

An aberrant encrusting graptolite from the Ordovician of Estonia

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An organic microfossil, *Erecticamara maennili* gen. et sp. n., superficially similar to some imperfectly preserved chitinozoans, is described as an aberrant camaroid graptolite from the Lower Ordovician Kunda Stage, Aluoja Substage, of the Tallinn area, North Estonia. Its elongated, bottle-shaped or subconical thecae, interpreted as autothecae, are differentiated into a broader proximal part (camara), provided with a convex, rarely flat, bottom, and a narrower distal one (collum), devoid of any kind of apertural processes. The wall of the fossil is made of the fusellar tissue; irregularly distributed oblique sutures of fuselli are not arranged in a zigzag line. A sudden change of fuselli width leading to an appearance of the microfusellar tissue is sometimes observed in the distal part of the tube. The presence of primitive cortex (paracortex? pseudocortex?) is suggested. Robust, elongated vesicles are found inside two autothecae and interpreted as a dormant structure, tentatively compared with cysts of crustoid graptolites or a blastocrypt of graptoblasts. Its upper wall is situated between the camara and collum and looks like a sclerotized diaphragm described in other camaroids. The fossil unites certain characters of cephalodiscid pterobranchs and camaroid graptolites but is not interpreted as truly transient link between these two hemichordate groups.

Key words: Graptolites, Camaroidea, microfossils, ultrastructure, dormancy, Lower Ordovician, Estonia.

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Introduction

Remnants of encrusting graptolites are among the rarest acid-resistant microfossils. Almost all literature devoted to these poorly known fossils deals with specimens chemically extracted from Ordovician rocks of the Baltic region. Besides, the majority of them were described by Kozłowski (for example 1949, 1962, 1971) from the upper Tremadoc beds of Poland and Ordovician erratic boulders found in Pleistocene glacial

deposits. Many points of their morphology, astogeny and colony organization are far from clear. Moreover, both their stratigraphic and palaeogeographic record is scanty. It has been claimed that the evolution of encrusting graptolites from common ancestor with recent pterobranchs was by a process of gradual change. Unfortunately, no precise lineage can yet be traced. Thus, the explanation of the phylogenetic relationships between different orders of sessile non-dendroid graptolites and pterobranchs is still very difficult (e.g., Mierzejewski 1985; Urbanek 1986; Bengtson & Urbanek 1986; Chapman *et al.* 1996). This paper deals with a peculiar Ordovician acid-resistant microfossil described as *Erecticamara maennili* gen. et sp. n., displaying a mosaic combination of some morphological and ultrastructural characters of cephalodiscid pterobranchs and some encrusting graptolites.

There is a superficial resemblance between *Erecticamara* and some poorly preserved conical representatives of the Chitinozoa, especially of the genus *Conochitina* Eisenack, 1931. However, because of the presence of the fusellar structure and, in some cases, an attachment surface, it is interpreted as an encrusting graptolite, most probably of the order Camaroidea.

The Camaroidea was proposed by Kozłowski (1938) on the basis of very rich and excellently-preserved material from the upper Tremadoc beds of the famous locality in Wysoczki (Holy Cross Mountains, Poland). Camaroid graptolites are characterized as comprising encrusting forms with autothecae composed of an inflated proximal portion (camara) provided with a structureless attachment surface (sole), and a distal erect, tubular portion (collum). As a rule camaroid rhabdosomes are devoid of bithecae, whereas stolothecae are usually in the form of peculiar extracameral tissue filling the space between adjacent camarae (Kozłowski 1938, 1949). The shape of their colonies and mode of development are completely unknown. All known specimens of camaroid graptolites were recovered from early Ordovician rocks of the Baltic region. For a half-century, there were known only five camaroid genera erected by Kozłowski (1949). They are assigned to two families, namely Bithecocamaridae and Cysticamaridae, recognized by Bulman (1955). Recently, the enigmatic Ordovician (and Silurian?) organic microfossil *Xenotheka* Eisenack was identified as another representative of the order Camaroidea (see Mierzejewski 2000).

Material and methods

The material comes from a well-known exposure of late Lower Ordovician deposits in North Estonia, situated at the southern entrance of the now-abandoned quarry in the area of Sukhrumägi (Tallinn). This locality was described by several authors (for references see Grahn 1984). The present writer visited and sampled this section in 1985 during his stay at the Institute of Geology (previously of the Estonian SSR Academy of Sciences, now Technical University, Tallinn). Specimens of the described graptolite were etched out by means of 10% formic acid from a sample (ca. 0.5 kg) of the grey, fine organodetritic limestone of the Aluoja age, Kunda Regional Stage (= upper *Didymograptus 'bifidus'* Zone). In addition, the following acid-resistant organic fossils were recorded in the sample: acritarchs, chitinozoans, hydroid *Rhabdohydra tridens* Kozłowski, 1959, polychaete jaws, rhabdopleurid pterobranch *Kystodendron*

sp., tuboid graptolite *Epigraptus kozłowskii* Mierzejewski, 1978, and fragments of unidentified dendroid graptolites.

