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ACRITARCHS FROM A ROGÖ-SANDSTONE-GESCHIEBE (LOWER ORDOVICIAN)

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A preliminary analysis of an erratic boulder of the Estonian lower Ordovician Rogö (Suurupi) Sandstone found in Hamburg has yielded eleven acritarch taxa in the > 60 µm fraction. These are: *Baltisphaeridium hirsutoides*, *B. hirsutoides* ssp. A, *B.* cf. *ingerae*, *B. longispinosum*, *B. pauciverrucosum*, *Goniosphaeridium connectum*, *G. connectum* ssp. A, *G. connectum* ssp. B, *G.* sp. A, *G.* sp. B., *Peteinosphaeridium velatum*. The genus *Goniosphaeridium* is emended and the genus *Baltisphaerosum* TURNER is called in question.

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Z u s a m m e n f a s s u n g: Eine nicht speziell palynologisch aufbereitete Probe eines Rogö(kalk)sandstein-Geschiebes, Stufe B3ß Estlands, liefert erste Information über eine zu erwartende bedeutende Acritarchenführung. Es konnten 11 Taxa der Artgruppe ausgeschieden bzw. wahrscheinlich gemacht werden. Die Gattung *Goniosphaeridium* KJELLSTRÖM wird emendiert und die Gattung *Baltisphaerosum* TURNER diskutiert. Die Fraktion < 60µ ist noch nicht erfaßt.

PREFACE

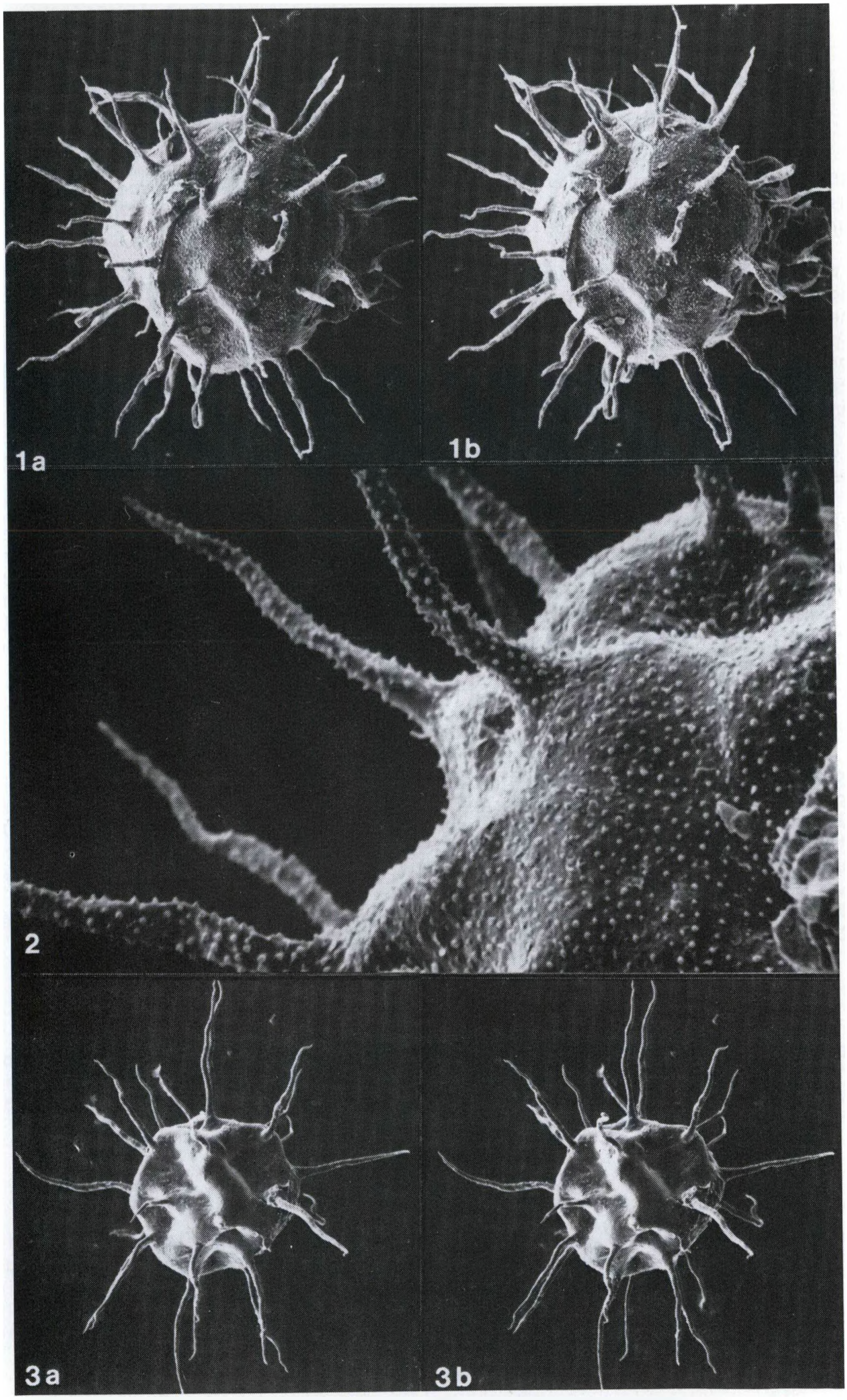
The present paper is a preliminary account of the acritarchs recovered from a Rogö-Sandstone erratic boulder and supplements ROGER SCHALLREUTER's micropaleontological studies on that erratic boulder (1989, this volume). The author is indebted to ROGER SCHALLREUTER for providing the macerates for this study. Special thanks to REED WICANDER (Central Michigan University) for revising the manuscript.
Complete investigation of the Rogö acritarchs will follow in a subsequent publication.

MATERIAL

The sample comes from an erratic boulder of calcareous Rogö (Suurupi) Sandstone , recently found in Hamburg. Ostracod data indicates the Estonian stage B3ß (SCHALLREUTER 1989, loc. cit.). The source area for this boulder is the region of the Eastern Baltic Sea.

METHODS

The sample provided was n o t subjected to standard palynological maceration techniques (pers. commun. R. SCHALLREUTER). Only maceration in acetic acid of slightly precrushed rock material, and sieving (mesh Ø > 60 µm) was applied to this sample. In this way the author was able to isolate about 40 acritarchs. There ist still material left and it will be processed using standard palynologic technique for the subsequent acritarch studies.


1a
1b
2
3a
3b

Specimens were individually picked using microcapillaries, washed 3 times with distilled water and mounted on a circular glass coverslip (Ø 12 mm), which was attached to a SEM standard stub and coated with Au-Pd. The palynomorphs are grouped into 3 rows. For example *1.1* indicates the first (beginning at the top) row and herein the first acritarch (counted from the left). The preparation is permanently stored in the collection of the **Archiv für Geschiebekunde** (GPIM Univ. Hamburg), labeled **H.W.1.**

SYSTEMATICS

ALGAE INCERTAE SEDIS

Group **ACRITARCHA** EVITT 1963

Genus ***Baltisphaeridium*** EISENACK 1958 emend. EISERHARDT 1989

Baltisphaeridium hirsutoides (EISENACK 1931) EIS. et al. 1973

H.W.1/1.11 Pl. 1, fig. 1a,b
H.W.1/1.17
H.W.1/2.7

H o l o t y p u s: EIS. 1931: p. 111, pl. 5:19 (lost). Neotypus : EIS. 1951: p. 189-190, pl. 3:8 (preparation $B_{2\alpha}$, 1 nr. 1; SMF).

L o c u s t y p i c u s and s t r a t u m t y p i c u m: Baltischport, Estonia; Unterer Glaukonitkalk ($B_{2\alpha}$), Ordovician.

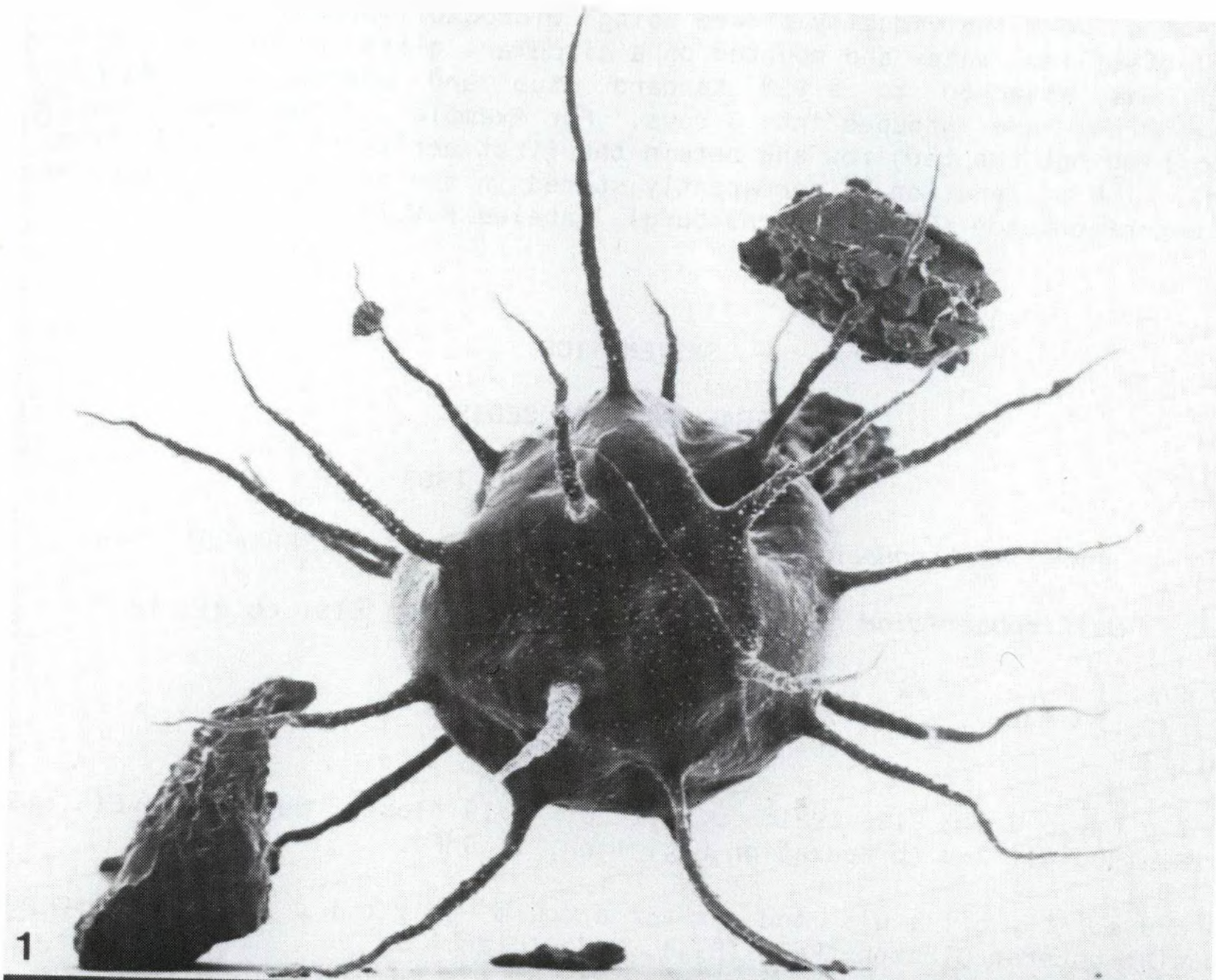
O r i g i n a l d i a g n o s i s (EIS. 1951): Zentralkörper kuglig, Anhänge zahlreicher als bei *H. longispinosum*, jedoch kürzer als bei dieser Art, etwa von der Länge des Halbmessers und darunter, meist dünn und borstenartig und in eine Spitze auslaufend. Im Vergleich mit *H. multipilosum* sind die Anhänge wesentlich geringer an Zahl und meist auch länger. Gegabelte Anhänge bisher nie beobachtet. Diese Art nimmt, wie ich schon 1931 (S. 111) betonte, eine Mittelstellung ein zwischen *H. longispinosum* und *H. multipilosum.*

R e d e s c r i p t i o n (KJELLSTR. 1971b): *Baltisphaeridium* sp. with thick, single walled, spherical, psilate vesicle. No excystment structure recorded. Angular proximal process contact with the vesicle. Separation of the interior of the process from the vesicle cavity. Processes, about 20 in number, in length about 1/3 of vesicle diameter, psilate, filiforme, homomorphic, simple with acuminate distal terminations.

