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# Genus *Silicoplacentina* (Class Amoebina) from the Miocene Machów Formation (Krakowiec Clays) of the northern Carpathian Foredeep

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Representatives of the genus *Silicoplacentina* have been found in the Jamnica S-119 borehole and in an open pit at the Machów mine in the upper part of the Krakowiec Clays (Machów Formation). They represent the thecamoebians, which have not been previously described from the Polish part of the Carpathian Foredeep. *Silicoplacentina* species are accompanied by foraminifers of the genus *Miliammina* characteristic of the Pannonian, Sarmatian relict forms of the genera *Quinqueloculina, Elphidium* and *Nonion*, as well as fragments of fish, otoliths and ostracods. A Late Sarmatian foraminiferal assemblage of the *Protelphidium subgranosum* Zone, already known in earlier literature, occurs below the deposits with *Silicoplacentina.* Such a microfaunal succession may suggest that the microfossil assemblage found in the Jamnica S-119 borehole and Machów open pit comes from yet higher levels of the Krakowiec Clays than those previously described from the *Protelphidium subgranosum* Zone. A strong connection with microfauna from the Intra-Carpathian basins of the eastern Paratethys is marked in these youngest assemblages.

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Key words: Carpathian Foredeep, Miocene, Krakowiec Clays, genus *Silicoplacentina.*

## INTRODUCTION

Continuing research on Miocene microfaunal assemblages from the Krakowiec Series of the northern part of the Carpathian Foredeep, has led to the discovery in its lowermost part of tests belonging to the genus *Silicoplacentina*.

These are present in two sites: in the Jamnica S-119 borehole and in an open pit at the Machów mine (Fig. 1), in marly claystones exhibiting varying textures, interbedded with sandstones or sandy siltstones. In the Jamnica S-119 borehole they occur at a depth interval of 56–117 m, and in the Machów mine at 32–35 m (Fig. 2).

Both a lack of any information regarding *Silicoplacentina* in Miocene deposits in the Polish part of the Carpathian Foredeep, and the stratigraphic importance of these organisms in the lowermost Pannonian deposits of Hungary (O. S. Schreiber *et al.*, 1985) and the Vienna Basin (R. Fuchs, O. S. Schreiber, 1988), have prompted detailed studies on the structure, taxonomy, biostratigraphy and ecology of these microfossils.

## GENERAL CHARACTERISTICS OF ORGANISMS BELONGING TO THE GENUS *SILICOPLACENTINA*

Originally, Pannonian *Silicoplacentina* were described as "peculiar white discs", "agglutinated foraminifers" (H. Fahrion, 1941), "Placentamina — group" (G. Szurovy, 1941) or "white agglutinated foraminifers" (K. Veljkovic-Zajec, 1952).

J. Kövåry in 1956 ultimately assigned ancient *Silicoplacentina* to the order Testacea within the class Amoebina assuming that they have a structure similar to modern representatives of the thecamoebians.

Connections with primitive agglutinated foraminifers has also been precluded by V. Pokorny (1958) due to differences in reproduction mode between these two groups. They differ from primitive agglutinated foraminifers only in their mode of reproduction (V. Pokorny, 1958).

The jelly-like amoeba body of modern thecamoebians (O. S. Schreiber *et al.*, 1985) possesses the ability to build a hard

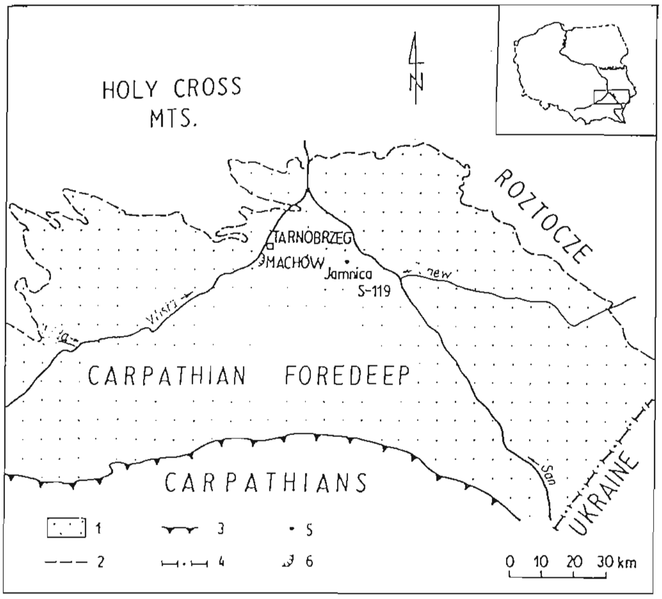


Fig. 1. Location of boreholes under study

1 — Miocene of the Carpathian Foredeep, 2 — northern extent of Miocene deposits, 3 — Carpathian thrust front, 4 — state border, 5 — borehole, 6 — outcrop of Miocene deposits

test in an endogenic or agglutinating way. Its main component is $SiO_2$, and sand grains and fragments of diatom tests are mainly used in the process of building.