All specimens of *Erecticamara maennili* were cleaned of mineral impurities by immersion in a 20% solution of hydrofluoric acid for 48 hours, then studied in an optical microscope in transmitted visible and infrared light. Two specimens were embedded in epoxy resin and cut by means of the L.K.B. Pyramitome. The sections obtained, of an approximate thickness of 2 μm , were studied with an optical microscope. The remaining specimens, selected for scanning electron microscopy, were washed in distilled water and dehydrated in graded ethanol solutions. They were mounted on SEM stubs and coated with gold, then investigated with Cambridge Stereoscan 180 at 30 kV. The described material is deposited at the Institute of Paleobiology of the Polish Academy of Sciences, Warsaw (abbreviated as ZPAL).

The terminology used in the description is adopted from Kozłowski (1949) and Bulman (1970).

Systematic paleontology

Phylum Hemichordata Bateson, 1885, emend. Fowler, 1892

Class Graptolithina Bronn, 1849

Order Camaroidea Kozłowski, 1938

Incertae familiae

Genus *Erecticamara* gen. n.

Type species: *Erecticamara maennili* sp. n.

Derivation of the name: Latin, *erectus* (= raised up), referring to the shape of the camara, and Greek, *kāmara* (= space enclosed by an arch, vaulted room), the standard ending of the camaroid graptolite generic names proposed by R. Kozłowski.

Diagnosis. — As for the type species.

Remarks. — The genus is monotypic, erected to include *Erecticamara maennili* sp. n.; stratigraphic and geographic range as for the type species. The family membership is unknown since the form presented here does not suggest any obvious affinities with other better known camaroids.

Erecticamara maennili sp. n.

Figs. 1–5.

Holotype: The specimen (an isolated autotheca) figured in Fig. 1 (ZPAL G/XXIV/5).

Type locality and type stratum: The abandoned quarry in the area of Suhkrumägi (Tallinn), Aluoja substage of Kunda Regional Stage.

Derivation of the name: In honour of the late Dr. Ralph Männil (1927–1989), an Estonian geologist and student of acid-resistant microfossils.

Diagnosis. — Encrusting graptolite with slender, bottle-shaped or subconoidal autothecae more or less differentiated into an erect, broad proximal part (camara), provided with a small stolonial opening, and a narrow distal part (collum), with an aperture devoid of any kind of apertural processes. The bottom of the camara convex with small camaral processus or in form of a small, flat sole.

Material. — Nine isolated autothecae (ZPAL G/XXIV/1-9), all etched from matrix.

Description. — Two forms of autothecae are represented in the material; one, spindle-shaped, with convex, subconoidal bottom of the camara (Fig. 1A, B, E), and the other, with the flattened, small