D i m e n s i o n s:

D_t: total Ø
D_V: vesicle Ø
N_P: number of processes
L_P: average process length
L_{Pmax}: max. proc. length
L_{Pmin}: min. proc. length
L_P/D_V: process length/vesicle Ø - ratio
δ_{LP}: proc. length dev.
S: process separation
B_b: proc. basal breadth
L_P/B_b: process elongation

Tafel 1 (Pl. 1): 1a,b *Baltisphaeridium hirsutoides* , prep. H.W.1/1.11 (x 820)
<———————— 2 *Baltisphaeridium hirsutoides* ssp. A, prep. H.W.1/1.9 (x 3030)
3a,b *Baltisphaeridium* cf. *ingerae* , prep. H.W.1/1.12 (x 545)



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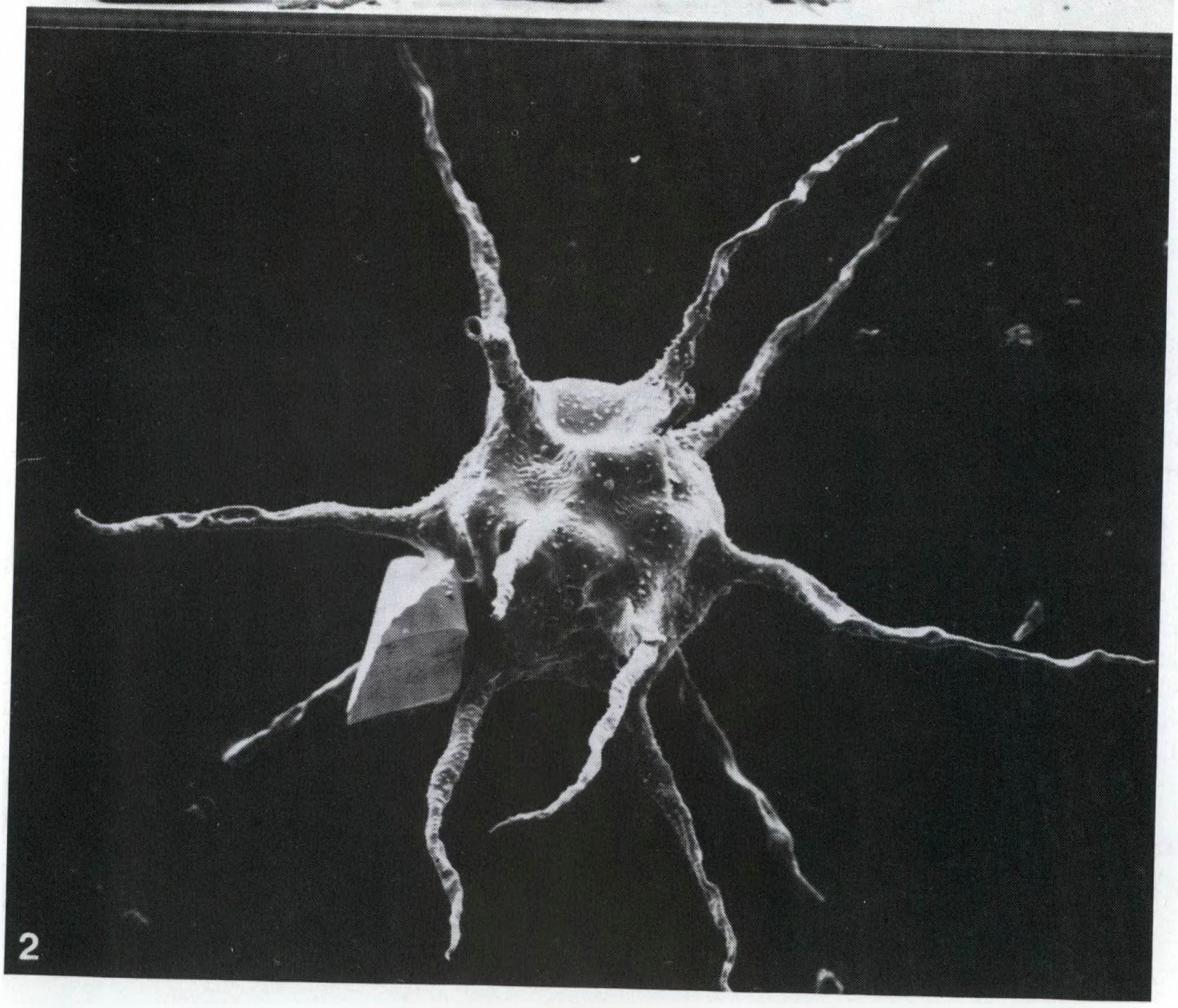


2

H.W.1/1.11 [neotype]*	H.W.1/1.11 [neotype]	H.W.1./11 [neotype]
D_t 71 µm [107 µm]	L_{Pmax} 21 µm	δ_{LP+} 35 %
D_V 37 µm [53 µm]	L_{Pmin} 11 µm	δ_{LP-} 29 %
N_P ~50 [~23]	L_P/D_V 0.4 [0.45]	B_B 1.5-2 µm [2.6 µm]
L_P 15.5 µm [~24 µm]	S 5-10 µm [~16 µm]	L_P/B_B 8.3 [9.2]

*new measurements from EIS. 1951: pl. 3, fig. 8

C o m p a r i s o n:

against *B. brevispinosum* (EIS. 1931): no curved process contact; tips not evexate - bulbous.
against *B. echinatum* KJELLSTR. 1971b): vesicle a n d process ornamented; not echinate but microgranulate surface ornamentation.
against *B. filosum* (KJELLSTR. 1971b): L_P/D_V increased, L_P/B_b and N_P smaller.
against *B. coutissianum* MARTIN 1968: L_P/D_V significantly smaller; angular basal process contact; processes without echinate ornamentation.

R e m a r k s: The Rogö-specimen has a microgranulate ornamentation of the vesicle and processes. That is visible only under SEM. Excystment by median split (see pl. 1: 1a,b; compare to EIS. 1968b, pl. 2:4). N_P significantly increased.

O c c u r r e n c e:

A. Geschiebe (glacial erratic boulders)

Glacial erratics from the baltic coast, coll. A. EISENACK;
EISENACK's catalogue-numbering before 1945:

18 (EIS. 1931) = Untere/Obere Linsenschichten, $B_{3\alpha}/C_{1\alpha}$ (compare to SCHALL-REUTER 1986a:159)
130 (EIS. 1938) = erratic type questionable

EISENACK's catalogue-numbering after 1945:

S.G. 106 (EIS. 1965) = Helle Ostseekalke ohne *Diplograptus gracilis*, Upper Caradocian
S.G. 1 (EIS. 1968) = Echinosphaeritenkalk, Lland. or Cystideenkalk, Caradocian (SCHALLREUTER 1986:160)

B. Non erratika
Lower Glaukonitkalk, Estonia/$B_{2\alpha}$ (EIS. 1951); Vaginatenkalk, Estonia/B_3 (EIS.1962); Upper Arenigian subsurfce material, Poland (GORKA 1969); Arenigian, Llanvirnian of England (LISTER, COCKS & RUSHTON 1969); Viruan subsurface material of Gotland/Sweden (KJELLSTR. 1971b); Lower Viruan subsurface material of östergotland/Sweden (KJELLSTR. 1976); Sylen Limestone of the Bothnian Sea, unspecified middle Ordovician (TYNNI 1976).
Middle Silurian (EIS. 1965b) and middle Devonian (SANNEMANN 1955) occurrence is v e r y doubtful.

Tafel 2 (Pl. 2): 1 *Baltisphaeridium* cf. *ingerae*, prep. H.W.1/1.16 (x 920)
<———————— 2 *Baltisphaeridium longispinosum*, prep. H.W.1/2.8 (x 665)

Baltisphaeridium hirsutoides ssp. A

H.W.1/1.9 Pl. 1, fig. 2
H.W.1/1.8

C o m p a r i s i o n:

against *B. hirsutoides h.*: entire surface (vesicle and processes) is ornamented by distinct granulae which can be develop a conical, nearly echinate shape.
against *B. echinatum* KJELLSTR. 1971b: processes not psilate.

D i m e n s i o n s:

H.W.1/1.8 [H.W.1/1.9]		H.W.1/1.8 [H.W.1/1.9]		H.W.1/1.8 [H.W.1/1.9]	
D_t 70 µm	[70 µm]	L_{Pmax} 18 µm	[19 µm]	δ_{LP+} 20 %	[16.5 %]
D_V 39 µm	[42 µm]	L_{Pmin} 12 µm	[13 µm]	δ_{LP-} 20 %	[20 %]
N_P 43	[~43 µm]	L_P/D_V 0.38	[0.38]	B_B 2.3 µm	[2.3 µm]
L_P 15 µm	[16 µm]	S 8-15 µm	[9-17 µm]	L_P/B_B 6.5	[7.0]

Baltisphaeridium cf. *B. ingerae* KJELLSTRÖM 1976

H.W.1/1.12 Pl. 1, fig. 3a,b
H.W.1/1.16 Pl. 2, fig. 1
H.W.1/1.6, H.W.1/1.14, H.W.1/3.3

H o l o t p u s: KJELLSTR: 1976: p. 20-21, fig. 14; SGU , slide 105.10.

L o c u s t y p i c u s and s t r a t u m t y p i c u m: Ekön Borehole No. 1, östergotland/Sweden: Lower Viruan, Folkeslundia Limestone, 105.10 m.

O r i g i n a l d i a g n o s i s: *Baltisphaeridium* sp. with moderately thick, single walled, spherical, granulate vesicle. No excystment structure recorded. Angular proximal process contact with the vesicle. Separation of the interior of the process from the vesicle cavity. Numerous processes, about 30, in length not exceeding the length of the vesicle diameter, echinate, slender, filiforme, homomorphic, simple with acuminate distal terminations.

D i m e n s i o n s:

H.W.1/1.16 [holotype]		H.W.1/1.16 [holotype]		H.W.1/1.16 [holotype]	
D_t 106 µm	[117 µm]	L_{Pmax} 42 µm		δ_{LP+} 13.5 %	
D_V 43 µm	[57 µm]	L_{Pmin} 34 µm		δ_{LP-} 8 %	
N_P ~24	[~30]	L_P/D_V 0.63	[0.63]	B_B 3.0 µm	[2.7 µm]
L_P 37	[~36 µm]	S ~16 µm	[13 µm]	L_P/B_B 12.3	[13.3]

R e m a r k s: In contrast to the protologue the membrane ornamentation is finer (SEM-range) and n o t echinate. One specimen (H.W.1/1.16, see pl. 2:1) with median split.

