Geological Quarterly, Vol. 39, No. 3, 1995, p. 341–372

Hanna GÓRKA

Lower Turonian radiolarians (Polycystina) from borehole Władysławowo IG 1 (Baltic region)

Six micropalaeontological samples from borehole Władysławowo IG 1 (Poland, Baltic region) supplied very rich material of siliceous radiolarian skeletons (Polycystina). The samples are of Lower Turonian age, as indicated by the Radiolaria and associated planktonic foraminifers. Seventeen species of spumellarians and thirteen nassellarians are described.

INTRODUCTION

Borehole Władysławowo IG 1 located in the Baltic region was drilled by the Polish Geological Institute (Warsaw, Poland). Six micropalaeontological samples from the following depths: 131.20, 128.00, 124.70, 124.00, 121.00, 114.00 m yielded rich material for studying siliceous skeletons of Radiolaria (Polycystina). The samples were dated as Lower Turonian, on the basis of Radiolaria and associated foraminifers. Described below are 17 species of Radiolaria belonging to Spumellaria and 13 belonging to Nassellaria. The collection of Radiolaria reported in this paper is housed in the Laboratory of Palaeontology of the Institute of Geology of Warsaw University; the collection acronym is IGPUW-V.

GEOLOGICAL, STRATIGRAPHICAL AND ECOLOGICAL REMARKS

Borehole Władysławowo IG 1 is situated in Baltic region, 50 km NNE from Gdańsk, at the base of the Hel Spit (Fig. 1). The thickness of Lower Turonian deposits in borehole Władysławowo IG 1 equals 72.00 m; their boundary with underlying Cenomanian strata

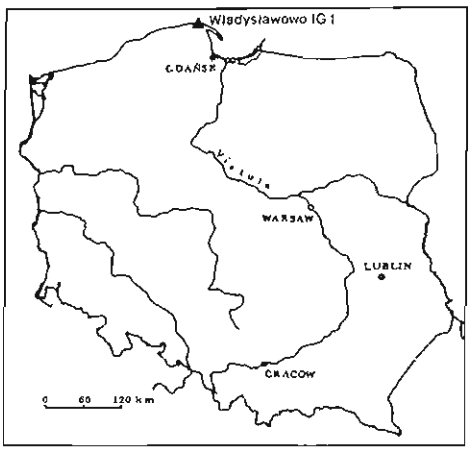


Fig. 1. Location of Władysławowo IG 1 borehole
Lokalizacja otworu wiertniczego Władysławowo IG 1

occurs at a depth 186.00 m, while the lower boundary of overlying Upper Turonian sediments is probably at 114.00 m depth.

The Radiolaria are best represented in dark grey, compact sandy silt at a depth of 119.70–131.20 m and in sandy clay at 114.00–119.70 m, where only a single planktonic foraminiferal species, *Hedbergella planispira* (Tappan), occurs (Fig. 2).

Among Radiolaria (Polycystina), typical Turonian species include *Cavaspongia antelopensis* Pessagno, *C. californiensis* Pessagno, *Crucella cachensis* Pessagno, *Eucyrtidium* (?)*matsumotoi* Taketani and *Orbiculiforma vacaensis* Pessagno.

In the Lower Turonian sediments of Władysławowo IG 1 there occur planktonic Foraminifera of the family Rotaliporidae, with *Hedbergella caspia* (Vassilenko), very common *H. trocoidea* (Gandolfi), as well as *Praeglobotruncana imbricata* (Mornod). Also represented are Heterohelicidae with *Heterohelix striata* (Ehrenberg) and Planomalinidae with *Globigerinelloides escheri* (Kaufmann).

There are no agglutinated foraminifers in the Lower Turonian of Władysławowo IG 1. Benthic foraminifers are represented only by a single species of Polymorphinidae — *Pyrulina cylindroides* (Roemer), and Turrillinidae — *Neobulimina schwageri* (Yokoyama). The latter species was previously reported only from the Boreal zone. There are also members of Nonionidae (*Nonionella cretacea* Cushman), Lingulogavellinidae, Anomalinidae and other families. Echinoid spines and fish teeth are also found.

The radiolarian assemblage described herein is much richer than the assemblage of the same age from borehole Łeba IG 1 (H. Górka, 1991), both in terms of species diversity and abundance.

CONCLUSIONS

Numerous Radiolaria from the families Porodiscidae, Patulibracchidae, Cavaspongidae, Spongodiscidae, Hagiastridae, Orbiculiformidae within Spumellaria, and from Xitidae, Stichocyrtidae, Theoperidae, Archaeodictyomitridae, Spongocapsulidae and Cyrtoidea *in-*

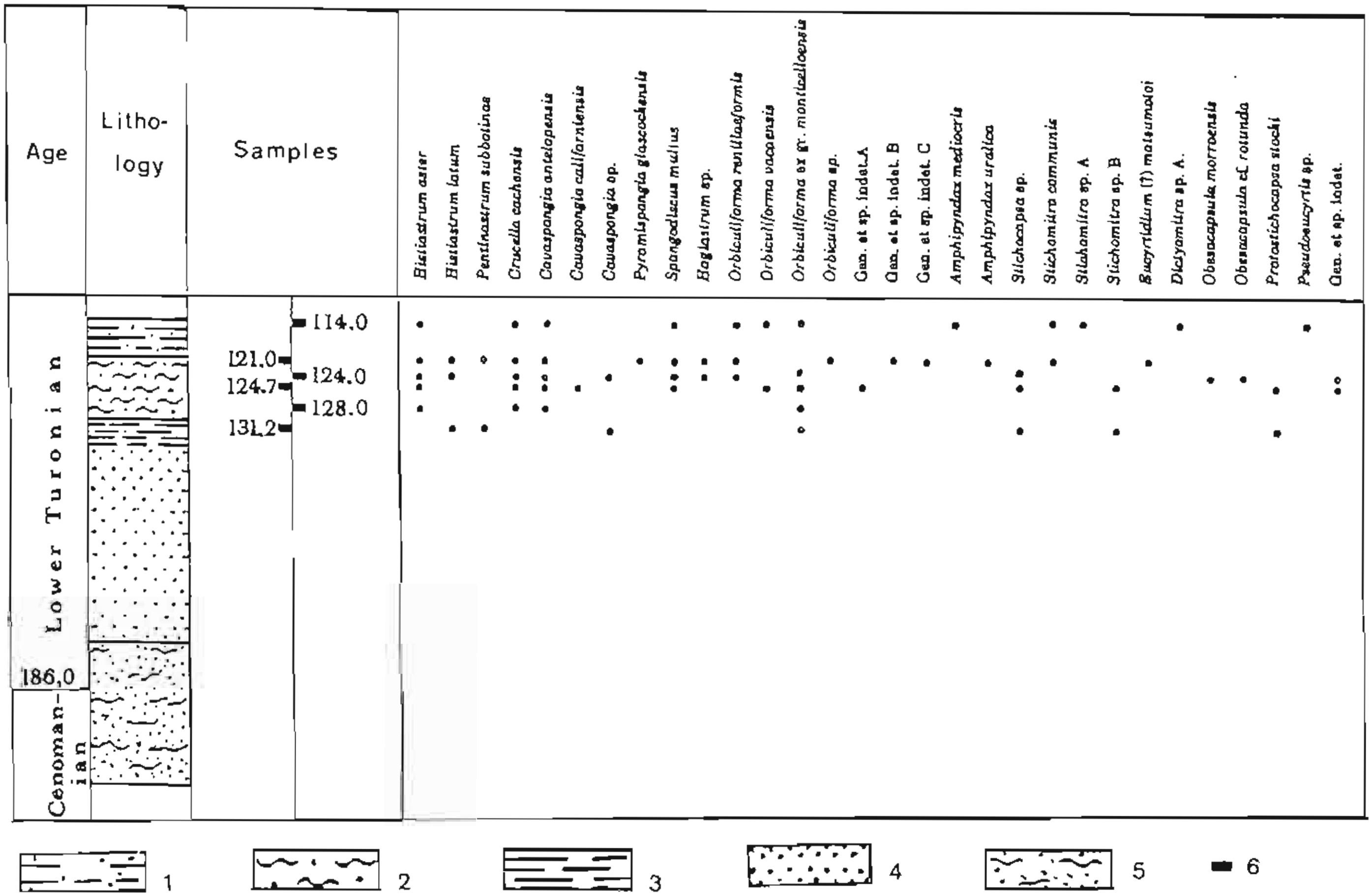


Fig. 2. Radiolarian distribution in Władysławowo IG 1 borehole

1 — sandy clay, 2 — sandy silt, 3 — clay, 4 — sand, 5 — silty sand, 6 — samples

Rozprzestrzenienie radiolarii w otworze wiertniczym Władysławowo IG 1

1 — ił piaszczysty, 2 — mułek piaszczysty, 3 — ił, 4 — piasek, 5 — piasek pylasty, 6 — miejsce opróbowania

certae sedis within Nassellaria, as well as accompanying planktonic Foraminifera of several families: Heterohelicidae, Planomalinidae, Schackoinidae and Rotaliporidae may indicate presence of Boreal Province in Baltic region during Early Turonian. Planktonic foraminifers suggests rather shallow and cold water basin.

