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Ewa OLEMPSKA and Janusz BŁASZYK

Institute of Paleobiology
Polish Academy of Sciences
Żwirki i Wigury 93
02-089 Warszawa, POLAND

Ostracods from Permian of Spitsbergen

ABSTRACT: The ostracod fauna were examined from the Kapp Starostin Formation sequences (Upper Permian) from West Spitsbergen (Svalbard). The ostracod taxa are mainly confined to 3 superfamilies: Kirkbyacea, Healdiacea and Bairdiacea. 11 taxa are identified. One new species, *Kindlella bellsundi* is proposed. The ostracod assemblage dominated by kirkbyacean taxa is related to open shelf marine environment.

K e y w o r d s: Arctic, Spitsbergen, Permian, paleontology (Ostracoda).

Introduction

Ostracods are common faunal elements in the Permian marine units in South-West Spitsbergen (Svalbard). The sediments and fauna are from the Kapp Starostin Formation of Burov *et al.* (1965), and were investigated in the area between Hornsund and Isfjord (Fig. 1). The ostracod fauna was identified from material collected by K. Małkowski during the 1974–1976 scientific expeditions to Spitsbergen organized by the Institute of Paleobiology of the Polish Academy of Sciences.

The Kapp Starostin Formation consists primarily of cherts and organodetrital limestones rich in fossils (Birkenmajer 1964; Małkowski 1982, 1988; Małkowski and Hoffman 1979; Szaniawski and Małkowski 1979). It is variable in total thickness, from a few to a dozen meters in the Horsund region, to several hundred meters in the Bellsund-Isfiord region (*cf.* Małkowski 1982).

The abundant benthic fauna of the Kapp Starostin Formation was described by Forbes *et al.* (1958), brachiopods were described by Birkenmajer and Czarniecki (1960), Gobbett (1963), Sarytscheva (1977), Biernat and Birkenmajer (1981), Małkowski (1988), corals by Fedorowski (1982), tabulates by Nowiński (1982), gastropods by Karczewski (1982), bivalves by Frebold (1937), sponges

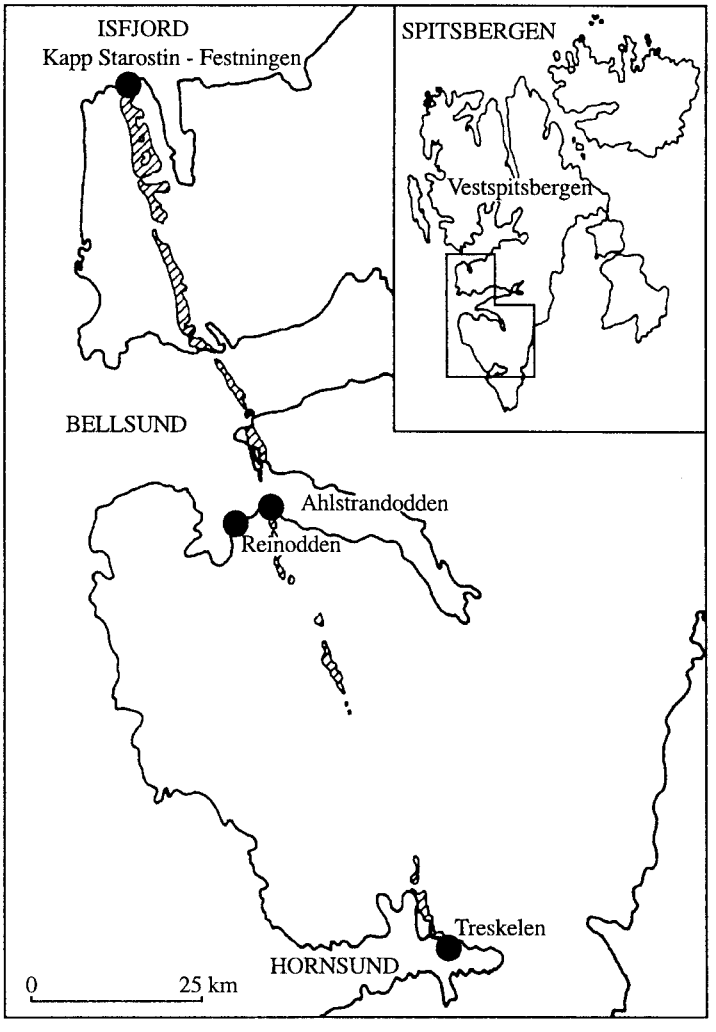

Fig. 1. Outline map of Spitsbergen showing the location of sections from which the ostracods were collected.

by Siedlecka (1970), foraminifera by Sosipatrova (1967), and bryozoans by Małecki (1968, 1977).

Based upon the conodont fauna (Szaniawski and Małkowski 1979) it was possible to correlate the base of the formation to the Leonardian (Roadian), or the uppermost Lower Permian. The continuous sedimentary transition from the Kapp Starostin Formation to overlying Triassic strata (Birkenmajer 1977) indicates that the formation encompasses the entire Upper Permian (Małkowski 1988) see Table 1.

Table 1

Stratigraphic position of the Kapp Starostin Formation within the Permian System (after Małkowski 1988).

Russian Platform	Spitsbergen		Delaware Basin (USA)	
TATARIAN	Kapp St. Fm.	HOVTINDEN	OCHOAN	
KAZANIAN				CAPTIAN
UFIMIAN		SVENSKEEGGA	GUADELUPIAN	WORDIAN
KUNGURIAN		VORINGEN		Roadian
ARTINSKIAN			LEONARDIAN	
SAKMARIAN				
ASSELIAN			WOLFCAMPIAN	

Reconstruction of the sedimentary development and facies model of the Kapp Starostin Formation was proposed by Małkowski and Hoffman (1979) and Małkowski (1982, 1988).

Ostracods were obtained by dissolving cherty rocks in hydrofluoric acid and from limestones by dissolving in acetic acid. Silicified ostracod specimens have been found only in deposits of Hovtinden Member (Upper Permian). They were collected from 4 sections (Fig. 2). Of the samples collected, 7 contained specimens of ostracods, providing a total of more than 200 specimens. The kirkbyacean taxa are most common components, they constitute approximately 90% of the specimens.

The work was carried out at the Institute of Paleobiology of the Polish Academy of Sciences, Warszawa, where the material is housed (ZPAL O.XXVI).

Stratigraphical and paleogeographical remarks

Permian ostracod assemblage of the Kapp Starostin Formation comprise 11 species arrayed in 8 genera. Only 3 of the Spitsbergen species — *Kirkbya permiana* (Jones, 1850), *Roundyella simplicissima* (Knight, 1928) and *Roundyella lebaensis* Krömmelbein, 1958 occur abroad, while the rest seem to be "endemic". Unnamed taxa probably also represent new species. This assemblage consist predominantly of the kirkbyacean species. *Kirkbya permiana* is the only one kirkbyan species in common with Permian of England and western Europe (Kirkby 1859, Knüpfer 1967, Jordan 1968).