Chemical analysis by I. Waldherr (O. S. Schreiber *et al.*, 1985) showed that thecamoebian tests are composed of 82% $SiO_2$, 2.02% $FeO_3$, 2.59% CaO, 2.29% MgO, 0.64% $K_2O$, 1.44% $Na_2O$, the remainder being organic matter.

Tests of ancient *Silicoplacentina*, probably produced similarly to other thecamoebians, are usually flattened, rarely convex. They are round, oval or elliptical in shape. They range in diameter from 0.2 to 1.3 mm. Walls are 35–75 μ thick. The outer surface of the test is unsculptured, finely granular or coarsely granular. Folds, wrinkles and concavities (Pl. II, Figs. 4, 5; Pl. III, Figs. 5a, 6; Pl. IV, Figs. 1–3) were probably formed due to compaction (O. S. Schreiber *et al.*, 1985). The foramen leading just into the test is visible on some specimens (Pl. II, Figs. 1, 3a; Pl. III, Fig. 6). Most frequently it is filled with sediment, only a concavity being observed, or it may be entirely unrecognizable (Pl. III, Fig. 1a, b, 5a). Sometimes a cross fracture reveals the interior filled with sediment (Pl. I, Figs. 7, 8). Tests of most of specimens are white or grey but they may also be brown in colour.

## TAXONOMY

The genus *Silicoplacentina* from the Lower Pannonian of Hungary has been subdivided by J. Kőváry (1956) into 4 species:

1. *Silicoplacentina hungarica* (Fig. 3E): white round tests, irregularly convex, with the foramen located noncentrically on a small rise below which a semicircular concavity occurs. Diameter: 0.25–0.70 mm.

2. *Silicoplacentina majzoni* (Fig. 3C, D): discoidal tests with a furrow parallel to the test axis on one or both sides. The central part is convex or concave. The foramen is invisible. Diameter: 0.5–1.2 mm.

3. *Silicoplacentina inflata* (Fig. 3B): small test, convex on one side, slightly convex or concave on the other. The foramen is usually situated at the test's periphery. Outer surface is finely agglutinated, and frequently brown in colour. Diameter: 0.25–0.5 mm.

4. *Silicoplacentina irregularis*: forms of irregular shapes with wrinkled and grainy surfaces. Both sides are strongly flattened and the space once infilled with body is not visible. The foramen is almost always invisible. Diameter: 0.5–1.2 mm.

A variety of deformation styles resulting from sedimentary compaction causes difficulties in the application of this subdivision. That is why, in 1985, O. S. Schreiber *et al.* proposed the use of only two species: *Silicoplacentina majzoni* Kőváry, 1956 and *S. irregularis* Kőváry, 1956.

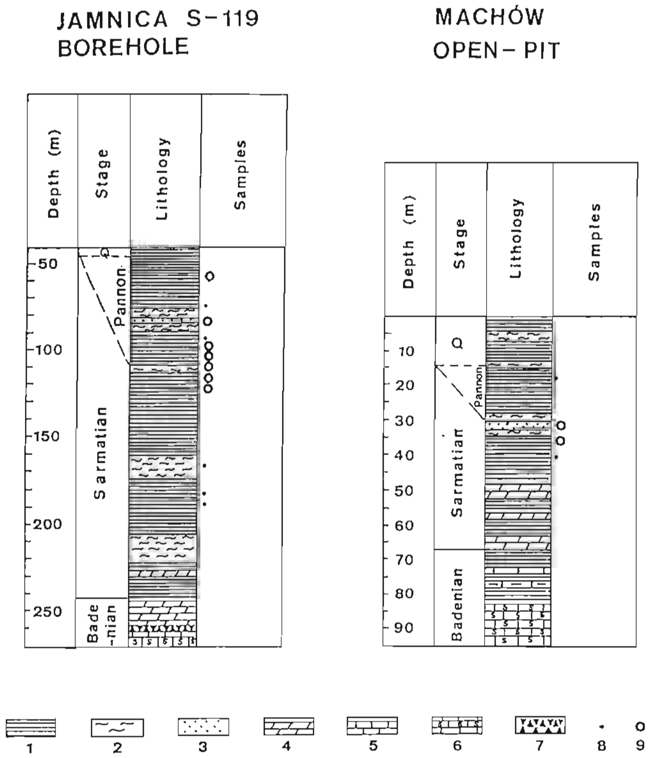


Fig. 2. Schematic lithostratigraphic sections of the boreholes studied

1 — clays, 2 — mudstones, 3 — sandstones, 4 — marls, 5 — limestones, 6 — sulphur-bearing limestones, 7 — breccias, 8 — samples lacking of *Silicoplacentina*, 9 — samples containing *Silicoplacentina*

Subkingdom **Protozoa** Goldfuss
Subphylum **Rhizopoda** Siebold
Class **Amoebina** Ehrenberg
Order **Testacea** Schultze
Genus *Silicoplacentina* Kőváry, 1956
*Silicoplacentina majzoni* Kőváry, 1956
(Pl. I, Figs. 7, 8; Pl. II; Pl. III, Figs. 1–4)

1956 *Silicoplacentina majzoni* Kőváry; J. Kőváry: tab. 37, fig. 1.
1985 *Silicoplacentina majzoni* Kőváry; O. S. Schreiber *et al.*: p. 469, tab. 61, figs. 3–6, 8; tab. 62, fig. 9; tab. 63, figs. 1–11; tab. 64, figs. 1–3, tab. 65, figs. 3–6.
1992 *Silicoplacentina majzoni* Kőváry; N. Gagić: tab. 1, figs. 6a, b.