PREVIOUS WORKS ON CRETACEOUS RADIOLARIA IN POLAND

The first unspecified Cretaceous Radiolaria from Poland were mentioned by Z. Sujkowski in 1930. They came from a deep borehole in Lublin. In 1932, the same author presented a list of 20 species of Radiolaria (Polycystina) from the Eastern Carpathians. Then, after quite a long break, S. Geroch and W. Nowak (1963) described Radiolaria from the Lower Cretaceous deposits of Lipnik near Bielsko-Biała in the Western Carpathian region. This study was revised by H. Górka and S. Geroch (1989).

The present author described Lower Turonian Radiolaria from the Łeba IG 1 borehole (H. Górka, 1991), as well as Radiolaria from Lower Campanian outcrops in Cracow (H. Górka, 1989).

Recently, M. A. Gasiński (1988) and M. Bąk (1993) described Radiolaria from the Pieniny Klippen Belt (Carpathians). The latter author recognized 53 species of Polycystina. The present author's research on Radiolaria from an Upper Cretaceous outcrop in Spława (Carpathians) is in preparation.

SYSTEMATIC DESCRIPTIONS

Subclass **Radiolaria** Müller 1858
Superorder **Polycystina** Ehrenberg 1875 emend. Riedel 1967
Order **Spumellaria** Ehrenberg 1875
Family **Porodiscidae** Haeckel 1881 emend. Koslova
in: M. G. Petrushevskaya, G. E. Koslova, 1972
Genus *Histiastrum* Ehrenberg 1847
Type species *Histiastrum quaternarium* Ehrenberg 1847

Histiastrum aster Lipman 1952
(Pl. I, Fig. 12; Pl. II, Figs. 5–11)

1952 *Histiastrum aster* Lipman; R. H. Lipman: p. 35, Pl. 6, 7, 11.
1962 *Histiastrum aster* Lipman; R. H. Lipman: p. 300, Pl. 2, Fig. 5.
1966 *Histiastrum aster* Lipman; G. E. Koslova, A. N. Gorbovetz: p. 84, Pl. 3, Fig. 9.
1981 *Crucella aster* (Lipman); K. Nakaseko, A. Nishimura: p. 148, Pl. 2, Figs. 9, 10.
1981 *Histiastrum aster* Lipman; A. Schaaf: p. 435, Pl. 8, Fig. 1; Pl. 11, Fig. 5.
1989 *Histiastrum aster* Lipman; H. Górka: p. 333, Pl. 14, Fig. 11.
1989 *Histiastrum aster* Lipman; H. Górka, S. Geroch: p. 187, Pl. 3, Fig. 5.
1991 *Histiastrum aster* Lipman; H. Górka: p. 43, Pl. 2, Fig. 11.

Material: 80 well preserved specimens.
Dimensions (in μm): total length along the diagonal — 180–237, basal shoulder width — 60–80.

Remarks. There is much variability of width and extent of the shoulders, of the degree of concavity of the sides, and of rounding of the terminations.

Occurrence. Cosmopolitan species of Albian to Campanian. Poland: Hauterivian at Lipnik (near Bielsko-Biała), Campanian of Cracow, Lower Turonian of Łeba IG 1 and Władysławowo IG 1.

Histiastrum latum Lipman 1960
(Pl. II, Figs. 1–3)

1960 *Histiastrum latum* Lipman; R. H. Lipman: p. 130, Pl. 19, Figs. 7, 8.
1962 *Histiastrum latum* Lipman; R. H. Lipman: p. 303–304, Pl. 2, Fig. 4.

Material: 38 well preserved specimens.
Dimensions (in μm): distance between shoulder terminations — 110–140.

Description. Skeleton square, flat, with straight or rarely slightly concave sides. Terminations straight or slightly extended. Centrum slightly raised. Irregularly spaced perforations with small pores.

Remarks. The specimens from Władysławowo IG 1 tend to have quite regular dimensions, and the variability concerns the degree of concavity of sides and protrusion of the terminations.

Occurrence. Santonian to Campanian of Western Siberia. Poland: Lower Turonian of Władysławowo IG 1.

Family **Porodiscidae** Haeckel 1881 emend. Petrushevskaya, Koslova 1972
Genus *Pentinastrum* Haeckel 1881
Type species *Pentinastrum asteriscus* Haeckel 1887

Pentinastrum subbotinae Lipman 1960
(Pl. IV, Fig. 8)

1960 *Pentinastrum subbotinae* Lipman; R. H. Lipman: p. 132, Pl. 30, Figs. 6, 7.
1962 *Pentinastrum subbotinae* Lipman; R. H. Lipman: p. 306–307, Pl. 2, Fig. 7.

Material: 5 differently preserved specimens.
Dimensions (in μm): distance between terminations — 76–100, width without processes — 90–115, maximum width of processes — 45–75.

Description. Skeleton pentagonal, flat, porous, with 5 stout, short conical processes. Between the processes the sides are deeply concave.

Remarks. The terminations of processes are truncated or rounded, without spines.

O c c u r r e n c e . Santonian to Campanian of Russia. Poland: Lower Turonian of Władysławowo IG 1.

Family **Patulibracchidae** Pessagno 1971 emend. Baumgartner 1980
Genus *Crucella* Pessagno 1971 emend. Baumgartner 1980
Type species *Crucella messina* Pessagno 1971

Crucella cachensis Pessagno 1971
(Pl. I, Figs. 1–11; Pl. II, Fig. 4)

1971 *Crucella cachensis* Pessagno; E. A. Pessagno: p. 53, Pl. 9, Figs. 1–3.
1976 *Crucella cachensis* Pessagno; E. A. Pessagno: p. 31–32, Pl. 3, Figs. 14, 15.
1986 *Crucella cachensis* Pessagno; J. Thurow, W. Kuhnt: p. 436, Fig. 9: 5, 6.
1989 *Crucella cachensis* Pessagno; H. Górka: p. 331, Pl. 11, Figs. 3, 4.
1991 *Crucella cachensis* Pessagno; H. Górka: p. 42, Pl. 2, Figs. 7, 8.

M a t e r i a l : 120 well preserved specimens.
D i m e n s i o n s (in µm): maximum shoulder length along diagonal — 140–254, basal shoulder width — 48–85.

R e m a r k s . The specimens from Władysławowo IG 1 display substantial variability of shoulder width, angle between shoulders, and size of the central part.

O c c u r r e n c e : Lower and Middle Turonian of California, Cenomanian and Turonian of Morocco, Spain and Italy. Poland: Lower Turonian of Łeba IG 1 and Władysławowo IG 1, Lower Campanian of Cracow.

Family **Cavaspongidae** Pessagno 1973
Genus *Cavaspongia* Pessagno 1973
Type species *Cavaspongia antelopensis* Pessagno 1973

Cavaspongia antelopensis Pessagno 1973
(Pl. III, Figs. 1–3, 6–12; Pl. IV, Fig. 14)

1973 *Cavaspongia antelopensis* Pessagno; E. A. Pessagno: p. 76–77, Pl. 18, Fig. 46; Pl. 19, Fig. 1.
1976 *Cavaspongia antelopensis* Pessagno; E. A. Pessagno: p. 37, Pl. 4, Fig. 4.
1986 *Cavaspongia antelopensis* Pessagno; A. Schaaf, V. Thomas: p. 1597, Pl. 2, Fig. F.
1986 *Cavaspongia antelopensis* Pessagno; J. Thurow, W. Kuhnt: Pl. 9, Fig. 3.
1991 *Cavaspongia antelopensis* Pessagno; H. Górka: p. 40–42, Pl. 2, Fig. 9.

M a t e r i a l : 90 well preserved specimens.
D i m e n s i o n s (in µm): height — 84–142, maximum shoulder width — 52–80.

R e m a r k s . There is little variability of size, but the specimens vary in the degree of concavity of sides, "gate" depth and rounding of the terminations.

O c c u r r e n c e . Lower Turonian of California, Morocco and Italy, Lower Campanian of Wadi Ragmi de Semail, Oman. Poland: Lower Turonian of Łeba IG 1 and Władysławowo IG 1.

Cavaspongia californiensis Pessagno 1973
(Pl. IV, Fig. 7)

1973 *Cavaspongia californiensis* Pessagno; E. A. Pessagno: p. 77, Pl. 19, Figs. 2–4.
1976 *Cavaspongia californiensis* Pessagno; E. A. Pessagno: p. 37, Pl. 4, Figs. 2–3.

M a t e r i a l : 15 specimens.
D i m e n s i o n s (in μm): height — about 130, maximum shoulder width — about 50.

R e m a r k s . The specimens from Władysławowo IG 1 have more slender and elongated shoulders than the type and paratypes of *Cavaspongia californiensis* Pessagno.

O c c u r r e n c e . Cenomanian to Coniacian, Lower and Middle Turonian of California. Poland: Lower Turonian of Władysławowo IG 1.

