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DISTRIBUTION OF CHITINOZOANS IN THE LATE LLANDOVERIAN RUMBA FORMATION (*PENTAMERUS OBLONGUS* BEDS) OF ESTONIA

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ABSTRACT

Nestor, V., 1984. Distribution of chitinozoans in the Late Llandoverian Rumba Formation (*Pentamerus oblongus* beds) of Estonia. Rev. Palaeobot. Palynol., 43: 145—153.

The *Pentamerus oblongus* beds or the Rumba Formation in Estonia were formed during the initial stage of the extensive Late Llandoverian transgression. A remarkable taxonomic diversity despite only a relatively low number of specimens is a characteristic feature of the chitinozoan assemblage of this formation. Through the Rumba Formation succession the species composition is rather uniform. Correlations of the Rumba Formation with some sequences in other areas are made mainly on the basis of the presence of *Conochitina* aff. *proboscifera*, *Eisenackitina dolioliformis* and species of *Cyathochitina*.

INTRODUCTION

The beds with *Pentamerus esthonus* (= *P. oblongus*) in Estonia were distinguished as a stratigraphical unit already by Fr. Schmidt (1858). At the present time they are recognized as the Rumba Formation of the Adavere Stage which is overlain by the marls of the Velise Formation (Jürgenson, 1966; Männil, 1970; Einasto et al., 1972, etc.). The Adavere Stage has been regarded as the regional equivalent of the Upper Llandovery (Kaljo, 1962) and the Rumba Formation is correlated broadly with the *Monograptus sedgwickii* Zone in the graptolitic succession (Nestor, 1972, etc.).

Pentamerus oblongus is very widespread in many regions and the corresponding beds are considered a good correlative level. Investigation of the diverse chitinozoan assemblage of the *Pentamerus* beds will contribute to the tracing of this stratigraphical interval.

It is beyond the scope of the present paper to describe the species but photographs of well-preserved specimens are presented (Plates I—II).

It is worth mentioning that A. Eisenack also described some species of chitinozoans from two outcrops of the Rumba Formation — Päri and Väike-Rôude (Eisenack, 1959, 1968, 1970).

