackitina cf. cyrtopleura** (Tsegelnjuk, 1982)

(pl.1, figs.3, 7; pl.3, fig.4)

cf. 1982 *Bursachitina cyrtopleura* sp. nov.; Tsegelnjuk, p.43-44, pl.4, figs.1-2.

Material: More than fifteen flattened specimens from Locs. 8 and 11.

Description: When compressed the vesicle is trepazoid and wider than long, while longer than wide when restored. The body is topped by a membranous collarette. There is no flexure, nor shoulder. The flank is straight. The basal margin is sharply or broadly rounded with a concave base. No basal structure is observed. The surface wall is furnished with closely spaced, discrete granules.

Dimensions: Means calculated from ten flattened specimens from Locs. 8 and 11 (in μm) Text-fig.34.

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<th>L</th>
<th>D</th>
<th>L/D</th>
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<tbody>
<tr>
<td>Mean (flattened specimens)</td>
<td>96</td>
<td>110</td>
<td>0.9</td>
</tr>
<tr>
<td>After restoration of the flattening (coeff. 0.7)</td>
<td>mean</td>
<td>96</td>
<td>77</td>
</tr>
<tr>
<td>range</td>
<td>80-110</td>
<td>62-87</td>
<td>1.0-1.5</td>
</tr>
</tbody>
</table>
Remarks: Tsegelnjuk's (1982) type specimens are 74-98 µm long and 62-72 µm wide after restoration of the flattening (coeff. 0.7) calculated from his figures. The dimensions of Podolian specimens, therefore, match comparatively well with those recorded herein. It should be noted that the type materials narrow more rapidly through their length than the Yangtze specimens, with an apertural width/vesicle width ratio being 0.5-0.6 and ca. 0.7, respectively. It is unclear whether the smaller aperture in the type materials is inherent or the consequence of curved folds subparallel to the longitudinal axis of the vesicle. Therefore identification of our specimens is reserved to this species.

_E_. cf. _cyrtopleura_ has the same silhouette in its light microscopy characteristics as _E. zhangjiajieensis_. When SEM is used, it is clear that _E. cf. cyrtopleura_ possesses coarser granules than _E. zhangjiajieensis_. In addition, the granules in _E. zhangjiajieensis_ are united by a subordinate "strap" lying between them to form an unequally long and tortuous ridge especially on the basal margin, but as is indiscernible in _E. cf. cyrtopleura_, which bears a constantly discrete granules.


_Eisenackitina daozhenensis_ Geng, 1986
(pl. 1, figs. 2, 4-6; pl. 20, figs. 10-11)

1971 _Conochitina_ n. sp.1; Laufeld, pl. 1, fig. D.
1986 _Eisenackitina daozhenensis_ sp. nov.; Geng, p. 121-222, pl. 1, figs. 1-3.
1986 _Eisenackitina bayuensis_ sp. nov.; Geng, p. 122, pl. 1, fig. 8; pl. 2, fig. 3.
1988 _Eisenackitina daozhenensis_ Geng; Geng and Cai, pl. 1, fig. 6 (Geng's 1986, pl. 1, fig. 2 refigured), 7 (Geng's 1986, pl. 1, fig. 3 refigured).
1988 _Eisenackitina dolioliformis_ Umnova, Grahm, fig. 16.

Material: More than one hundred specimens flattened or reserved in full relief from Locs. 12-18 and 21.

Description: The vesicle is conical. The body attains eight- to nine-tenths of the total length of the vesicle. The neck reduces to a membranous flaring collarette. The apertural margin is smooth. There is no flexure. The flank is straight. The basal margin is broadly rounded with a flat base. At the center of the base there is a short, wide concentric mucron which has a length of ca. 1 µm and a diameter of 10-20 µm. It is bordered by a depression and then, via a slope, passes into the flat base. At the center of the mucron there is a hole with a diameter of 2.5 µm. The entire vesicle surface is decorated with granules except for the adcollarette and peri-mucron areas.

Dimensions: Mean from ten specimens preserved in full relief from Loc. 21 (in µm) (Text-fig. 35).

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<th>L</th>
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<tbody>
<tr>
<td>Mean</td>
<td>108</td>
<td>86</td>
<td>1.2</td>
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<tr>
<td>Range</td>
<td>100-115</td>
<td>74-98</td>
<td>1.1-1.4</td>
</tr>
</tbody>
</table>

Remarks: In describing Lower Silurian _chiinozoans_ from Bayu of Daozhen, N. Guizhou Geng (1986) established two new species _Eisenackitina daozhenensis_ and _E. bayuensis_ only based on the difference in size. At present it is demonstrated that specimens with intermediate dimensions, but identicule in shape, bridge those two "species". Therefore they are considered as being conspecific with _E. daozhenensis_ having page priority over _E. bayuensis_ as name-bearing species.

In morphology, the present species is similar to Verniers' (1982) _E. sp. C_ from Upper Llandovery
and Lower Wenlock of Mechaigne, Belgium, but different in having a flaring collarette in contrast with E. sp. C. Furthermore E. sp. C bears a heteromorphic ornamentation including fine spines, granules, reticula, and rugae. Such is not the case for E. daozenhensis.

E. daozenhensis is distinguished from E. dolioliformis, proposed by Umnova (1976) from the Wenlock part of Wells Virtsu and Krasnoborskaya in possessing a less coarser granules than those of E. dolioliformis and in the maximum diameter of the visicle lying at the basal edge instead of the central part of the body as seen in Umnova’s 1976 pl.2, figs.20-21 and text-figs.6a-c. In addition, E. dolioliformis has a much larger size (Umnova 1976, 141-255 μm long).

E. daozenhensis differs from E. barbantium Grootel, an invalid undescribed species, in the proportion of total length to maximum diameter, that is, 1.1-1.4 in E. daozenhensis and 1.5-2.0 in E. barbantium. Moreover the latter species is much larger in size than the present species.

Text-fig.34. The L/D ratio for Eisenackitina cf. cyptopleura (Tsegelnjuk).

Text-fig.35. The L/D ratio for Eisenackitina daozenhensis Geng.

Asselin et al.’s (1989) E. aff. dolioliformis shows a resemblance to E. daozenhensis in outline but it is flattened. After correction of the compression (coefficient 0.7), E. aff. dolioliformis bears the ratio total length/maximum diameter of 1.6-2.2, with Quebec specimens being considerably much slender.

Specimens referred to E. dolioliformis by Grahn (1988) from the Upper Llandovery Restevco Beds of Podolia, Ukraine, from which Laufeld’s Conochitina n. sp.1 was taken, have a maximum diameter lying at the basal margin, while it lies definitively at the middle flank in the type material of E. dolioliformis. Additionally Grahn’s figured specimen is 88 μm long (calculated from his illustration). This value makes further the attribution of his specimen to E. dolioliformis doubtful. These features fit quite well for E. daozenhensis, but its granulate ornamentation seems to be coarser and adjacent granules are fused to constitute unevenly long crests, as indiscernible in the present species. So embrace of Laufeld’s (1971) and Grahn’s (1988) specimens is questionable in E. daozenhensis.

Occurrence: Hanchiatien Formation of Hanjiadian, Saba, Leijiatun of N. Guizhou, and Guanyinqiao of S. Sichuan; Nanjiang Formation of Qiaoting of N. Sichuan; Ningqian Formation of Xuanhe of N. Sichuan; Luoquanwan Formation of Lengji of Sichuan and Daluzhai Formation of Daguan of NE Yunnan.
**Eisenackitina rimos**a Umnova, 1976  
(pl.2, figs.7-9, pl.3, figs. 5-6, 9-10)

1976 *Eisenackitina castor* Jansonius; Umnova, pl.2, figs.15-17.  
p 1976 *Eisenackitina rimos* a n. sp.; Umnova, p.405, pl.2, fig.19 only.

Lectotype: Umnova’s 1976, pl.2, fig. 19, designated herein.

Material: Thirty-five flattened specimens from Locs. 1, 5, 8, 11, 19, and 20.

Description: The vesicle is conical and terminated with a short membranous collarette. There is no flexure, nor shoulder. The flank is straight and the basal margin is broadly rounded with a flat or concave base. There is a circular ca.10 μm wide scar with concentric lines at the central of the base. The granulate ornamentation covers almost entire vesicle except the surface wall near the aperture and round the scar.

Dimensions: The means are calculated from ten flattened specimens from Locs. 5 and 11 (in μm) (Text-fig. 36).