Cavaspongia sp.
(Pl. III, Figs. 4, 5, 13, 14)

M a t e r i a l : 7 specimens.
D i m e n s i o n s (in μm): height — about 108–153, maximum shoulder width — about 55–75.

R e m a r k s . Those specimens which are more flattened than *Cavaspongia antelopensis* Pessagno and which have no prominent "gate" were designated as *Cavaspongia* sp.

O c c u r r e n c e . Lower Turonian of Władysławowo IG 1.

Genus *Pyramispongia* Pessagno 1973
Type species *Pyramispongia magnifica* Pessagno 1973

Pyramispongia glascockensis Pessagno 1973
(Pl. IV, Figs. 9–11)

1973 *Pyramispongia glascockensis* Pessagno; E. A. Pessagno: p. 79–80, Pl. 21, Figs. 2–5.
1976 *Pyramispongia glascockensis* Pessagno; E. A. Pessagno: p. 37, Pl. 1, Fig. 9.
1982 *Pyramispongia glascockensis* Pessagno; Y. Takeuchi: Pl. 1, Fig. 18.
1982 *Pyramispongia glascockensis* Pessagno; M. Yamauchi: Pl. 1, Fig. 5; Pl. 2, Fig. 9.
1986 *Pyramispongia glascockensis* Pessagno; J. Thurow, W. Kuhnt: text-Fig. 9: 4.
1988 *Pyramispangia glascockensis* Pessagno; J. Thurow: p. 31, Pl. 2, Fig. 23.

M a t e r i a l : 25 well preserved specimens.
D i m e n s i o n s (in μm): maximum width — 148–166.

R e m a r k s . In specimens from Władysławowo IG 1 no cupola in the central part nor spines have been observed, probably due to their damage.

O c c u r r e n c e . Upper Cenomanian to Middle Turonian of Europe and NW Africa, Cenomanian to Turonian of California, Cenomanian to Santonian of Japan. Poland: Lower Turonian of Władysławowo IG 1.

Family **Spongodiscidae** Haeckel 1882
Genus *Spongodiscus* Ehrenberg 1854
Type species *Spongodiscus resurgens* Ehrenberg 1854

Spongodiscus multus Koslova 1966
(Pl. IV, Figs. 1–4)

1966 *Spongodiscus* (?) *multus* Koslova; G. E. Koslova, A. N. Gorbovetz: p. 87–88, Pl. 4, Fig. 10.
1989 *Spongodiscus multus* Koslova; H. Górka, S. Geroch: p. 188, Pl. 3, Fig. 6.
1991 *Spongodiscus multus* Koslova; H. Górka: p. 43, Pl. 1, Figs. 1–3.

M a t e r i a l : 35 specimens.
D i m e n s i o n s (in µm): diameter — about 95–130, height — about 23–40.

R e m a r k s . There is little size variability in specimens from Władysławowo IG 1.

O c c u r r e n c e . Cosmopolitan species in Turonian to Campanian. Poland: Lower Turonian of Łeba IG 1 and Władysławowo IG 1.

Family **Hagiastridae** Riedel 1971 emend. Baumgartner 1980
Genus *Hagiastrum* Haeckel 1881 *sensu* Baumgartner 1980
Type species *Hagiastrum plenum* Rüst 1885

Hagiastrum sp.
(Pl. IV, Figs. 5, 6)

1989 *Hagiastrum* sp.; H. Górka: p. 329–330, Pl. 14, Fig. 12.

M a t e r i a l : 7 specimens.
D i m e n s i o n s (in µm): maximum height — 160–210, maximum width — 90–100.

D e s c r i p t i o n . Skeleton flat, formed by four shoulders, set at right angles to each other; one coaxial pair of shoulders is longer than the other, perpendicular pair. Shoulder terminations are rounded and without spines. Central area concave, forming a small lacuna.

R e m a r k s . No patagium has been observed in specimens from Władysławowo IG 1. Furthermore, the angle between shoulders tends to be wider than the straight angle given in the original diagnosis of the genus *Hagiastrum*.

O c c u r r e n c e . Poland: Lower Campanian of Cracow and Lower Turonian of Władysławowo IG 1.

Family **Orbiculiformidae** Pessagno 1973
Genus *Orbiculiforma* Pessagno 1973
Type species *Orbiculiforma quadrata* Pessagno 1973

Orbiculiforma renillaeformis (Campbell et Clark 1944) emend. Pessagno 1976
(Pl. V, Figs. 3, 5, 9)

1944 *Spongodiscus (Spongodiscaulus) renillaeformis* Campbell et Clark; A. S. Campbell, B. L. Clark: p. 18, Pl. 6, Figs. 5, 6, 8, 10.
1966 *Spongodiscus impressus* Lipman: G. E. Koslova, A. N. Gorbovetz: p. 87, Pl. 4, Figs. 8, 9.
1976 *Orbiculiforma renillaeformis* (Campbell et Clark): E. A. Pessagno: p. 36, Pl. 11, Fig. 8.
1981 *Spongodiscus renillaeformis* Campbell et Clark; A. Schaaf: p. 438, Pl. 8, Figs. 4, 5, 8
1984 *Spongodiscus renillaeformis* Campbell et Clark; A. Schaaf: p. 161, Fig. 1.
1988 *Orbiculiforma renillaeformis* (Campbell et Clark); V. S. Vishnevskaya: Pl. 2, Fig. 2.

M a t e r i a l : 35 very well preserved specimens.
D i m e n s i o n s (in µm): diameter — 140–180, central cavity diameter — 50–70.

R e m a r k s . The presence of small triradiate spines in this species seems to be doubtful.

O c c u r r e n c e . Cosmopolitan species, present in W and E Europe from Albian to Maastrichtian, as well as in the Maastrichtian of California. Poland: Lower Turonian of Władysławowo IG 1.

Orbiculiforma vacaensis Pessagno 1973
(Pl. V, Figs. 1, 2)

1973 *Orbiculiforma vacaensis* Pessagno; E. A. Pessagno: p. 74–75, Pl. 17, Figs. 1–6.
1976 *Orbiculiforma vacaensis* Pessagno; E. A. Pessagno: p. 37, Pl. 6, Figs. 6, 8, 9.
1982 *Orbiculiforma vacaensis* Pessagno; M. Yamauchi: p. 394, Pl. 2, Fig. 8.
1989 *Orbiculiforma vacaensis* Pessagno; H. Górka: p. 330, Pl. 9, Figs. 7, 10.

M a t e r i a l : 25 well preserved specimens.
D i m e n s i o n s (in µm): diameter — 107–165, diameter of the central cavity — 50–55.

R e m a r k s . This species shows high variability of dimensions. Specimens from Poland are smaller and less incised at the periphery.

O c c u r r e n c e . Upper Cretaceous of California and Japan. Poland: Lower Turonian of Władysławowo IG 1 and Campanian of Cracow.

Orbiculiforma ex gr. *monticelloensis* Pessagno 1973
(Pl. V, Figs. 4, 6, 7)

1973 *Orbiculiforma monticelloensis* Pessagno; E. A. Pessagno: p. 72–73, Pl. 16, Figs. 5, 6; Pl. 18, Figs. 1, 2.
1976 *Orbiculiforma monticelloensis* Pessagno; E. A. Pessagno: p. 35, Pl. 6, Figs. 4, 5.

1982 *Orbiculiforma monticelloensis* Pessagno; Y. Takelani: p. 368, Pl. 2, Fig. 18.
1990 *Orbiculiforma* ex gr. *monticelloensis* Pessagno; E. A. M. Koutsoukos, M. B. Hart: p. 56, Pl. 3, Figs. 2–5.

Material: 15 well preserved specimens.
Dimensions (in μm): maximum width —150–190, maximum diameter of the central cavity — 35–190, length of processes: about 3.

Description. Discoidal shape, almost circular with a small peripheral incision. Central cavity shallow. Very short processes are present at the periphery.

Remarks. Triradiate spines have not been observed on specimens from Poland.

Occurrence. Turonian to Santonian of California, Lower Campanian to lower Upper Turonian of NE Brazil. Poland: Lower Turonian of Władysławowo IG 1.

Orbiculiforma sp.
(Pl. V, Fig. 8)

1988 Gen. et sp. indet. aff. *Holocryptocanium* sp. A; J. Thurow, Pl. 8, Fig. 19.
1990 *Archaeosphaera*(?) sp. A; E. A. M. Koutsoukos, M. B. Hart: p. 54, Pl. 2, Figs. 1–3.

Material: 2 well preserved specimens.
Dimensions (in μm): total diameter — about 175–180.

Remarks. *Orbiculiforma* sp. resembles *Archeosphaera*(?) sp. A from Lower to Middle Turonian of northeastern Brazil because of its sphaerical shape, presence of tiny perforations and spongy structure of the skeleton, although the description deviates from E. Haeckel's (1862) diagnosis. The material described herein is most closely similar to the Cretaceous specimen from the Atlantic Ocean illustrated by J. Thurow (1988) and labelled as Gen. et sp. indet.

Occurrence. Poland: Lower Turonian of Władysławowo IG 1.