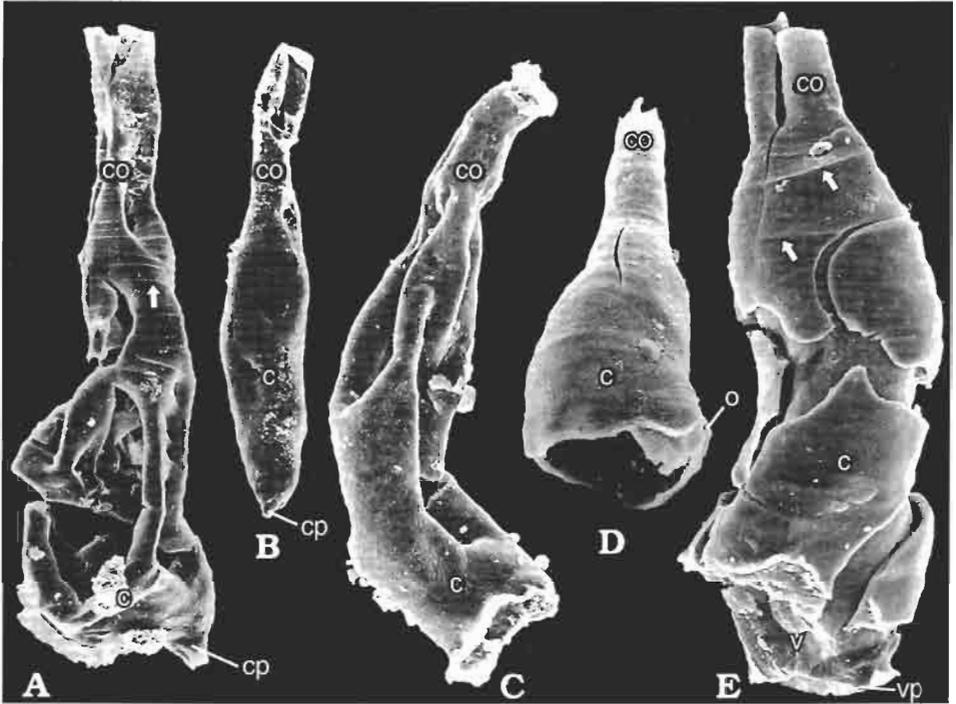


Fig. 1. *Erecticamara maennili* gen. et sp. n. Lower Ordovician (Kunda Stage, Aluoja Substage), Sukhrumägi in Tallinn (Estonia). SEM micrographs of isolated autothecae, lateral views. **A, B.** Spindle-shaped autothecae (devoid of soles); $\times 100$ (ZPAL G/XXIV/1) and $\times 60$ (ZPAL G/XXIV/2), respectively. **C, D.** Subconoidal autothecae (provided with soles); $\times 100$ (ZPAL G/XXIV/3) and $\times 70$ (ZPAL G/XXIV/4), respectively. **E.** Holotype (spindle-shaped autotheca with inner vesicle); $\times 80$ (ZPAL G/XXIV/5). Abbreviations: **c**, camara; **co**, collum; **cp**, camaral processus; **o**, opening for autothecal stolon; **v**, inner vesicle; **vp**, vesicular processus; arrows indicate fusellar ridges.

sole (Fig. 1C, D). In different specimens one cannot observe forms of camarae intergrading between these two extreme types. Some autothecae are infilled with pyrite (Fig. 3B).

The holotype is an isolated autotheca, belonging to spindle-shaped forms (Fig. 1E). It resembles a slightly irregular bottle having a rounded body (camara) with a convex bottom, and a comparatively short and narrow neck (collum). The bottom of the camara was shaped like a broad cone provided with a small, circular opening. The aperture of the collum is misshapen but presumably was devoid of any kind of apertural processes (Figs. 1E, 2A). The boundary between the camara and the collum is sometimes very distinct as a consequence of the change in their diameter as well as of a sudden change in fuselli width. In some cases, the camara fluently passes into the collum and the width of their fuselli changes gradually (Fig. 1A). The fuselli appear as more or less visible ridges on the periderm surface and are particularly prominent on the collum and on the uppermost part of the camara (Figs. 1, 2, 3C). They are arranged irregularly over the entire length of the autotheca and taper irregularly at different places forming oblique sutures, which are not, however, arranged in a zigzag line. Dimensions of the holotype: total length 0.95 mm, maximal width of camara 0.29 mm and of the collum 0.14 mm, width of fuselli 0.08–0.10 mm and of microfuselli ca. 0.01 mm. The remaining autothecae attain length from 0.35 to 1.05 mm and maximal width of camarae – 0.35 mm.

The autothecal cavity of two specimens (including the holotype) contains an intriguing body in the form of a closed vesicle (Figs. 1E, 2B, 3A). These structures are large, oblong and almost com-