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<th>L</th>
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<th>L/D</th>
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<tbody>
<tr>
<td>Mean (flattened specimens)</td>
<td>119</td>
<td>84</td>
<td>1.3</td>
</tr>
<tr>
<td>After restoration of the</td>
<td>119</td>
<td>66</td>
<td>1.8</td>
</tr>
<tr>
<td>mean</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>flattening (coeff. 0.7)</td>
<td>107</td>
<td>61</td>
<td>1.7</td>
</tr>
<tr>
<td>range</td>
<td>133</td>
<td>74</td>
<td>2.1</td>
</tr>
</tbody>
</table>

Text-fig. 36. The L/D ratio of *Eisenackitina rimos* a Umnova.

Remarks: Umnova (1976) illustrated two specimens in pl.2, figs. 18-19 from the Upper Ludlow of the Kustiskaya bore as being representative of her new species, but she did not designate which of them is type specimen. The specimen of her pl.2, fig.18 is herein removed to *Grahnichitina philipp*. Another specimen in pl.2, fig. 19 is herein designated as the lectotype specimen of *E. rimos*. The diagnosis of this species provided by Umnova is based mainly on material in pl.2, fig.18. Therefore the original diagnosis for this species is inappropriate and proposal of a revised diagnosis for *E. rimos* a based on material in pl.2, fig. 19 is as follows: vesicle conical, tapering gently oralwards. No flexure nor shoulder, flank straight or slightly convex. Basal margin broadly rounded, base flat.
Surface wall with granules.

The Yangtze specimens taper less slowly than Umnova’s (1976), but conform otherwise to her illustration.

Occurrence: Fenou Formation of Well N-4 of Taixian, N. Jiangsu and Kuanti Formation of Qujing, NE Yunnan.

*Eisenackitina venusta* Tseglnjk, 1982
(pl.2, figs.1-5; pl.3, fig.7)

1982 *Eurychitina venusta* sp. nov.; Tseglnjk, p.40, pl.3, fig.3.

Material: More than one hundred flattened specimens from Loc.11.

Description: The vesicle is originally subovoid. The elongate body attains more than four-fifths of the total length of the vesicle. The short thin neck ends with a flaring collarette. A discoid operculum is cemented on the inner wall of the neck. There is no flexure, nor shoulder. The flank is straight or convex. The basal margin is broadly rounded. The concave base bears a truncatedly conical micron at its center, where there is a depression making up three-fifths of the diameter of the micron and the depression does not communicated with the interior of the body. There is a concentric ridge which consists of the adjacent granules linking through "straps" on the micron and the vesicle surface of the circum-micron. The thick vesicle wall comprises two layers, an ornamented outer layer 0.56 µm thick and a smooth inner layer 2.7 µm thick. The surface wall is covered with a closely spaced miniature granules which diminish neckwards.

Dimensions: Mean calculated from the fifteen flattened specimens from Loc.11 (in µm) (Text-fig. 38).

<table>
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<tr>
<th></th>
<th>L</th>
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<th>L/D</th>
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<tbody>
<tr>
<td>Mean (flattened specimens)</td>
<td>97</td>
<td>92</td>
<td>1.1</td>
</tr>
<tr>
<td>After restoration of the</td>
<td>mean</td>
<td>64</td>
<td>1.5</td>
</tr>
<tr>
<td>flattening (coeff. 0.7)</td>
<td>range</td>
<td>82-113</td>
<td>54-77</td>
</tr>
</tbody>
</table>

Remarks: Our specimens described above conform in shape with and correspond in length to those illustrated by Tseglnjk (1982) in pl.3, figs.3-5 (60-125 µm), but the type material has a greater width than ours. Those Podolian specimens from the Uppermost Llandovery basal Furmanov Formation seem to be flattened. If so then their width range is 53-66 µm after restoration of the flattening (coeff. 0.7) and consistent with that recorded herein (54-77 µm).

Occurrence: Xiaoxiyu Formation of Dayong, NW Hunan.

*Eisenackitina verruculifera* sp. nov.
(pl.1, figs.8-9)

p1992 *Conochitina brevis* Taugourdeau et Jekhowsky; Wang and Chen, p.72, pl.1, figs.1-3, 6-7, 9; pl.2, figs.1-6.

Derivation of name: Latin, verruculifer, wart-bearing, with reference to the ornamentation of the vesicle.

Holotype: Pl.1, fig.8.

Type stratum: Kaochiapien Formation of Well J-21.
Type locality: Jintan, S. Jiangsu.

Description: The vesicle is subconical. The body-neck differentiation is more or less conspicuous. The length of the body makes up more than two-thirds of the total length of the vesicle. The neck tapers orallywards and is terminated with a slightly flaring membranous collarette of ca. 4 μm in length. The flexure is present, but the shoulder is lacking. The flank is somewhat convex. The basal margin is broadly rounded with a flat or slightly convex base. The surface wall is ornamented with closely spaced verrucae. The thick vesicle wall comprises two layers, a ca. 0.25 μm thick decorated outer layer and a ca. 1.3 μm thick smooth inner layer.

Dimensions: Means calculated of the eleven flattened specimens from Locs. 5-6, and 10 (in μm).

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<th>L/D</th>
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<tbody>
<tr>
<td>Mean (flattened specimens)</td>
<td>147</td>
<td>120</td>
<td>1.2</td>
</tr>
<tr>
<td>After restoration of the mean</td>
<td>147</td>
<td>84</td>
<td>1.8</td>
</tr>
<tr>
<td>flattening (coeff. 0.7) range</td>
<td>120-178</td>
<td>60-100</td>
<td>1.7-2.2</td>
</tr>
</tbody>
</table>

Text-fig. 38. The L/D ratio of *Eisenackitina verruculifera* sp. nov.

Remarks: *E. verruculifera* discriminates from age-overlapping *Belonechitina postrobusta* in the nature of its ornaments and the possession of a flexure. The ornamentation is verrucose in *E. verruculifera* and spinose in *B. postrobusta*. In addition, the latter taxon lacks a flexure.

Most specimens placed by Wang and Chen (1992) in *Conochitina brevis* are nothing more than granule-removed *E. verruculifera*. To our knowledge, most specimens of *E. verruculifera* in our collection have lost their decorated outer layer. It is especially the case for those specimens collected from an outcropping section. The loss of the vesicle surface wall is less surprising considering its thin thickness (0.25 μm).

Occurrence: Kaochiapien Formation of Wells N-4 of Taixian and J-21 of Jintan and Lungmachi Formation of Yichang, W. Hubei and Daguan, NE Yunnan.

*Eisenackitina zhangjiajieensis* sp. nov.

( pl.1, figs. 10-12)
non 1960 *Desmochitina cylindrica* n. sp.; Taugourdeau et Jekhowsky, p.1226, pl.7, fig.91.

Derivation of name: Latin *Zhangjiajieensis*, after *Zhangjiajie* of Dayong, NW Hunan, referring to the type locality.

Holotype: Pl. 1, fig.11.

Type stratum: Lower Xiaoxiyu Formation.

Type locality: *Zhangjiajie* of Dayong, NW Hunan.

Diagnosis: Short conical vesicle, longer than wide; collarette straight; surface wall with granules.

Description: In flattened state of preservation, the vesicle is trapezoid in outline, wider than long, but is originally short conical, longer than wide with a L/D ratio of 1.5. The body is topped immediately by a membranous collarette. The flexure and shoulder are absent. The flank is convex with a concave base, at the center of which there is a 15 µm wide scar. There is a concentric line on the surface wall of the circum-scar. The surface wall is decorated with a closely spaced granules.

Dimensions: Means calculated of the ten flattened specimens Loc. 11 (in µm) (Text-fig. 39).

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<th>L/D</th>
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<tbody>
<tr>
<td>Mean (flattened specimens)</td>
<td>79</td>
<td>78</td>
<td>1.0</td>
</tr>
<tr>
<td>After restoration of the</td>
<td>mean</td>
<td>55</td>
<td>1.5</td>
</tr>
<tr>
<td>flattening (coeff. 0.7)</td>
<td>range</td>
<td>63-95</td>
<td>53-63</td>
</tr>
</tbody>
</table>

Remarks: *E. zhangjiajieensis* is closely similar to *E. venusta* in shape and size but different in the absence of a flaring collarette and a short neck.

Podolian topmost Llandovery specimens identified by Tsegelnjuk (1982) to *Bursachtitina cylindrica* (pro *Desmochitina cylindrica*) are not that species since Tsegelnjuk’s specimens do not bear a very wide and flaring aperture given specific recognition by Taugourdeau et Jekhowsky (1960, p.1226). Alternatively, they may be ascribed to the present species on the basis of their trapezoid outline in flattened state of preservation and dimensions (60-65 µm long and 52-59 µm width after correction of the compression for the type material).