Family Incertae sedis
Gen. et sp. indet. A
(Pl. III, Fig. 15)

Material: 1 well preserved specimen.
Dimensions (in μm): height — 180, maximum width — 194.

Remarks. The specimen is slightly bigger than those of *Cavaspongia antelopensis* Pessagno, more robustly built, with two sides convex and one side concave, and with markedly rounded terminations.

Occurrence. Poland: Lower Turonian of Władysławowo IG 1.

Gen. et sp. indet. B
(Pl. IV, Fig. 12)

Material: 1 well preserved specimen.
Dimensions (in μm): height — 160, maximum shoulder width — 80.

Description. Skeleton flat, of triangular outline, with arched, concave base and the two opposite sides incised in mid-length. Terminations rounded. Structure spongy.

Occurrence. Poland: Lower Turonian of Władysławowo IG 1.

Gen. et sp. indet. C
(Pl. IV, Fig. 13)

Material. 1 well preserved specimen.
Dimensions (in μm): height — 140, maximum width — 120.

Description. Skeleton flat, tiara-shaped, of triangular outline, with slightly concave base and the two other sides convex. Terminations less rounded than in the specimen described above. Structure spongy.

Occurrence. Poland: Lower Turonian of Władysławowo IG 1.

Order **Nassellaria** Ehrenberg 1875
Family **Xitidae** Pessagno 1977*b*
Genus *Amphipyndax* Foreman 1966 emend. Empson-Morin 1982
Type species *Lithostrobus* (*Lithostrobus*) *pseudoconulus* Pessagno 1963

Amphipyndax mediocris (Tan Sin Hok 1927)
(Pl. VI, Figs. 1, 2)

1927 *Dictyomitra mediocris* Tan Sin Hok; Tan Sin Hok: p. 1955, Pl. 10, Fig. 82.
1944 *Stichocapsa* (?)*stocki* Campbell et Clark; A. S. Campbell, B. L. Clark: p. 44, Pl. 8, Figs. 31–33.
1968 *Amphipyndax stocki* (Campbell et Clark); H. Foreman: p. 78, Pl. 8, Fig. 12a–c.
1974 *Amphipyndax mediocris* (Tan Sin Hok); G. W. Renz: p. 788, Pl. 5, Figs. 7, 9; Pl. 12, Fig. 3.
1981 *Amphipyndax mediocris* (Tan Sin Hok); A. Schaaf: p. 431, Pl. 3, Fig. 11; Pl. 22, Fig. 7a, b.
1988 *Amphipyndax mediocris* (Tan Sin Hok); J. Thurow: Pl. 1, Fig. 7; Pl. 4, Fig. 5.
1991 *Amphipyndax mediocris* (Tan Sin Hok); H. Górka: p. 43, Pl. 2, Figs. 2, 3.

Material: 35 well preserved specimens.
Dimensions (in μm): height — 117–140, width at the base — 70–78

Description. Skeleton conical, with subsphaerical, unperforated cephalis. Postabdominal segments, numbering 3 to 5, of subtrapezoidal shape, slightly swollen, with very minuscule perforation of irregular to rounded pores, arranged in transverse rows. Locally, a second layer is observed. Basal orifice subcircular.

R e m a r k s . Little variability of size is observed in *Amphipyndax mediocris* (Tan Sin Hok).

O c c u r r e n c e . Cosmopolitan species from Turonian to Campanian. Poland: Lower Turonian of Łeba IG 1 and Władysławowo IG 1.

Amphipyndax uralica (Gorbovetz 1966)
(Pl. VI, Fig. 10)

1966 *Dictyomitra uralica* Gorbovetz; G. E. Koslova, A. N. Gorbovetz: p. 116, Pl. 6, Figs. 6, 7.

M a t e r i a l : 7 well preserved specimens.
D i m e n s i o n s (in μm): height — 170–180, maximum width — 50–58.

D e s c r i p t i o n . Skeleton conical, elongate, widening towards the base, consisting of a small, rounded capitulum and 6 more segments of trapezoidal shape with slightly convex sides. Incisions between segments are more pronounced in the initial part. Wall with tiny perforation, basal orifice hardly discernible.

R e m a r k s . The preservation of specimens from Poland does not allow for precise description of the perforation pattern nor for confirmation of the existence of a second layer of the wall, because the covering meshwork obscures deeper structures.

O c c u r r e n c e . Campanian of W Siberia. Poland: Lower Turonian of Władysławowo IG 1.

Family Stichocyrtidae Haeckel 1882 1885
Genus *Stichomitra* Cayeux 1897
Type species *Stichomitra costata* Cayeux 1897

Stichomitra communis Squinabol 1903
(Pl. VI, Figs. 8, 11, 17)

1975 *Stichomitra* sp.; P. Dumitrica: p. 87–89, Pl. 2, Fig. 21.
1982 *Stichomitra communis* Squinabol; Y. Tuketani: p. 54, Pl. 3, Fig. 9; Pl. 11, Fig. 5.
1986 *Stichomitra communis* Squinabol; W. Kuhnt *et al.*: p. 236, Pl. 7w.
1987 *Stichomitra communis* Squinabol; S. Goričan: p. 186, Pl. 3, Fig. 21.
1988 *Stichomitra communis* Squinabol; V. S. Vishnevskaya: Pl. 4, Fig. 6.
1993 *Stichomitra communis* Squinabol; M. Bąk: p. 193, Pl. 3, Figs. 11, 12.

M a t e r i a l : 38 well preserved specimens.
D i m e n s i o n s (in μm): height — 147–220, width — 50–75.

D e s c r i p t i o n . Skeleton conical, slender or slightly widened, consisting of 7 to 10 segments of trapezoidal shape. In some specimens the cephalis bears tiny perforations. Postabdominal segments irregularly perforated — both the pores and their arrangement are irregular.

O c c u r r e n c e . Cosmopolitan species; Cenomanian to Turonian of S Europe and NW Africa, Upper Cenomanian to lowermost Coniacian of Japan, and Albian to Turonian of Oman. Poland: Upper Albian to Lower Cenomanian of the Pieniny Klippen Belt (Carpathians), Lower Turonian of Władysławowo IG 1.

Stichomitra sp. A
(Pl. VI, Fig. 6)

M a t e r i a l : 5 well preserved specimens.
D i m e n s i o n s (in μm): height — 148–170, maximum width — 63–70.

D e s c r i p t i o n . Skeleton conical, elongate. Cephalis small, trapezoidal. Abdomen and postabdominal segments, numbering 5 to 7, are trapezoidal, low and wide, divided by shallow incisions. Segments are wider in the middle part. The skeleton has spongy structure.

R e m a r k s . *Stichomitra* sp. A from Władysławowo IG 1 differs from *Stichomitra* sp. from Lower Turonian of Łeba IG 1 (H. Górka, 1991) by having a smaller number of segments. It is most similar to a *Stichomitra* sp. specimen from Cretaceous sediments of the Atlantic Ocean, illustrated by J. Thurow (1988).

O c c u r r e n c e . Poland: Lower Turonian of Władysławowo IG 1.

Stichomitra sp. B
(Pl. VI, Figs. 14, 16)

M a t e r i a l : 9 well preserved specimens.
D i m e n s i o n s (in μm): height — 148–170, maximum width — 70–85.

R e m a r k s . Specific assignment of this form is difficult despite its abundance in the studied material. Skeleton conical, with quite widened base, consists of poorly discernible, unperforated capitulum, trapezoidal thorax, and 5 to 6 postabdominal segments, which are low, and widening towards the base. The last segment is often smaller than the other ones. The incisions between segments are only slightly marked at the periphery. In some specimens an oval orifice has been noted. Skeleton with spongy structure.

O c c u r r e n c e : Poland: Lower Turonian of Władysławowo IG 1.

Genus Stichocapsa Haeckel 1881 *sensu* Petrushevskaya, Koslova 1972
Type species *Stichocapsa jaspidea* Rüst 1885

Stichocapsa sp.
(Pl. VI, Figs. 3, 4)

M a t e r i a l : 7 well preserved specimens.
D i m e n s i o n s (in μm) height — 159–170, maximum width — 50–65

D e s c r i p t i o n . Skeleton elongate, spindle-shaped, cephalis more or less rounded. Present are thorax, abdomen and postabdominal segments, of trapezoidal shape with slightly marked incisions. Skeleton spongy. The base slightly rounded, closed.

R e m a r k s . The specimens described herein from Poland do not match any known species of *Stichocapsa*.

O c c u r r e n c e . Poland: Lower Turonian of Władysławowo IG 1.

Family **Theoperidae** Haeckel 1881 emend. Riedel 1967
Genus *Eucyrtidium* Ehrenberg 1847
Type species *Lithocampe acuminata* Ehrenberg 1844

Eucyrtidium (?)*matsumotoi* Taketani 1982
(Pl. VI, Fig. 9)

1982 *Eucyrtidium* (?)*matsumotoi* Taketani; Y. Taketani: p. 365, Pl. 2, 3.

M a t e r i a l : 2 well preserved specimens.
D i m e n s i o n s (in µm): height — 160–175, maximum width — about 60.