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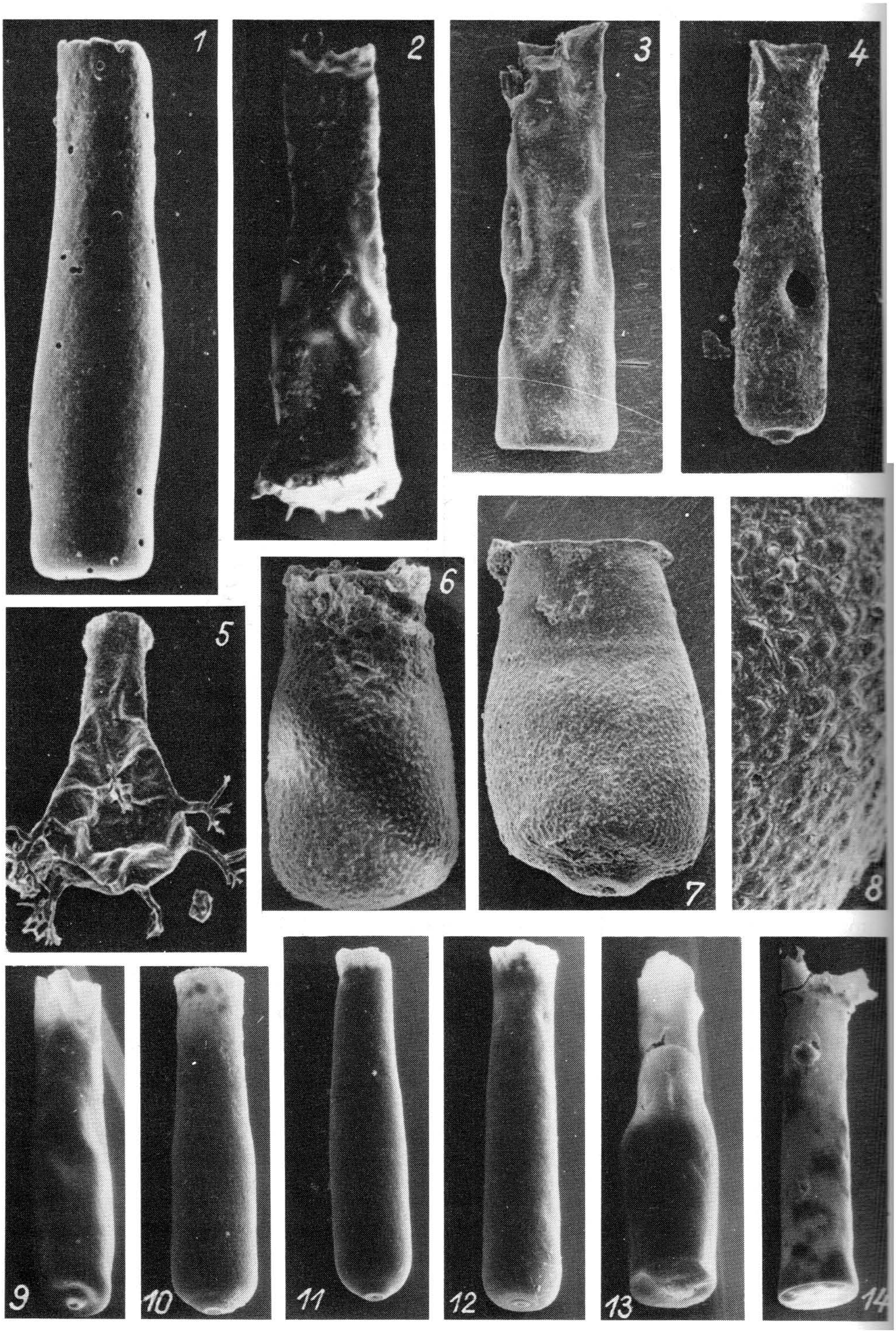
PLATE I



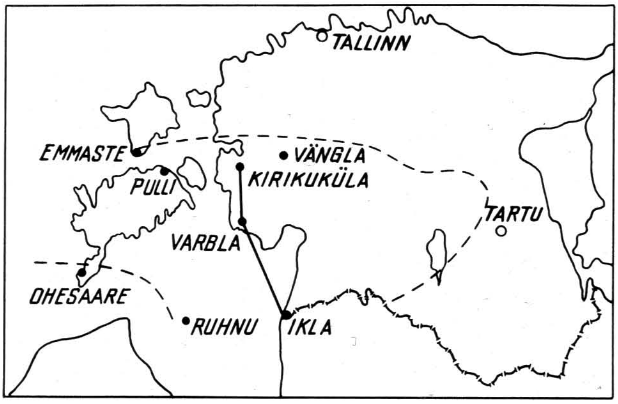


Fig.1. Locality map and limit of the present distribution of the Rumba Formation in Estonia.

GEOLOGICAL SETTING

Lithologically the Rumba Formation consists of nodular limestones with thin intercalations of marls. It has a rich benthic fauna. Within the formation the limestone/marl ratio and the type of bedding change cyclically; up to twelve elementary cycles have been distinguished (Einasto et al., 1972). The Rumba Formation lies transgressively on rocks of the Raikküla Stage and is in most places separated from older strata by a hiatus (Nestor, 1976, etc.). It is overlain by marls or calcareous mudstones of the Velise Formation, which are in places red-coloured in the lower part.

In the borings studied (Figs.1, 2) the thickness of the Rumba Formation does not exceed 20 m; westwards it decreases, and to the southwest (Ohesaare boring) the formation thins out quite rapidly.