O c c u r r e n c e: Upper Llanv. of Poland (GORKA 1980); Lower Viruan of Sweden (KJELLSTRÖM 1976).

Baltisphaeridium longispinosum (EISENACK 1931,1959) STAPLIN et al. 1965

H.W.1/2.8 Pl. 2, fig. 2

H o l o t y p u s: EIS. 1931: p. 110-11, pl. 5:10; prep. 10 Nr. 17 (lost).

N e o t y p u s: EIS. 1959: p. 195, pl. 15:1; prep. E1, öland 1 Nr. 11.

L o c u s t y p i c u s and s t r a t u m t y p i c u m:
holotype: erratic boulder: "Ostseekalk?" (compare to EIS. 1931:76);
neotype : *Chasmops*-Limestone, Böda (öland,Sweden)/Lower Caradocian.

O r i g i n a l d i a g n o s i s (EIS. 1959): Schale kugelförmig, mit 4 bis etwa 20 dünnen, langen, spitz endigenden, häufig unverzweigten, doch nicht selten auch mit einzelnen gegabelten oder verzweigten Anhängen, deren Länge im allgemeinen den Durchmesser übertrift. Die Schale ist verhältnismäßig dünnwandig, infolgedessen meist hellgelb gefärbt und nicht immer völlig kugelförmig, sondern ± polyedrisch verformt. Die Anhänge sind sehr lang und schon von der Basis an dünn und fadenförmig. Nur selten ist ein Anhang gegabelt.

Additional morphologic information: EIS. 1969: 250; GORKA 1969: 34-35.

D i m e n s i o n s:

H.W.1/2.8 [neotype]*	H.W.1/2.8 [neotype]	H.W.1/2.8 [neotype]
D_t 155 µm [~190 µm]	L_{Pmax} 71 µm [19 µm]	δ_{LP+} 22.6 %
D_V 41.5 µm[60 µm]	L_{Pmin} 50 µm [13 µm]	δ_{LP-} 13.9 %
N_P 11 [10]	L_P/D_V 1.4 [1.3]	B_B 5.2 µm [4.2 µm]
L_P 57,5 µm[79 µm]	S ~18	L_P/B_B 12 [19]

*measured ex EISENACK 1959: pl.15, fig.1

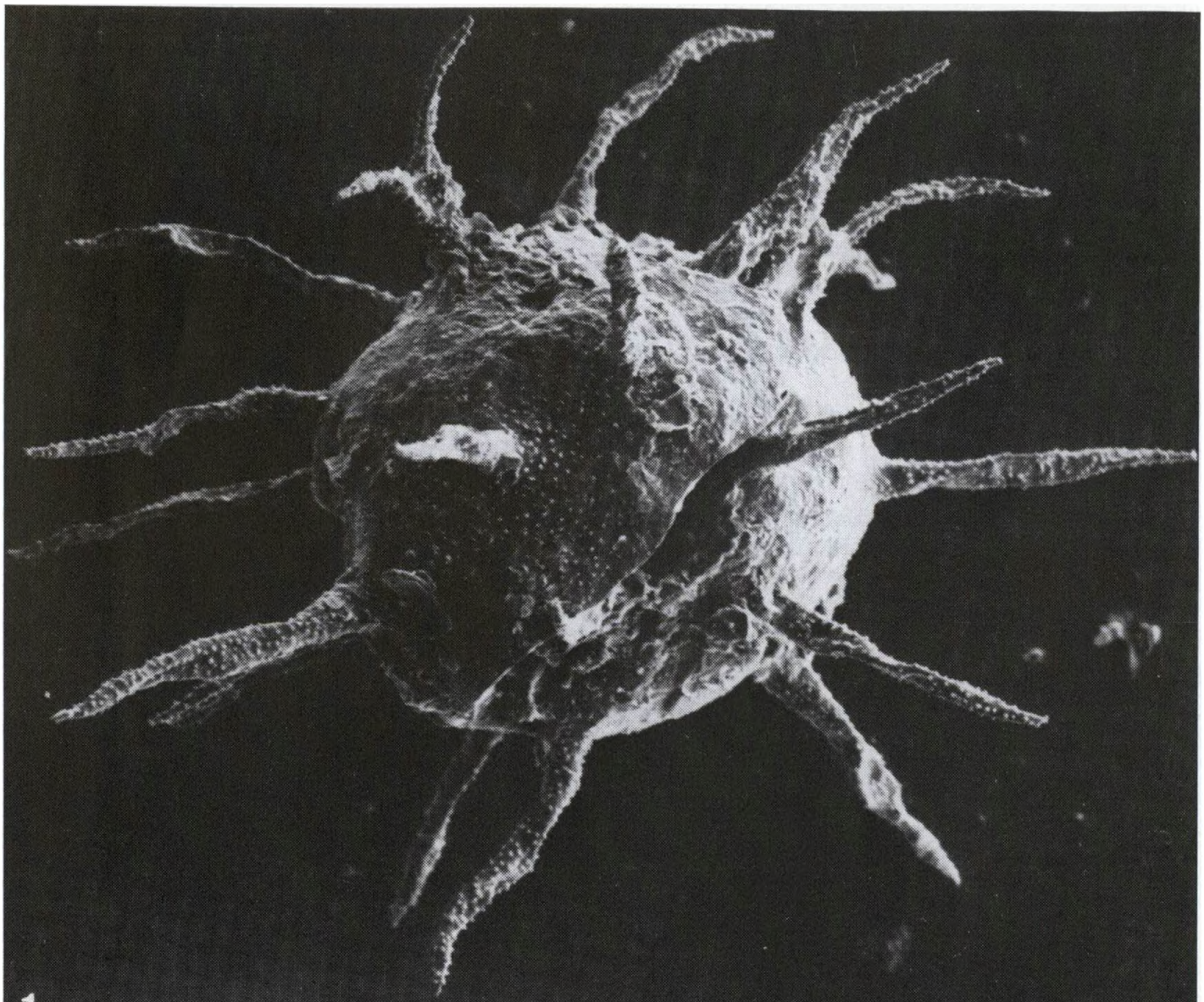
R e m a r k s: Measurements and proportions of H.W.1/2.8 are in close agreement with those of the neotype except for the L_P/B_b-ratio, which is slightly smaller.

O c c u r r e n c e:

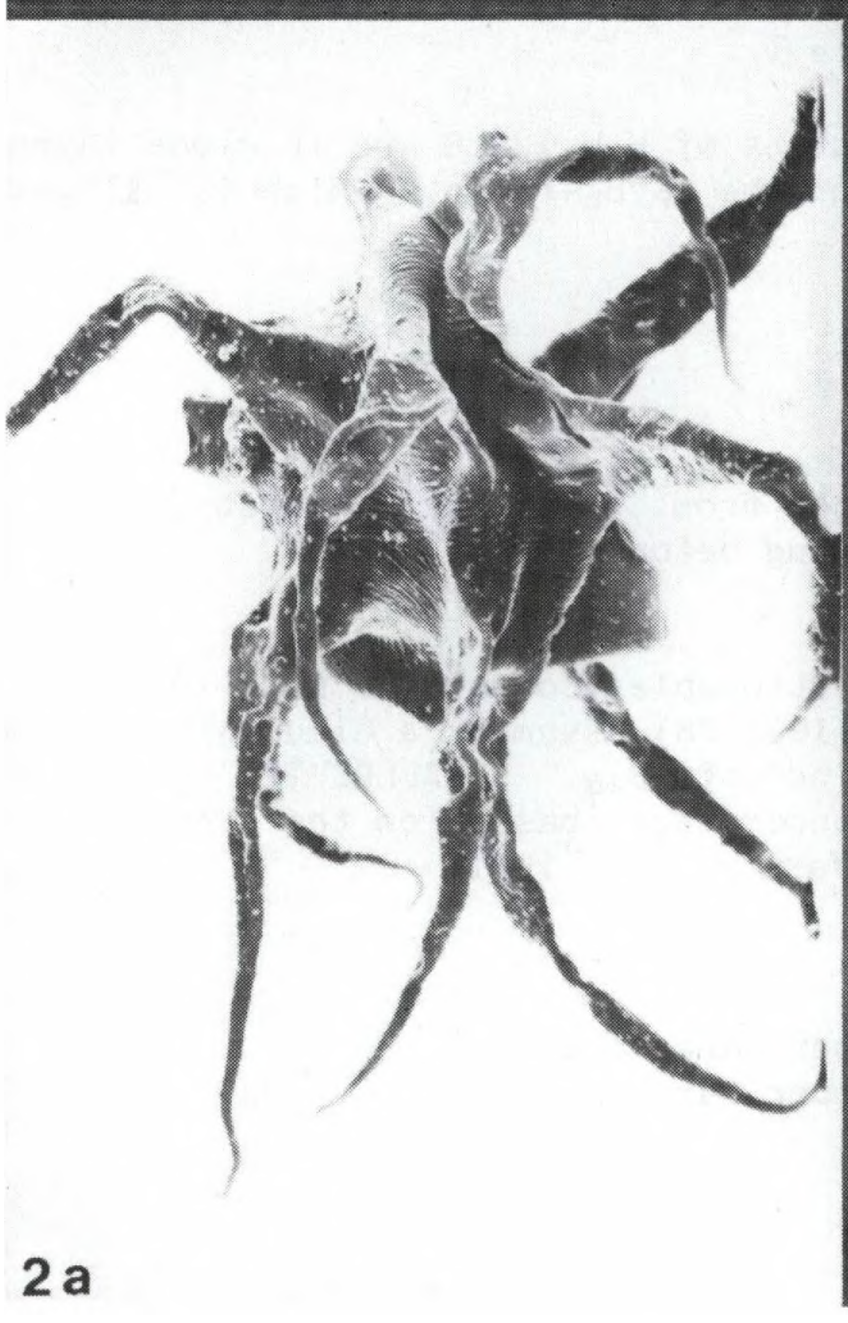
A. Geschiebe (glacial erratic boulders)

1. Glacial erratics of Ordovician age from the Baltic coast , coll. A. EISENACK; EISENACK's catalogue-numbering before 1945:

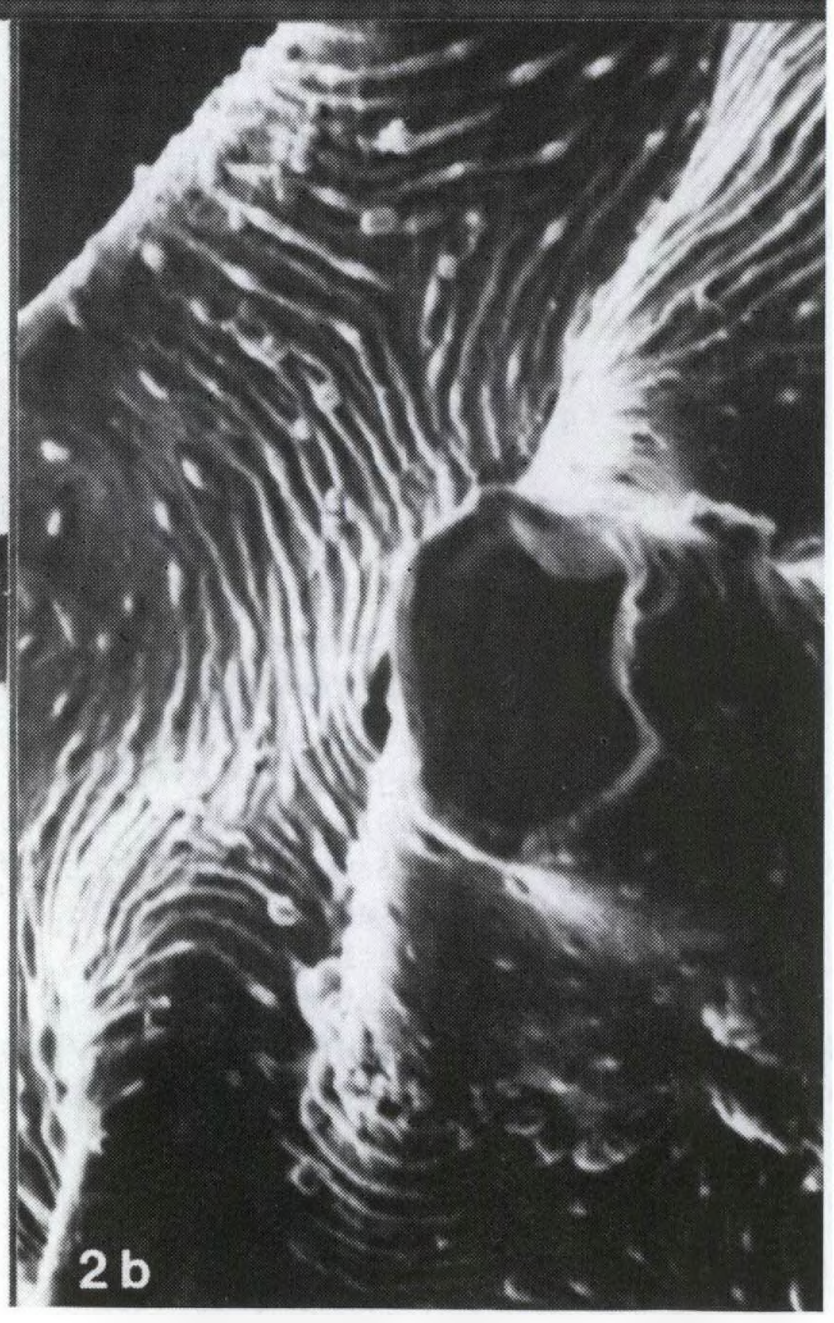
3 (EIS. 1931) = Ostseekalk/$F_{1\alpha}$
10 (EIS. 1931) = ?Ostseekalk/$F_{1\alpha}$ (questionable; compare to EIS. 1931:76)
17 (EIS. 1938) = questionable; EIS. (1931:76) assumes a Glaukonitkalk-analogon, that could indicate $B_{2\alpha}$. SCHALLREUTER (1986:158-159) presumes a younger age based on the chitinozoan *Desmochitina ? complanata* EIS. 1931.
21 (EIS. 1938) = Glaukonitkalk/B2α
131 (EIS. 1938) = questionable
161 (EIS. 1951) = questionable
108 (EIS. 1965a)= heller Otseekalk/Upper Caradocian
113 (EIS. 1965a)= heller Ostseekalk/Upper Caradocian



1



2 a



2 b

EISENACK's catalogue-numbering after 1945:

S.G. 118 (EIS. 1968b)= Öjlemyrkalk/F_{1c} and/or F_2

EISENACK (1965a:143) mentioned *B. longispinosum* f. filifera (= *B.longispinosum longispinosum* , compare to STAPLIN et al. 1965:190) from the following variants of the Upper Caradocian Ostseekalk:

S.G. 66, 100 = *Diplograptus*-Kalke/F_{1c} (and perhaps uppermost Caradocian; compare to SCHALLREUTER 1986:2)
S.G. 14, 24, 101, 106, 108-109, 112-114, 127-128
= Helle Ostseekalke ohne *Diplograptus gracilis*/Upper Caradoc
S.G. 129 = Rötliche Kalke

2. Glacial erratics of Ordovician age from Poland: GORKA (1969:p. 15,tb. 2), coll. R. KOZLOWSKI:

O.26 Poznan-Glówna with *Pseudoasaphus aff. limatus* and *Baltisphaeridium calicispinae* GORKA 1969. Stratigraphical implications not given. *B. calicispinae* is known from the Upper Arenigian to the Lower Caradocian of Poland (GORKA 1969), from Middle Viruan subsurface material of Gotland (KJELLSTR. 1971b), and from Lower Viruan subs. mat. of östergotland (KJELLSTR. 1976).
O.94 Jaroslawiec = Middle Ordovician
O.342 Zakroczym = unspecified Ordovician
O.519 Mochty with *Goniosphaeridium polygonale pachyacanthum* (EIS.), *Ordovicidium nudum* (EIS.), *B. calicispinae* GORKA, *B. varsoviensis* GORKA, *B. mochtiensis* GORKA, *B. spinigerum* GORKA, *Peteinosphaeridium trifurcatum* (EIS.). This palynomorph assemblage does not indicate finer resolution than undiff. Ordovician (e.g. DIEZ & CRAMER 1974).

B. Non erratika

Chasmops-Limestone, öland/Caradocian (EIS. 1959); "Kalk der Revaler Stufe"/B_3 (EIS. 1968a).

(EISENACK plotted the stratigraphic range of *B. longispinosum* in the Baltic Ordovician from the Estonian stages B_2-F_1; compare to EIS. 1962:359;tab.2).

Viruan subsurface material of Gotland/Sw. (KJELLSTR. 1971b/question.); Lower Viruan subsurface material of östergotland/Sw. (KJELLSTR. 1976/question.); Middle Ordovician Sylen Limestone, Bothnian Sea (TYNNI 1976/questionable).

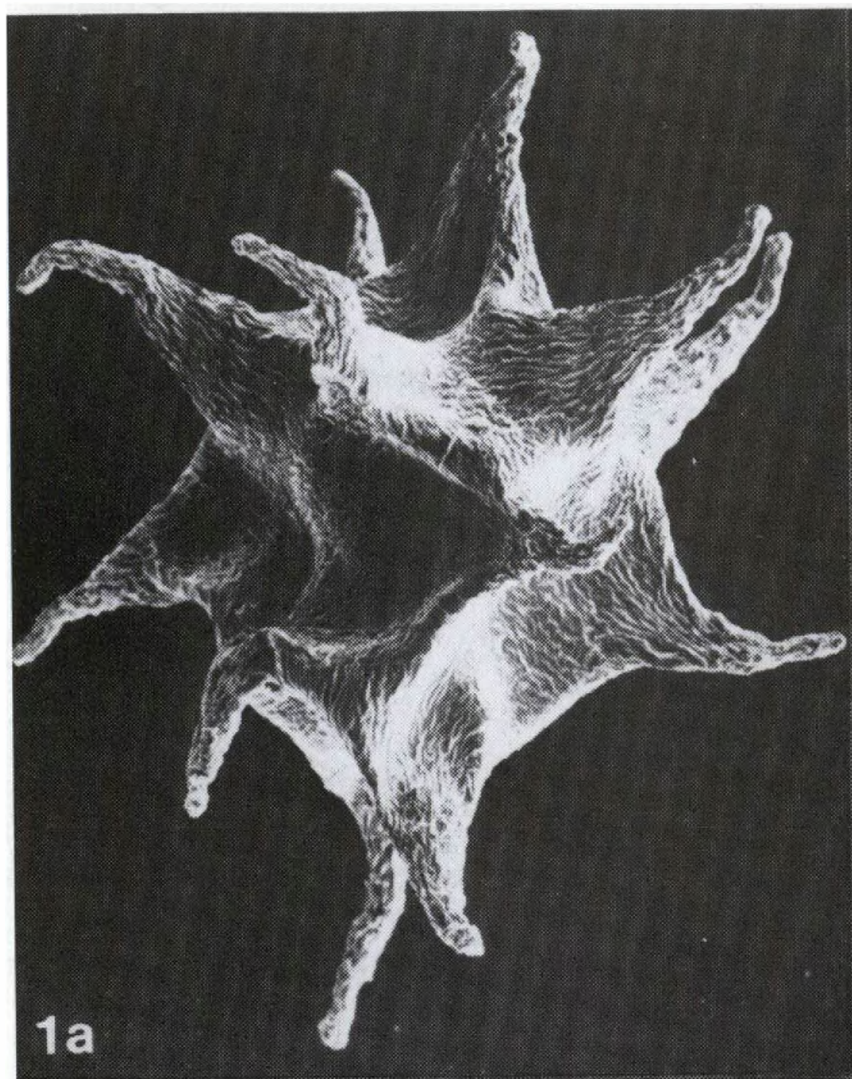
Baltisphaeridium pauciverrucosum KJELLSTRÖM 1971a

H.W.1/2.5 Pl. 3, fig. 1

H o l o t y p u s: KJELLSTR. 1971a: p. 17,19; fig. 9; SGU slide no. 452:1.

L o c u s t p i c u s and s t r a t u m t y p i c u m: Grötlingbo Borehole No. 1, Gotland/Sweden; Middle Ordovician (Lower Viruan), Folkeslundia - Lower Uhaku beds, 452.10 m.