D e s c r i p t i o n . Skeleton spindle-shaped, with unperforated capitulum, ending in a little spine. Thorax trapezoidal. 5 postabdominal segments relatively high and wide are widest at mid-height. Basal orifice not visible. Perforation irregular.

O c c u r r e n c e . Turonian of Hokkaido (Japan). Poland: Lower Turonian of Władysławowo IG 1.

Family **Archaeodictyomitridae** Pessagno 1976
Genus *Dictyomitra* Zittel 1876 emend. Pessagno 1976
Type species *Dictyomitra multicostata* Zittel 1876

Dictyomitra sp.
(Pl. VI, Fig. 15)

M a t e r i a l : 1 well preserved specimen.
D i m e n s i o n s (in µm): height — 158, maximum width — 68.

D e s c r i p t i o n . Skeleton conical, elongate, with small, smooth cephalis and trapezoidal thorax. The other segments are low, growing bigger along the series. At the periphery, there are clearly noticeable incisions between segments. The last segment is lower than the remaining ones and bears an oval orifice. The costae typical for this genus are at places covered by an irregularly perforated meshwork.

R e m a r k s . The specimen described herein resembles most closely a Middle Jurassic *Dictyomitra* sp. from the Baltic region (V. S. Vishnevskaya, 1988).

O c c u r r e n c e . Poland: Lower Turonian of Władysławowo IG 1.

Family **Spongocapsulidae** Pessagno 1977*a* emend. Pessagno 1977*b*
Genus *Obesacapsula* 1977*a* emend. Pessagno 1977*b*
Type species *Obesacapsula morroensis* Pessagno 1977*a*

Obesacapsula morroensis Pessagno 1977*a*
(Pl. VI, Fig. 19)

1977*a* *Obesacapsula morroensis* Pessagno; E. A. Pessagno: p. 87, Pl. 11, Figs. 5–8.
1977*b* *Obesacapsula morroensis* Pessagno; E. A. Pessagno: p. 53, Pl. 11, Fig. 8.
1984 *Obesacapsula morroensis* Pessagno; A. Schaaf: p. 126–127.

Material: 15 well preserved specimens.
Dimensions (in µm): height — 195–220, maximum width — 112–118.

Description. Skeleton robust, consisting of 5 to 9 segments, the last of which is markedly swollen and continues into a cylindrical tubular extension. The proximal part of the skeleton is conical frustum-shaped and not perforated. The wall is thick and spongy.

Remarks. *Obesacapsula morroensis* Pessagno differs from *O.* (?)*rotunda* (G. J. Hinde, 1902, Pl. 1, Fig. 5) by having less pronounced incisions between segments, reduced number of segments and the last segment being much higher than the others. The discovery of *O. morroensis* Pessagno in Lower Turonian deposits of Władysławowo IG 1 extends the known geographical range of the species.

Occurrence. Valanginian and Lower Turonian of California. Poland: Lower Turonian of Władysławowo IG 1.

Obesacapsula cf. *rotunda* (Hinde 1902)
(Pl. VI, Fig. 5)

Material: 1 well preserved specimen.
Dimensions (in µm): height — 146, maximum width — 68.

Remarks. *Obesacapsula* cf. *rotunda* (Hinde) differs from the above described *O. morroensis* Pessagno by having more prominent incisions between segments, though less marked than in *O.* cf. *rotunda* (Hinde), and more numerous segments which grow slightly bigger in size along the series. In *O.* cf. *rotunda* (Hinde) from Poland there is an inconspicuous tubular structure.

Occurrence. Poland: Lower Turonian of Władysławowo IG 1.

Cyrtoidea incertae sedis

Genus *Protostichocapsa* Empson-Morin 1982
Type species *Stichocapsa* (?)*stocki* Campbell et Clark 1944 emend. Foreman 1968

Protostichocapsa stocki (Campbell et Clark, 1944) emend. Foreman 1968
(Pl. VI, Figs. 13, 20)

1944 *Stichocapsa* (?)*stocki* Campbell et Clark; A. S. Campbell, B. L. Clark: p. 44, Pl. 8, Figs. 31–35.
1944 *Stichocapsa megalocephala* Campbell et Clark; A. S. Campbell, B. L. Clark: p. 44, Pl. 8, Figs. 26, 34.
1968 *Amphipyndax stocki* (Campbell et Clark); H. Foreman: p. 78, Pl. 8, Fig. 12a–c.
1982 *Protostichocapsa stocki* (Campbell et Clark); K. M. Empson-Morin: p. 516, Pl. 4, Figs. 1–12.
1986 *Amphipyndax stocki* (Campbell et Clark) var. B; V. S. Vishnevskaya: p. 53, Pl. 6, Figs. 1–5.
1989 *Protostichocapsa stocki* (Campbell et Clark) emend. Foreman; H. Górka: p. 343, Pl. 14, Figs. 6, 7.
1991 *Protostichocapsa stocki* (Campbell et Clark) emend. Foreman; H. Górka: p. 44, Pl. 2, Fig. 6.
1993 *Amphipyndax stocki* (Campbell et Clark); M. Bąk: p. 186, Pl. 2, Figs. 8–10.

Material: 30 well preserved specimens.
Dimensions (in μm): height — 146–170, maximum width — 73–78.

Description of specimens and remarks: *Protostichocapsa stocki* (Campbell et Clark) displays large variability of the size and degree of elongation of the skeleton. The specimens from Władysławowo IG 1 are always conical, and consist of 6 to 8 segments with poorly marked borders on periphery. They have been classified to this species on the basis of their rounded cephalis, lacking an apical spine divided internally into 2 sections. Trapezoidal thorax is poorly marked. Postabdominal segments grow successively bigger. Sometimes the last segment is slightly higher. Basal orifice not always visible. Perforations of irregular shape and size.

Occurrence. Cosmopolitan species from Albian to Campanian. Poland: Upper Albian to Lower Cenomanian of Pieniny Klippen Belt (Carpathians), Lower Turonian of Władysławowo IG 1.

Genus *Pseudoeucyrtis* Pessagno 1977*b*
Type species *Eucyrtis* (?)*zhamoidai* Foreman 1973
Pseudoeucyrtis sp.
(Pl. VI, Fig. 7)

Material: 1 well preserved specimen.
Dimensions (in μm): height — 160, maximum width — about 50.

Description. Skeleton elongate, spindle-shaped. Cephalis small, rounded, lacking an apical spine (perhaps due to damage). The other 7 segments grow gradually higher. They are widest in mid-length of the skeleton. Incisions between segments poorly marked. Distal end truncated. Perforation irregularly spaced.

R e m a r k s . This *Pseudoeucyrtis* sp. seems to be conspecific with the *Pseudoeucyrtis* sp. described from Hauterivian Grodziszcze Shales at Lipnik (H. Górka, S. Geroch, 1989).

O c c u r r e n c e . Poland: Hauterivian at Lipnik (Outer Carpathians), Lower Turonian of Władysławowo IG 1.

Gen. et sp. indet.
(Pl. VI, Figs. 12, 18, 21)

M a t e r i a l : 10 differently preserved specimens.
D i m e n s i o n s (in μm): height — 157–202, maximum width — 70–111.

D e s c r i p t i o n . Skeleton elongate, robust, frustum-shaped, consisting of few (5–7) segments of trapezoidal shape with slightly convex sides. Borders between segments well marked. The size of segments grows towards the base, and they are widest around the middle of the skeleton's height (i.e., at the 2nd or 3rd postabdominal segment). Cephalis and thorax are indeterminable in the studied specimens. No apieal spine has been observed. The skeleton has spongy structure, locally with finely granulate surface. Perforations of irregular shape and irregularly spaced. Basal orifice small, circular, often not visible.

R e m a r k s . Despite large number of specimens, it is difficult to identify their generic and specific affinities, because the incompleteness of the first 2 segments in all of them. The general shape of the skeleton, as well as the number and size of segments make them comparable to *Dictyomitra* (?)*nodosa* Koslova from the Campanian of the Eastern Caucasus, although the illustrated holotype consists of only 5 segments and not of 8, as stated in the diagnosis. The cephalis is also obscured. Both forms have granulate tuberosities, but the perforation is different. In the species described herein, the pores are smooth and framed with an inflated surface. A size variability has been observed.

O c c u r r e n c e . Poland: Lower Turonian of Władysławowo IG 1.

Translated by Karol Sabath

Instytut Geologii Podstawowej
Uniwersytetu Warszawskiego
Warszawa, al. Żwirki i Wigury 93
Received: 27.03.1995

REFERENCES

BAUMGARTNER P. O. (1980) — Late Jurassic Hagiastridae and Patulibracchidae (Radiolaria) from the Argolis Peninsula (Peloponnesus, Greece). Micropaleontology, 26, p. 274–322, no. 3.

BĄK M. (1993) — Late Albian-Early Cenomanian Radiolaria from the Czorsztyn succession, Pieniny Klippen Belt, Carpathians. Studia Geol. Pol., 102, p. 177–207.

CAMPBELL A. S., CLARK B. L. (1944) — Radiolaria from Upper Cretaceous of middle California. Geol. Soc. Amer. Spec. Pap., 57, p. 1–61.