Roundyella simplicissima occuring mostly in the Westphalian of Europe and Pennsylvanian of N-America was described also by Kellett (1943) and Melnyk

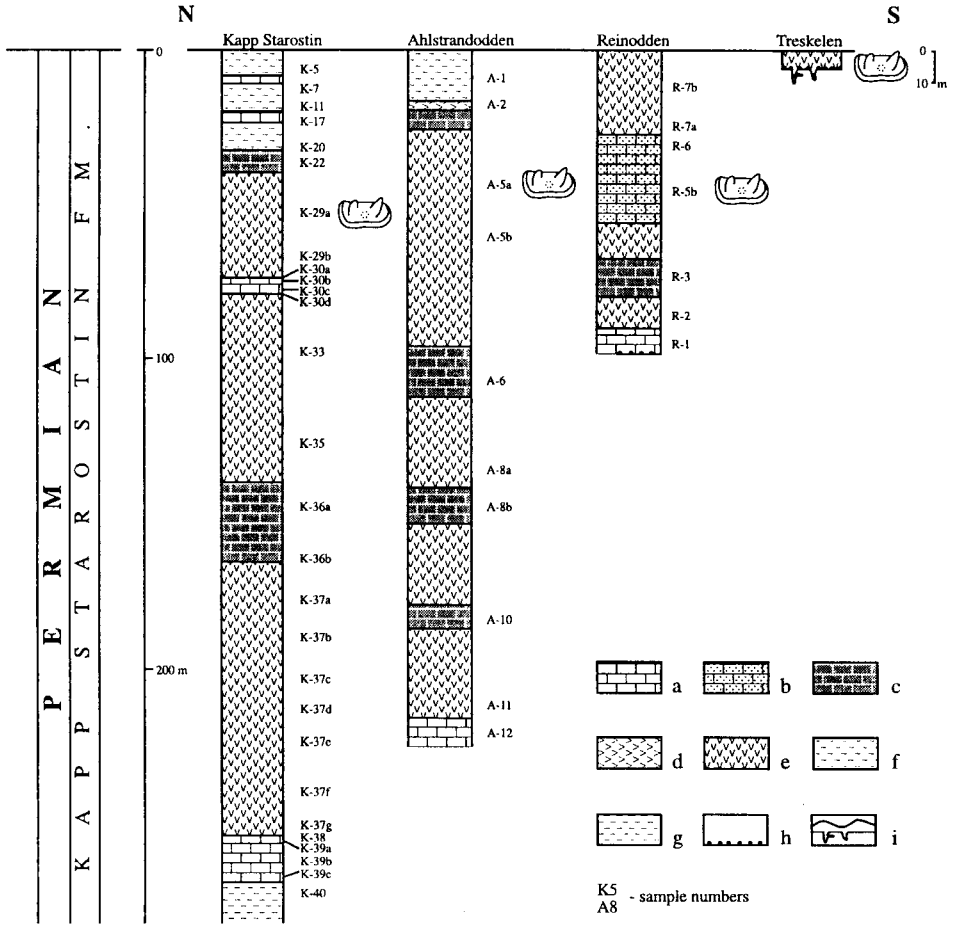

Fig. 2. Geological sections of the Kapp Starostin Formation marked ostracod bearing samples indicated. *a* limestone, *b* sandy limestone, *c* cherty limestone, *d* marly limestone, *e* chert, *f* cherty marl, *g* marl, *h* pebbles and granules, *i* disconformities (after Małkowski 1979).

and Maddocks (1988b) from Wolfcampian and Leonardian (early Permian) rocks of Texas.

Roundyella lebaensis occurs in the Zechstein of Europe (Krömmelbein 1958, Knüpfer 1967, Jordan 1968).

Work by Małkowski (1982, 1988) demonstrates that the strata of the Kapp Starostin Formation were all deposited within a rather small epicontinental marine basin, partly separated from the ocean. It was located in a warm climatic zone, probably around 30–40° N (Harland 1973, Birkenmajer 1977, Małkowski 1988), and was migrating northward during deposition of the Kapp Starostin Formation, probably accompanied by a climatic cooling. During the late Permian its sea connections to the Cisuralian area were disrupted (see Małkowski 1988).

The Kapp Starostin Frmation ostracod assemblage is different with regard to species content but bears all genera in common with other Permian assemblages. The generic links most clearly occur between the Spitsbergen assemblage and North America (see Hamilton 1942, Kellett 1943; Sohn 1950, 1954, 1982) and Europe (see Krömmelbein 1958, Knüpfer 1967, Jordan 1968). The low generic affinities are between the ostracods of the Kapp Starostin Formation and China (see Chen De-giong and Shi Cong-quang 1982, Shi Cong-quang and Chen De-giong 1987, Becker and Wang 1992) and the Ural region (see Kotschetkova and Guseva 1972).

Paleoecological characterization of Ostracoda

All the investigated sections of the Kapp Starostin Formation start at the base with deposits of near-shore to shallow-water marine facies replaced upwards by open sea-facies (Małkowski and Hoffman 1979; Małkowski 1982, 1988). Małkowski and Hoffman (1979) recognized a few basic facies types of the formation and produced a static model of their spatial distribution (Fig. 3). They categorized the fauna into broad morphological groups which they considered to have similar ecological requirements (data set consisting mostly of thin sections, relative-abundance data studied by means of factor analysis of correspondences of biotic and abiotic rock consistuents). Małkowski and Hoffman (1979) recognized eight main biofacies of the Kapp Starostin Formation: thick-shelled brachiopod, bryozoan, brachiopod-crinoid, bryozoan-ostracod, sponge-ostracod, sponge, foraminifer-algal, and foraminifer biofacies and interpreted as indicative of distinct facies zones including nearshore, offshore trough, bank, open sea, and lagoon.

Ostracods studied in thin sections are relatively the most abundant in marly-clayey sediments within facies zones IV and V deposited in shallow to deeper shelf waters (Fig. 3), with low-diversity fossil assemblages dominated by sponges and fenestelloid bryozoans (Małkowski and Hoffman 1979).

Ostracods, extraced by dissolving in acids, also have been found in samples of V–VI facies zones in Kapp Starostin section, Ahlstrandodden section, and Treskelen section (Figs 2–3). The ostracod assemblage of this zone includes the following taxa: *Kirkbya permiana*, *Kirkbya* sp. n., *Kindlella bellsundi* sp. n., *Miltonella*? sp., *Roundyella simplicissima*, *Roundyella lebaensis*, *Bairdia* sp., *Healdia* sp.. A sparse ostracod assemblage occurs in zone III (bank). Only 4 species documented by a small number of specimens were found here: *Kindlella bellsundi*, *Kindlella* sp., *Amphissites (Amphikegellites)*? sp., and *Shemonaella*? sp.

Kirkbyacea are widely distributed, from the deep-sea to extreme nearshore environments, they are the most frequent group in many near-shore and shallow off-shore deposits (*cf.* Bless 1970, 1983; Becker 1978).