PLATE I

1. *Conochitina* cf. *iklaensis* Nestor 1980. Ch 216/1206, Emmaste, 34.56 m. SEM, × 250.
2. *Coronochitina* cf. *fragilis* Nestor 1980. Ch 217/1718, Ruhnu, 489.45 m. SEM, × 310.
3. *Conochitina* sp.4. Ch 219/9233, Pulli, 59.80 m. SEM, × 250.
4. *Conochitina* aff. *C. proboscifera* Eisenack 1937. Ch 227/1141, Ikla, 305.5 m. SEM, × 135.
5. *Ancyrochitina* cf. sp.A. Ch 235/1940, Vängla. SEM, × 250.

6—8. *Eisenackitina dolioliformis* Umnova 1976. 6. Ch 221/1395, Varbla, 141.35 m. SEM, × 310. 7—8. Ch 220/9233, Pulli, 59.8 m. 7. SEM, × 460. 8. Detail of fig. 7. SEM, × 1360.

9—12. *Conochitina* aff. *C. proboscifera* Eisenack 1937. 9. Ch 224/1276, Varbla, 160.15 m. SEM, × 175. 10. Ch 228/1940, Vängla. SEM, × 155. 11. Ch 229/1940, Vängla. SEM, × 135. 12. Ch 230/1940, Vängla. SEM, × 155.

13. *Conochitina*? sp.1. Ch 222/1387, Varbla, 154.7 m. SEM, × 450.
14. *Conochitina* sp.4. Ch 218/1213, Emmaste, 37.3 m. SEM, × 245.

According to the sedimentological model of the Baltic Silurian Basin (Nestor and Einasto, 1977) rocks of the Rumba Formation in western Estonia accumulated mainly in an open-shelf environment at the initial stage of the extensive Late Llandoverian transgression (see Nestor, 1972). It serves as a good horizon for interregional correlation.

ASSEMBLAGE OF CHITINOZOANS

A specific feature of the chitinozoan assemblage of the Rumba Formation is its remarkable taxonomic diversity exhibited by relatively low numbers of specimens. In this respect the Rumba Formation differs from both the underlying Raikküla and the overlying Velise beds. For instance, in the Middle Llandoverian sequence of Ikla boring there appear for the first time six species, and in the Rumba Formation this number is twelve, although thickness of the Middle Llandoverian beds in the Ikla boring exceeds that of the Rumba Formation by approximately nine times. In the Varbla core the corresponding numbers are two and fourteen. Calcareous mudstones and marls of the overlying Velise Formation contain abundant chitinozoans but the species diversity and the number of appearing species do not equal those of the Rumba assemblage.

Through the sequence of the Rumba Formation the species assemblage is rather uniform, but the successions of the appearing species are not the same in different boring sections (Fig.2). This may reflect a generally low frequency of chitinozoans which produces the effect of sporadic occurrence within this interval. Therefore, it is not possible to subdivide the Rumba Formation into formal chitinozoan zonal subunits but based on distribution patterns we can distinguish five groups of species:

(1) Species which occur also in the Raikküla Stage but have not been found above the Rumba Formation: *Conochitina edjelensis*, *C. iklaensis*, *Cyathochitina campanulaeformis*, *C. kuckersiana*.

(2) Species present in the Rumba Formation as well as in older and younger strata: *Ancyrochitina ancyrea*.

(3) Species found so far only in the Rumba Formation: *Ancyrochitina* sp.A, *A.* cf. sp.A, *A.* sp.B, *A.* aff. *convexa*, *Coronochitina* cf. *fragilis*, *Conochitina*? sp.1, *C.* sp.2, *C.* aff. *emmastensis*.

PLATE II

1—2. *Ancyrochitina* sp.A. 1. Ch 226/1135, Ikla, 309.2 m. SEM, × 250. 2. Ch 225/1385, Varbla, 159.5 m. SEM, × 310.

3. *Ancyrochitina ancyrea* (Eisenack 1931). Ch 234/1940 Vängla. SEM, × 335.

4. *Conochitina emmastensis* Nestor 1980. Ch 233/1940, Vängla. SEM, × 295.