CAYEUX L. (1897) — Contribution à l'étude micrographiqne des terrains sédimentaires. 1. Etude de quelques depots siliceux secondaires et tertiaires du bassin de Paris et de la Belgique. 2 Craie du Bassin de Paris. Mém. Soc. Géol. Nord, Lille, 4, p. 1–591, no. 2.

DUMITRIČA P. (1975) — Cenomanian Radiolaria at Podul Dimbovitei (Excursion B). In: Micropaleontological guide to the Mesozoic and Tertiary of the Romanian Carpathians 14th European Micropal. Coll., p. 87–89.

EHRENBERG C. G. (1844) — Über 2 neue lager von Gebirgsmassen aus Infusorien als Meeres Absatz in Nord-Amerika und eine Vergleichung derselben mit den organischen Kreide — Bebilden in Enropa nnd Afrika. Kgl. Preuss. Akad. Wiss. Berlin, Jg., 1844, p. 57–97.

EHRENBERG C. G. (1847) — Über eine halibiolithische, von Herrn R. Schomburgk entdeckte, vorheerschend aus mikroskopischen Polycystinen gebildete, Gebirgsmasse von Barbados. Monatsber. Kgl. Preuss. Akad. Wiss. Berlin, Jg., 1845, p. 382–385.

EHRENBERG C. G. (1854) — Die systematische Charakteristik der neuen mikroskopischen Organismen des Tiefen Atlantischen Ocean für den Monatsbericht zum Druck zu übergeben, deren Verzeichniss im Monat Februar bereits mitgeteilt worden ist. Monatsber. Kgl. Preuss. Akad. Wiss. Berlin, p. 236–250.

EHRENBERG C. G. (1875) — Fortsetzung der mikrogeologischen Studien als Gesammt-Uebersicht der mikroskopischen Paliontologie gleichartig analysierter Gebirgsarten der Erde, mit speceller Rucksicht auf den Polycystinen-Mergel von Barbados. Abh. Kgl. Akad. Wiss. Berlin, Jg., 1875, p. 1–226.

EMPSON-MORIN K. M. (1983) — Reexamination of the Late Cretaceous radiolarians genus *Amphipyadax* Foreman. J. Paleont., 56, p. 507–519, no. 2.

FOREMAN H. (1966) — Two Cretaceous radiolarian genera. Micropaleontology, 12, p. 355–359, no. 3.

FOREMAN H. (1968) — Upper Maastrichtian Radiolaria of California. Spec. Pap. Palaeont., 3, p. 182.

FOREMAN H. (1973) — 13. Radiolaria from DSDP Leg 20. In: Initial Rep. Deep Sea Drilling Project (eds. B. C. Heezen *et al.*), 20, p. 249–305.

GASIŃSKI M. A. (1988) — Foraminiferal biostratigraphy of the Albian and Cenomanian sediments in the Polish part of the Pieniny Klippen Belt, Carpathian Mountains. Cret. Res., 9, p. 217–247.

GEROCH S., NOWAK W. (1963) — Lower Cretaceous in Lipnik near Bielsko, Western Carpathians (in Polish with English summary). Rocz. Pol. Tow. Geol., 33, p. 241–264, no. 2.

GORIČAN S. (1987) — Jurassic and Cretaceous radiolarians from the Budva zone (Montenegro, Yugoslavia). Rev. Micropalcont., 30, p. 177–196, no. 3.

GÓRKA H. (1989) — Les Radiolaires du Campanien inférieur de Craeovie (Pologne). Acta Palaeont. Pol., 34, p. 327–354, no. 4.

GÓRKA H. (1991) — Les Radiolaires du Turonien inférieur du sondage de Łeba IG 1 (Pologne). Cahiers de Micropaléont., 6, p. 39–45, no. 1.

GÓRKA H., GEROCH S. (1989) — Radiolarians from a Lower Cretaceous section at Lipnik near Bielsko-Biała (Carpathians, Poland). Ann. Soc. Geol. Pol., 59, p. 183–195, no. 1–2.

HAECKEL E. (1862) — Die Radiolarien (Rhizopoda Radiolaria). Eine Monographie.

HAECKEL E. (1881) — Entwurf eines Radiolarien-Systems auf Grund von Studien der Challenger-Radiolarien. Jena. Z. Naturwiss, 15, N. Ser., 8, p. 418–472, no. 3.

HAECKEL E. (1882) — List of Radiolaria. In: Exploration of the Faroe Channel, during the summer of 1880, in H. M. hired ship "Knight Errant" (eds. T. H. Tizard, J. Murray), p. 656. Proc. Roy. Soc. Edinburgh, 11, p. 638–677.

HAECKEL E. (1887) — Report on the Radiolaria collected by H. M. S. Challenger during the years 1873–76. Rept. Voyage Challenger Zool., 18, 1, 2, CLXXXVIII + 1803.

HINDE G. J. (1902) — Description of fossil Radiolaria from the rocks of Central Borneo. In: Borneo-Expedition: Geologische Verkenningstochten in Central Borneo (1893–1894) (ed. G. A. F. Molengraaf), p. 1–51.

KOSLOVA G. E., GORBOVETZ A. N. (1966) — Radiolarii verkhnemelovykh i verkhnesenonovykh otlozhenii zapadnosibirskoj nizmennosti. Trudy Vses. Neft. Nauczno-Issledov. Geol. Inst. (VNIGRI), 248, p. 1–159.

KOUTSOUKOS E. A. M., HART M. B. (1990) — Radiolarians and diatoms from the mid-Cretaceous successions of the Sergipe Basin, Northeastern Brazil: palaeoceanographic assessment. J. Micropal., 9, p. 45–64, no. 1.

KUHNT W., THUROW J., WIEDMAN J., HERBIN J. P. (1986) — Oceanic anoxic conditions around the Cenomanian/Turonian boundary and the response of the biota. Mitt. Geol.-Palaont. Inst. Univ. Hamburg, 60, p. 205–246.

LIPMAN R. H. (1952) — Materialy k izucheniyu verkhnemelovykh otlozhenii Russkoj platformy. Trudy Vses. Nauk. Issl. Geol. Inst. (VSEGEI), Palcont. Strat., p. 24–51.