Tafel 3 (Pl. 3): *1* *Baltisphaeridium pauciverrucosum*, prep. H.W.1/2.5, (x 1015)
<———————— 2a *Goniosphaeridium* sp., prep. G.149/1-öjlemyrflint (F1c/F2) (erratic boulder, NW Gotland/Sw.) (x 1250)
2b same spec. (x 6150): rugulate vesicle surface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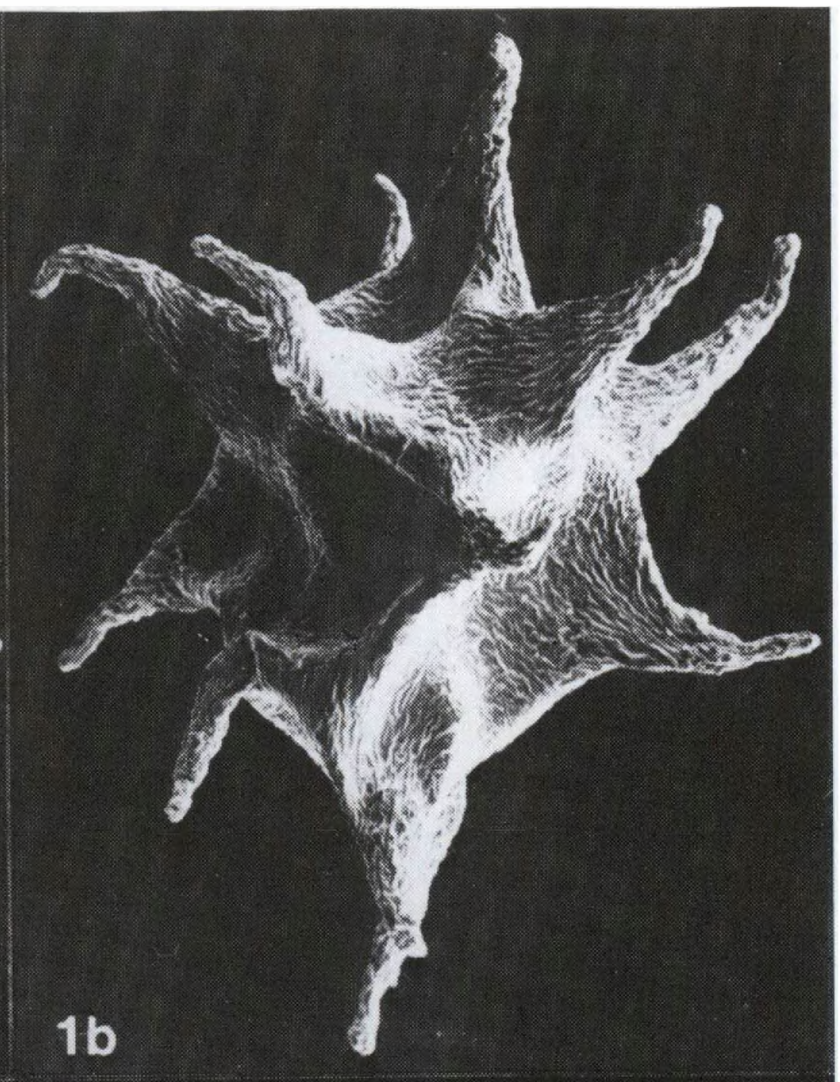
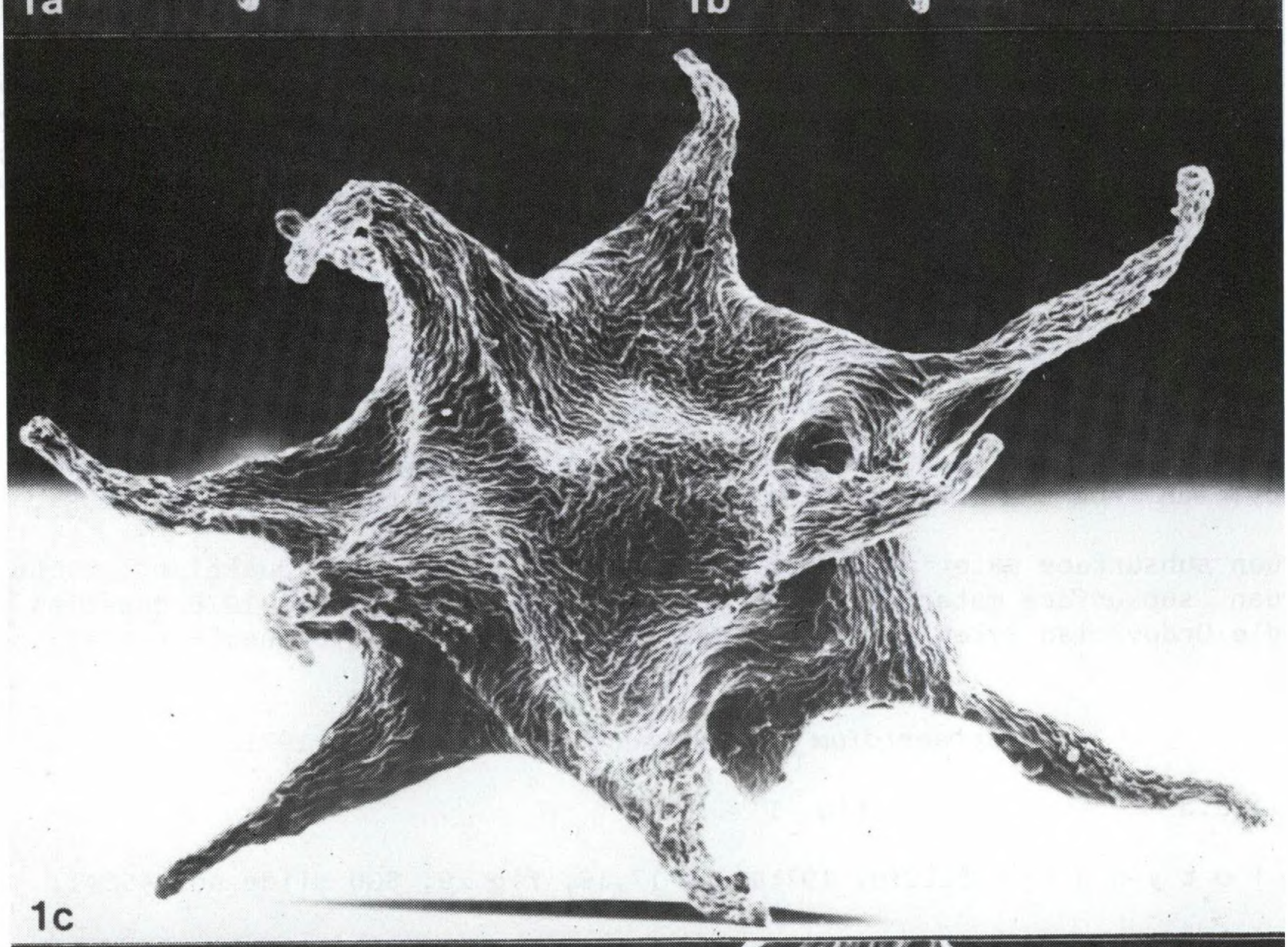
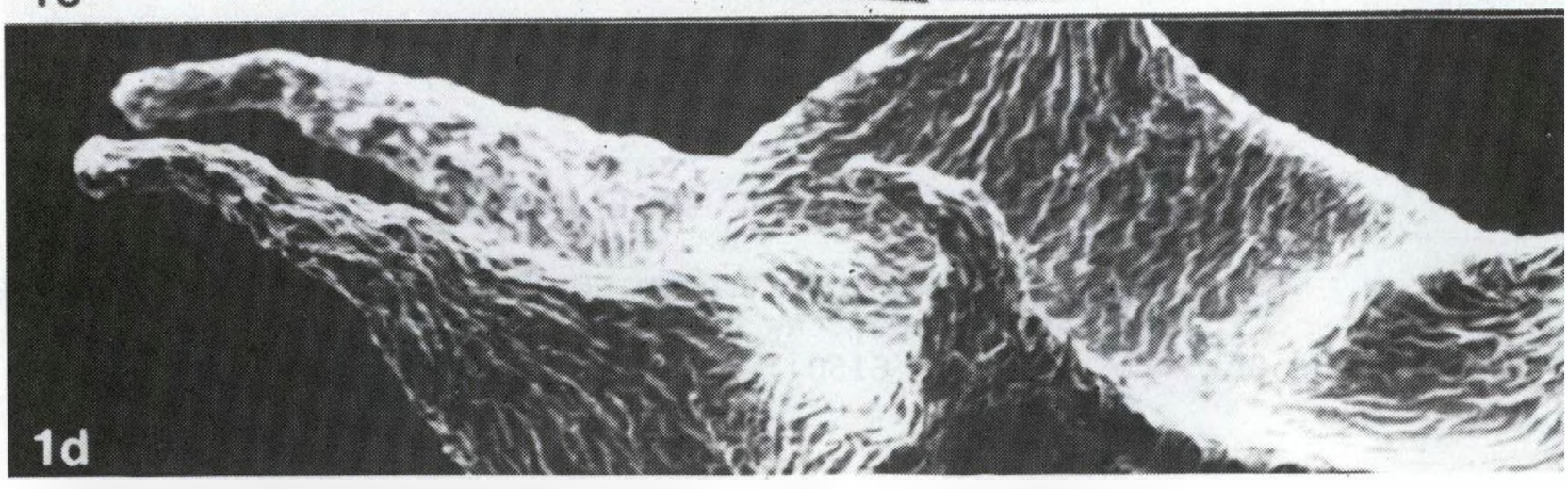

1b


1c


1d

O r i g i n a l d i a g n o s i s: *Baltisphaeridium* sp. with thin, single walled, sub-spherical, shagrinate vesicle. No excystment structure recorded. Curved proximal process junction with the vesicle. Separation of the interior of the processes from the vesicle. Processes, about 22 in number, in length almost equal to the vesicle diameter, broad bases, verrucate, conical, simple with acuminate whiplike distal terminations.

D i m e n s i o n s:

H.W.1/2.5 [holotype]	H.W.1/2.5 [holotype]	H.W.1/2.5 [holotype]
D_t 106 µm [152 µm]	L_{Pmax} 31 µm	δ_{LP+} 5.5 %
D_V 49 µm [70 µm]	L_{Pmin} 27 µm	δ_{LP-} 8.9 %
N_P ~24 [~22]	L_P/D_V 0.6 [0.7]	B_B 3.5 µm [5.5 µm]
L_P 29 µm [~47 µm]	S 15 µm	L_P/B_B 8.3 [8.5]

R e m a r k s: H.W.1/2.5 differs from the holotype in beeing smaller, but all proportions indicate conspecifity.

O c c u r r e n c e: Upper Llanvirnian of Poland (GORKA 1980); unspecified middle Ordovician subsurface material from the Bothnian Sea (TYNNI 1976); Lower Viruan of Gotland (KJELLSTR. 1971a).