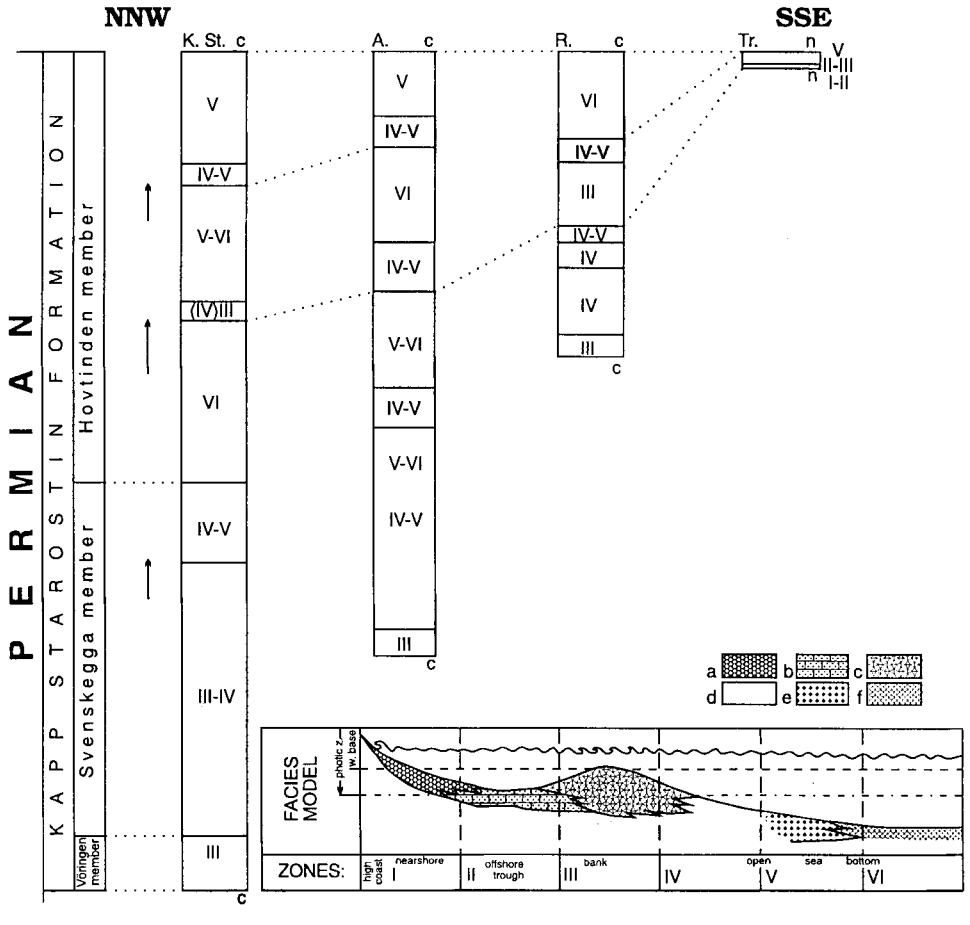

Fig. 3. Litho-chronostratigraphic correlation of the investigated sections of the Kapp Starostin Formation (after Małkowski 1982).

1. I–VI symbols for lithological sets and corresponding facies zones. 2. Contacts of the Kapp Starostin Fm. with the adjacent formations: *c* conformity, *n* nonconformity. 3. Arrows — supposed uplifts. Facies model (after Małkowski and Hoffman 1979). Lithology: *a* pebbles and granules, *b* silt, *c* lime mud, *d* sand, *e* silica clay, *f* coquina.

The Kapp Starostin assemblages closely resemble faunas from the Spanish Westfalian demonstrated to be from sheltered near-shore environments (Becker 1978, 1992); however, Melnik and Maddocks (1988a), in their study of palaeoecology of Permo-Carboniferous ostracods of Texas, concluded that species of well-ornamented Amphissitidae appear to have been restricted largely to offshore environments and most of the species seem to have similar mean positions on the coenocline. The species of heavily ornamented Kirkbyidae are predominantly offshore dwellers.

Systematic Paleontology

Order Palaeocopida Henningsmoen, 1953
Suborder Kirkbyocopina Gründel, 1969
Superfamily Kirkbyacea Ulrich and Bassler, 1906
Family Kirkbyidae Ulrich and Bassler, 1906

See Sohn (1954, 1961), Kozur (1985) and Becker and Wang (1992) for a discussion of this family.

Genus *Kirkbya* Jones, 1859

Type species: *Dithyrocaris permiana* Jones, 1850

Kirkbya permiana (Jones, 1850)
(Pl. 2, Figs 1–2)

1967. *Kirkbya permiana* (Jones); Knüpfer, Pl. 4: 1–2, p. 75 (here earlier synonymy).

Material. — 20 valves, some damaged.

Dimensions (figured specimens):

	L	H
ZPAL O.XXVI/1	1.92	0.92
ZPAL O.XXVI/2	1.60	0.72

All measurements are in millimetres.

Description. — Carapace comparatively large, subrectangular in lateral outline. Dorsal margin straight, as long as valve length; anterior cardinal angle 90°, posterior angle acute. Anterior margin almost straight, curved in ventral part; posterior truncated in ventral part; ventral margin mid-ventral nearly straight. Posterior shoulder not abrupt. (Outer) carina distinct, extending to cardinal angles. Kirkbyan pit well defined, located slightly below mid-height. Reticulae of moderate size.

Remarks. — See Sohn (1954) for the discussion of this species. Specimens from the Kapp Starostin Formation are poorly preserved and partly destroyed but they are most similar to Jones' (1850) figure 1a and 1b of Pl. 18, designated by Kellett (1933: 85) as holotype of *K. permiana*.

Occurrence. — In the Kapp Starostin Formation: Hovtinden Member — Kapp Starostin section, Treskelen section. Uppermost part of the Permian of England and Europe. Poorly preserved specimens were also noted from early Carboniferous of Tibet (Shi Cong-guang 1982).

Kirkbya sp. n.
(Pl. 4, Fig. 3; Pl. 5, Figs 1–8)

Material. — 50 valves.

Dimensions (figured specimens):

	L	H
ZPAL O. XXVI/13	3.40	1.40
ZPAL O. XXVI/14	2.28	1.30
ZPAL O. XXVI/15	1.62	1.18
ZPAL O. XXVI/16	1.36	1.08
ZPAL O. XXVI/17	2.10	0.96
ZPAL O. XXVI/18	1.88	0.88
ZPAL O. XXVI/19	1.28	0.76
ZPAL O. XXVI/20	1.00	0.52
ZPAL O. XXVI/21	0.68	0.36

Description. — Carapace large, subrectangular in lateral outline. Dorsal margin straight, as long as valve length, terminating in small spines in both ends, posterior spine longer. Cardinal angles almost 90°. Anterior and posterior margins curved, posterior truncated in ventral part; ventral margin nearly straight. (Outer) carina relatively wide, extending to cardinal angles. One row of larger reticulae present along outer carina. In adult specimens thin inner carina parallel to anterior, anteroventral, posterior and posteroventral part of outer carina, separated by row of reticulae. Carina and marginal structures separated by 3–4 rows of reticulae. Some horizontal and irregular lateral ridges developed, one below kirkbyan pit and 3 or 4 above, connected by perpendicular ridges. Kirkbyan pit subcircular, subcentrally located. Surface coarsely reticulate.

Remarks. — This species is most similar to *Kirkbya magna* Roth *sensu* Cooper, 1946 from the Pennsylvanian of Illinois (Cooper 1946) in having bifurcating ridges extending over the lateral surface. The material represents a new species but because it is poorly preserved, the species is not named.

Occurrence. — In the Kapp Starostin Formation: Hovtinden Member — Ahlstrandodden section, Treskelen section.

Family Amphissitidae Knight, 1928
Genus *Amphissites* Girty, 1910
Subgenus *Amphikegelites* Sohn, 1983

Type species: *Amphissites (Amphikegelites) henryi* Sohn, 1983.

Amphissites (Amphikegelites)? sp.
(Pl. 6, Fig. 5)

Material. — 1 valve.

Dimensions (figured specimen):

	L	H
ZPAL O.XXVI/26	0.66	0.34

Remarks. — One fragmentary specimen in the collection is questionably assigned to *Amphissites (Amphikegelites)*. Incomplete anteriorly, it has a small central node, poorly developed dorsal crest, and small kirkbyan pit at the ventral edge of the central node.

Occurrence. — In the Kapp Starostin Formation: Hovtinden Member — Reinodden section.

Family Kellettinidae Sohn, 1954

According to Becker and Wang (1992), this family is probably an advanced, late Paleozoic offshoot of the Kirkbyacea derived from phylogenetically specialized Kirkbyidae ("*Aurikirkbya* branch").

Genus *Kindlella* Sohn, 1954

Type species: *Kindlella fissiloba* Sohn, 1954

Kindlella bellsundi sp. n.
(Pl. 2, Figs 3–4; Pl. 3, Figs 1–4)

Holotype: specimen ZPAL O.XXVI/3; Pl. 3, Fig. 1.
Type horizon: Kapp Starostin Formation, Hovtinden Member, Upper Permian.
Type locality: Ahlstrandodden section (sample A-5a), Bellsund area, West Spitsbergen.
Derivation of the name: From Bellsund in west Spitsbergen.