*E. zhangjiajieensis* exhibits also a prominent resemblance to *E. cyrtoleura* (Tsegelnjuk) in outline. However, the latter species has a greater size and a coarser granules than the present species.

Occurrence: Xiushan and Xiaoxiyu Formations of Dayong, NW Hunan.

*Eisenackitina* sp.
(pl.2, fig.6)

Material: Three flattened and deformed specimens from Locs.5 and 9.

Description: The vesicle is conical. The body-neck differentiation is not apparent. The neck thins to a membranous collarette. The flexure is weakly developed. The flank is straight. The basal margin is broadly rounded. The base is more or less flat, but protruded in deformed individuals, giving an ogival appearance. No basal structure is observed. The surface wall is furnished with an irregularly spaced fine spines. The spines are 3 µm long on the basal margin and 1 µm long on the higher body and disappear on the vesicle wall approximal to the aperture.

Dimensions: Total length 142-156 µm; maximum diameter 35-42 µm after restoration of the flattening using the coefficient of 0.7; L/D ratio 3.6-4.5.
Remarks: Slim *Eisenackitina* has rarely been recorded before in the literature. It differs from *Eisenackitina* sp. A of Paris (1986) in having no i.e. fine ornaments consisting of adjacent granules linked by an irregularly oriented ridges seen in the latter taxon. It discriminates from *E. elongata* Eisenack, 1972b in a considerably greater L/D ratio and a much longer neck. Wrona’s (1980) species *E. cupellata*, another slender taxon, was said to be smooth. It has a much more slender shape of the vesicle than those recorded representatives of the genus. These usual specimens clearly merit description and illustration but are numerically insufficient and ill-preserved for formal naming.

Occurrence: Fentou Formation of Well N-4 of Taixian, N. Jiangsu and Kuanti Formation of Qujing, NE Yunnan.

Subfamily Pterochitininae Paris, 1981

Genus *Cingulochitina* Paris, 1981

Type species: *Desmochnitina cingulata* Eisenack 1937 (p.220-221, pl.15, fig. 6), by original designation.

Diagnosis: Vesicle small, often occurring in chains, ovoid to conoid, neck absent, collarette small, subcylindrical or absent, flexure and shoulder sometimes present; basal margin sharp, carina membranous, occasionally reduced, but always present; base flat to convex; vesicle relatively thin, wall surface smooth; copula tabular and short, attached on operculum of preceding vesicle, forming interconnection of neighbouring individuals; discoid operculum, with aborally prolonged flange, internal, not at the same plane as oral rim.

Remarks: The type species of *Cingulochitina, Desmochnitina cingulata*, was established by Eisenack (1937) on the basis of materials from the Silurian in Baltic and was transferred to *Eremochitina*? by Taugourdeau (1966). *Eremochitina* has a broad, medium sized copula. This is not case for *C. cingulata*. Eisenack (1968) expressed discontentment with the inclusion of *cingulata* to *Eremochitina* and re-assigned this species to his newly erected genus *Linochitina*. Paris (1981) strictly followed Eisenack’s (1968) diagnosis for *Linochitina* based on the type species and proposed *Cingulochitina* only to accommodate species with a membranous carina on the basal margin. We regard *Cingulochitina* to be worthy of generic rank. The carina is a character shared by *Armoricochitina*, a genus simultaneously proposed by Paris (1981) with *Linochitina? ceneratiensis* as type species. At present state of knowledge, the characters that would appear to separate these two taxa from being synonyms are the following: *Armoricochitina* has a more undifferentiated collarette and a pedestal-shaped carina.

*Cingulochitina cingulata* (Eisenack, 1937)  
(pl.5, fig.1)

1937 *Desmochnitina cingulata* n. sp.; Eisenack, p. 220, pl.15, figs.6-7; pl.31, fig.18.
non 1955 *Desmochnitina cingulata*? Eisenack; Eisenack, p.162, pl.1, figs.9-10.
non 1964 *Linochitina cingulata* Eisenack; Cramer, p.348, pl.22, fig.17.
1966 *Eremochitina? cingulata* (Eisenack); Taugourdeau, p.38, pl.1, fig.4.
non 1966 *Eremochitina cingulata* Eisenack; Cramer, p.93, pl.3, figs.71-72.
on 1966 *Eremochitina cingulata* (Eisenack); Cramer, p.232, 234.
1968 *Linochitina cingulata* (Eisenack); Eisenack, p.170-171; pl.24, figs.12, 16; pl.29, figs.29-32; pl.31, fig.18.
non 1973 *Linocithina cingulata* (Eisenack); Cramer, pl.2, figs.25-26.
1974 *Linocithina cingulata* Eisenack; Laufeld, p.82, fig.57.
non 1974 *Linocithina (Desmochitina) cingulata* (Eisenack); Cramer and Diez, p.3.
non 1974 *Linocithina cingulata* (Eisenack); Cramer and Diez, p.4.
1978 *Linocithina cingulata* (Eisenack); Verniers and Rickards, pl.2, fig.14.
1981 *Linocithina cingulata* (Eisenack); Dorning, p.206.
1981 *Linocithina cingulata* (Eisenack); Verniers, pl.2, fig.26.
1981 *Linocithina cingulata* (Eisenack); Aldridge et al., pl.2, fig.9.
1982 *Linocithina cingulata* (Eisenack); Verniers, p.20, 23, pl.6, fig.122; pl.2, figs.148, 157-169.
1982 *Linocithina cingulata* (Eisenack); Nestor, p.90-91.
1982 *Linocithina cingulata* (Eisenack); Tsegelnjuk, p.103, pl.14, figs.5-8.
1986 *Cingulochitina cingulata* (Eisenack); Paris; Schallreuter, pl.1, fig.1 (Eisenack, 1937, pl.15, fig.6 refigured).
1989 *Cingulochitina cingulata* (Eisenack); Paris, fig.175.
1990 *Linocithina cingulata* (Eisenack); Nestor, pl.14, fig.28.
1991 *Linocithina cingulata* Eisenack; Nestor, pl.3, fig.5.
1991 *Linocithina cingulata* Eisenack; Nestor and Nestor, p.53.
1991 *Cingulochitina cingulata* (Eisenack); White et al., p.303.
1993 *Cingulochitina cingulata* (Eisenack); Swire, p.100,104-105.
1995 *Cingulochitina cingulata* (Eisenack); Dufka, pl.1, figs.5,9.

Material: Three flattened and one low relief specimens from Loc.1.

Description: The body is funnel-shaped with a constriction just oralward of the cingulum where the maximum diameter is situated. The neck is elongate, attaining half of the total length of the vesicle and widens oralwards. The aperture appears to be straight. The flexure is inconspicuous and the shoulder is absent. The basal margin is provided with a cingulum. It is very thin and frequently damaged in our material. So some individuals display only the scar of the original existence of the cingulum (pl.5, fig.1). The base is convex. The wall surface is smooth.

Dimensions: Total length 104 - 138 μm, maximum diameter 56 - 62 μm after restoration of the flattening with a coefficient of 0.7.

Remarks: In the literature the specimens referred to this species show more variation in shape, from slender forms (e.g. Eisenack 1968, pl.24, figs.12,16; pl.29, figs.6-7; Laufeld, 1974 fig.57D) to squat forms (e.g. Eisenack 1931, pl.15, figs.6-7; Laufeld 1974, fig.57B; Paris,1989, fig.175E; Nestor, 1990, pl.14, fig.28).

The holotype and paratype illustrated by Eisenack in 1937 (pl.15, figs.5-6) were taken from erratic boulders assigned as Graptolithengestein. Unfortunately, the types were lost during the Second World War. Therefore Eisenack (1968) selected a neotype (pl.29, fig.29) among specimens from the Graptolithengestein. The type and the neotype are a stout form and a slender form respectively. At that time, it is not known whether the lost holotype and neotype are isolated stratigraphically since the Graptolithengestein has an age ranging from the Late Wenlock to the Early Ludlow according to Martinsson (1976, p.360). Laufeld’s (1974) detailed studies indicate that these two forms co-occur at least at the Slite Beds of Loc. Valbytte 1, on Gotland. On this ground Eisenack’s (1968) neotype may be accepted. According to Laufeld (1974), Paris (1989) and Nestor (1990), *C. cingulata* occupies an interval from the Wenlock *limnocarsoni* to *ludgensi* biozones. More recently Swire (1993) reported that *Cingulochitina cingulata* makes its first appearance at the *riccartonensis*-murchisoni biozone in the Wenlock type area, extending downwards its range. However, no illustration is given.