LIPMAN R. H. (1960) — Radiolaria. In: Stratigrafiya i fauna melovykh otlozheni zapadnosibirskoj nizmennosti. Trudy VSEGEI. New. Ser., 29, p. 124–134.
LIPMAN, R. H. (1962) — Pozdnemelovye radiolarii Zapadno-Sibirskoj nizmennosti i Turgaiskogo progiba. L. ONTI. Trudy VSEGEI, p. 271–315.
MÜLLER J. (1858) — Über die Thalassicolen, Polycystinen und Acanthometren des Mittelmeeres. Abh. Kgl. Akad. Wiss. Berlin, Jg., 1–62.
NAKASEKO K., NISHIMURA A. (1981) — Upper Jurassic and Cretaceous Radiolaria from the Shimanto Group in Southwest Japan. Sc. Rep. Col. Gen. Educ. Osaka Univ., 30, p. 133–203, no. 2.
PESSAGNO E. A. (1963) — Upper Cretaceous Radiolaria from Puerto Rico. Micropaleontology, 9, p. 197–214, no. 2.
PESSAGNO E. A. (1971) — Jurassic and Cretaceous Hagiastridae from the Blake Basin (Site 5 A Joides Leg I) and the Great Valley sequence, California Coast Ranges. Bull. Amer. Paleont., 60, p. 1–83, no. 264.
PESSAGNO E. A. (1973) — Upper Cretaceous Spumellariina from the Great Valley sequence, California Coast Ranges. Bull. Amer. Paleont., 63, p. 49–102, no. 276.
PESSAGNO E. A. (1976) — Radiolarian zonation and stratigraphy of the Upper Cretaceous portion of the Great Valley sequence, California Coast Ranges. Micropaleont., Spec. Pap., 2, p. 1–95.
PESSAGNO E. A. (1977*a*) — Upper Jurassic Radiolaria and radiolarian biostratigraphy of the California Coast Ranges. Micropaleontology, 23, p. 56–113, no. 1.
PESSAGNO E. A. (1977*b*) — Lower Cretaceous Radiolarian biostratigraphy of the Great Valley sequence and Franciscan complex, California Coast Ranges. Cushm. Found. Foram. Res. Spec. Publ., 5, p. 1–87.
PETRUSHEVSKAYA M. G., KOSLOVA G. E. (1972) — Radiolaria: Leg 14, Deep Sea Drilling Project. In: Initial Rep. DSDP, 14 of the cruises of the Drilling Vessel Glomar Challenger (ed. D. E. Hayes), p. 495–648.
RENZ G. W. (1974) — Radiolaria from Leg 27 of the Deep Sea Drilling Project, p. 769–841.
RIEDEL W. R. (1967) — Some new families of Radiolaria. Geol. Soc. London Proc., 1640, p. 148–149.
RIEDEL W. R. (1971) — Systematic classification of Polycystine Radiolaria. In: The micropaleontology of the Oceans (eds. B. M. Funnel, W. R. Riedel). Cambridge Univ. Press. p. 649–661.
RÜST D. (1885) — Beitrage zur Kenntnis der fossilen Radiolarien aus Gesteinen des Jura. Palaeontographica, 31, p. 269–321, no. 3.
SCHAAF A. (1981) — J2. Late early Cretaceous Radiolaria from Deep Sea Drilling Project Leg. 62. In: Initial Rep. Deep Sea Drilling Project (eds. J. Thiede *et al.*), 72, p. 419–470.
SCHAAF A. (1984) — Les Radiolaires du Crétacé inférieur et moyen. Biologie et Systématique. Sc. Géol. Mém., 75, p. 1–189.
SCHAAF A., THOMAS V. (1986) — Les Radiolaires campaniens du Wadi Ragmi (nappe de Semail, Oman) un nouveau repére chronologique de l'obduction omanaise. C. R. Acad. Sc. Paris, 303, p. 1593–1598, no. 2.
SQUINABOL S. (1903) — Le Radiolarie dei noduli selciosi nella Scaglia degli Euganei. Riv. Ital. Paleont., 9, p. 105–150, no. 4.
SUJKOWSKI Z. (1930) — Étude pétrographique du Crétacé de Pologne. La série de Lublin et sa comparaison avec la craie blanche (in Polish with French summary). Spraw. Państw. Inst. Geol., 6, p. 485–628, no. 3.
TAKETANI Y. (1982) — Cretaceous Radiolaria from Hokkaido. In : JRS 81 Osaka Proc. First Japanese Radiolarian Symposjum. News of Osaka Micropalcont., Spec., 5, p. 361–370.
TAN SIN HOK (1927) — Over de sommenstelling en het onstaan van Krijten mergelgesteenten van de Molukken. S' Gravenhage.
THUROW J. (1988) — Cretaceous Radiolarians of the North Atlantic Ocean (Leg 103 ODP, Site 638, 640, 641, Leg. 93 DSDP Site 603, Leg 47 B DSDP Site 398). Proc. Final Repts. (Pt. BX), ODP, 103, p. 1–32.
THUROW J., KUHNT W. (1986) — Mid-Cretaceous of the Gibraltar Arch Area. North Atlantic Palaeoceanography. Jour. Geol. Soc. London, Spec. Publ., 22, p. 423–445.
VISHNEVSKAYA V. S. (1986) — Middle to Late Cretaceous radiolarian zonation of the Bering region U.S.S.R. Mar. Micropaleont., 11, p. 139–149, no. 1–3.
VISHNEVSKAYA V. S. (1988) — O vozmohnostiakh jursko-palcocenovykh vulkanogenno-kriemnistykh formacij severo-zapadnogo obramleniya Paeifiki (w priedielah SSSR). In: Ocherki po geologii Kamehatki i Karyaskogo Nagorya (ed. J. M. Pusheharovskiy), p. 8–16. Nauka.
YAMAUCHI M. (1982) — Upper Cretaceous radiolarians from the Northern Shimanto Belt along the course of Shimanto River, Kochi prefecture, Japan. In: JRS 81 Osaka Proc. First Japanese Radiolarian Symposjum. News of Osaka Micropalcont., Spec., 5, p. 383–398.
ZITTEL K. A. (1876) — Über einige fossile Radiolarien aus der norddeutschen Kreide. Zeit. Deutsch. Geol. Ges., 28, p. 75–86.

Hanna GÓRKA

RADIOLARIE DOLNOTURONSKIE (POLYCYSTINA) Z OTWORU WIERTNICZEGO WŁADYSŁAWOWO IG 1 (REGION BAŁTYCKI)

S t r e s z c z e n i e

Z próbek pobranych do badań mikropaleontologicznych z otworu wiertniczego Władysławowo IG 1 sześć stanowi materiał wyjątkowo bogaty w dobrze zachowane krzemionkowe szkieleciki radiolarii (promienice). Opracowano 30 gatunków radiolarii (Polycystina), w tym 17 przedstawicieli Spumellaria i 13 Nassellaria.

Na podstawie radiolarii i towarzyszących im otwornic planktonicznych, wiek badanych próbek określono na wczesny turon. Ponadto przedstawiono historię badań radiolarii kredowych w Polsce, przeprowadzono analizę biometryczną oraz wyciągnięto wnioski ekologiczne, sugerując że występujące otwornice planktoniczne, jak również radiolarie wskazują na otwarte, płytkie i ciepłe morze.

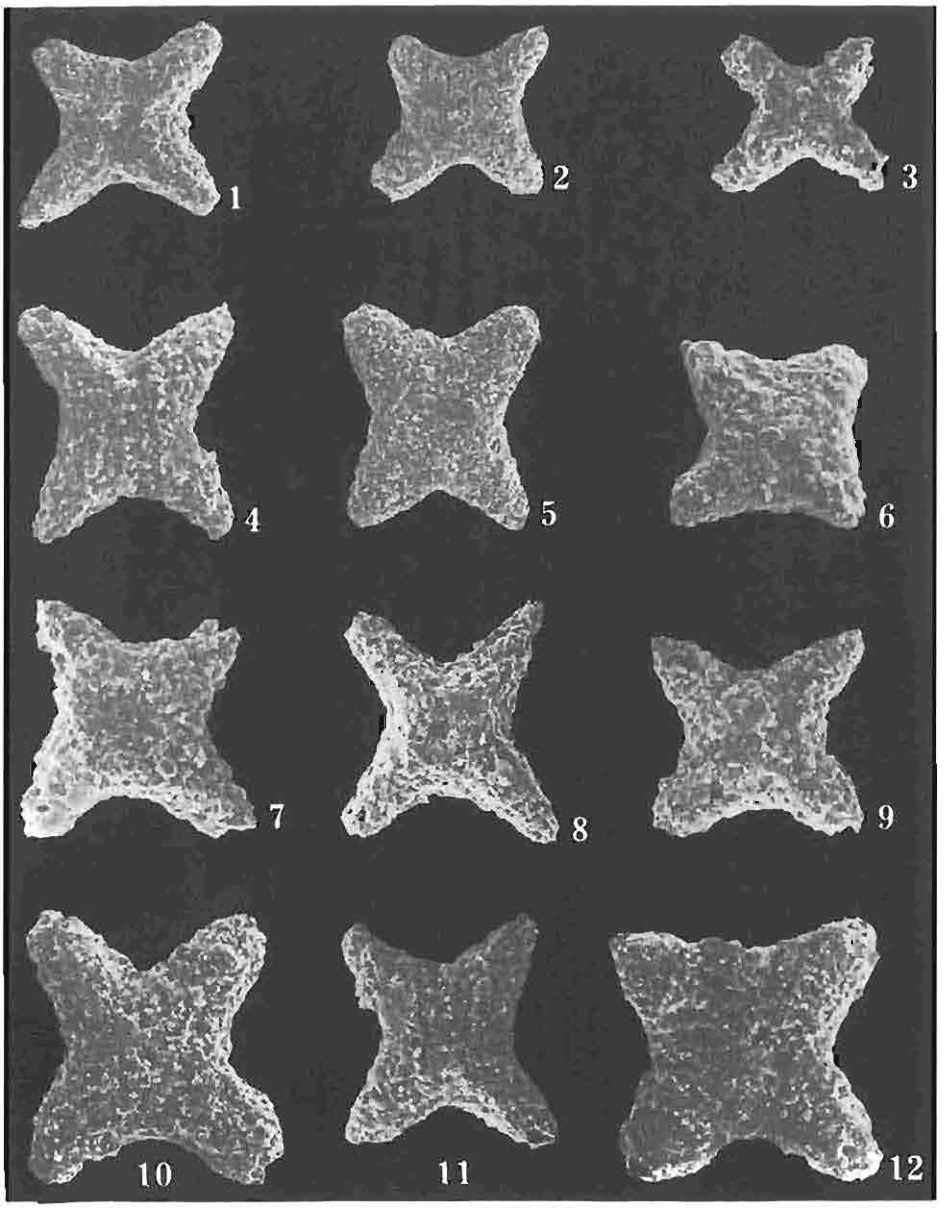
PLATE I

Figs. 1–11. *Crucella cachensis* Pessagno

Fig. 1 — IGPUW-V-47, depth 124.00 m, x 410; Fig. 2 — IGPUW-V-82, depth 124.70 m, x 410; Fig. 3 — IGPUW-V-105, depth 128.00 m, x 410; Fig. 4 — IGPUW-V-4, depth 114.00 m, x 410; Fig. 5 — IGPUW-V-20, depth 114.00 m, x 275; Fig. 6 — IGPUW-V-99, depth 124.00 m, x 420; Fig. 7 — IGPUW-V-6, depth 114.00 m, x 410; Fig. 8 — IGPUW-V-27, depth 124.00 m, x 410; Fig. 9 — IGPUW-V-26, depth 124.00 m, x 410; Fig. 10 — IGPUW-V-25, depth 121.00 m, x 410; Fig. 11 — IGPUW-V-107, depth 128.00 m, x 410