D e s c r i p t i o n . — Discoidal test, round or oval in outline, white or brown in colour. Chaotically arranged siliceous grains are visible on the surface. Due to a varying degree of flattening, tests may be convex on both sides, convex-concave, flat-concave or flat on both sides. Most specimens exhibit thickened peripheries in the form of semicircular folds. A variably situated foramen was visible in a few specimens. Diameter 0.2–1.1 mm, wall is 35–75 μ thick.

R e m a r k s . — Due to deformation resulting from compaction *Silicoplacentina hungarica* Kőváry and *S. inflata* Kőváry are considered to be morphological varieties of the species *S. majzoni* Kőváry.

O c c u r r e n c e . — Poland — northern part of the Carpathian Foredeep (Jamnica S-119, Machów) — Early Sarmatian (eastern Paratethys), Austria, Croatia, Slovakia, Slovenia; Hungary — Lower Pannonian.

*Silicoplacentina irregularis* Kőváry, 1956
(Pl. III, Figs. 5, 6; Pl. IV)

1956 *Silicoplacentina irregularis* Kőváry; J. Kőváry: tab. 39, fig. 1.
1985 *Silicoplacentina irregularis* Kőváry; O. S. Schreiber *et al.*: p. 470, tab. 61, figs. 1, 2, 7, 9; tab. 62, fig. 1–8; tab. 65, figs. 2.

D e s c r i p t i o n . — Discs oval or irregular in outline, light in colour. Rough surfaces with coarse siliceous grains and elongated or transverse folds or a distinct callosity at the periphery. The foramen is recognizable in few specimens. Diameter 0.7–1.5 mm; wall is 50–75 μ thick.

O c c u r r e n c e . — Poland — northern part of the Carpathian Foredeep (Jamnica S-119, Machów) — Early Sarmatian (eastern Paratethys), Austria, Croatia, Serbia, Slovakia; Hungary — Lower Pannonian.

## ENVIRONMENTAL REMARKS

Most modern thecamoebians inhabit shallow fresh-water basins, a few species living at greater depths. Few forms have been described from open-marine basins, and their taxonomic position has not been unequivocally determined (O. S. Schreiber *et al.*, 1985).

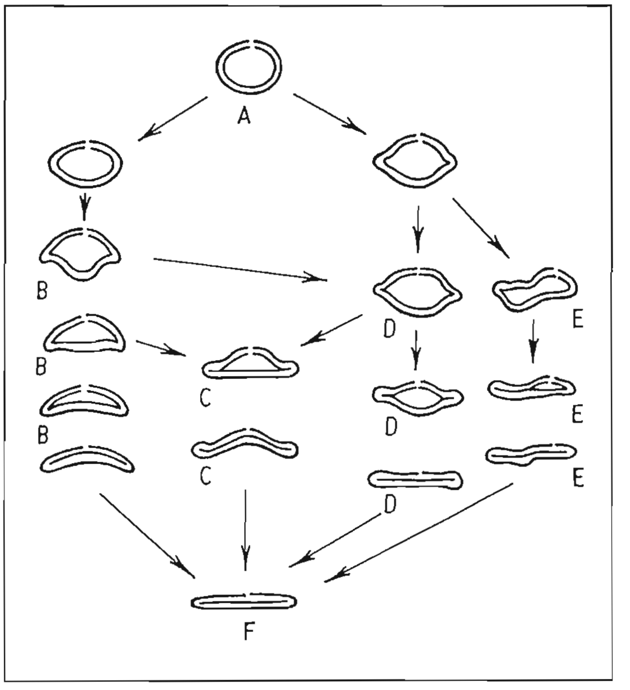


Fig. 3. Idealized scheme of deformations of *Silicoplacentina* (after O. S. Schreiber *et al.*, 1985)

A — hypothetical primary form, B — *Silicoplacentina inflata*, C, D — *Silicoplacentina majzoni*, E — *Silicoplacentina hungarica*, F — final form

They usually live on aquatic vegetation, rarely in a bottom mud, in peat or forest mosses (A. Asioli *et al.*, 1996).

Modern thecamoebians (A. Asioli *et al.*, 1996) are considered to be easily adaptable to changing environmental conditions. Euryhaline forms from fresh-water environments which managed to adapt themselves to subsaline conditions have been recognized lately.

Some of species can tolerate both high environmental acidity (pH 3.9–4.5) and different contaminants such as sulphides, ammonium salts and nitrogen compounds.