The Spanish and Libyan specimens referable to this species are doubtful owing to those collections
taken from the post-Wenlock rocks. Those light micrographs provided by Cramer and his co-workers (1964 et sq.) hinder them from comparing with this species. It should be noted that at least some individuals from Libya with “lateral striations” on the wall surface (Cramer and Diez, 1974, p.4, pl.4, fig.64) should be transferred to *Cingulochitina serrata* (Taugourdeau et Jekhowsky, 1960).

Our specimens are more slender than the holotype and stouter than the neotype, being intermediate. The range of the total length (104-138 μm) is larger than that recorded by Eisenack (1937, holotype, 100 μm), and less than that recorded by Eisenack (1968, maximum value 146 μm long). Therefore, the size range of our material falls within that of the types.


Subfamily Margachitininae Paris, 1981

Genus *Margachitina* Eisenack, 1968b

Type species: *Desmochitina margarifera* Eisenack, 1937 (p.221, pl.15, fig.9), by original designation.

Diagnosis: Vesicle small, spherical to lenticular; base extended, operculum simple, convex, attached to base of next higher vesicle; colonial forms.

Remarks: The unique morphology and the mode of connection between individuals serve to separate *Margachitina* from the following chain-form genera *Hoegisphaera*, *Desmochitina*, *Linochitina*, *Cingulochitina*, and *Balbochitina*. Laufeld’s (1974, p.102) stating that the erection of the genus *Margachitina* by Eisenack (1968, p.182) was most justified has yet to gain universal acceptance (e.g. Paris 1981, p.141).

*Margachitina* sp. A

(pl.5, fig. 3)

Material: One aborally flattened specimen from Loc.20.

Description: The vesicle is more or less subspherical. The surface wall is unornamented (destruction of the outer layer?). The specimen figured herein is compressed approximately perpendicular to the horizontal axis of the vesicle. The flattening of the vesicle prevents any observation of the oral pole, so the presence or absence of a reduced collarette cannot be demonstrated. The copula is not observed and its length, therefore, cannot be measured. The base is attached to a wide operculum of the subjacent vesicle. The aboral surface of the operculum is smooth. The operculum is convex towards the oral pole and has an up to 10 μm wide flange, occupying approximately one-seventh of the diameter. The internal wall of the vesicle is smooth. The vesicle wall is composed of a ca. 0.4 μm-thick single layer.

Dimensions: Maximum diameter of vesicle 84 μm and that of operculum 68 μm.

Remarks: The Yunnan specimen is similar to those established by Collinson and Schwalb (1955) as *Desmochitina poculum*, which was re-identified by Paris (in Goldstein et al. 1969) as *Margachitina poculum* in the absence of the annuluses on the vesicle as well in the ratio of vesicle diameter to operculum diameter of less than 1. However, the Yunnan specimen has a width of 84 μm in excess of the width range of the latter (40 to 60 μm in width). The Yunnan specimen is militated against identifying to the specific level because of inimical preservation.
Occurrence: Yulongssu Formation of Qujing, E. Yunnan.

Genus Urnochitina Paris, 1981
1982 Calycichitina Tsegelnjuk

Type species: Desmochitina? urna Eisenack, 1934 (p. 69-70, pl.5, fig.7), by original designation.

Diagnosis: Vesicle cylindro-ovoid to piriform; neck not differentiated; body length greater than maximum width; aperture flaring; operculum discoid with short membrane aborally; basal margin rounded, base with a tubular copula, its distal end thinned and expanded to form peduncle attached to operculum of subjacent vesicle; surface wall smooth, rugose, shagrinate or verrucate; chain formation common.

Remarks: Tsegelnjuk (1982) introduced a new genus Calycichitina with Desmochitina? urna Eisenack, 1934 as type species. A diagnosis for Calycichitina translated from the Russian version of Tsegelnjuk’s 1982 paper is as follows: “Small long conical or ovoid vesicle having no collarette. Vesicle flank more or less convex, base slightly convex or semicircular. Copula not wide, short, connected with massive plug located deep in aperture of adjacent vesicle. Vesicle surface smooth” (p.104). These features are within the circumscription of Urnochitina, a genus proposed by Paris one year earlier. Moreover these two genera have the same nomenclatural type. Accordingly Urnochitina Paris, 1981 has priority over Calycichitina Tsegelnjuk, 1982.

Urnochitina thyrae (Cramer, 1964)
(pl.5, fig.4)

1967 Desmochitina? thyrae Cramer; Rauscher et Doubinger, p.319, pl.3, fig.5.
1967 Desmochitina erratica Eisenack; Magloire, pl.5, fig.36.
1973 Linochitina erratica Eiserack; Cramer, pl.2, fig.15.
1964 Desmochitina thyrae n. sp; Cramer, p.350, pl.24, figs.4-5.
1980 Eisenackitina cupellata sp. n.; Wrona, p.138-139, pl.3, figs.10-11.

Material: Two flattened specimens from Loc.5.

Description: The vesicle is slender, conical. The neck is not differentiated. The apertural margin is straight. The flexure and shoulder are absent. The maximum diameter is situated in about one-seventh the total length from the aboral pole. The basal margin is broadly rounded with a wide and narrow copula at the base. The copula has a height of 5 μm and a width of 17.5 μm. The surface wall is smooth and its granular wall stems from frambooidal pyrites growing within the vesicle. No vesicle-chain is encountered in our collection.

Remarks: Cramer (1967, p.350) proposed his new species Desmochitina thyrae which has a short and wide copula. On this basis D. thyrae is herein re-assigned as Urnochitina thyrae. Wrona’s (1980) new species Eisenackitina cupellata also bears a short, wide and conical copula which may expand distally to form peduncles as discerned in pl. 30, fig. 13 and pl. 31, figs. 9 and 11 (holotype). For this reason, part of specimens referable to E. cupellata should be transferred to Urnochitina. The slender forms representative of its holotype show prominently similarities to U. thyrae in terms of their shape, size and smooth surface wall except that its neck tapers less rapidly than that of U. thyrae. It is unclear that the narrower neck in U. thyrae is initial or secondary judging from Cramer’s illustration from light microscopy.

Occurrence: Fentou Formation of Well N-4 of Taixian, N. Jiangsu.
Order Prosomatiferia Eisenack, 1972b
Subfamily Conochitininae Paris, 1981


1966 *Clavachitina* Taugourdeau
1966 *Euconochitinia* Taugourdeau
1974 *Trepazochitina* German
1980 *Fustichitina* Achab
1980 *Steneyochitina* Zaslavskaya (invalid, diagnosis not provided)
1982 *Sclerochitina* Tsegelnjuk
1983 *Conochitinia* Zaslavskaya (err. typogr. pro *Conochitinia*)
1986 *Coanochitinia* Grootel (err. typogr. pro *Conochitinia*)

Type species: *Conochitinia claviformis* Eisenack, 1931 (p.84, pl.1, fig.17), by monotypy.

Diagnosis: Vesicle elongated, claviform conical; neck elongated, subcylindrical, more or less developed, imperceptibly passing to body; shoulder and flexure weak or absent; maximum diameter at aboral pole; base flat or slightly convex; surface wall thick, outer layer smooth, shagrinate or finely reticulat, exclusive of spine or granule; prosome confined to transition between neck and body; mucron well-developed or rudimentary but always present (Translated from Paris 1981, p.178).

Remarks: *Conochitinia* was nominated by Eisenack (1931) with *C. claviformis*, 1931 as type species. In proposing the genus, Eisenack (1931, p.6) provided the following generic diagnosis translated from the German version of Eisenack’s (1931) paper: “Chitinaza with generally conical outline, maximum diameter near distal end.” The diagnosis above for *Conochitinia* is oversimplified. Therefore it is not surprising that the heterogeneous taxa are embraced under the generic name. After that time, many pious efforts have been made to improve its value both in systematic taxonomy and in stratigraphic application.

Jansonius (1964, p.906-907) established the genus *Belonechitina* to include those forms with vesicles as in *Conochitinia* but with spines involving most of the body rather than occurring only at the basal edge in *Conochitinia*. Paris (1981, p.190) introduced the genus *Jenkinsonchitina* which is adopted herein. The difference between *Conochitinia* and *Jenkinsonchitina* is in the latter genus with a sharply rounded basal margin.