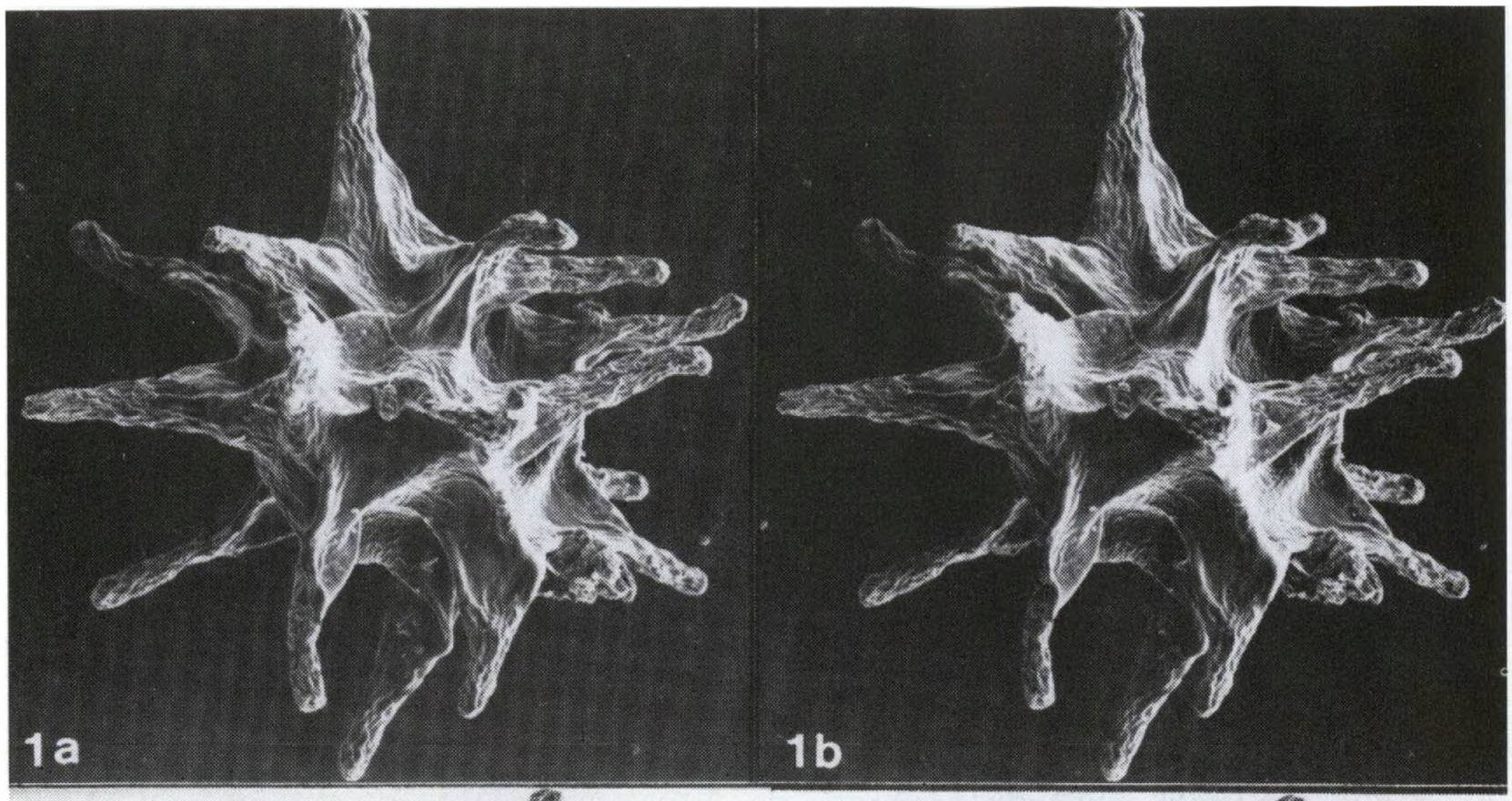
Genus *Baltisphaerosum* TURNER 1984

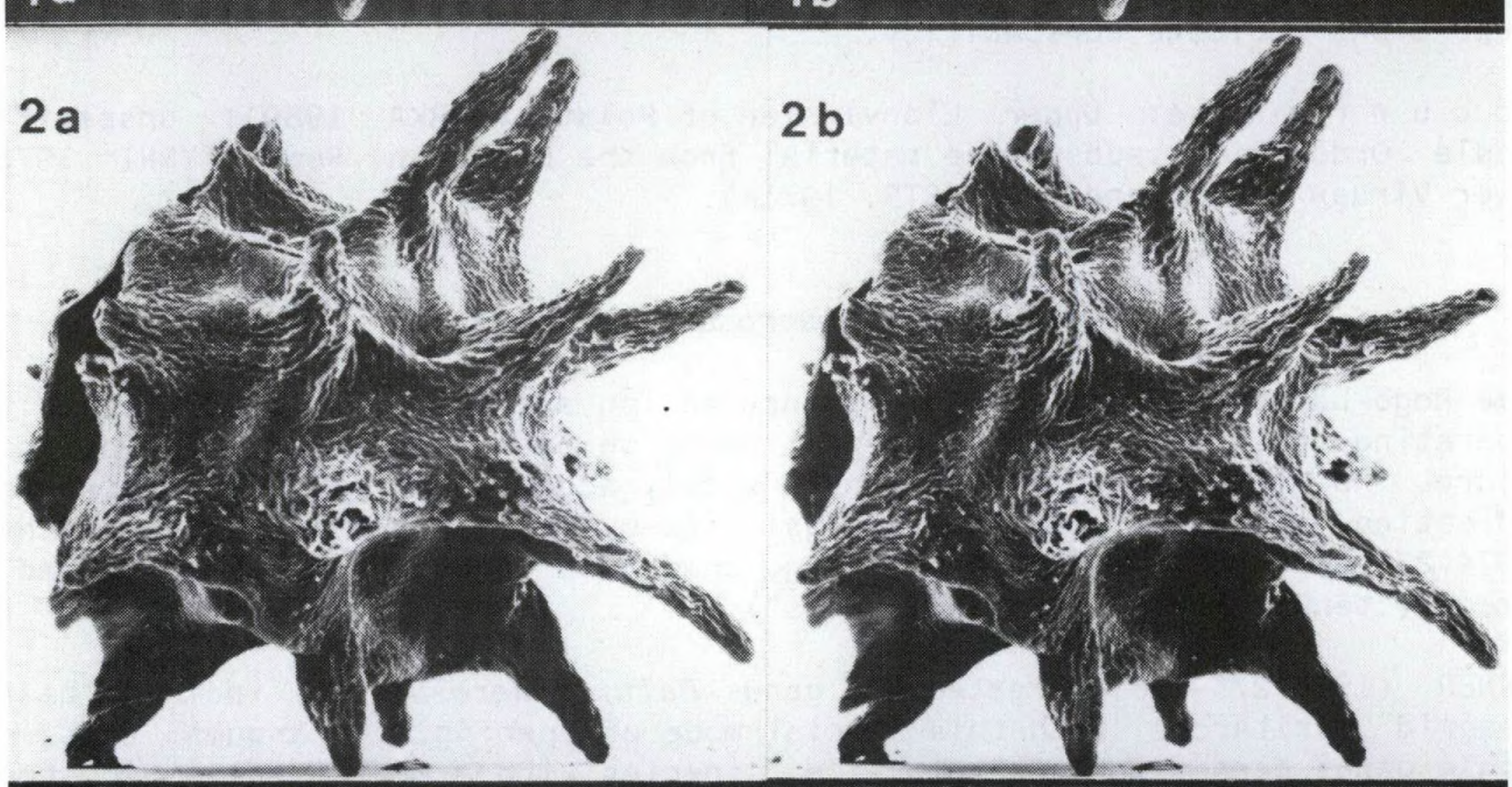
Some Rogö-baltisphaerids show a distinct median split (pl. 1:1a,b; pl. 2:1), separating the vesicle into ± equal parts on both sides of the dividing suture. Apertures like this have been widely accepted as excystment openings, indicating a special stage in an algal life-cycle. In contrast to EISENACK (1974:275-276) they c a n be distinguished from irregular ruptures caused by damage ("tension or compressing cracks").

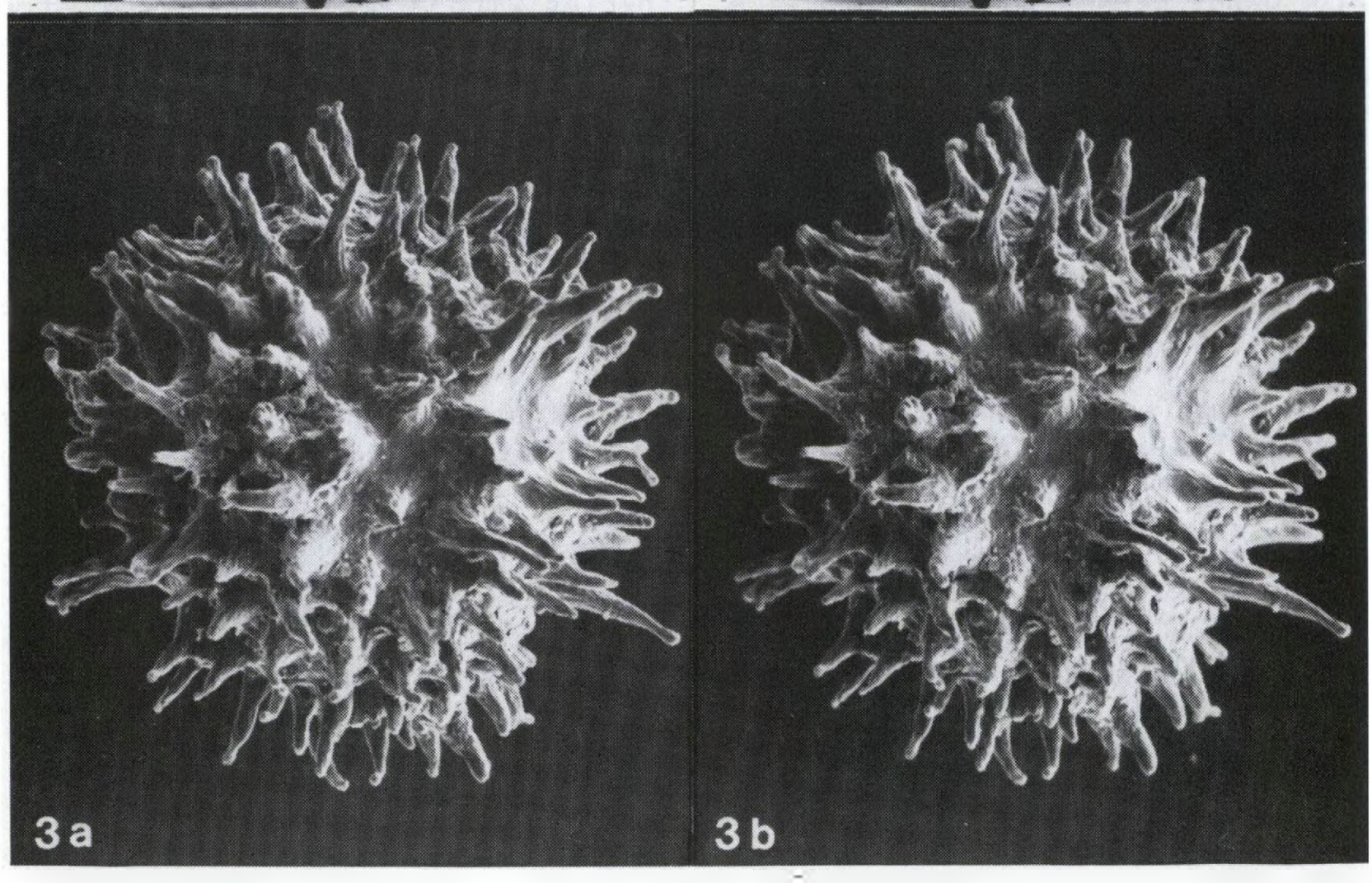
TURNER (1984:275-276) erected the genus *Baltisphaerosum* to include baltisphaerid acritarchs with this special mode of opening. He argues that one single genus cannot include both, i.e. species with a median split excystment structure and those with cyclopylomes. Further differences between both genera are not described. Under this aspect H.W.1/1.11 and H.W.1/1.16 would be transfered to *Baltisphaerosum*.

The present author can show that *Baltisphaerosum* is no valid acritarch genus because of differences between protologue and holotype (ICBN art. 10.2). Furthermore, it seems to be practically impossible to subdivide two morphological indifferent taxa only by means of one single seasonnally occurring feature. Add to this, a cyclopylome is n o t constituent part of the protologue of genus *Baltisphaeridium*. That is on the whole why the present author cannot support the concept of genus *Baltisphaerosum*. Complete evaluation will follow in a subsequent publication (EISERHARDT 1989).

Tafel 4 (Pl. 4): 1a,b *Goniosphaeridium connectum*, prep. H.W.1/1.1, (x 615)
<———————— 1c same specimen (x 980)
1d same specimen (x 1350)


1a
1b


2a
2b


3a
3b

Goniosphaeridium EIS. 1969 emend. KJELLSTRÖM 1971b

Goniosphaeridium connectum KJELLSTRÖM 1971b

H.W.1/1.1 Pl. 4, fig. 1a-d

H o l o t y p u s: KJELLSTRÖM 1971b: p. 44-45, pl. 3:5, SGU slide 425:1.

L o c u s t y p i c u s and s t r a t u m t y p i c u m: Grötlingbo Borehole No. 1, Gotland; Middle Ordovician (Viruan), Skagen, 425,00 m.

O r i g i n a l d e s c r i p t i o n: *Goniosphaeridium* sp. with thin, single walled, polygonal, psilate vesicle. No excystment structure recorded. Curved proximal process contact with the vesicle. Free communication between the process interior and the vesicle cavity. Proceses, about 10 in number, in length not exceeding the vesicle diameter, psilate, broad bases, conical, homomorphic, simple with evexate and/or bulbous distal terminations.

R e m a r k s: The most striking feature of H.W.1/1.1 is the vesicle ornamentation: the entire surface is rugulate with the rugulae following in general, the process outline.