Owing to these features, thecamoebians are employed as bioenvironmental indicators for environmental reconstructions (A. Asioli *et al.*, 1996).

In Tertiary deposits thecamoebians are represented by the genus *Silicoplacentina* which has been described from Hungary, Austria (O. S. Schreiber *et al.*, 1985; J. Kőváry, 1987), Serbia and Croatia (N. Gagić, 1992) and recently also from Poland (Jamnica S-119, Machów). Their representatives occur in sandy-marly sediments which were deposited in shallow-marine, low-salinity basins under reducing conditions, as confirmed by the high amount of sulphides, bacteriopyrite concretions, plant detritus and occurrence of specific agglutinated foraminifers — *Miliammina* and *Ammobaculites* (I. V. Venglinsky, 1975; I. Korecz-Laky, 1985, 1987; N. Gagić, 1992).

Table 1

**Stratigraphic correlation of the Miocene of the Paratethys, after F. Rögl (1996)**

| M. A. | EPOCH | AGE | CENTRAL PARATETHYS STAGES | EASTERN PARATETHYS STAGES | BIOZONES: Mammal Zones | BIOZONES: Planktonic Foraminifera | BIOZONES: Calcareous Nanno-plankton |
|---|---|---|---|---|---|---|---|
| 5 | PLIO-CENE | ZANCLEAN | DACIAN (5.6) | KIMMERIAN (5.2) | MN 14 | PL1 | NN13 |
| | 5.3 | | | | | | NN12 |
| | Late MIOCENE | MESSINIAN | PONTIAN | PONTIAN | MN 13 | M14 | |
| | | 7.1 TORTONIAN | PANNONIAN | MAEOTIAN | MN12 | M13 b | NN11 |
| | | | | | MN11 | M13 a | NN10 |
| 10 | | | | (10.0) | MN 10 | | NN9b |
| | 11.0 | | | SAR-MATIAN: Khersonian | MN 9 | M12 | NN9a/8 |
| | Middle MIOCENE | SERRAVALLIAN | 11.5 SARMATIAN (13.0) p | SAR-MATIAN: Bessarabian | MN 8-7 | M11-M8 | NN7 |
| | | | | SAR-MATIAN: Volhynian | | | NN6 |
| | | 14.8 | BADENIAN | Konkian Karaganian Tshokrakian | MN 6-5 | M7 | |
| 15 | | LANGHIAN | | TARKHANIAN | | M6 | NN5 |
| | 16.4 | | | | | M5 | |

p — stratigraphical range of deposits from borehole Jamnica S-119 and Machów open pit

## STRATIGRAPHIC IMPORTANCE

*Silicoplacentina* microfossils are characteristic of Lower Pannonian deposits. They are most frequent in its lowermost part, whereas in the Middle Pannonian they appear only sporadically. Such a limited range causes them to be good indicators for the boundary between the Lower and Middle Pannonian (O. S. Schreiber *et al.*, 1985).

Single specimens of *Silicoplacentina* have also been noted in the Egerian, Eggenburgian and Ottnangian (I. Cicha *et al.*, 1971).

In Poland *Silicoplacentina majzoni* and *S. irregularis* come from the upper part of the Krakowiec Series (Machów Formation) (A. Garlicki, 1994) from the Jamnica S-119 borehole, depth 56–117 m, and Machów mine, depth 32–35 m (Fig. 2). Here they are accompanied by a few foraminifers characteristic of the Pannonian and represented by the genera *Miliammina* and *Nodobacurariella* (Tab. 1), rare relict Late Sarmatian forms represented largely by *Quinqueloculina, Elphidium, Nonion* as well as by fragments of fish, otoliths, ostracod fragments, molluscs, gastropods and plant detritus. A Late Sarmatian foraminiferal assemblage of the *Protelphidium subgranosum* Zone (see E. Odrzywolska-Bieńkowa, 1972; I. Czepiec, 1996; E. Łuczkowska, 1998), occurs below the deposits with *Silicoplacentina* (Fig. 2).

Such a microfaunal succession may suggest that the microfossil assemblage found in the Jamnica S-119 borehole and in the Machów open pit comes from still younger series of the Krakowiec Clays than those previously described from the *Protelphidium subgranosum* Zone (E. Odrzywolska-Bieńkowa, 1972; I. Czepiec, 1996; E. Łuczkowska, 1998). A strong connection with the microfauna from the Intra-Carpathian basins of the eastern Paratethys is observed in the youngest assemblages.

E. Gaździcka (1994) has also recognized the nannoplankton zone NN 8/9 suggesting a Pannonian age for these deposits. According to Table 1, zone NN 9a/8 is Lower Pannonian with regard to the central Paratethys area or Early Sarmatian (Bessarabian) for the eastern Paratethys.

Palaeomagnetic investigations conducted by E. Król and M. Jeleńska (1999) in the Jamnica S-119 borehole have shown a succession of changes in geomagnetic field polarity corresponding to the time span of 11–7.5 Ma, i.e. to the Pannonian (see Tab. 1).