Diagnosis. — *Kindlella* species with prominent posterior node extending above hinge line. Adventral structure (velum) a finely striated thickened ridge. Muscle spot large, round.

Material. — 78 valves.

PLATE 2

1–2. *Kirkbya permiana* (Jones, 1850). 1 Right valve, *a* lateral view, *b* internal view, *c* ventral view; ZPAL O.XXVI/1; Kapp Starostin section (sample K-29a); × 40. 2. Left valve (juv.), *a* lateral view, *b* ventral view; ZPAL O.XXVI/2; Kapp Starostin section (sample K-29a); × 40.
3–4. *Kindlella bellsundi* sp. n. 3. Right valve (juv.), *a* lateral view, *b* internal view; ZPAL O.XXVI/7; Ahlstrandodden section (sample A-5a), × 40. 4. Right valve (juv.), lateral view; ZPAL O.XXVI/8; Ahlstrandodden section (sample A-5a); × 40.
5. *Roundyella lebaensis* Krömmelbein, 1958. Right valve, *a* lateral view, *b* internal view, ZPAL O.XXVI/10; Treskelen section (sample C); × 55.

Dimensions (figured specimens):

	L	H
ZPAL O. XXVI/3	1.76	0.92
ZPAL O. XXVI/4	1.78	0.92
ZPAL O. XXVI/5	1.44	0.80
ZPAL O. XXVI/6	1.20	0.60
ZPAL O. XXVI/7	1.32	0.60
ZPAL O. XXVI/8	0.52	0.28

Description. — Valves comparatively large, subrectangular in lateral outline. Dorsal margin straight as long as valve length. Hinge with ridge and well developed terminal teeth in right valve, that fit into open sockets in opposing valve. Anterior and posterior angles slightly greather than 90°. Anterior and posterior margin rounded, posterior slightly truncated in ventral part; ventral margin nearly straight, slightly concave in mid-length. Posterior node prominent, extending above hinge line, directed dorsoposteriorly; anterior lobe less prominent; lobes extending below mid-height. Round, comparatively large muscle spot located subcentrally. Marginal structure a thick ridge covered by delicate striate. Reticulae of moderate size; surface parallel to marginal structure smooth.

Remarks. — It differs from congeneric species by exhibiting a striate marginal structure and prominent posterior lobe extending above the dorsal margin.

Occurrence. — In the Kapp Starostin Formation: Hovtinden Member — Kapp Starostin section, Ahlstrandodden section, Reinoden section, Treskelen section.

Kindlella sp.
(Pl. 5, Fig. 9)

Material. — One valve.

Dimensions (figured specimen):

	L	H
ZPAL O.XXVI/9	0.68	0.34

PLATE 3

1–4. *Kindlella bellsundi* sp. n. Ahlstrandodden section (sample A-5a). 1. Left valve, holotype ZPAL O.XXVI/3, *a* lateral view, *b* internal view, *c* ventral view; × 40. 2. Right valve ZPAL O.XXVI/4, *a* lateral view, *b* internal view, *c* ventral view; × 40. 3. Left valve ZPAL O.XXVI/5 *a* lateral view, × 40; *b* detail of muscle spot; × 200. 4. Right valve (juv.) ZPAL O.XXVI/6, lateral view; × 40.

Remarks. — It is possible that the illustrated specimen represents juvenile stage of *Kindlella bellsundi* sp. n. but differs from the latter in exhibiting more coarse reticulation and in lacking striation on adventral structure.

Occurrence. — In the Kapp Starostin Formation: Hovtinden Member — Reinoden section.

Family Miltonellidae Sohn, 1950
Genus *Miltonella* Sohn, 1950

Type species: *Miltonella shupei* Sohn, 1950

Miltonella? sp.
(Pl. 6, Fig. 4)

Material. — 11 valves.

Dimensions (figured specimen):

	L	H
ZPAL O.XXVI/24	0.60	0.32

Description. — Lateral surface poorly preserved, indistinctly reticulate. Dorsal margin straight, venter almost straight to slightly concave posterior to mid-length. Anterior and posterior margins rounded. Greatest height near anterior cardinal angle. Greatest length at mid-height. Narrow groove extends from anterior part of dorsal margin, parallel to ventral margin below mid-height and to posterodorsal corner. Valve slightly inflated in postero-dorsal part. Muscle spot invisible.

Remarks. — Specimens are poorly preserved with corroded surface questionably assigned to *Miltonella* Sohn. *Miltonella shupei* Sohn, 1950 from Permian of Texas is much larger, extending to 2.50 mm.

Occurrence. — In the Kapp Starostin Formation: Hovtinden Member — Treskelen section.

PLATE 4

1. *Roundyella lebaensis* Krömmelbein, 1958. Right valve, ZPAL O.XXVI/11, *a* lateral view, *b* internal view; Ahlstrandodden section (sample A-5a); × 55.
2. *Roundyella simplicissima* (Knight, 1928). Right valve, ZPAL O.XXVI/12, *a* lateral view, *b* internal view; Ahlstrandodden section (sample A-5a); × 55.
3. *Kirkbya* sp. n. Left valve, ZPAL O.XXVI/13, *a* lateral view, *b* internal view, *c* ventral view; Treskelen section (sample B); × 25.

Family Scrobiculidae Posner, 1951
Genus *Roundyella* Bradfield, 1935

Type species: *Amphissites simplicissimus* Knight, 1928

Roundyella simplicissima (Knight, 1928)
(Pl. 4, Fig. 2)

1928. *Amphissites simplicissimus* Knight; Knight, p. 266–267, Pl. 32, Fig. 11; Pl. 34, Fig. 6.
1961. *Roundyella simplicissima* (Knight); Sohn, p. 150–151 (here older synonymy).
1991. *Roundyella simplicissima* (Knight); Fohrer, p. 25, Pl. 9, Figs 7–8; Pl. 10, Figs 1–2 (here remaining synonymy).

Material. — 15 valves

Dimensions (figured specimen):

	L	H
ZPAL O. XXVI/12	0.88	0.44

Description. — Valves up to 1.0 mm long. Valve outline slightly postplete to subamplete. Hinge line moderately long. Greatest length at mid-height. Greatest height slightly behind mid-length. Dorsal margin straight. Cardinal angles more than 90°, posterior greater than anterior. Anterior and posterior margins rounded, ventral margin slightly concave in middle part. Round musce spot slightly forward of center. Lateral surface reticulate with small papillae.

Remarks. — It is similar in surface ornamentation and outline to *Roundyella dorsopapillosa* Sohn, 1954 from the Permian of the Glass Mountains, Texas, but differs in lacking the larger spine in the dorsoposterior part.

Occurrence. — Pennsylvanian — early Permian of N-America and Europe.

In the Kapp Starostin Formation: Hovtinden Member — Ahlstrandodden section, Treskelen section.

PLATE 5

1–8. *Kirkbya* sp. n. 1. Right valve (juv.), ZPAL. O.XXVI/21, *a* lateral view, *b* internal view, *c* ventral view; Ahlstrandodden section (sample A-5a); × 30. 2. Right valve (juv.), ZPAL O.XXVI/20, *a* lateral view, *b* ventral view; Ahlstrandodden section (sample A-5a); × 30. 3. Right valve, ZPAL O.XXVI/19, *a* lateral view, *b* internal view, *c* ventral view; Treskelen section (sample E); × 30. 4. Left valve, ZPAL O.XXVI/18, *a* lateral view, *b* ventral view; Ahlstrandodden section (sample A-5a); x 30. 5. Left valve, ZPAL O.XXVI/17; Ahlstrandodden section (sample A-5a); × 30. 6. Left valve (broken), ZPAL O.XXVI/16; Ahlstrandodden section (sample A-5a); × 30. 7. Right valve (broken), ZPAL O.XXVI/15, *a* lateral view, *b* ventral view; Ahlstrandodden section (sample A-5a); × 30. 8. Right valve (partly broken), ZPAL O.XXVI/14; Treskelen section (sample B); × 25.