D i m e n s i o n s:

HW1/1.1 [(holotype)]	H.W.1/1.1 [(holotype)]	H.W.1/1.1 [(holotype)]
D_t 100 µm (-) [110]	L_{Pmax} 43 µm	δ_{LP+} 34.5 %
D_V 48 µm (42) [48]	L_{Pmin} 22 µm	δ_{LP-} 29.5 %
N_P 15 (~10) [>10]	L_P/D_V 0.7 (0.7) [0.75]	B_B 19 µm (5-8) [18]
L_P 32 µm (30) [~36]	S 0-16 µm	L_P/B_B 1.66 [2.0]

in (): data given by KJELLSTR. 1971b: p.45
in []: new measurements ex KJELLSTR. 1971b: pl.3:5

O c c u r r e n c e: Middle Ordovician of Gotland/Sw. (KJELLSTR. 1971b); Occurrence in the Caradocian of Shropshire/England (TURNER 1984) is doubtful (uncertain conspecifity).

Goniosphaeridium connectum ssp. A

H.W.1/1.15 Pl. 5, fig. 1a,b
H.W.1/2.9

C o m p a r i s i o n:

against *G. connectum connectum*: number of processes exceeds range given by KJELLSTR. (1971b:45). Processes more elongate without differences in L_P/D_V-ratio; vesicle Ø reduced.

Tafel 5 (Pl. 5): 1a,b *Goniosphaeridium connectum* ssp. A, prep. H.W.1/1.15 (x 610)
<———————— 2a,b *Goniosphaeridium connectum* ssp. B, prep. H.W.1/2.4 (x 790)
3a,b *Goniosphaeridium* sp. A, prep. H.W.1/1.7, (x 740)

D i m e n s i o n s:

H.W.1/1.15 (H.W.1/2.9)	H.W.1/1.15 (H.W.1/2.9)	H.W.1/1.15 (H.W.1/2.9)
D_t 82 µm (95 µm)	L_{Pmax} 32 µm (33 µm)	δ_{LP+} 17.6 % (16.9 %)
D_V 35 µm (42 µm)	L_{Pmin} 20 µm (18 µm)	δ_{LP-} 24.4 % (37.0 %)
N_P 23 (22)	L_P/D_V 0.76 (0.66)	B_B 12.2 µm (12 µm)
L_P 27 µm	S 0-6 µm	L_P/B_B 2.0 (2.3)

Goniosphaeridium connectum ssp. B

H.W.1/2.4 Pl. 5, fig. 2a,b

1976 *Goniosphaeridium* cf. *makrosphaericum* EISENACK,1970 -- KJELLSTR.:fig.24.

C o m p a r i s i o n:

against *G. connectum*: vesicle about 20 % larger, N_P>, L_P/D_V<.
against *G. connectum* ssp. A: vesicle Ø 40 % enlarged, L_P<; L_P/D_V<; Processes more separated by constant basal breadth. Process elongation reduced.
against *G. polygonale* EIS. (1931): distal process terminations evexate to bulbous, process separation enlarged, vesicle Ø reduced.

D i m e n s i o n s:

D_t 90 µm	L_{Pmax} 23.5 µm	δ_{LP+} 18.7 %
D_V 54 µm	L_{Pmin} 17.0 µm	δ_{LP-} 14.1 %
N_P ~27	L_P/D_V 0.37	B_B ~12 µm
L_P 20 µm	S 8-19 µm	L_P/B_B 1.65

Goniosphaeridium sp. A

H.W.1/1.7 Pl. 5, fig. 3a,b
H.W.1/2.6

1976 *Multiplicisphaeridium alloiteaui* DEUNFF 1955 -- KJELLSTR.:p.32-33,fig. 26

D e s c r i p t i o n: Vesicle circular in outline, ± spherical, surface slightly rugulate, numerous short conical hollow processes, evenly distributed over the vesicle; distal process terminations evexate to bulbous, with some showing incipient bifurcation; no excystment method observed.

D i m e n s i o n s:

H.W.1/2.6 (H.W.1/1.7)	H.W.1/2.6 (H.W.1/1.7)	H.W.1/2.6 (H.W.1/1.7)
D_t 74 µm (77 µm)	L_{Pmax} 15.0 µm (17.0 µm)	δ_{LP+} 20 % (42 %)
D_V 66 µm (61 µm)	L_{Pmin} 5.7 µm (4.6 µm)	δ_{LP-} 54 % (62 %)
N_P >100 (~150)	L_P/D_V 0.19 (0.12)	B_B 8 µm (5.5 µm)
L_P 13 µm (12 µm)	S 0-2 µm (0-3 µm)	L_P/B_B 1.56 (2.2)

Goniosphaeridium sp. B.

H.W.1/1.18 Pl. 6, fig. 2

D e s c r i p t i o n: Vesicle ± sperical in outline, surface microgranulate to rugulate; processes distinct from vesicle, elongate, gently tapering from a circular base to evexate to bulbous distal tips; processes surface microgranulate to rugulate (psilate periphragma in a wrinkled state of preservation?); no excystment aperture observed.

D i m e n s i o n s:

D_t 92 µm	L_{Pmax} 28 µm	δ_{LP+} 12 %
D_V 58 µm	L_{Pmin} 20 µm	δ_{LP-} 20 %
N_P ~22	L_P/D_V 0.43	B_B 5 µm
L_P 25 µm	S 18 µm	L_P/B_B 5

C o m p a r i s i o n: *G.* sp. B is similar to *G. mochtiensis* (KJELLSTR. 1971a (p. 25-26, fig. 16) from Viruan subsurface material of Gotland/Sweden, but differs in having a smaller vesicle a n d smaller L_P/D_V-ratio.

R e m a r k s: KJELLSTRÖM declared *Baltisphaeridium mochtiensis* GORKA 1969 to be conspecific to his goniosphaerid specimen (loc. cit, fig. 16): *Goniosphaeridium mochtiensis* (GORKA) n. comb. This new combination is incorrect because the holotype of *B. mochtiensis* shows separation between process interior and vesicle cavity (compare to GORKA 1969: pl. XII, fig. 2b).

Goniosphaeridium connectum - c o n c l u s i o n s:

A. *Goniosphaeridium connectum* KJELLSTR. 1971b proves the capability of process multiplying. The greater the number of processses the shorter the process length becomes. Because of this i) ssp. A is closely related to *G. connectum connectum* and perhaps even conspecific, ii) *G.* sp. A could represent the final stage of process multiplying and would then be related to *G. connectum* via *G. connectum* ssp. B, and iii) *G.* sp. B is a very different taxon and at best only slightly related to *G. connectum* via *G. connectum* ssp. A.

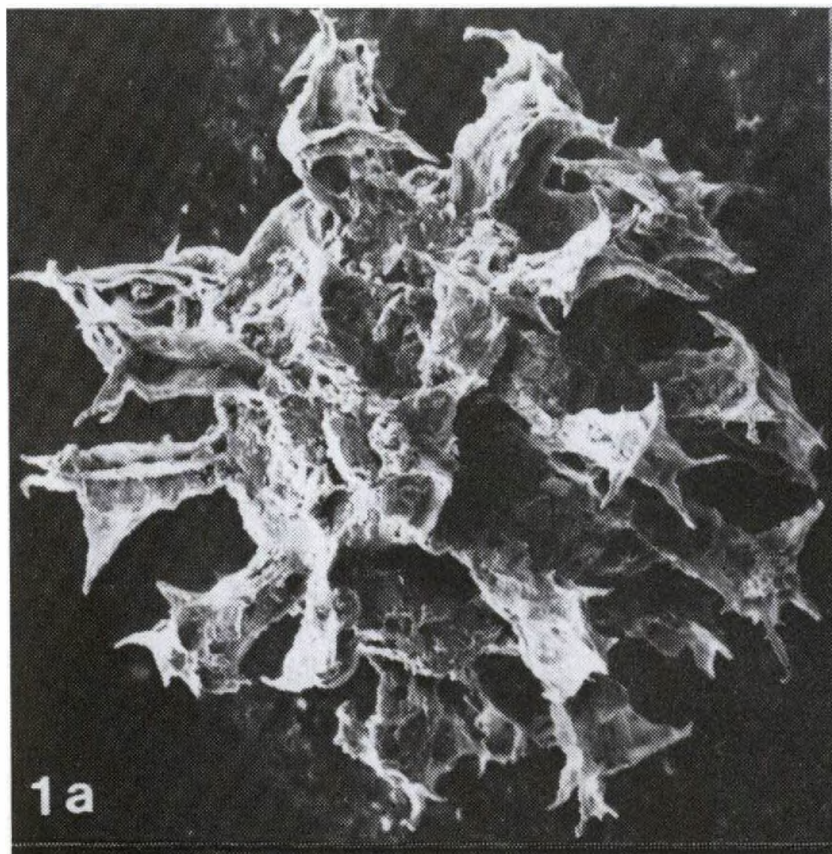
B. Emendation of the generic diagnosis

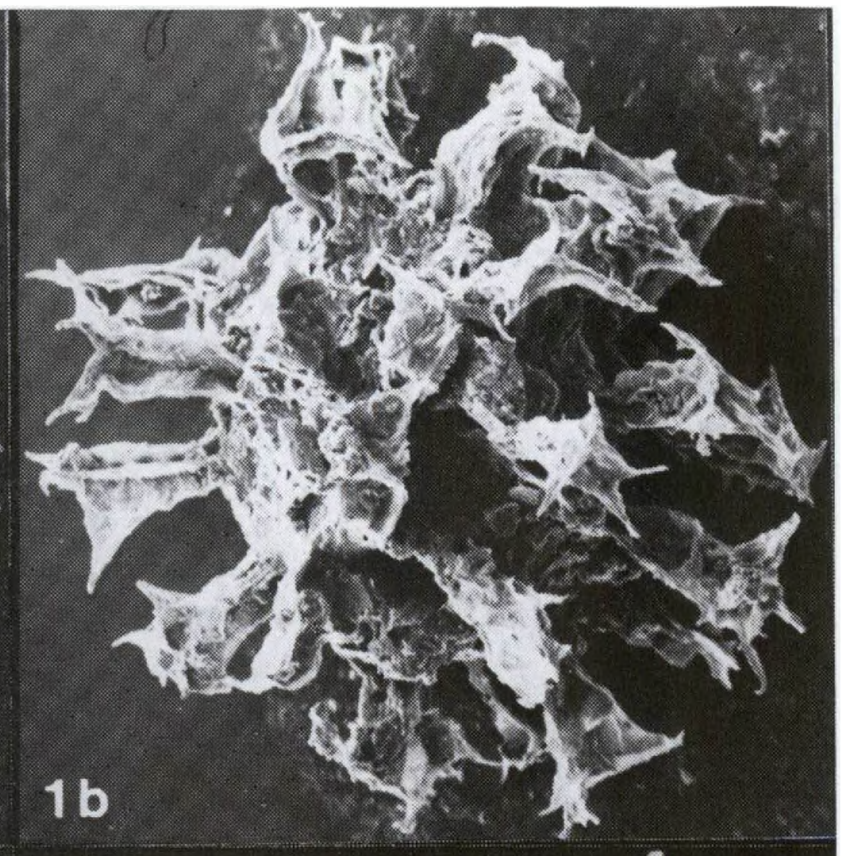
Because a l l recorded goniosphaerid Rogö-acritarchs show the significant striate-rugulate surface sculpture, and unpubl. observations on goniosphaerids from the upper Ordovician öjlemyrflint (Isle of Gotland/Sweden) seem to prove this fundamental feature (see pl. 3, fig. 2a,b), the only possible interpretation should be: vesicle wall is not homogenous but m u l t i l a y e r e d. A ± delicate periphragma is present which may show a rugulate-striate surface ornament. Since morphologically very different goniosphaerids show those periphragmatic structures, it is rather unlikely that this feature could be of taxonomic value for specific rank.