Analyses of deposits from the Jamnica S-119 borehole and the Machów open pit carried out using different methods show a strong need to state precisely their stratigraphic position with regard to the lowermost part of the Krakowiec Clays (Machów Formation).

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## RODZAJ *SILICOPLACENTINA* KÖVÁRY, 1956 Z SERII KRAKOWIECKIEJ Z PÓŁNOCNEJ CZĘŚCI ZAPADLISKA PRZEDKARPACKIEGO

Streszczenie

W osadach pochodzących z młodszej serii formacji z Machowa (Jamnica S-119, Machów) stwierdzono przedstawicieli rodzaju *Silicoplacentina* reprezentujących grupę thecamoebians. Mikrofauna ta, znana z basenu pannońskiego, dotychczas nie była opisywana z polskiej części zapadliska przedkarpackiego. W badanym materiale silicoplacentinom towarzyszą charakterystyczne dla pannonu otwornice z rodzaju *Miliammina* oraz sarmackie formy reliktowe z rodzajów: *Quinqueloculina, Elphidium* i *Nonion*, jak również szczątki ryb, otolity i małżoraczki.

Współwystępowanie fauny charakterystycznej dla pannonu centralnej Paratetydy (Węgry) z fauną typową dla sarmatu wschodniej Paratetydy (Rumunia) potwierdza we wczesnym sarmacie możliwość połączeń między basenem przedkarpackim na obszarze Polski a basenami śródkarpackimi w innych częściach Paratetydy.

## EXPLANATIONS OF PLATES

### PLATE I

Fig. 1. *Miliammina* sp.
a — side view, b — apertural view; depth 87 m, x 300

Fig. 2. *Miliammina* sp.
a — side view, b — apertural view; depth 112 m, x 250

Fig. 3. *Miliammina* sp.
Side view; depth 87 m, x 300

Fig. 4. *Miliammina* sp.
Apertural view; depth 87 m, x 300

Fig. 5. *Miliammina* sp.
Apertural view; depth 87 m, x 300

Fig. 6. *Nodobaculariella* sp.
Side view; depth 118 m, x 400

Fig. 7. *Silicoplacentina majzoni* Kováry
Breach; depth 56 m, x 200

Fig. 8. *Silicoplacentina majzoni* Kováry
Breach; depth 56 m, x 300

Jamnica S-119 borehole; coll. MUZ PIG J. Paruch-Kulczycka

### PLATE II

Fig. 1. *Silicoplacentina majzoni* Kováry
Depth 110 m, x 250

Fig. 2. *Silicoplacentina majzoni* Kováry
Depth 32 m, x 400

Fig. 3a, b. *Silicoplacentina majzoni* Kováry
Depth 117 m, x 200

Fig. 4. *Silicoplacentina majzoni* Kováry
Depth 110 m, x 150

Fig. 5. *Silicoplacentina majzoni* Kováry
Depth 105 m, x 250

Figs. 1, 3–5 — Jamnica S-119 borehole; Fig. 2 — Machów open pit; coll. MUZ PIG J. Paruch-Kulczycka