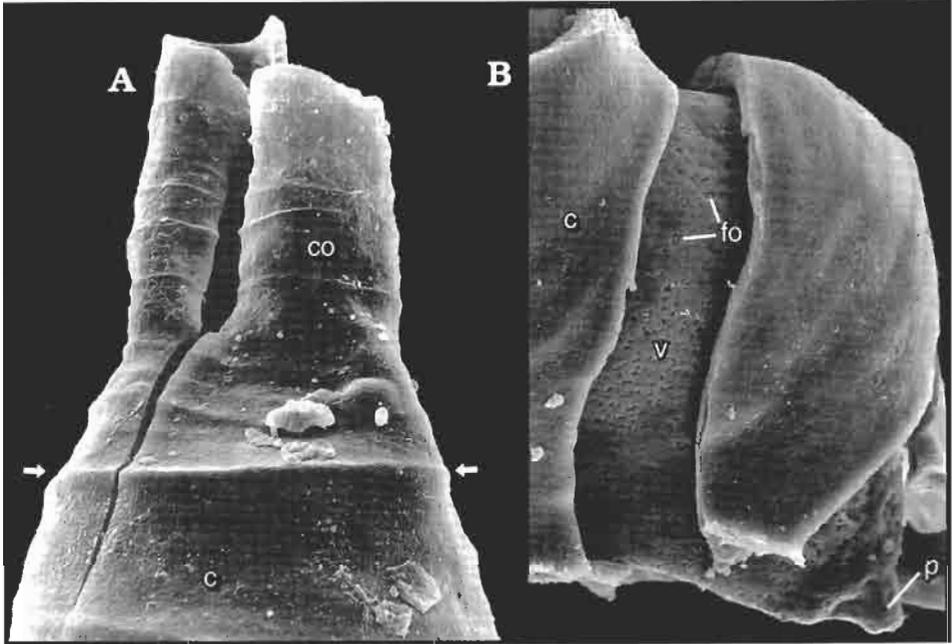


Fig. 2. *Erecticamara maennili* gen. n., sp. n. Lower Ordovician (Kunda Stage, Aluoja Substage), Sukhrumägi in Tallinn (Estonia). SEM micrographs. Details of holotype (ZPAL G/XXIV/5). **A.** Distal part of autotheca showing distinct fusellar ridges. Arrows indicate boundary between camara built of typical fusellar tissue and collum composed of microfuselli; $\times 250$. **B.** Proximal part of camara revealing inner vesicle; $\times 250$. Abbreviations: c, camara; co, collum; fo, foramina in vesicle wall; p, process of inner vesicle; v, inner vesicle.

pletely fill the camarae. Their robust walls adhere closely to those of the autothecae. Locally, the adhesion of the walls is so strong that looks like a fusion, even in microtome longitudinal sections (Fig. 3A). The separation of the autothecal periderm and the vesicle wall is clearly seen in SEM (Figs. 1E, 2B, 3C, D). The basal part of the vesicle preserved inside the holotype is convex and terminates in a short processus (Figs. 1E, 2B). It assumes the shape of the above mentioned proximal portion of the autotheca. The vesicle expands up to the very beginning of the collum as it was seen in infrared and in longitudinal microtome sections. The upper wall of the vesicle looks like a transverse diaphragm between the camara and collum (Fig. 3A). The inner cavity of the vesicle illustrated in Fig. 3A contains an irregular accumulation of organic matter. This material is partly fused with the vesicle wall and composed of globular bodies.

Bithecae, sclerotized stolonal sheaths or extracameral tissue are unknown.

Remarks. — *E. maennili* does not resemble any encrusting graptolite so far described because of the peculiar shape of its autothecae. It should be stressed that autothecae of almost all hitherto known encrusting graptolites are sharply differentiated as a rule into a distinct, proximal creeping portion and, except for *Cysticamara accollis* Kozłowski, 1949, a distal erect portion. The autotheca of *E. maennili* is completely devoid of a creeping portion.

All described specimens possibly originated from a single colony which was disintegrated during solution of the matrix. Unfortunately, the lack of better preserved material makes it rather difficult to reconstruct the general shape of the colony. However, one may presume that it was in the form of a bulky mass or cake, and composed of loosely set, vertically directed autothecae which were connected by irregular system of stolons and more or less completely embedded in the extracameral tissue (Fig. 5).