5—6. *Conochitina* aff. *C. emmastensis* Nestor 1980. Ch 223/1273, Varbla, 155.0 m. 5. SEM, × 215. 6. Detail of fig. 5. SEM, × 2700.

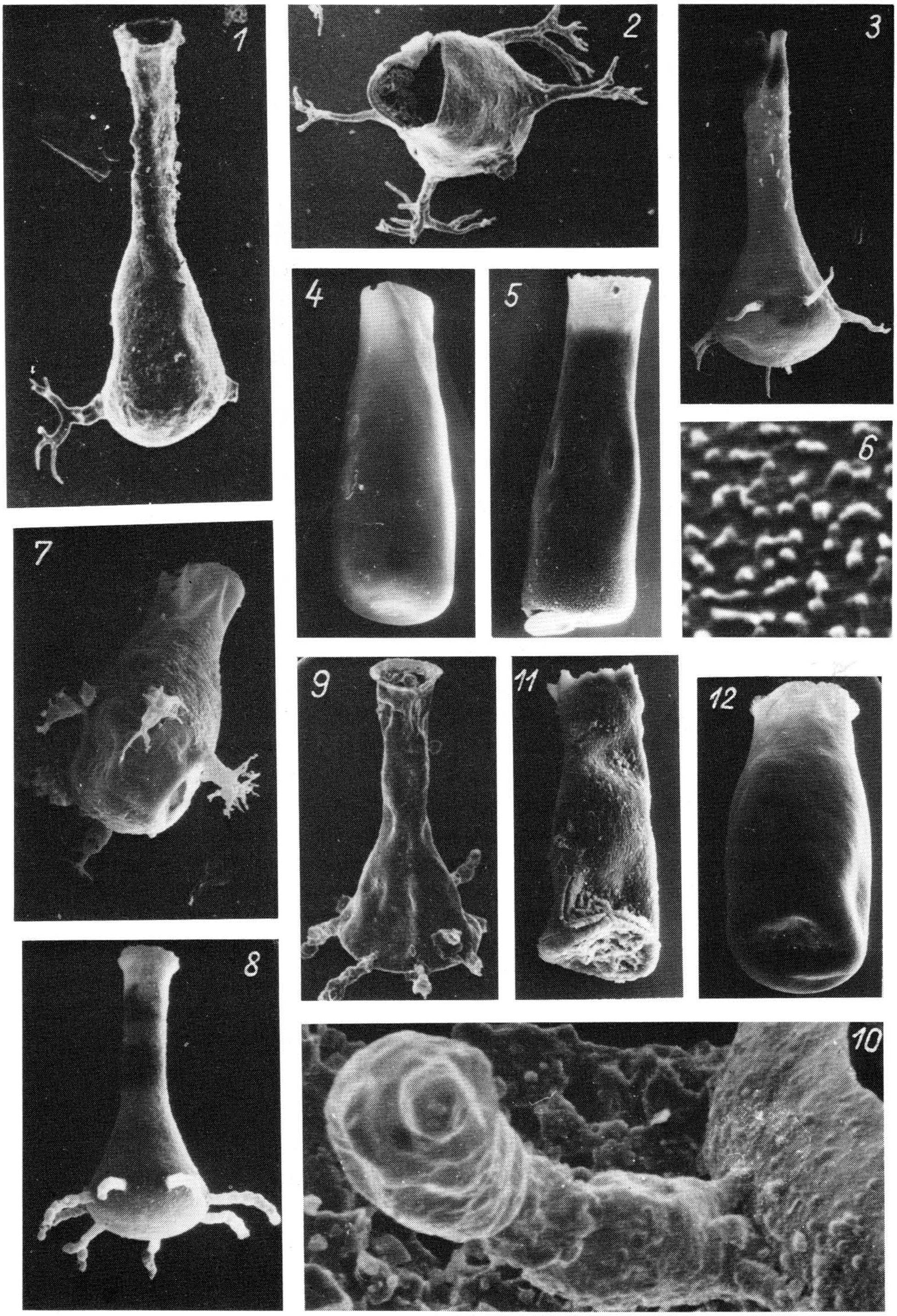
7. *Ancyrochitina* aff. sp.A. Ch 236/1940, Vängla. SEM, × 335.