It is worth while to note that *Conochitinia* has been suffered from excessive splitting. The following genera are regarded, totally or partially, as junior synonyms of *Conochitinia*, including *Clavachitina* Taugourdeau, 1966, *Euconochitinia* Taugourdeau, 1966, *Trepazochitina* German, 1974, *Fustichitina* Achab, 1980, *Steneyochitina* Zaslavskaya, 1980, and *Sclerochitina* Tsegelnjuk, 1982.

*Clavachitina* was named by Taugourdeau, 1966 for those forms with a bludgeon-shaped vesicle with *Clavachitina claviformis* Taugourdeau, 1961 as type species. We are in agreement with Paris (1984) in synonymizing *Clavachitina* with *Conochitinia*. There is synonymous problem resulting from the transfer at the generic level. *Conochitinia claviformis* Eisenack, 1931, which by the original designation of Eisenack (1931) is the type species for *Conochitinia. Euconochitinia* is a genus segregated by Taugourdeau (1966, p.38-39) from *Conochitinia* Eisenack, 1931. According to his opinion, *Euconochitinia* is distinguished from *Conochitinia* emand. Taugourdeau, 1966 by the possession of a short cylindrical or reduced copula at the aboral pole. Jansonius (1967) favoured just-stated view and also used the presence of a short copula as a mean of his separation of these two genera. Later, Jansonius (1970) turned his view reversely: a short mucron or copula
at the aboral pole has *Conochitina* instead of *Euconochitina*. It seems to us that the criterion for separating the two is unworkable because the presence or absence of a mucron or copula appears to relate at least with the state of preservation within *Conochitina*. The shape of the aboral pole may be variously modified by the compression of the body. When the invagination of the aboral pole towards the inner cavity of the body takes place, the mucron or copula cannot be observed. Therefore, we do not believe that a separation even at the subgeneric level would be useful, and both names are synonymized.

*Trepazochitina* proposed by German (1974, p.22) on the basis of material from the Lower Ordovician Glauconitic Horizon of the Russian Platform is characterized by a trapezoidal vesicle with straight flanks and a slightly convex base. The illustration of the type species *T. angularis* German is poor. However, its attributes do not militate against the assignment to *Conochitina* sensu Paris, 1981.

*Steneyochitina* was erected by Zaslavskaya (1980) who designated the type species but included no generic diagnosis. Since 1931, however, the International Code of Zoological Nomenclature (ICZN) has required a verbal diagnosis for the validation of a new genus. So this generic name is invalid by ICZN Article 13 (Ride et al. 1985). All the same some assessments may be made and the type species designated by Zaslavskaya, *Steneyochitina ovatoelongata* Zaslavskaya from the Llandoveryan rocks of the Siberian Platform, appears to be the best starting point for an evolution of the “genus”. A description translated from the Russian version of Zaslavskaya's (1980) paper as follows: “Vesicle long-ovoid, basal edge smoothly rounded, base convex, neck tapering progressively toward aperture, collarette wide, inconspicuously differentiated, aperture straight or slightly concave.” In 1983 Zaslavskaya, on page 78, gave the additional description: “base with a circle of bolster, no mucron, ...vesicle surface with delicate tubercules”. Judging from the SEM microphotograph for *S. ovatoelongata* provided by Zaslavskaya (1983) and Obut and Zaslavskaya (1984) the so-called “delicate tubercules” are due to contamination unevenly distributed on the vesicle surface.

It should be pointed out here that in 1984 Zaslavskaya illustrated two specimens of *S. ovatoelongata*. One of them (pl.8, fig. 10) collected from Late Llandoveryan rocks of the Russian Platform, is true *Conochitina*. In our opinion, it is nothing but *Conochitina truncata* Laufeld. This evidence leaves no doubt in our mind that *Steneyochitina* is congeneric with *Conochitina*.

*Fustichitina* was established by Achab (1980) on the basis of material from the Lower Arenig Levis Formation of Quebec, Canada for those forms displaying a bludgeon-shaped vesicle. In addition, she also paid some emphasis on the spherical shape of the body. The importance of these characteristics is not clear and it is debatable whether they should command generic recognition in taxonomy. Paris and Mergl (1984, p.49) expressed that the concept of *Fustichitina* is completely unacceptable and regarded it as a junior synonymy of *Conochitina* sensu Paris 1981. Grahn and Geng (1980, p.227) reduced *Fustichitina* to a subgenus in *Conochitina*, but did not discuss the reasons for the reduction. The proposal of *Fustichitina* appears to represent a return towards the classification of Taugourdeau (1966). To our knowledge, *Conochitina* consists of at least two main forms somewhat different in over-all shape, namely, one form with conical vesicles, e.g. *Conochitina tuba* Eisenack, 1932 (Laufeld 1974, figs. 36 A-E) while the other with claviform vesicles, e.g. *Conochitina havliceki* Paris et Mergl. 1984 (Paris and Mergl 1984, pl.1, figs.5-6, 10-11, 14-15). Their taxonomic separation is by no means viable. Intermediate forms in shape seem to occur. The latter species is not easily distinguishable from *Fustichitina* morphologically. Additionally, owing to effects of diagenetic compaction, the inherent shape of the aboral pole may be apparently altered within *Conochitina*. A rounded base exhibited by some conochitinitids may result either from the invagination of the base towards the cavity of the body or from buckling. In the light of these observation, we cast doubt on the utility of this feature as a sound morphologic basis for generic
separation. It may, however, be appropriated at specific level.

_Sclerochitina_ was established by Tsegelnjuk (1982) with type species being _Conochitina intermedia_ Eisenack, 1955. In erecting the genus, he wrote on paper 32 (our translation): “Vesicle large, conical; chamber and neck in part differentiated, neck wide in basal part and progressively tapering toward aperture; flank straight; base sharp; vesicle wall smooth or verrucose”. Obviously, this definition overlaps _Conochitina_. Comparison of _Sclerochitina_ with _Conochitina_ is unfortunately ignored by Tsegelnjuk. In our opinion, smooth forms of _Sclerochitina_ may be removed to _Conochitina_. See also above under the remarks of _Eisenackitina._

_Conochitina acuminata_ Eisenack, 1959 emend. Laufeld, 1974

( pl.5, figs. 7-9)

1959 _Conochitina acuminata_ n. sp.; Eisenack, p.6, pl.3, figs. 10-11.
1964 _Conochitina acuminata_ Eisenack; Eisenack, p.316, pl.26, fig.3.
1964 _Conochitina acuminata_ Eisenack; Taugourdeau and Jekhowsky, p.859, pl.1, fig.9.
1964 _Conochitina brevis conica_ n. subsp.; Taugourdeau and Jekhowsky, p.858, pl.3, fig. 26, excl. 27.
1966 _Conochitina acuminata_ Eisenack; Taugourdeau, p.35, pl.1, figs.19,22; pl.2, fig.49.

_non_ 1968 _Conochitina acuminata_ Eisenack; Rauscher, p.53, pl.1, figs 8-9.
1968 _Conochitina acuminata_ Eisenack; Eisenack, p.159-160, pl.25, figs. 12-15, excl.10-11.
1974 _Conochitina acuminata_ Eisenack; Laufeld, p.58-59, fig.21.
1978 _Conochitina acuminata_ Eisenack; Verniers and Rickards, pl.2, figs.1-2.

_non_ 1980 _Conochitina acuminata_ Eisenackitina; Zaslavskaya, p.56, pl.1, figs.5-6.
1981 _Conochitina acuminata_ Eisenack; Verniers, p.171-172, pl.1, fig.11.
1982 _Conochitina acuminata_ Eisenack; Verniers, p.28, pl.14, figs. 74-82.

_non_ 1983 _Conochitina acuminata_ Eisenack; Zaslavskaya, p. 53-54, pl.2, fig.5.

1989 _Conochitina acuminata_ Eisenack; Asselin, Achab and Bourque, pl.6, figs. 1-6, 9,11-12.

Material: Five flattened specimens from Loc. 21.

Description: The vesicle is subconical. The body and neck are not differentiated. A columnar prosome lies within the neck. The maximum diameter attains more than two-fifths the total length of the vesicle after restoration of the flattening (coeff. 0.7). The basal margin is broadly rounded with a convex base. At the center of the base there is a short and wide copula with a central depression, which is enclosed by a raised edge. The vesicle wall thins toward the oral pole to generate a membranous collarette with a length of ca. 19 μm. The surface wall is smooth and locally provided with an imbricate ornamentation (Laufeld’s 1974 term roofing tile).