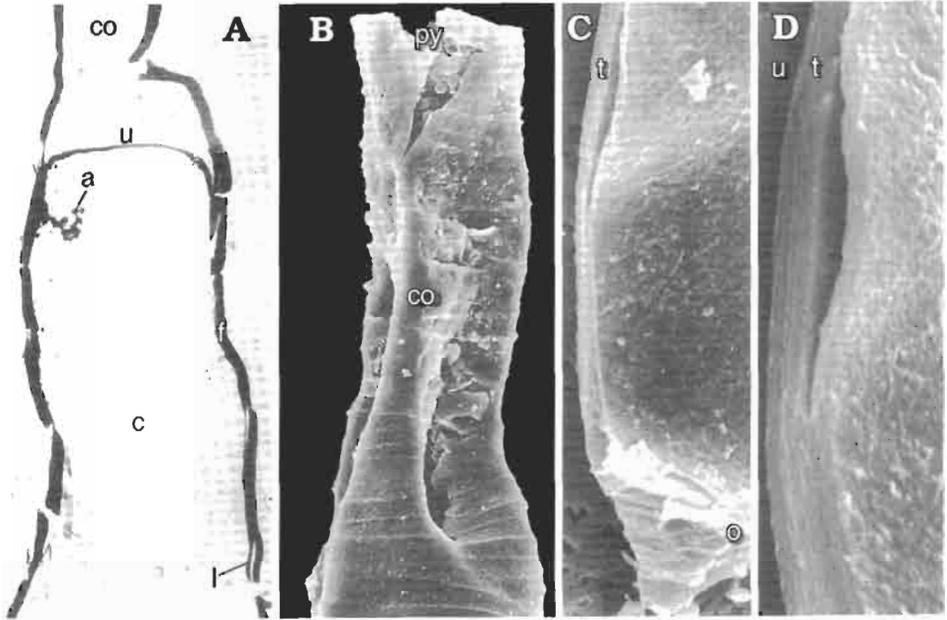


Fig. 3. *Erecticamara maennili* gen. et sp. n. Lower Ordovician (Kunda Stage, Aluoja Substage), Suhkru-mägi in Tallinn (Estonia). **A.** Light micrograph showing fragment of longitudinal microtome section cut through part of collum and camara containing inner vesicle; $\times 167$ (ZPAL G/XXIV/6). **B–D.** SEM micrographs. **B.** Details of the microfusellar structure of the collum; $\times 295$ (ZPAL G/XXIV/1). **C.** Broken periderm showing distinct traces of lamination; $\times 930$ (ZPAL G/XXIV/5). **D.** Enlargement of area outlined on C; $\times 1500$. Abbreviations: **a**, accumulation of unknown organic substance; **c**, camara; **co**, collum; **f**, periderm fused with lateral wall of vesicle; **l**, lateral wall of inner vesicle; **o**, area of obliquely broken periderm; **p**, periderm; **t**, area of transversally broken periderm; **py**, pyrite; **u**, upper wall of inner vesicle.

The inner vesicles found inside autothecae of *Erecticamara* are of special interest. Most likely they may be interpreted as peculiar dormant structures. There is a great resemblance between the vesicles and the cysts of crustoid graptolites described and illustrated by Kozłowski (1962) or to the blastocrypt of graptoblasts studied in detail by Urbanek *et al.* (1986). Moreover, in longitudinal microtome sections through autothecae, the upper wall of the vesicle looks exactly like sclerotized diaphragms of camaroid graptolites (see Kozłowski 1949: pl. 26: 8). Last of all, the processus of the inner vesicle may be regarded as a homologue of a graptoblast filum. Undoubtedly, the finding of these vesicles in *Erecticamara* makes a contribution to the poorly known question of dormancy in the Camaroidea. This subject, however, is outside the scope of the present paper and will be discussed elsewhere (Mierzejewski in preparation). So far, the problem of dormancy in camaroids was discussed only by Kozłowski (1949, 1971) and Urbanek (1983, 1986).

The organic material filling the cavity of the inner vesicle seems to be fully comparable with similar structures described in some camaroids (Kozłowski 1949; Mierzejewski 2000), crustoids (Urbanek & Mierzejewski 1984) and graptoblasts (Crowther *et al.* 1987). But first of all, it strikingly resembles clusters of minute spherules found inside cysts of sterile buds of the Ordovician rhabdopleurid pterobranch *Kystodendron longicarpus* (Eisenack, 1937) *sensu* Kozłowski described by Mierzejewski (1986: p. 184, pl. 28: 11B, 31–33). This material seems to correspond to yolk matter known from modern species of the pterobranch *Rhabdopleura* (see Stebbing 1970: p. 210, fig. 6).

Occurrence. — Lower Ordovician, Aluoja Substage of Kunda Stage, North Estonia.

Fine structure of *Erecticamara*

The condition of the periderm is diversified. In general, except for numerous cracks and fissures due to the state of preservation, the periderm is smooth, almost enamel-like (Figs. 1, 2, 3B). There is no evidence for the ribbon-like units of secretion, i.e., cortical bandages, or other secondary deposits over the primary fusellar layer. The presence of very fine, narrow fuselli in the periderm of the collum is a noteworthy feature among graptolites (Figs. 2A, 3B). Undoubtedly, they represent microfusellar tissue, a peridermal material recognized and carefully studied by Urbanek (for example 1976b) in a few graptoloid graptolites. Similarly, as in these graptolites, microfuselli of *E. maennili* built the most distal portion of the autotheca.

The fine structure of the periderm is not easily recognized because of the poor differentiation of the material. Under a light microscope, longitudinal microtome sections of the autothecal wall appear completely featureless, and it is impossible to recognize boundaries between succeeding fuselli (Fig. 3A). Moreover, the boundary between the periderm and the vesicle wall is discernible only locally in as a short, narrow fissure. In the SEM, the broken periderm appears distinctly laminated (Fig. 3C, D). It is clearly made of numerous, tightly packed layers. No traces of any fibrillar material were found. It was impossible to recognize if the layers of periderm were made of only multiple sheets or of sheets with little or ill-defined intersheet material.