PLATE III

Fig. 1a, b. *Silicoplacentina majzoni* Kőváry
Depth 105 m, x 300

Fig. 2. *Silicoplacentina majzoni* Kőváry
Depth 110 m, x 250

Fig. 3. *Silicoplacentina majzoni* Kőváry
Depth 110 m, x 200

Fig. 4. *Silicoplacentina majzoni* Kőváry
Depth 105 m, x 250

Fig. 5a, b. *Silicoplacentina irregularis* Kőváry
Depth 110 m, x 200

Fig. 6. *Silicoplacentina irregularis* Kőváry
Depth 110 m, x 150

Jamnica S-119 borehole; coll. MUZ PIG J. Paruch-Kulczycka

PLATE IV

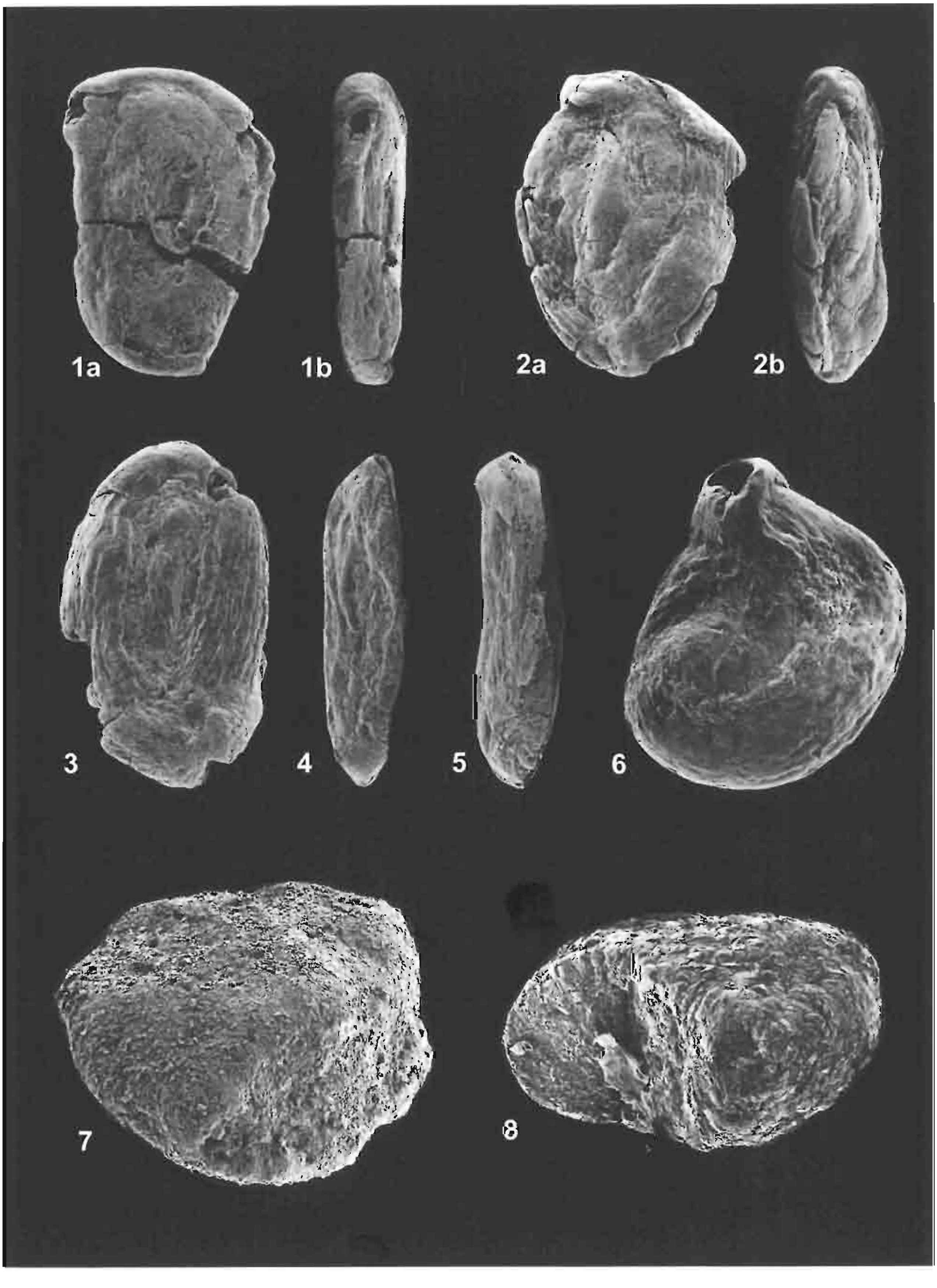
Fig. 1a, b. *Silicoplacentina irregularis* Kőváry
Depth 56 m, x 160

Fig. 2a, b. *Silicoplacentina irregularis* Kőváry
Depth 56 m, x 150

Fig. 3. *Silicoplacentina irregularis* Kőváry
Depth 56 m, x 200

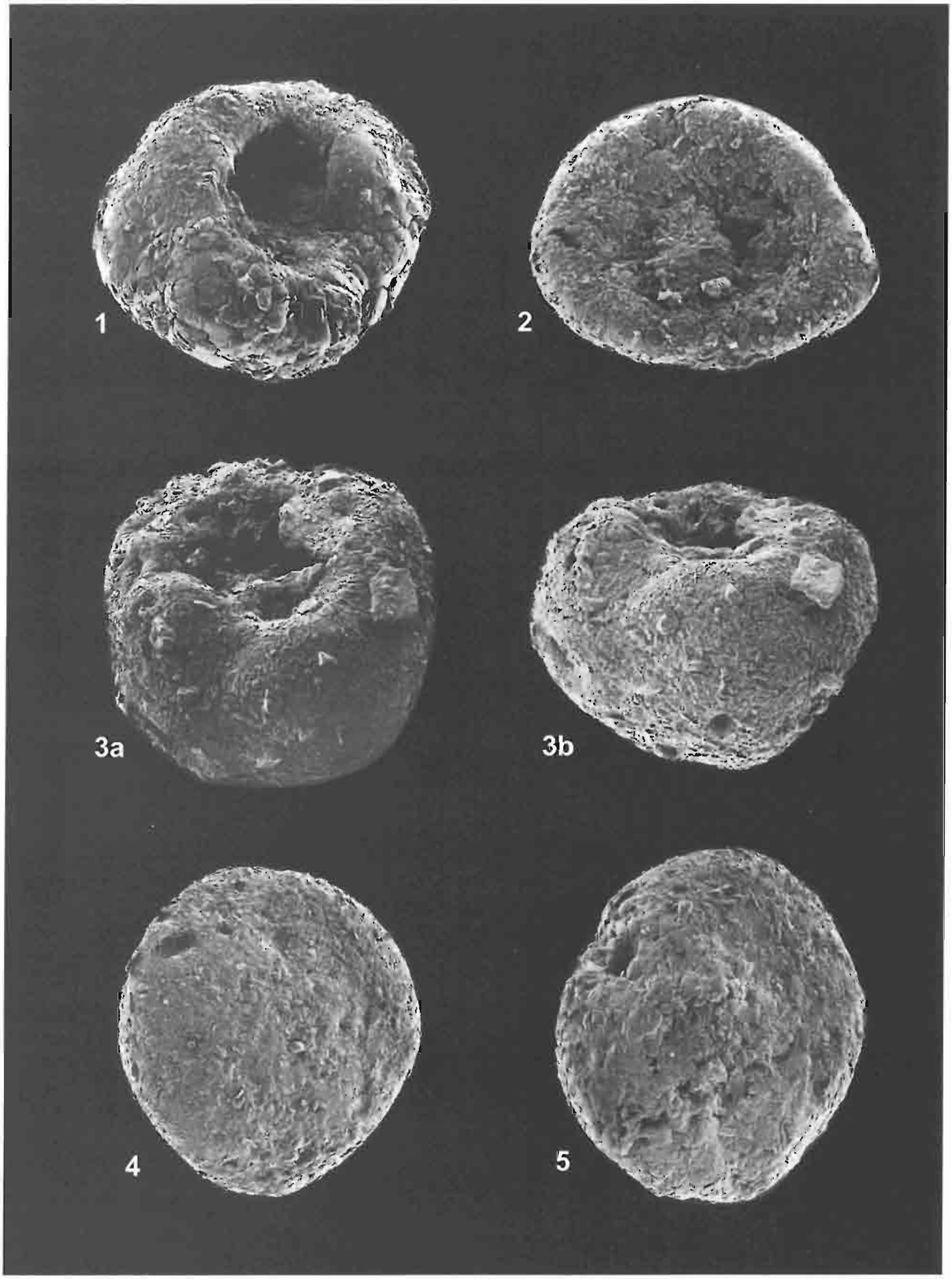
Fig. 4. *Silicoplacentina irregularis* Kőváry
Depth 105 m, x 200