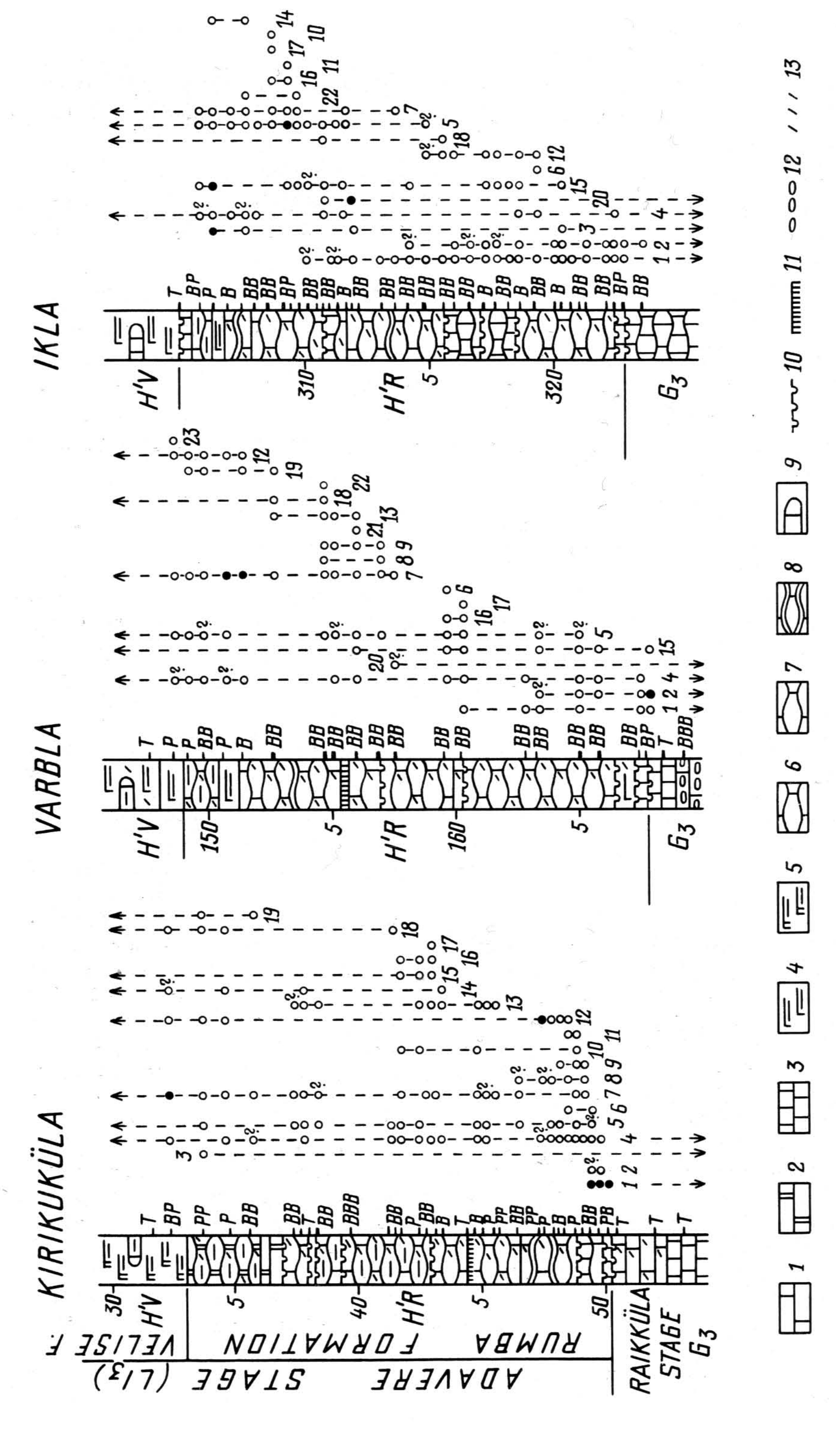
8—10. *Ancyrochitina* sp. B. Vängla. 8. Ch 237/1940. SEM, × 285. 9. Ch 238/1940. SEM, × 310. 10. Ch 239/1940. SEM, × 2040.