The fine structure of the periderm in *Erecticamara* differs greatly from that in other camaroid graptolites. Urbanek & Mierzejewski (1991) and Mierzejewski (2000) found that the periderm of the studied camaroids (*Tubicamara coriacea* Kozłowski and *Xenotheka klinostoma* Eisenack) is made of rather typical fusellar and cortical components. Moreover, in the case of *Xenotheka*, both tissues were excellently discernible in microtome thin sections under a light microscope. No traces of typical cortical and fusellar material were recognized in the autothecal wall of *Erecticamara*. At first glance, these differences in the fine structure appear to be substantial. However, the multilayered structure recognized in the periderm of the graptolite under discussion may be interpreted as closely related to the cortex of crustoid graptolites. The ultrastructure of the crustoid periderm was studied in detail by Urbanek & Mierzejewski (1984). According to their observations, the crustoid cortex is diversified and made of multiple sheets separated by an intersheet material in the form of condensed meshwork of fibrous material (paracortex) or completely devoid of fibrous material (pseudocortex).

The poor differentiation of the periderm fine structure may be very significant. As was observed by Rickards *et al.* (1984), the periderm of Silurian *Rhabdopleura hollandi* Rickards *et al.* shows no trace of ultrastructure under the SEM. Moreover, Urbanek *et al.* (1992) found that zooidal tubes of Cambrian *Rhabdotubus johanssoni* Bengtson & Urbanek are made of almost completely homogenous substance. They were of the opinion that the presence of homogenous material indicates 'an abundance of ground substance and a relative scarcity of the fibrous component – an essentially rhabdopleurid, or more generally a pterobranch feature' (Urbanek *et al.* 1992: p. 349). On the other hand, one cannot exclude that the structureless character of the skeletal layers is actually secondary.

The vesicle wall, studied by means of optical microscopy, seems to be made of completely homogenous material, similar to that of the periderm (Fig. 3A). In the

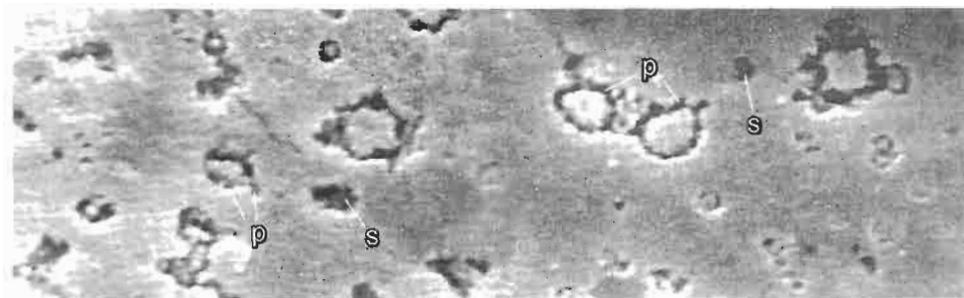


Fig. 4. *Erecticamara maennili* gen. et sp. n. Lower Ordovician (Kunda Stage, Aluoja Substage). Suhkru-mägi in Tallinn (Estonia). Outer surface of inner vesicle revealing perforations. Note characteristic ring-like structures composed of primary foramina (p) and secondary foramina (s) originated due to fusion of primary ones; SEM micrograph, $\times 2400$ (ZPAL G/XXIV/5).

SEM, one may observe that the cyst surface is rather evenly perforated by a large number of minute foramina (Figs. 2B, 4). Their presence is even observed on the basal processus of the cyst. One may distinguish two types of these apertures:

(1) Primary foramina with a diameter less than $0.5 \mu\text{m}$. They are usually arranged in quite regular assemblages forming subcircular patterns. Each assemblage is made of a dozen or so foramina (Fig. 4, p).

(2) Secondary foramina, undoubtedly originated due to the fusion of the primary foramina (Fig. 4, s). In general, they are about 2.0 to $5.5 \mu\text{m}$ in diameter.

SEM observations did not show whether these foramina lead only to depressions in the wall or to a system of canaliculi. The inner surface of the cyst is unknown, thus it is no known if it was also foraminate.