Jamnica S-119 borehole; coll. MUZ PIG J. Paruch-Kulczycka




Jolanta PARUCH-KULCZYCKA — Genus *Silicoplacentina* (Class Amoebina) from the Miocene Machów Formation (Krakowiec Clays) of the northern Carpathian Foredeep

Geol. Quart., 1999, **43** (4)

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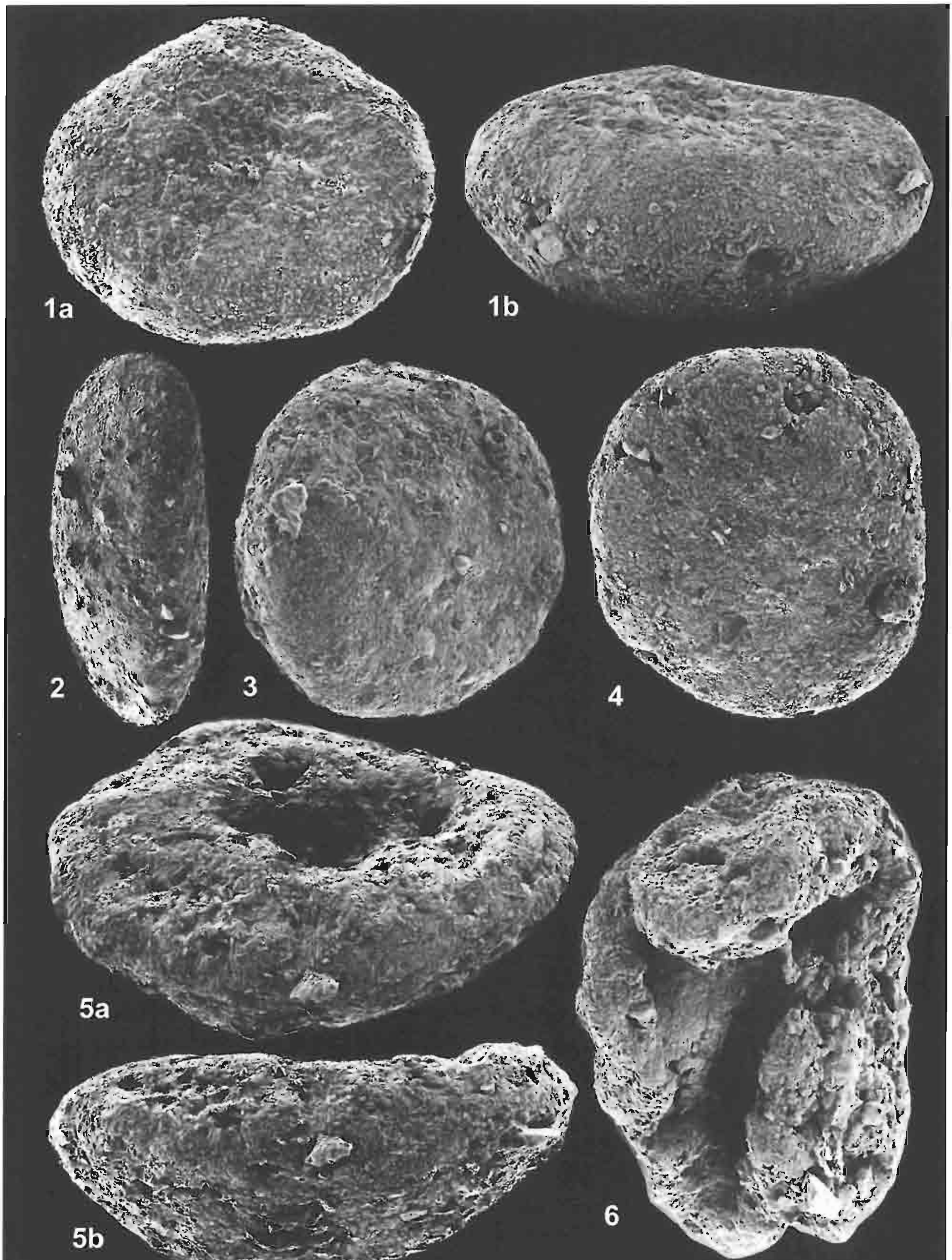