11. *Conochitina*? sp.3. Ch 231/1085, Kirikuküla, 25.6 m. SEM, × 320.

12. *Conochitina* sp.5. Ch 232/1940, Vängla. SEM, × 345.

PLATE II




KIRIKUKÜLA
VARBLA
IKLA
ADAVERE STAGE
RUMBA FORMATION
RAIKKÜLA STAGE
G3
H'V
H'R

(4) Species occurring also in the Velise Formation: *Conochitina*; sp.3, *C.* sp.4, *C.* sp.5, *C.* aff. *proboscifera.*

(5) Species ranging from the Rumba Formation into the Jaani Stage (Wenlock): *Eisenackitina dolioliformis, Ancyrochitina primitiva, Pterochitina macroptera.*

As chitinozoans generally occur in small numbers, it is difficult to recognize the dominating taxa among the species of the Rumba Formation. However, *Conochitina emmastensis* and *Eisenackitina dolioliformis* are numerous.

It is worth mentioning that in the lower part of the Velise Formation *Conochitina* aff. *proboscifera, C*? sp.3, *C.* sp.4 and *C.* sp.5 disappear from the sequence. At the same level, above the red-coloured marls, appear *Angochitina longicollis, Conochitina proboscifera* (type form), *C.* cf. *leptosoma* and *Desmochitina densa.* In the Ohesaare boring this interval is characterized by graptolites and considered to correspond to the *Monoclimacis griestonensis* Zone (Kaljo, 1970).

CORRELATIONS

To some extent chitinozoans occur also in the graptolitic sequence of the East Baltic Middle Llandovery, although their abundance and diversity decrease considerably in the graptolitic rocks. In the Ventspils boring in western Latvia, R. Ulst (unpublished data) has distinguished three graptolite zones within the interval from 851.5 to 862.5 m: *D. triangulatus, M. convolutus* and *M. sedgwickii* without precise boundaries between them. A meter below the top of the *M. sedgwickii* Zone (851.5 m) at the depth of 852.5 m

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Fig.2. Distribution of chitinozoans of the Rumba Formation in some boring sections of Estonia.

Chitinozoan species: *1* = *Conochitina iklaensis* Nestor; *2* = *Conochitina edjelensis* Taugourdeau; *3* = *Cyathochitina* cf. *kuckersiana* (Eisenack); *4* = *Ancyrochitina ancyrea* (Eisenack); *5* = *Conochitina emmastensis* Nestor; *6* = *Coronochitina* cf. *fragilis* Nestor; *7* = *Eisenackitina dolioliformis* Umnova; *8* = *Conochitina*? sp.1; *9* = *Conochitina* sp.2; *10* = *Ancyrochitina* cf. sp.A; *11* = *Ancyrochitina* aff. *A. clathrospinosa* Eisenack; *12* = *Conochitina* sp.4; *13* = *Conochitina* aff. *C. emmastensis* Nestor; *14* = *Conochitina* sp.5; *15* = *Conochitina* aff. *C. proboscifera* Eisenack; *16* = *Ancyrochitina* sp.A; *17* = *Ancyrochitina* sp.B; *18* = *Ancyrochitina primitiva* Eisenack; *19* = *Conochitina*? sp.3; *20* = *Cyathochitina campanulaeformis* (Eisenack); *21* = *Pterochitina macroptera* Eisenack; *22* = *Ancyrochitina* aff. *A. convexa* Nestor; *23* = *Desmochitina densa* Eisenack.