9. *Kindlella* sp. Left valve (juv.), ZPAL O.XXVI/9; Reinodden section (sample R-5b); × 70.

Roundyella lebaensis Krömmelbein, 1958

(Pl. 2, Fig. 5; Pl. 4, Fig. 1)

1958. *Roundyella lebaensis* Krömmelbein; p. 118, Pl. 1, Figs 11–15; Pl. 3, Figs 45–46.
1967. *Roundyella lebaensis* Krömmelbein; Knüpfer, p. 76, Pl. 1, Fig. 1.

Material. — 8 valves.

Dimensions (figured specimens):

	L	H
ZPAL O.XXVI/10	1.04	0.64
ZPAL O.XXVI/11	0.98	0.48

Description. — Valves up to 1.1 mm long. Outline almost amplete. Dorsal margin straight, moderately long. Cardinal angles obtuse. Greatest length at or slightly above mid-height, greatest height near middle. Anterior and posterior margins rounded, ventral margin straight to slightly concave in middle part. Round musce spot in central part of valve. Lateral surface covered by small spines especially concentrated along anterior and posterior margins.

Remarks. — This species is similar to *Roundyella neopapillosa* Ishizaki, 1964 from the Middle Permian of northeast Japan (Ishizaki 1964). *Roundyella lebaensis wangi* described by Kozur (1985) from Carboniferous of Hungarian differs in having a strongly reticulate lateral surface. It is also similar to *Roundyella nodomarginata* (Bradfield, 1935) from the Upper Pennsylvanian of the Hoxbar Formation, Oklahoma, but differs in having spines also near the dorsal margin.

Occurrence. — In the Kapp Starostin Formation: Hovtinden Member — Treskelen section. Zechstein of Rügen (Germany) and Pomerania (Poland).

PLATE 6

1. *Healdia* sp. Right valve, ZPAL O.XXVI/23, *a* lateral view, *b* internal view; Ahlstrandodden section (sample A-5a); × 45.
2. *Bairdia* sp. Right valve, ZPAL O.XXVI/22, *a* lateral view, *b* internal view; Ahlstrandodden section (sample A-5a); × 35.
3. *Shemonaella*? sp. Right valve, ZPAL O.XXVI/25, *a* lateral view, *b* internal view; Reinodden section (sample R-5b); × 60.
4. *Miltonella*? sp. Left valve, ZPAL O.XXVI/24, *a* lateral view, *b* internal view; Treskelen section (sample E); × 70.
5. *Amphissites (Amphikegellites)*? sp. Right valve, ZPAL O.XXVI/26, lateral view; Reinodden section (sample R-5b); × 70.

Order Podocopida Sars, 1866
Suborder Podocopina Sars, 1866
Superfamily Bairdiacea Sars, 1888
Family Bairdiidae Sars, 1888
Genus *Bairdia* McCoy, 1844

Type species: *Bairdia curta* McCoy, 1844

Bairdia sp.
(Pl. 6, Fig. 2)

Material. — 18 valves.

Dimensions (figured specimen):

	L	H
ZPAL O. XXVI/22	1.88	1.08

Remarks. — *Bairdia* sp. from Spitsbergen may be compared with *Bairdia concinna* Guseva, 1972 from the early Permian of the Ural region (Kotchetkova and Guseva 1972), *B. rhomboidalis* Hamilton, 1942 from the Middle Permian of Texas (Hamilton 1942, Sohn 1960), and many similar upper Palaeozoic *Bairdia* forms.

Occurrence. — In the Kapp Starostin Formation: Hovtinden Member — Ahlstrandodden section, Treskelen section.

Suborder Metacopina Sylvester-Bradley, 1961
Superfamily Healdiacea Harlton, 1933
Family Healdiidae Harlton, 1933

Genus *Healdia* Roundy, 1926

Type species: *Healdia simplex* Roundy, 1926.

Healdia sp.
(Pl. 6, Fig. 1)

Material. — 4 valves.

Dimensions (figured specimen):

	L	H
ZPAL O. XXVI/23	1.20	0.20

Remarks. — Because of the small amount of material, the species is not named. It differs from other species of the genus mainly by the poorly developed round nodes in the posterior part. It is similar to *Healdia incisurelloides* Knüpfer, 1967 from Zechstein of Rügien, but differs in having a more elongate lateral outline.

Occurrence. — In the Kapp Starostin Formation: Hovtinden Member — Ahlstrandodden section.

Order indet.
Suborder Paraparchitocopina Gramm, 1975
Superfamily Paraparchitacea Scott, 1959
Family Paraparchitidae Scott, 1959
Genus *Shemonaella* Sohn, 1971

Type species: *Shemonaella dutroi* Sohn, 1971

Shemonaella? sp.
(Pl. 6, Fig. 3)

Dimensions (figured specimen):

	L	H
ZPAL O.XXVI/25	0.84	0.56

Remarks. — Three silicified right valves have been found in the present material. Unfortunately the material is too badly preserved to be described in detail. Specimens are strongly preplete in lateral outline, with straight dorsal margin, anterior margin broadly rounded, and posterior margin truncated in ventroposterior part. Cardinal corners slightly rounded, both greater than 90°. Elongate swelling present near and subparallel to the ventral margin (probably female valves?). Spines are absent. Surface smooth. The material agrees with *Shemonaella* in lacking spines, not having an incised dorsum, and lack of pronounced overreach but because of insufficient material and lack of closed carapaces the taxon is not formally named. The best specimen is illustrated.

Occurrence. — In the Kapp Starostin Formation: Hovtinden Member — Reinodden section.