The nature of the pits within the inner vesicle surface is rather an open question. One possibility is that they were caused by parasitic microorganisms, as it is observed in numerous organic microfossils (e.g., chitinozoans and other plant fossils, scolecodonts, graptolites). The perforations of these fossils are generally attributed to bacteria and parasitic fungi. However, there is a significant difference. According to Wrona (1980), who studied borings in vesicles of the Chitinozoa, there are fewer than twenty borings randomly distributed per specimen and they are distinctly larger than in the cyst under discussion. Moreover, foramina of *Erecticamara* differ markedly in morphology and dimensions from those of the Ordovician alleged cephalodiscid pterobranch (aberrant camaroid graptolite?) *Pterobranchites antiquus* Kozłowski (for comparison see Mierzejewski 1984: pl. 23: 4). On the other hand, there is possibly an alternative interpretation of the pits as channels for metabolite transport.

General remarks

Some characters of *Erecticamara*, particularly differentiation of the autotheca into two portions, one broader provided with the small opening in the base, presumably for a stolon, and the other, narrower, in form of a slender tube, suggest that it was of a camaroid graptolite. However, it should be stressed that *Erecticamara* departs in

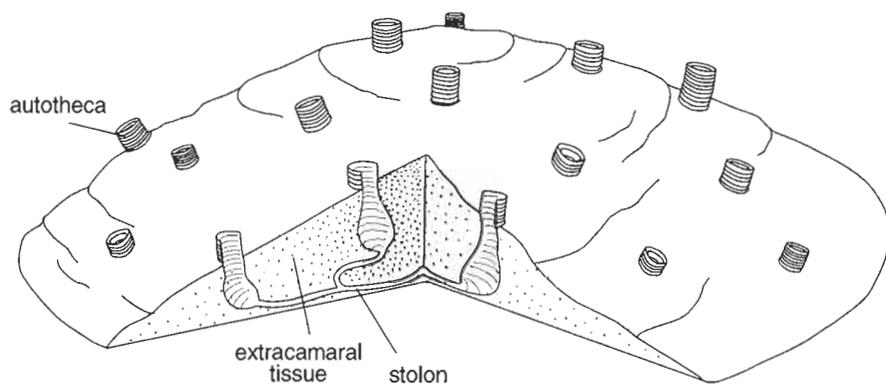


Fig. 5. *Erecticamara maennili* gen. et sp. n. Diagrammatic restoration of a colony.

some other respects from typical camaroids. These features of *Erecticamara* deserve particular attention and are as follows:

(1) The proximal portion of the autotheca, i.e. camara, is not creeping as in all known so far camaroid graptolites (Kozłowski 1949, 1966; Bulman 1955, 1970) but erect.

(2) The most proximal end of the camara is often distinctly convex, i.e. devoid of flattened part, namely the structureless lower layer characteristic for camaroid autothecae (Kozłowski 1949), and it means that the some autothecae do not adhere with one side to the substratum.

(3) Fuselli are irregular in form and spacing and there is the lack of a zigzag suture formed by fusellar bands, which marks the plane of the bilateral symmetry of the camaroid graptolite autotheca (Kozłowski 1949, 1966).

(4) There are no traces of the typical cortical tissue (eucortex), i.e. secondary deposits in the graptolite skeletal tissues made of the well defined cortical fibrils and sheets, observed in camaroids by Urbanek & Mierzejewski (1992) and Mierzejewski (2000).

(5) Secondary deposits of the periderm are presumably made only of several sheets with ill-defined intersheet material and represent paracortex or pseudocortex in terminology of Urbanek & Mierzejewski (1984).

It is remarkable that all the mentioned features, differing *Erecticamara* from the typical camaroid graptolites, appear to be characteristic for some recent representatives of the pterobranch order Cephalodiscida. For example, the zooidal tubes of *Cephalodiscus (Orthoecus) solidus* Andersson or *C. (O.) rarus* Andersson are in form of elongated subcylindrical, erect structures embedded in the common coenecial tissue (Fig. 6). The proximal part of the tube is ended with a blind, convex, sometimes bulbous bottom, and does not adhere to the substratum (e.g., John 1931). The periderm of cephalodiscids is made of irregular fuselli and devoid of the zigzag suture (Kozłowski 1949, 1966). Ultrastructural studies on the skeletal tissues of *Cephalodiscus* demonstrated that the secondary deposits in its periderm are in form of densely packed sheets and devoid of layers composed of typical cortical fibrils (Urbanek 1976a and unpublished SEM observations of Dilly, Urbanek & Mierzejewski).