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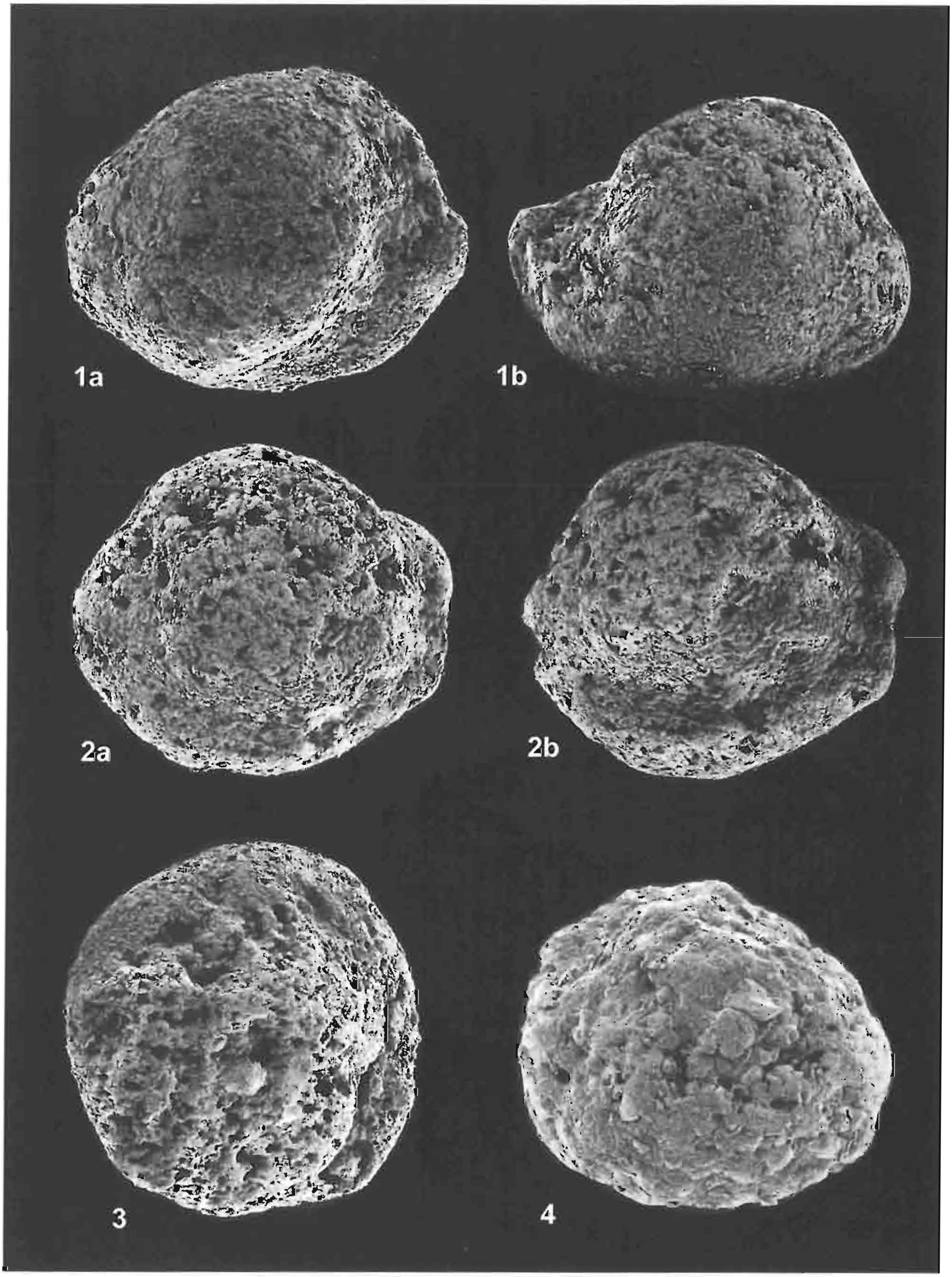


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