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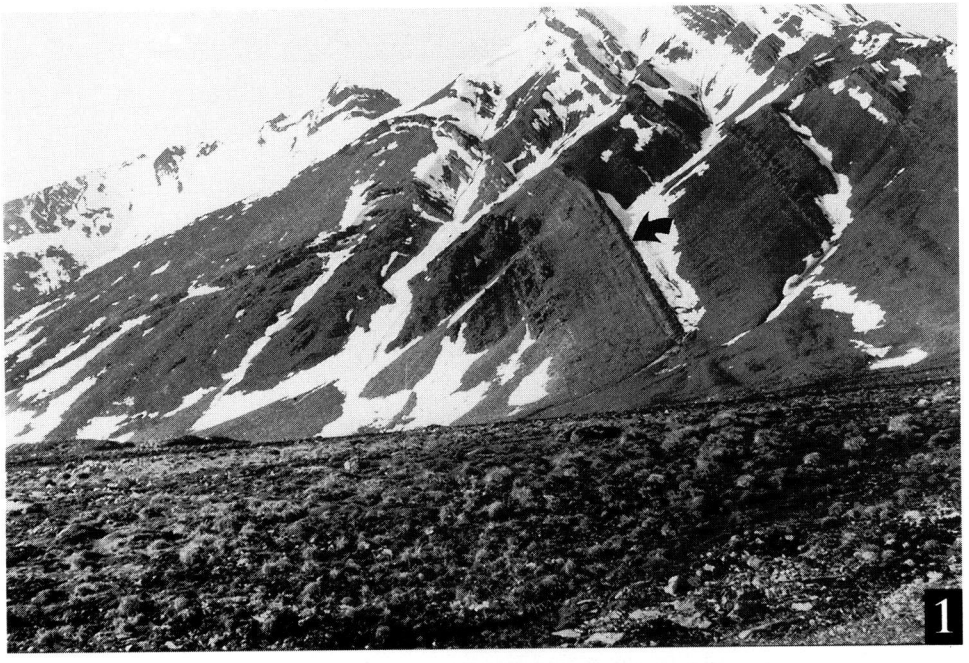
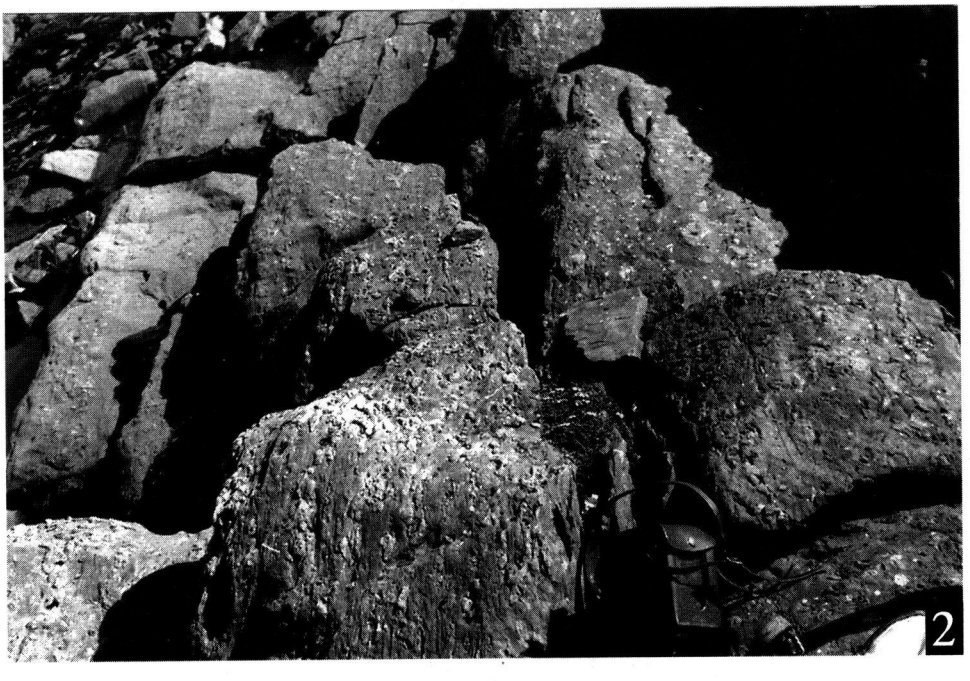
Streszczenie

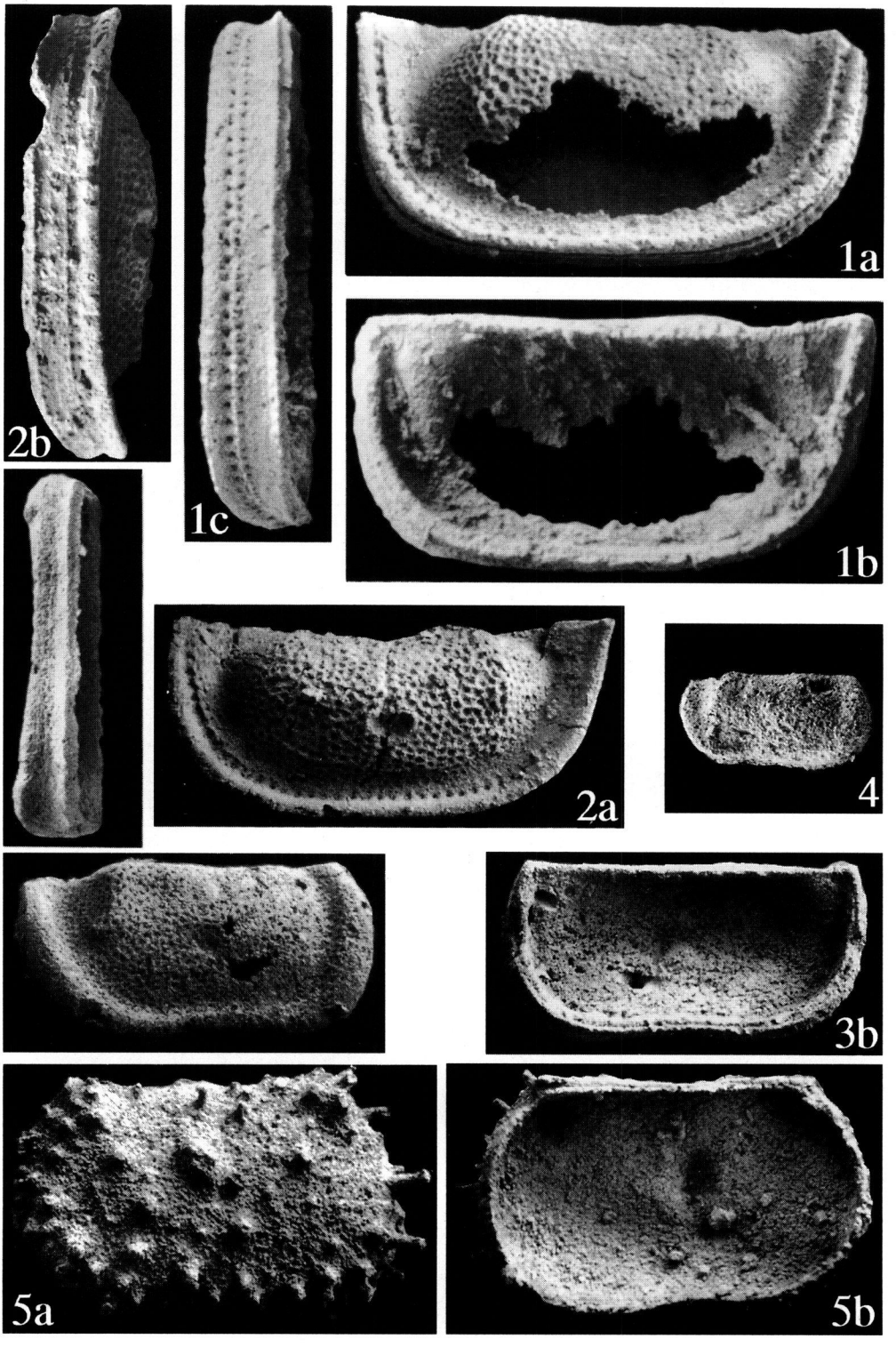
Z czterech odsłonięć (Kapp Starostin, Ahlstrandodden, Reinodden, Treskelen) późnopermskich osadów formacji Kapp Starostin na S-W Spitsbergenie (tab. 1, fig. 1–3) opisano zespół 11 gatunków małżoraczków (pl. 1–6), w tym jeden nowy gatunek *Kindlella bellsundi* sp. n. Opisane gatunki należą do trzech głównych nadrodzin małżoraczków: Kirkbyacea, Healdiacea i Bairdiacea. Gatunki reprezentujące nadrodzinę Kirkbyacea, głównie z rodzajów *Kirkbya*, *Kindlella* i *Roundyella* dominują w opisanym zespole. Najliczniej występują w profilach Ahlstrandodden i Treskelen w osadach reprezentujących IV–VI poziomy facjalne wydzielone przez Małkowskiego i Hoffmana (1979), reprezentujące osady otwartego morza.