Dimensions: The means are calculated from five flattened specimens from Loc.21 (in μm).

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<th>D</th>
<th>L/D</th>
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<tbody>
<tr>
<td>Mean (flattened specimens)</td>
<td>202</td>
<td>106</td>
<td>1.9</td>
</tr>
<tr>
<td>After restoration of the</td>
<td>202</td>
<td>74</td>
<td>2.8</td>
</tr>
<tr>
<td>flattening (coeff.0.7)</td>
<td>range</td>
<td>69-84</td>
<td>2.6-3.0</td>
</tr>
</tbody>
</table>

Remarks: Two forms were placed by Eisenack (1959) within this species, one form being short (Eisenack 1959, pl.3, figs.10-13; 1968, pl.25, figs.12-16) and the other slim (Eisemann 1968, pl.25, figs.10-11). Laufeld (1974) erected a new species, _C. flamma_, to embrace those fairly slender forms restricted to the Hogklinth Beds. His emendation is herein adopted. According to Eisenack (1959, 1964) _C. acuminata_ has a broad range in length from 147-320 μm. The Yunnan specimens referred to this
species have a length of 196-209 μm, falling within the size range of C. acuminata s. s.

Zaslavskaya (1983) considered C. vishyensis to be a synonym of C. acuminata. The former species differs, however, from the latter one in the possession of fine rugose ornamentation on the vesicle surface, especially developed in its basal edge (Laufeld 1974, fig.37). Zaslavskaya’s suggestion is therefore rejected herein.

**Conochitina acuminata** is very useful biostratigraphically as its confinement in Sweden to the Lower Visby Beds and the Upper Visby Beds (Laufeld, 1974), correlative of the *griestoniensis-cremulata* to *centrifugus-murchisoni* biozones (Larsson, 1979). This interval corresponds with the horizon from which Verniers (1982) identified the species in Belgium and from which Asselin et al. (1989) reported it in their collection. Zaslavskaya’s (1980, 1983) specimens from the Siberian *gregarius* to *convolutus* biozones (1980, pl.1, figs.5-6; 1983, pl.2, fig.5) are of similar dimensions to *C. acuminata* but have no copula at the centre of the base. Therefore those Siberian specimens are not retained in this species. France specimens assigned by Rauscher (1968) to *C. acuminata* are *Eremochitina* Benoit and Taugourdeau at generic level in all likelihood.

Occurrence: Daluzhai Formation of Daguan, NE Yunnan.

**Conochitina brevis** Taugourdeau et Jekhowsky, 1960
(pl.5, figs.5-6)

- p 1960 *Conochitina brevis* n.sp; Taugourdeau et Jekhowsky, p.1222, pl.3, figs.47-49.
- p 1961 *Conochitina brevis* Taugourdeau et Jekhowsky; Benoit and Taugourderu, p.140.
- 1964 *Conochitina brevis* Taugourdeau et Jekhowsky; Cramer, p.343, pl.24, fig.16.
- 1965 *Conochitina brevis* Taugourdeau et Jekhowsky; Bouche, p.154,156, pl.1, figs.4-5.
- 1967 *Conochitina brevis* Taugourdeau et Jekhowsky; Cramer, p.87, pl.2, figs.23-24; pl.3, fig.62.
- 1968 *Conochitina brevis* Taugourdeau et Jekhowsky; Rauscher, p.54, pl.2, figs.11-13.
- 1969 *Conochitina brevis* Taugourdeau et Jekhowsky; Martin, p.100, pl.2, fig.28.
- 1969 *Conochitina brevis* Taugourdeau et Jekhowsky; Umnova, pl.1, figs.18-19.
- non 1974 *Conochitina brevis* Taugourdeau et Jekhowsky; Cramer, fig.11.
- 1980 *Conochitina brevis* Taugourdeau et Jekhowsky; Zaslavskaya, p.58, pl.1, fig.11.
- p 1982 *Conochitina brevis brevis*? Taugourdeau et Jekhowsky; Verniers, p.31-32, pl.3, figs.46-48, excl.49-50.
- 1983 *Conochitina brevis* Taugourdeau et Jekhowsky; Zaslavskaya, p.56, pl.3, figs.1-3.
- non 1983 *Conochitina brevis* Taugourdeau et Jekhowsky; Khanna and Sah, pl.2, fig.4.
- non 1986 *Conochitina brevis* Taugourdeau et Jekhowsky; Achab, p.687, 689, pl.1, figs.13-18; pl.1, fig.10.
- v.1986 *Conchitina* cf. *vasculiformis* Bouche; Geng, p.120-121, pl.2, fig.9.
- 1992 *Conochitina brevis* Taugourdeau et Jekhowsky; Wang and Chen, p.72, pl.1, figs.1-7; p.12, figs.1-10.

Material: More than fifty specimens from Locs.3, 10, and 21.

Description: The vesicle is subconical and the neck is cylindrical with a straight oral margin. The flexure is present about two-fifths from the oral pole. The shoulder lacks, but the flank is bulged medially to loweromedially. The basal margin is rounded with a convex base. The short and narrow mucron is situated in the middle part of the base. The surface wall is smooth.

Dimensions: The means are calculated from fourteen flattened specimens from Locs. 10 and 21 (in μm).
Remarks: *Conochitina brevis* has long been used as a “rucksack” species in the literature, a result almost entirely of the fact that Taugourdeau and Jekhowsky (1960) illustrated two specimens as *C. brevis*: the specimen tapering in the ratio of over 0.8 is *C. brevis* representative of the holotype (pl.3, fig.47) and one of two paratypes (pl.3, fig.48) from the Sahara Silurian, while another of paratypes (pl.3, fig.49) is, in our definite opinion, an as yet unnamed species from the Sahara Ordovician, differing *C. brevis* s.s. in its more rapidly tapering in the ratio of under 0.8 (see Table 3). Some subsequent authors use the Ordovician unnamed species as the standard of identifying *C. brevis*. Inevitably this has led to some confusion. Consequently, *C. brevis* s. l. occurs partitively in strata of Arenig-Llandeilo age and of Llandovery age and there is not an interval of overlap in their stratigraphic range. Such stratigraphically isolated range is unallowable. For this reason we argue that they are best to keep distinct at specific level.

Martin’s (1969) Belgian Arenig specimen has a length of 150 μm, being much smaller than that recorded by Taugourdeau and Jekhowsky (1960) in the original description of this species (220 μm long). We consider that the Belgian specimen should be transferred to *C. simplex* Eisenack.

Cramer’s (1974) illustrated specimen of the Upper Ordovician Cedarberg Formation in S. Africa is strongly deformed and exhibits no flexure and bulge which diagnose *C. brevis*. Therefore, the specimen of S. Africa is rejected from the synonimous list above.

<table>
<thead>
<tr>
<th>author and year</th>
<th>pl. and fig.</th>
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<tr>
<td>Taug. and Jekh. (1960)</td>
<td>pl.3:47</td>
<td>Llandovery</td>
<td>110</td>
<td>85</td>
<td>0.86</td>
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<tr>
<td></td>
<td>pl.3:48</td>
<td></td>
<td>130</td>
<td>105</td>
<td>0.82</td>
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<td></td>
<td>pl.3:44</td>
<td>Ordovician</td>
<td>130</td>
<td>75</td>
<td>0.75</td>
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<tr>
<td>Rauscher (1980)</td>
<td>pl.2:11</td>
<td>Arenig</td>
<td>100</td>
<td>78</td>
<td>0.78</td>
</tr>
<tr>
<td></td>
<td>pl.2:12</td>
<td></td>
<td>110</td>
<td>67</td>
<td>0.61</td>
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<td></td>
<td>pl.2:13</td>
<td></td>
<td>100</td>
<td>75</td>
<td>0.75</td>
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<tr>
<td>Achab (1986)</td>
<td>pl.1:13</td>
<td>Arenig</td>
<td>110</td>
<td>80</td>
<td>0.73</td>
</tr>
<tr>
<td></td>
<td>pl.1:14</td>
<td></td>
<td>120</td>
<td>80</td>
<td>0.67</td>
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<tr>
<td></td>
<td>pl.1:15</td>
<td></td>
<td>120</td>
<td>90</td>
<td>0.75</td>
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<tr>
<td></td>
<td>pl.1:16</td>
<td></td>
<td>120</td>
<td>90</td>
<td>0.75</td>
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<tr>
<td></td>
<td>pl.1:18</td>
<td></td>
<td>120</td>
<td>80</td>
<td>0.67</td>
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<tr>
<td>Umnova (1969)</td>
<td>pl.1:18</td>
<td>Llandeilo</td>
<td>90</td>
<td>60</td>
<td>0.67</td>
</tr>
<tr>
<td></td>
<td>pl.1:19</td>
<td></td>
<td>100</td>
<td>60</td>
<td>0.60</td>
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</table>
The specimen from the Silurian rocks of Spiti, India, assigned by Khanna and Sah (1983) to this species does not fit in with the specific diagnosis because the poorly preserved specimen lacks an inflation at the corresponding position and moreover it is too broad in the upper half for this species with a da/D ratio of 0.98.