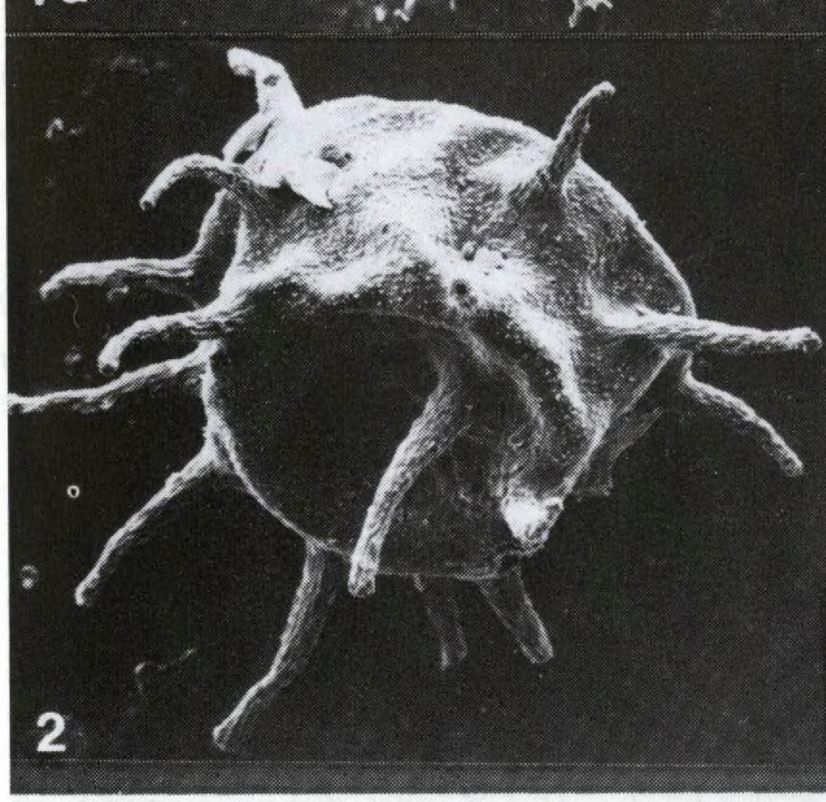
Genus ***Peteinosphaeridium*** STAPLIN et al. 1965 emend. EISENACK 1969

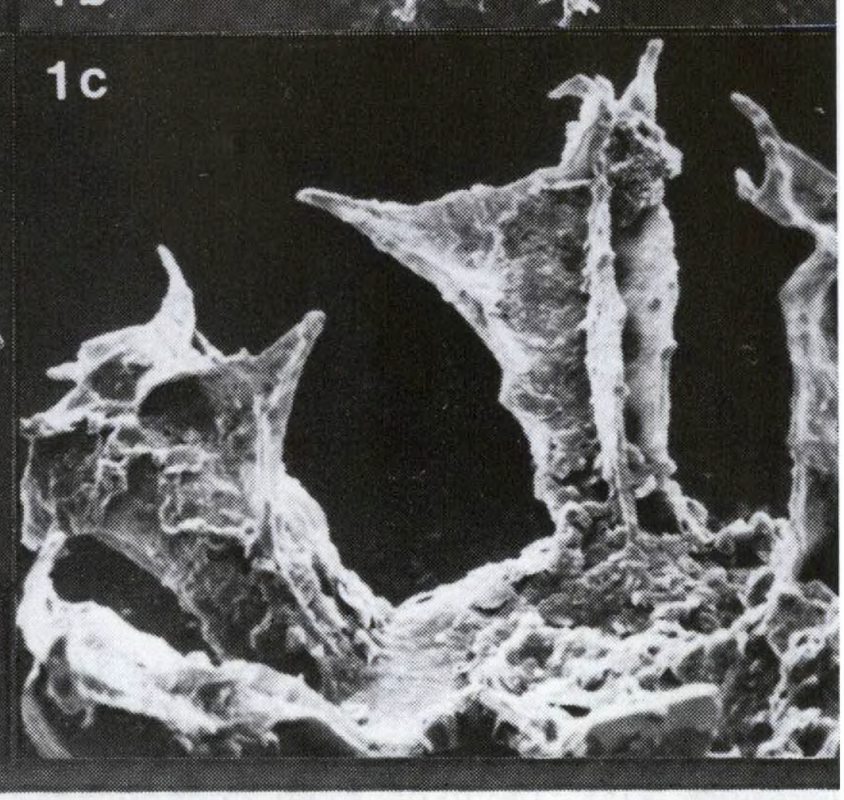
Peteinosphaeridium velatum KJELLSTRÖM 1971b

H.W.1/1.5 Pl. 6, fig. 1a-d
H.W.1/3.2

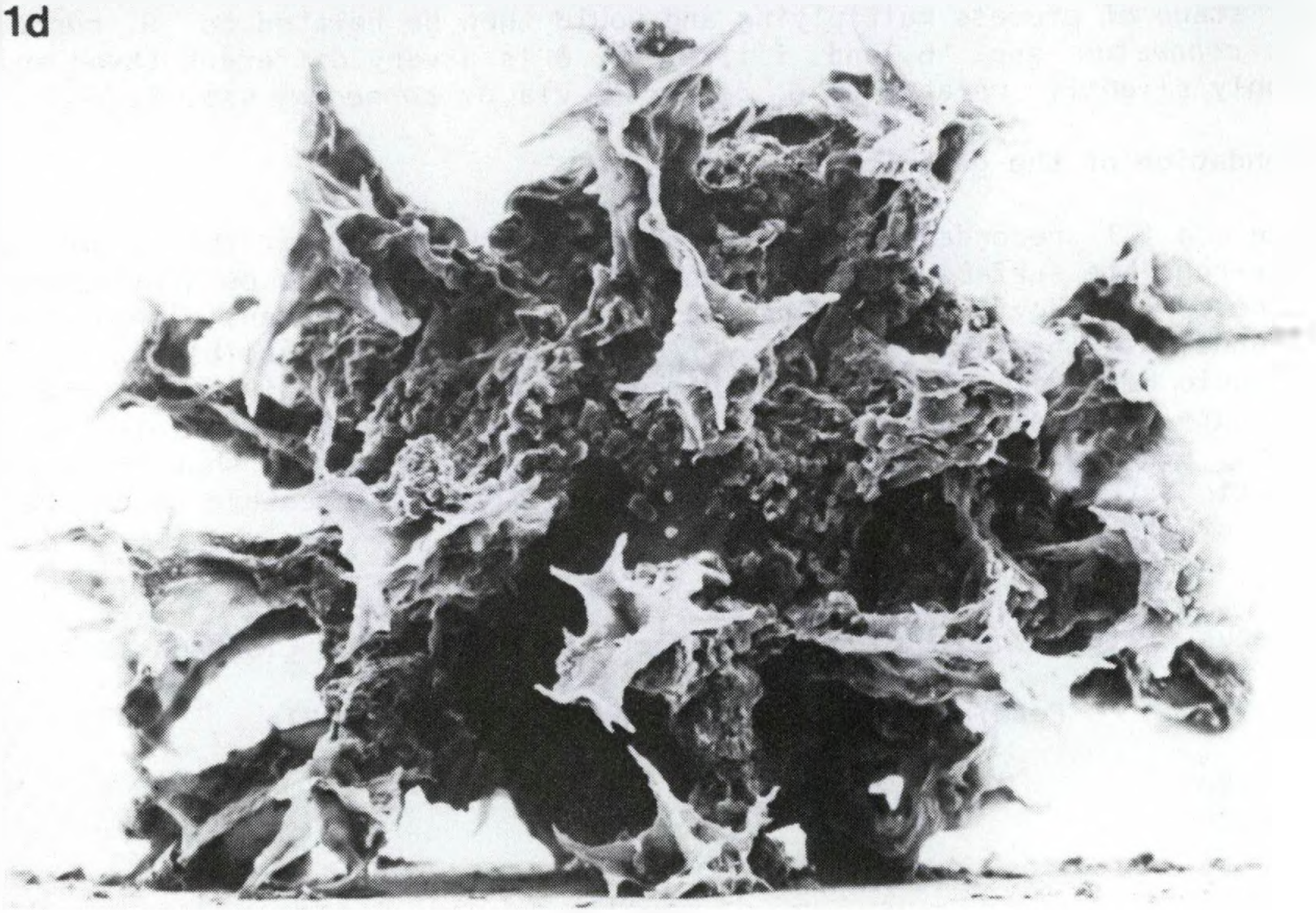








1d



H o l o t y p u s: KJELLSTRÖM 1971b: p. 58, pl. 4:8; SGU slide no. 472:1.

L o c u s t y p i c u s and s t r a t u m t y p i c u m: Grötlingbo Borehole No.1, Gotland/Sweden; Middle Ordovician (Viruan), 432.00 m.

O r i g i n a l d e s c r i p t i o n: *Peteinosphaeridium* sp. with thin, single walled, ellipsoidal, shagrinate vesicle. No excystment structure recorded. Angular process stem contact with the vesicle. Separation of the interior of the process stem from the vesicle cavity. Processes, about 17 in number, in length about 1/3 - 1/4 of vesicle diameter, psilate, peteinos ornament along the entire process stem, each velate process containing three stems, filiforme, homomorphic, trifurcate.

D i m e n s i o n s:

H.W.1/1.5 (holotype)		H.W.1/1.5 (holotype)		H.W.1/1.5 (holotype)	
D_t 89 µm	(78 µm)	L_{Pmax}		δ_{LP+}	
D_V 47x58 µm	(41x50 µm)	L_{Pmin}		δ_{LP-}	
N_P~24	(17)	L_P/D_V 0.34		B_B 5 µm	(6 µm)
L_P 18 µm	(12 µm)	S 9 µm	(6 µm)	L_P/B_B 3.6	(2)

R e m a r k s: H.W.1/1.5 differs from the holotype by an increased L_P and L_P/B_b. Furthermore, process stems are most often four in number, and secondary branching of distal terminations seems possible. Further studies on more material could necessitate the designation of a new taxon at the intraspecific level.

C o m p a r i s i o n: H.W.1/1.5 shows the c l o s e s t relationship to *P. hymenoferum* (EIS. 1938), whose holotype comes from a Glaukonitkalk erratic boulder (see EIS. et al. 1973:903). Conspecifity between *P. velatum* KJELLSTR. and *P. hymenoferum* EIS. cannot be positively excluded (compare to EIS. 1938, pl. 2:fig.3 and EIS. et al. 1973, p. 931). There may be a close relationship to *P. dissolutum* (BURMANN 1970) from the upper Llanvirnian (G.D.R./not otherwise specified) and *P. trifurcatum hypertrophicum* EIS. 1976 from the Kundastage of Hälludden, öland. Both, *P. dissolutum* and *P. trifurcatum hypertrophicum* reveal process main-stems with significant additional branching.

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Tafel 6 (Pl. 6): 1a,b *Peteinosphaeridium velatum* , prep. H.W.1/1.5, (x 585)
<———————— 1c same specimen (1520): petaloid processes
1d same specimen (x 1120)

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