1. Hyrnfjellet massif, boundary between Permian and Triassic is indicated.
2. Cherts typical of Hornsund-Treskelen area.

Photo by K. Małkowski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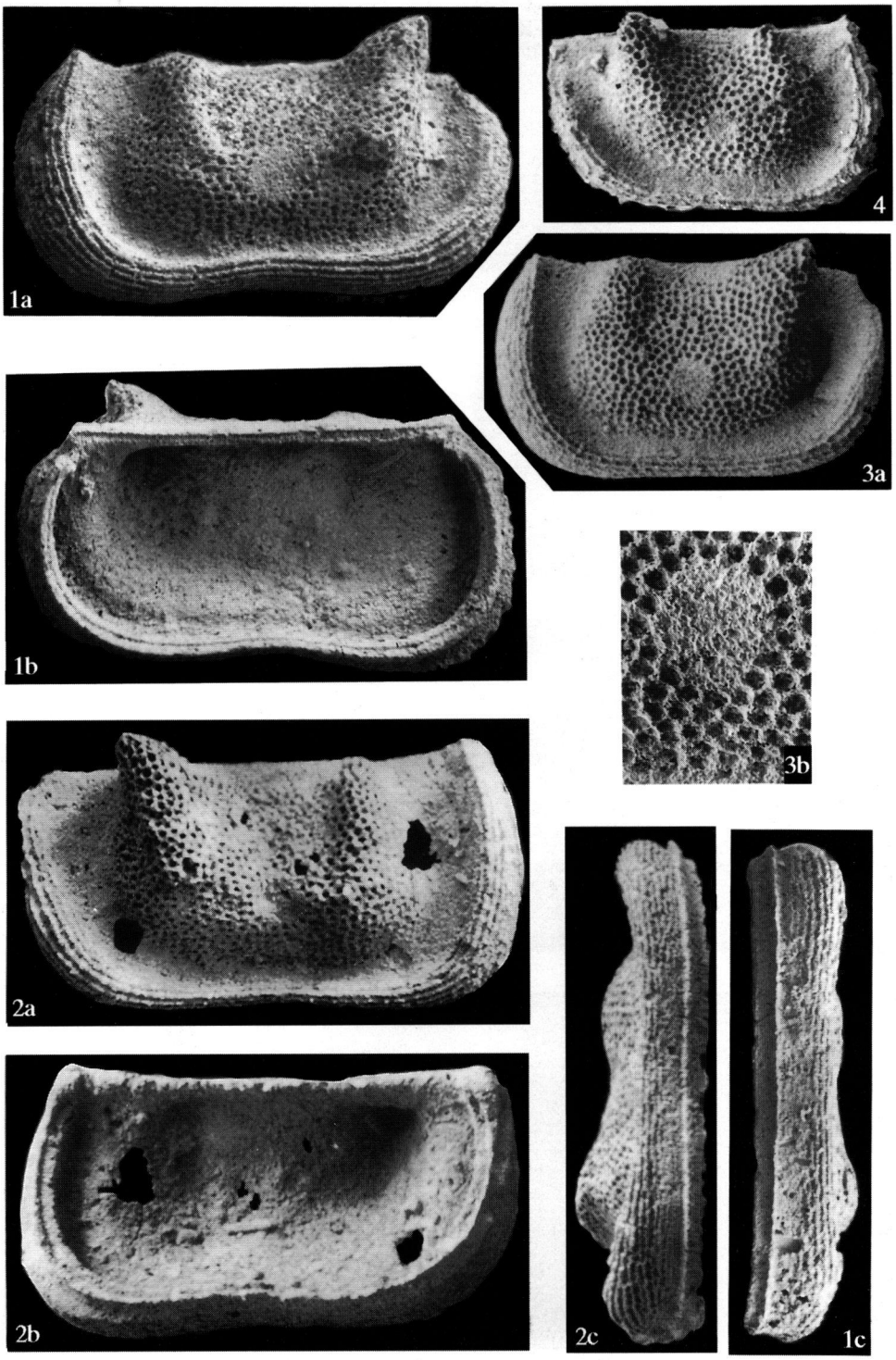
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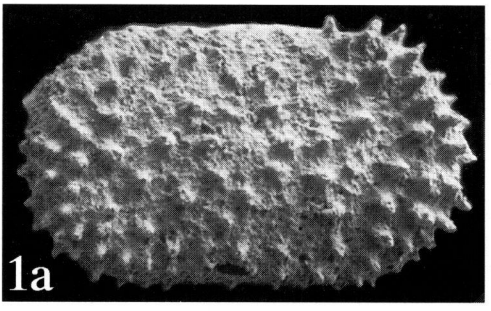
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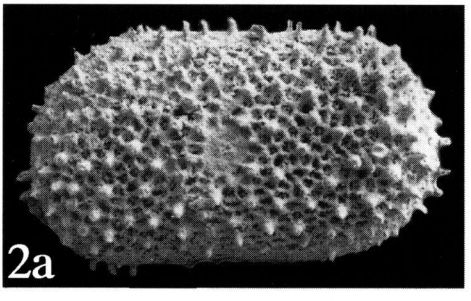
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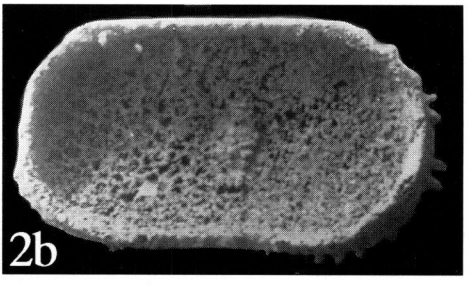
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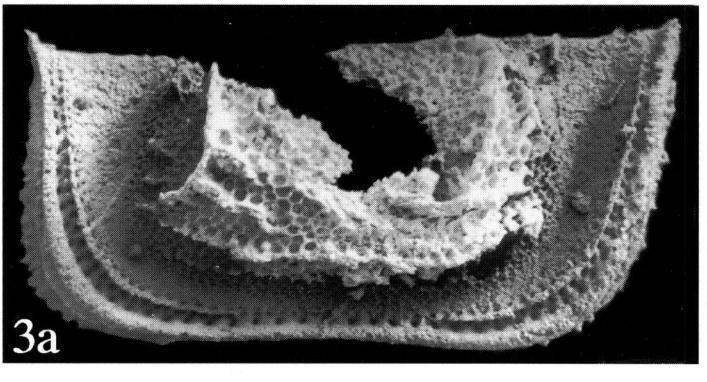
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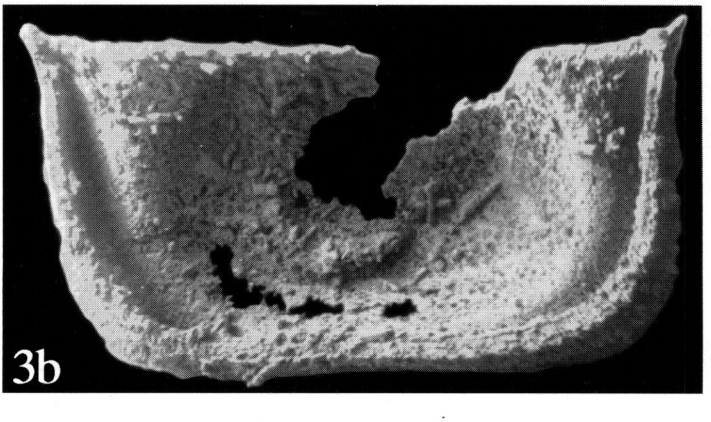
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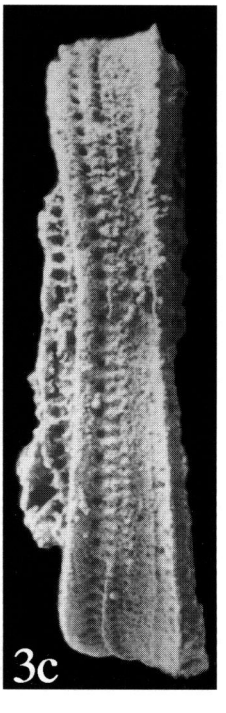
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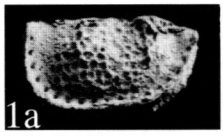
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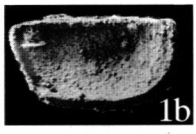
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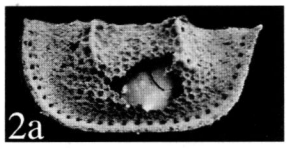
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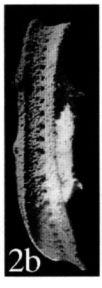
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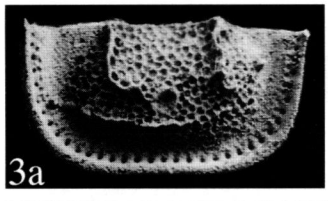
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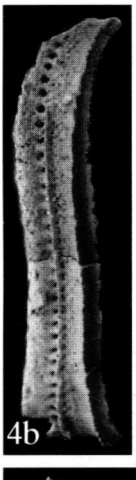
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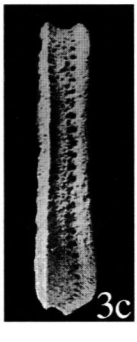