Thus, one may say that the encrusting graptolite here described likewise realizes a stage intermediate morphologically between the Cephalodiscida and the Camararoidea because it combines in a mosaic fashion some characters of both orders. However, there

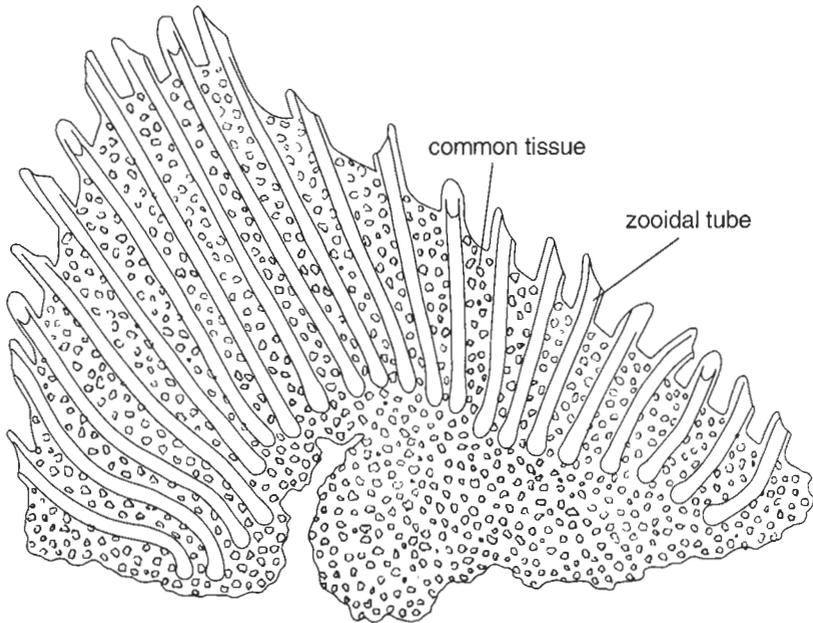


Fig. 6. *Cephalodiscus (Orthoecus) solidus* Andersson, Recent. Diagrammatic representation of a vertical section through the middle of a colony (from Ridewood 1916).

is little basis for speculation concerning the intriguing possibility that these two hemichordate groups may be closely related. According to Kozłowski (1938, 1949, 1966), the Rhabdopleurida rather than the Cephalodiscida were more closely related to the Graptolithina. Urbanek (1994: p. 18) wrote that: 'it is little likely that the graptolite skeleton could generally be derived from the skeletons of *Cephalodiscus*.' But the fact remains, that there is one striking similarity between some colonies of both orders – skeletal structures housing zooids, i.e. zooidal tubes of some cephalodiscid species of the subgenus *Cephalodiscus (Orthoecus)* Andersson and thecae of camaroid graptolites are embedded in a common tissue, named the common coenecial substance and the extracamaral tissue respectively. Of course, one could arrive at the conclusion that this similarity and the combining of cephalodiscid and camaroid features in *Erecticamara* may not be significant at all. However, the presented facts may also suggest that encrusting graptolites (Camaroidea, Crustoidea, Tuboidea, and some forms *incertae ordinis*), did not emerge monophyletically from the common ancestor.

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***Erecticamara maennili* gen. et sp. n. – niezwykle graptolit z ordowiku Estonii**

PIOTR MIERZEJEWSKI

Streszczenie

W utworach dolnego ordowiku (piętro Kunda), w odsłonięciu znanym w literaturze geologicznej jako Sukhrumägi (Tallin, Estonia) stwierdzono występowanie organicznych mikroskamieniałości przypominających źle zachowane okazy Chitinozoa. Okazy te zinterpretowano jako szczątki nieznanego dotąd graptolita inkrustującego. Forma ta, opisana pod nazwą *Erecticamara maennili* gen. et sp. n., reprezentuje prawdopodobnie nieznaną dotąd rodzinę graptolitów kamaroidowych rząd Camaroidea. Jest ona pod pewnymi względami pośrednia między pióroskrzelnymi z rzędu Cephalodiscida a niektórymi graptolitami osiadłymi. Do Cephalodiscida zbliża ją wydłużony kształt tek, fuzellum zbudowane z nieregularnych fuzelusów, brak szwu zygzakowatego i ultrastruktura peridermy (brak tkanki korowej zbudowanej z włókien korykalnych, obecność gęsto upakowanych struktur błoniastych). Zróznicowanie tek na rozszerzoną część proksymalną (camara) i zwężoną część dystalną (collum) jest również charakterystyczne dla graptolitów kamaroidowych. Obecność w części proksymalnej, małego otworka wskazuje na istnienie stolonów łączących poszczególne zooidy. We wnętrzu dwóch autetek stwierdzono obecność pojedynczych, zamkniętych pęcherzyków, niemal całkowicie wypełniających część proksymalną. Struktury te zdają się być morfologicznymi odpowiednikami blastokrypt graptoblastów bądź cyst graptolitów krustoidowych (Crustoidea).