None of nineteen specimens identified to this species by Wang and Chen (1992) are C. brevis from the Lungmachi Formation of Datianba, Xiushan, SE Sichuan. Their specimens in pl.1, figs. 4 and 8 carry a conspicuous constriction just orally of the basal margin, a character which is not indicated in the original diagnosis. This constriction is assuredly not the consequence of the effect of compression since they are preserved in full relief. The specimens in pl.1, figs. 1-3, 6-7, 9 and pl.2, figs. 2, 1-6 are Eisenackitina verruculifera (see above under remarks section for E. verruculifera). The specimens in pl.2, figs. 7-9 are C. longa Zaslawskaya.

The presence of a short and narrow mucron has not been noted before in this species.

Occurrence: Kaochiapien Formation of Wells S-1 of Dafeng and D-3 of Xinghua and Tangshan of Nanjing, Jiangsu; and Qiaogou Formation of Tongzi, N. Guizhou.

_Conochitina edjelensis_ Taugourdeau, 1963
(pl. 7, fig.9)

1966 _Euconochitina edjelensis_ (Taugourdeau); Taugourdeau, pl.1, figs.1-2,11.
1967 _Conochitina edjelensis_ Taugourdeau; Cramer, p.88, pl. 2, figs.51,54.
1980 _Conochitina edjelensis_ Taugourdeau; Nestor, p. 140-141, pl.3, fig.2; pl.4, figs.1-3.
1980 _Conochitina edjelensis_ Taugourdeau; Obut and Zaslawskaya, pl.1, fig.8.
1983 _Conochitina edjelensis_ Taugourdeau; Zaslawskaya, p.58, pl.4, fig.1 (Zaslawskaya's 1980, pl.2, fig.1 refigured).
1983 _Conochitina edjelensis_ Taugourdeau; Zaslawskaya et al., pl.1, figs.4,12.
1984 _Conochitina edjelensis_ Taugourdeau; Obut and Zaslawskaya, pl.7, figs. 6 (Zaslawskaya et al's 1983, pl.1, fig.4 refigured), 8.

_v.1987_ _Conochitina_ cf. _C. edjelensis_ Taugourdeau; Geng et al. p 731,733, pl.1, fig.1.
1989 _Conochitina_ sp.5; Achab et Bourque, pl.3, figs.5-6, 9-10.
1989 _Conochitina_ sp.3; Achab et Bourque, pl.3, fig.12.
1989 _Conochitina edjelensis_ Taugourdeau; Bassett et al., p.163.
1990 _Conochitina edjelensis_ Taugourdeau; Nestor, pl.14, fig.11.
1992 _Conochitina_ cf. _edjelensis_; Wang, p.86, pl.4, figs.1-5.

Material: More than sixty specimens in all states of preservation from Locs.8-10, 12, 15, and 21.

Description: The vesicle is conical. The vesicle wall is smooth and thin, ca.1 μm thick. It thins abruptly on the ad aperture to form a membranous collarette with a variable length. The aperture has an irregularly spaced finely serrated fringe. At the basal collarette there is frequently a crescent-shaped prosome. The basal margin is broadly rounded and passes into a flat or slightly concave base.

Dimensions: The means are established from ten flattened specimens from Locs.8 and 9 (in μm) (Text-fig. 40).

Remarks: Our specimens are referred to _C. edjelensis_ on the basis of their conical, almost equidimensional vesicle (Taugourdeau, 1963, 1966, 130-173 μm long).
Occurrence: Kaochiapien Formation of Wells D-2 and D-3 of Xinhua, and N-4 of Taixian and Tangshan of Nanjing, Jiangsu; Lojoping Formation of Yichang, W. Hubei; and Nanjiang Formation of, Nanjiang, N. Sichuan.

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<th>D</th>
<th>L/D</th>
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<tbody>
<tr>
<td>Mean (flattened specimens)</td>
<td>147</td>
<td>85</td>
<td>1.7</td>
</tr>
<tr>
<td>After restoration of the flattening (coeff.0.7)</td>
<td>mean</td>
<td>147</td>
<td>62</td>
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<tr>
<td></td>
<td>range</td>
<td>138-173</td>
<td>56-77</td>
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</table>

Text-fig.40. The L/D ratio for *Conochitina edjelensis* Taugourdeau.

Text-fig.41. The L/D ratio for *Conochitina emmastensis* Nestor, 1982.

*Conochitina electa* Nestor, 1980a

(Pl.6, figs. 4-5)

1980 *Conochitina electa* sp.n.; Nestor, p.102-103,107, pl.6, figs.1-3.
1981 *Conochitina* sp.1; Achab, pl.2, figs.1-5,7-8,14.
1985 *Conochitina* cf. *C. eleta* Nestor; Grahn, p.160, pl.1, fig.10.
1989 *Conochitina electa* Nestor; Bassett et al., p.163.
1988 *Conochitina electa* Nestor; Grahn, p.320, fig.21(Nestor 'a 1980a pl.6, fig.2a refigured).
1989 *Conochitina* sp.2; Asselin *et al.*, pl.2, figs. 2,5.
1990 *Conochitina electa* Nestor; Nestor, pl.14, fig.7.

Material. One incompletely preserved and compressed specimen from Loc. 6.
Description: The vesicle is conical. The body-neck is undifferentiated. Neither flexure nor shoulder is present. The flank is straight, nearly parallel. There is a broadly rounded constriction just orally of the bluntly rounded basal margin. The vesicle surface is smooth at low magnification and granular only at high magnification ($\times 2$ 600). The granules are 1.5 $\mu$m long and 1.5 $\mu$m wide at their bases. The vesicle surface between the granules is rough. The base is convex.

Dimensions: Total length more than 200 $\mu$m; maximum diameter 62 $\mu$m after restoration of the flattening with a coefficient of 0.7.

Remarks: Our specimen is quite close in size to the lower flange of the types given by Nestor (1980a, 220 $\mu$m long and 65-105 $\mu$m wide) and otherwise agrees also with her description and illustrations.


*Conochitina elongata* Taugourdeau, 1963
(pl.5, figs. 10-13)

1963 *Conochitina edjelensis elongata* n. subsp.; Taugourdeau, p.138, pl.3, figs.59-66.
1967 *Conochitina edjelensis elongata* Taugourdeau; Cramer, p.88, pl.2, figs.48-49.
1967 *Conochitina edjelensis elongata* Taugourdeau; Taugourdeau et al., p.33, pl.3, fig.78.
1980 *Conochitina edjelensis elongata* Taugourdeau; Zaslavskaya p. 60-61, pl.2, fig.2.
1980 *Conochitina edjelensis elongata* Taugourdeau; Nestor, p.140-142, pl.4, fig.3.
1981 *Conochitina aff. elegans* Eisenack; Hou and Wong, pl.1, figs.1-5.
1983 *Conochitina edjelensis elongata* Taugourdeau; Zaslavskaya, p.59, pl.4, fig.2 (Zaslavskaya’s 1980 pl.2, fig.2 refigured).
1985 *Conochitina edjelensis elongata* Taugourdeau; Paris in Hill et al., pl.13, figs.6, 11.

Material: More than one hundred flattened specimens from Locs.3, 5, 7, 10, 12, and 21.

Description: The vesicle is long-conical with no neck differentiated from the body in most specimens. The flexure is rarely present. The lightly incurved flank passes, through a broadly rounded basal margin, into the flat or concave base. The base bears a circular scar on which there are a series of concentric lines. At its center an irregular hole may occur with a diameter of ca. 0.8 $\mu$m. The circum-scar lines are also present at the base, but the vesicle surface becomes smooth on the adbasal margin, as seen on the vesicle surface.

Dimensions: The means are calculated from fifteen flattened specimens from Loc.5 (in $\mu$m).