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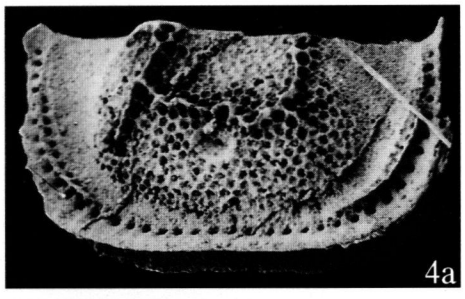
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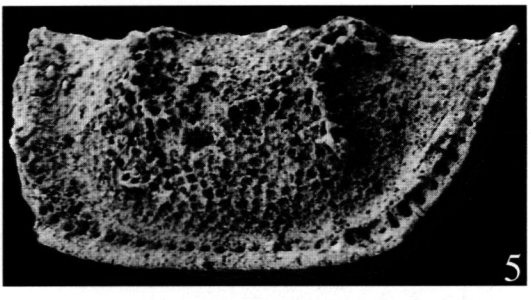
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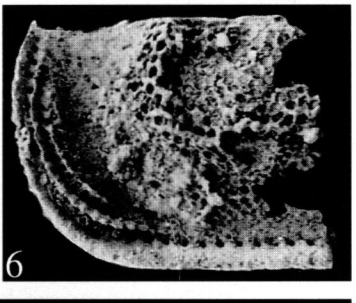
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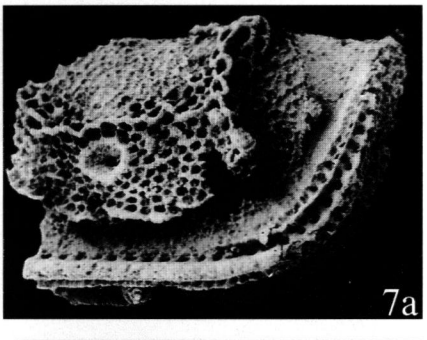
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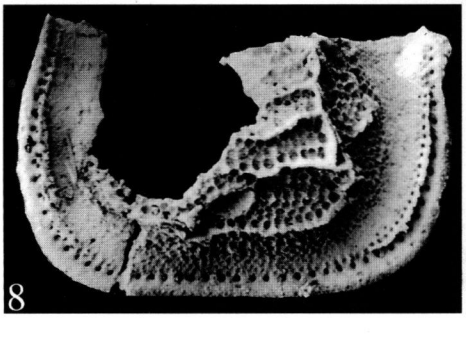
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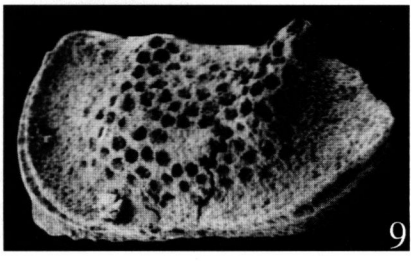
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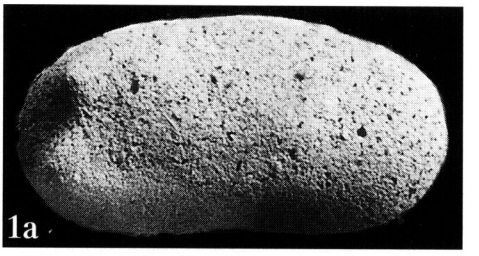
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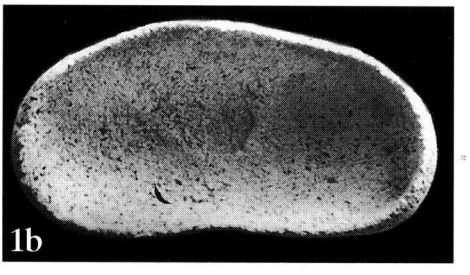
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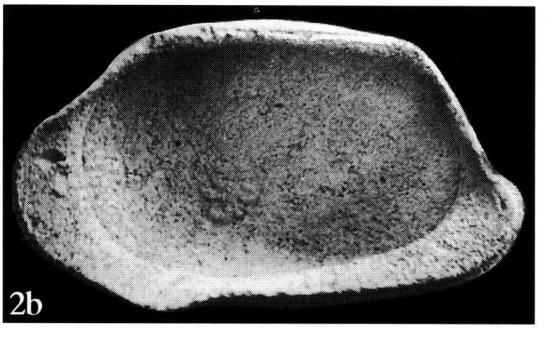
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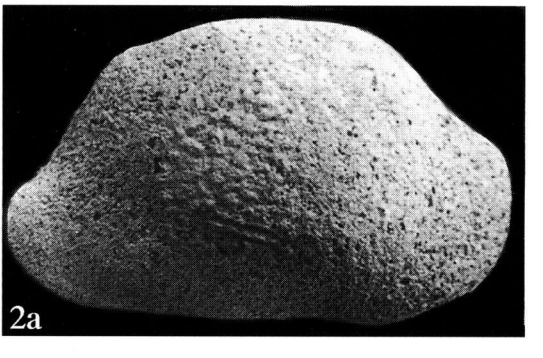
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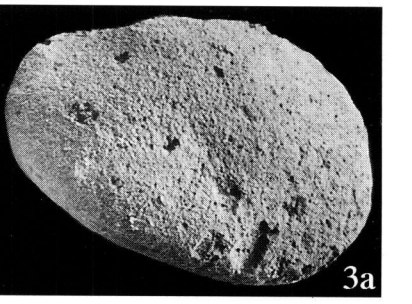
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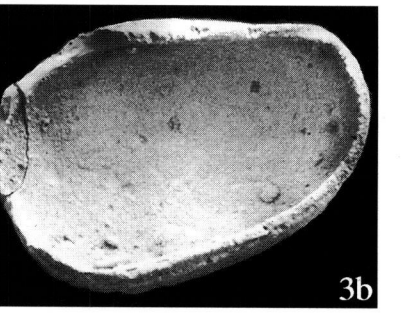
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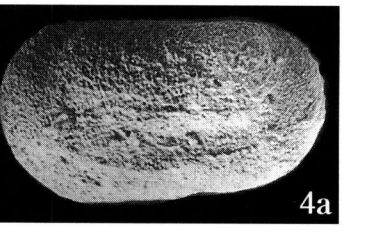
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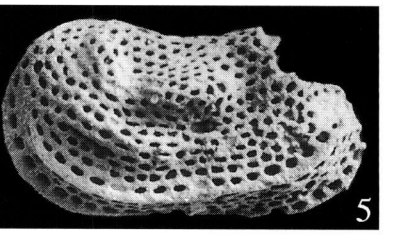
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