Legend to the lithological columns: *1* = limestone; *2* = dolomite; *3* = micro- and cryptocrystalline limestone; *4* = calcareous mudstone and marl; *5* = dolomitic marl; *6* = nodular limestone with thin interlayers of marl; *7* = nodular argillaceous limestone; *8* = nodular limestone with thick interlayers of marl; *9* = marls with limestone nodules; *10* = discontinuity; *11* = bentonite; *12* = conglomerate; *13* = skeletal detritus.

Organic-walled microfossil associations in the samples: *B, BB* = benthic elements (mainly scolecodonts) prevailing. (the number of letters stands for the stage of prevalence); *BBB* = absence of planktic elements; *P, PP* = planktic elements (mainly chitinozoans) prevailing; *T* = samples containing no organic-walled microfossils.

there occur chitinozoans typical of the Rumba Formation namely *Conochitina emmastensis*, *Eisenackitina dolioliformis*, and *Conochitina iklaensis*. Lower in the section typical Middle Llandoverian species (*Coronochitina maennili*, *Ancyrochitina* cf. *convexa*, etc.) are present. Overlying red-coloured marls considered as stratigraphical analogues of the Velise Formation do not contain chitinozoans. These data confirm the correlation of the Rumba Formation with mainly the *M. sedgwickii* Zone.

In the basal part of the Restevo Beds in Podolia Laufeld (1971) identified *Conochitina proboscifera*, *C.* n.sp.1 (= *Eisenackitina dolioliformis*) and *Angochitina longicollis* which constitute a chitinozoan assemblage typical for the Velise Formation. Analogues of the Rumba Formation are probably lacking there.

From the British Llandovery data on chitinozoans are available from the upper part of the Telychian Stage (C5—C6). *Conochitina proboscifera* and *Angochitina longicollis* have been identified from these strata (Aldridge et al., 1979; Mabillard, 1981), which allow us to correlate these beds with the Velise Formation.

In the Anticosti sequence (Achab, 1981) equivalents of the Rumba Formation should be present within the Jupiter Formation, based on the presence of *Cyathochitina campanulaeformis*, *C. kuckersiana*, *Conochitina* cf. *proboscifera*, *C.* sp.3 and *C.* sp.4 (Plate IV, 14 = *Eisenackitina dolioliformis*?) in the lower members (M1—M4) of the formation and also due to the absence of specific Velise species (*Angochitina longicollis*, *Conochitina proboscifera*, typical form). Besides, as compared with the older Anticosti formations, species diversity and abundance increase considerably in the Jupiter Formation (Achab, 1981) which is also characteristic of the Rumba Formation.

The chitinozoan succession in the Mehaigne area of the Brabant Massif, Belgium, has been described by Verniers (1982). As the basis for correlation with the Rumba Formation could serve the presence of atypical thin-walled *Conochitina proboscifera* and the appearance of an abundant *Eisenackitina* association (*E.* sp.A, *E.* sp.C, etc.) in member MB 3A (upper part of the B2 zone). In the Silurian chitinozoan succession of Estonia *Eisenackitina* occurs abundantly for the first time in the Rumba Formation. The appearance of *Conochitina proboscifera* (typical form) and *Angochitina longicollis* in member MB 3C (zone C) permits correlation of this level with the Velise Formation.

Among the chitinozoan biozones distinguished by Paris (1981) in south-west Europe, zone 19 may possibly be related to the Rumba level, because of the occurrence of *Cyathochitina* (sp.B) and atypical *Conochitina proboscifera* in the Lande—Murée Formation of the Armoricain Massif. It is necessary to mention that the chitinozoan zone 19 there is associated with the graptolite zone of *M. turriculatus*.

However, although there are general similarities between these chitinozoan assemblages, the correlations proposed above will remain provisional because of scarcity and certain contradictions of the available data.

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