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<th>L</th>
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<tbody>
<tr>
<td>Mean (flattened specimens)</td>
<td>232</td>
<td>91</td>
<td>2.6</td>
</tr>
<tr>
<td>After restoration of the flattening (coeff. 0.7)</td>
<td>mean</td>
<td>232</td>
<td>62</td>
</tr>
<tr>
<td></td>
<td>range</td>
<td>205-258</td>
<td>59-70</td>
</tr>
</tbody>
</table>

Remarks: At the same time or shortly after the establishment of *C. edjelensis* by Taugourdeau (1963) three subspecies were separated and widely accepted, viz. *C. e. edjelensis*, *C. edjelensis elongata*, and *C. edjelensis alargata* (Taugourdeau 1963, Cramer 1967a, Nestor 1980, Paris 1985, Asselin et al. 1989). They may appear at the same level of the same section or drillhole and have the same range or at least some overlap in range, as demonstrated by data from Sahara, Spain, and Estonia. It does not justify their separation at subspecies level because the subspecific concept of those authors is inconsistent with that in the usual sense. According to Sylvester-Bradly (1956, p.3), only those geographically or successationally isolated subspecies are valid in evolutionary theory. On this basis,
they are elevated to specific rank. Despite the less conspicuously incurved flank, our specimens are far closer this species than other *Conochitina* species.

Occurrence: Kaochiapien Formation of Wells S-1 of Dafeng, D-3 of Xinghua, N-4 of Taixian, and Je-2 of Jurong, and Tangshan of Nanjing, Jiangsu; Shamao Formation of Yichang, W. Hubei; Shihniulan Formation of Tongzi, N. Guizhou; and Lungmachi Formation of Daguan, NE Yunnan.

*Conochitina emmastensis* Nestor, 1982
(pl.6, fig.1)

1982 *Conochitina emmastensis* n.sp.; Nestor, p.105-106, pl.1, figs. 1-3.
1984 *Conochitina emmastensis* Nestor; Nestor, pl.2, fig.4.
1985 *Conochitina aff. emmastensis* Nestor; Grahn, p.160, pl.1, fig.11.
1988 *Conochitina emmastensis* Nestor; Geng and Cai, pl.1, fig.4.
1989 *Conochitina emmastensis* Nestor; Paris, p.281.
1990 *Conochitina emmastensis* Nestor; Nestor, pl.14, fig.13 (Nestor's 1982, pl.1, fig.3a refigured).

Material: Thirty-five flattened specimens from Loc.10.

Description: The vesicle is subconical with the maximum diameter at the central part or lower half of the body. Relatively short, less than one-third of the total length of the vesicle is the neck within which there is a 72 µm by 22 µm prosome. The aperture is surrounded by a 7-11 µm long membrane, flaring distally. The flexure is absent or, when present, broadly rounded. The shoulder is absent or imperceptible. In well-preserved specimens, the flank tapers progressively towards the apertural pole. Owing to the compression effect, the shape of the flank is not equally modified. Some of them exhibit a bulge at the midway of the body. The basal margin is broadly or obtusely rounded. The base is flat or convex and provided with a ca. 7 µm high and 33 µm wide, conical mucron possessing an irregular hole at the center. The vesicle wall is composed of two layers. The outer layer is smooth.

Dimensions: Mean calculated on ten flattened specimens from Loc.10 (in µm) (Text-fig. 41).

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<tbody>
<tr>
<td>Mean (flattened specimens)</td>
<td>317</td>
<td>140</td>
<td>2.1</td>
</tr>
<tr>
<td>After restoration of the flattening (coeff. 0.7)</td>
<td>317</td>
<td>98</td>
<td>3.0</td>
</tr>
<tr>
<td>range</td>
<td>264-360</td>
<td>82-106</td>
<td>2.2-3.2</td>
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Remarks: *Conochitina emmastensis* named by Nestor (1982) on the basis of material from the Lower Wenlockian beds of Estonia was said to range from the *sedgwickii* to *centrifugus-murchisoni* graptolite biozones. However, its range, according to Nestor (1990), confined to the *sedgwickii* biozone was denoted in fig.15 by a solid line, while its range from the *turriculatus* to *centrifugus-murchisoni* biozones is indicated by a dashed line. This seems to mean, according to an accustomed understanding, that doubts or reservations exist about the assignment of the Estonian specimens from the post-*sedgwickii* biozone to *C. emmastensis*. If this is the case, an unfortunate restriction is made because the remove of the type of *C. emmastensis* will inevitably prompt nomenclatural problems. At any rate, it is certain that *Conochitina emmastensis* is unlikely to be a long-ranging species as previously considered and is in great need of re-evaluation. Due to no reason given by Nestor (1990) for the above-mentioned change, we are detered from further discussing the visionary problem of this species.

Occurrence: Shamao Formation of Yichang, W. Hubei.
Conochitina iklagensis Nestor, 1980
(pl.6, figs.2-3)

1980 Conochitina iklagensis sp.n.; Nestor, p.142, pl.3, figs.3-5.
1981 Conochitina cf. C. iklagensis Nestor; Achab, pl.3, figs.5,14.
1983 Conochitina aff. elegans Eisenack; Hou and Wang, pl.1, figs.1,3.
1983 Rhabdochitina regularis Zaslavskaya; Zaslavskaya, p.25, pl.10, figs.1-2.
1983 Conochitina iklagensis Nestor; Zaslavskaya, p.75.
1984 Conochitina cf. iklagensis Nestor; Nestor, pl.1, fig.1.
1988 Conochitina edjelensis elongata Taugourdeau; Hou in Fang and Hou, pl.1, figs.1-2.
1988 Conochitina iklagensis Nestor; Grahn, fig.23 (Nestor 1980, pl.3, fig.5 refugured).
1988 Conochitina iklagensis Nestor; Hou in Fang and Hou, pl.1, fig.3.
1988 Conochitina chydaea Jenkins; Hou in Fang and Hou, pl.1, fig.5, excl. pl.1, fig.7.
1988 Conochitina iklagensis Nestor; Geng in Chen et al., pl.2, fig.2.
1988 Conochitina iklagensis Nestor; Geng and Cai, pl.1, fig.8.
1990 Conochitina iklagensis Nestor; Nestor, pl.14, fig.6 (Nestor, 1980, pl.3, fig.4 refugured).
1993 Conochitina iklagensis (sic) Nestor; Wang, p.80 (err. typogr. pro Conochitina iklagensis).

Material: More than forty flattened specimens from Locs.3,10,12,13,15, and 21.

Description: The vesicle is nearly cylindrical vesicle with a parallel or subparallel flank. When present, the neck is inconspicuous and short in comparison with the entire length of the vesicle (L/ln=11.4). The flexure is absent or when present broadly rounded. The shoulder is absent or present obscurely. The aperture is straight. The neck contains a 83 μm by 28 μm prosome. Its lateral membranous flange extends aborally and bends smoothly to the longitudinal axis, producing a shape somewhat like a diabolo. The basal margin is rounded. The base is often concave and has a 6 μm long and 20 μm wide mucron which possesses an inward depression at the center. The vesicle surface is smooth.

Dimensions: Means calculated of nine flattened specimens from Loc.3 (in μm) (Text-fig.42).

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<tbody>
<tr>
<td>Mean (flattened specimen)</td>
<td>267</td>
<td>83</td>
<td>3.2</td>
</tr>
<tr>
<td>After restoration of the flattening (coeff.0.7)</td>
<td>mean 267</td>
<td>58</td>
<td>4.6</td>
</tr>
<tr>
<td></td>
<td>range 251-288</td>
<td>50-70</td>
<td>4.0-5.8</td>
</tr>
</tbody>
</table>

Remarks: The nomination of the species by Nestor (1980) has been followed by almost all subsequent writers, but Zaslavskaya (1982) gave reasons for regarding this as unfounded. Indeed, Nestor (1980) introduced Conochitina iklagensis for the similar group of specimens for which Zaslavskaya, earlier at the same year named Rhabdochitina regularis, as acknowledged by Nestor (1980b, p.139). Therefore, R. regularis with priority over C. iklagensis was claimed by Zaslavskaya (1982, p.75). These two species all are here believed to constitute a valid publication with description, definition, indication and designation of a type, satisfying Article 12 of the ICZN (Ride et al. 1985). We prefer to conserve C. iklagensis rather than R. regularis for several consideration. Firstly, the concept of Zaslavskaya's species is difficult in the usefulness not only because of inadequate desription to characterize her species, but also because of the illustration given by Zaslavskaya as silhouette. Secondly Conochitina iklagensis as a well established species has been accepted widely for fifteen years. Therefore, it is not sagacious to resurrect Rhabdochitina regularis to accommodate the group of specimens. It is well known that the Principle of Priority has been using to