Fig. 12. *Histiastrum aster* Lipman

IGPUW-V-104, depth 128.00 m, x 380



Hanna GÓRKA — Lower Turonian radiolarians (Polycystina) from borehole Władysławowo IG 1 (Baltic region)

PLATE II

Fig. 1–3. *Histiastrum latum* Lipman

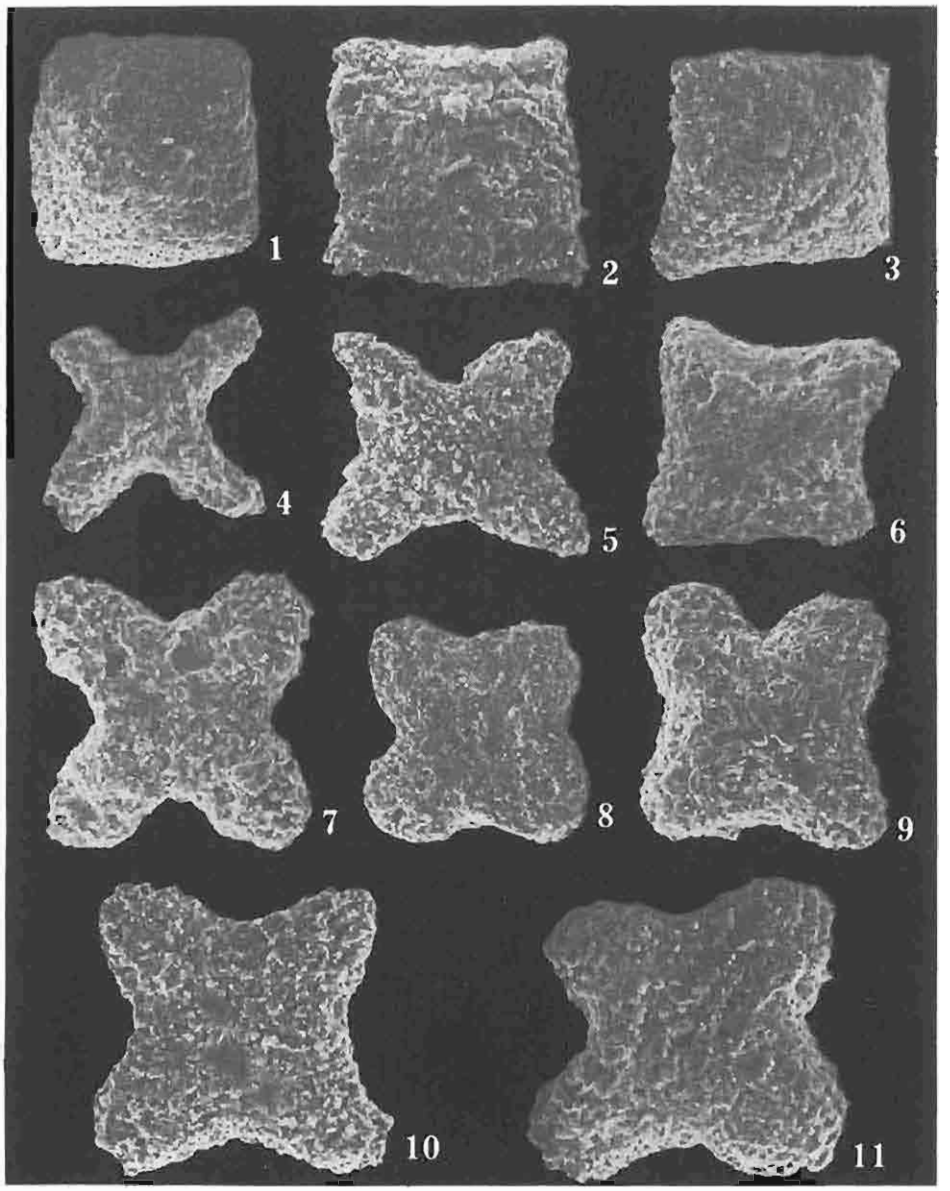
Fig. 1 — IGPUW-V-50, depth 124.00 m, x 500; Fig. 2 — IGPUW-V-118, depth 131.20 m, x 430; Fig. 3 — IGPUW-V-129, depth 131.20 m, x 416

Fig. 4. *Crucella cachensis* Pessagno

IGPUW-V-61, depth 124.00 m, x 390

Figs. 5–11. *Histiastrum aster* Lipman

Fig. 5 — IGPUW-V-23, depth 114.00 m, x 400; Fig. 6 — IGPUW-V-85, depth 124.70 m, x 375; Fig. 7 — IGPUW-V-44, depth 121.00 m, x 410; Fig. 8 — IGPUW-V-3, depth 114.00 m, x 410; Fig. 9 — IGPUW-V-26, depth 121.00 m, x 400; Fig. 10 — IGPUW-V-32, depth 121.00 m, x 400; Fig. 11 — IGPUW-V-67, depth 124.00 m, x 400



Hanna GÓRKA — Lower Turonian radiolarians (Polycystina) from borehole Władysławowo IG 1 (Baltic region)

PLATE III

Figs. 1–3, 6–12. *Cavaspongia antelopensis* Pessagno

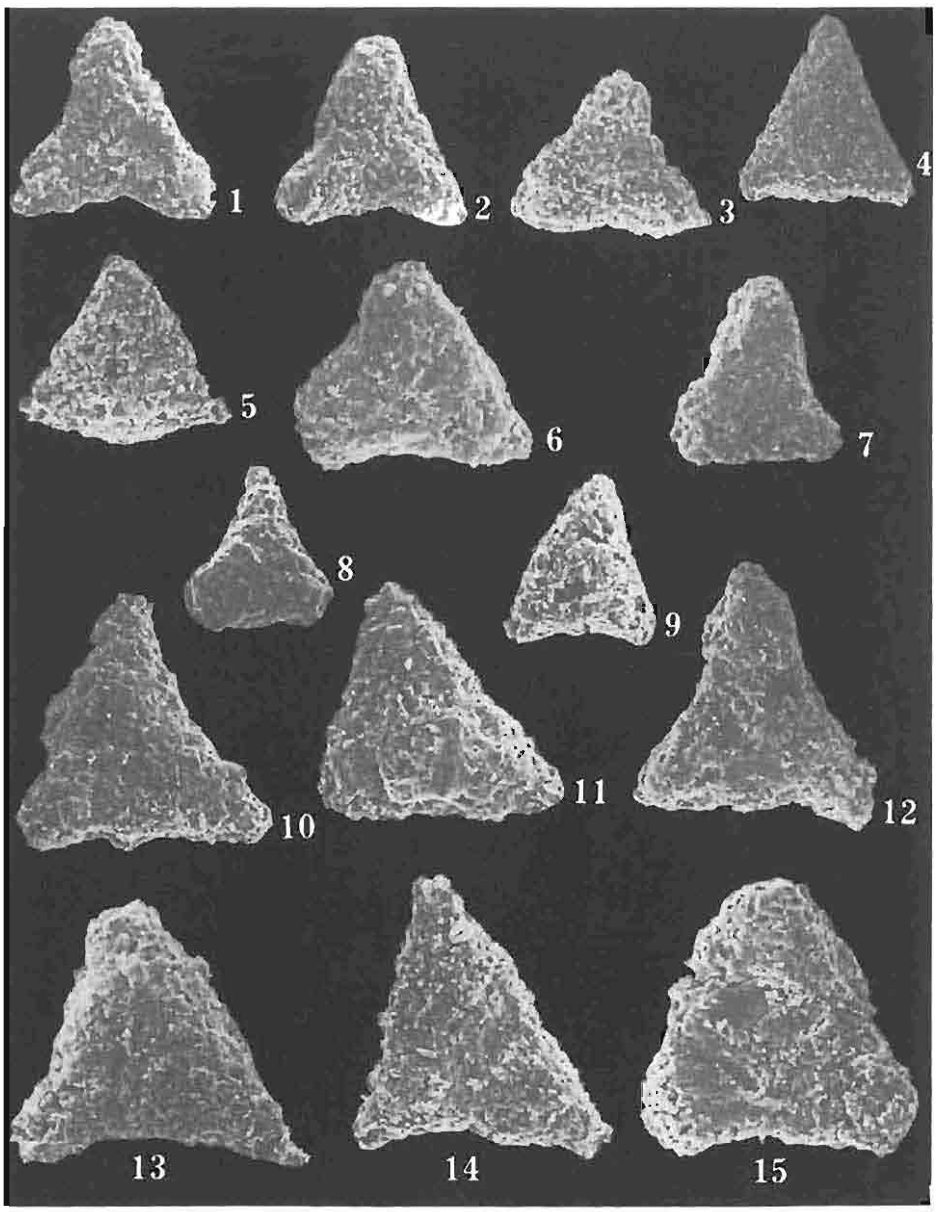
Fig. 1 — IGPUW-V-8, depth 114.00 m, x 410; Fig. 2 — IGPUW-V-15, depth 114.00 m, x 430. Fig. 3 — IGPUW-V-41, depth 121.00 m, x 450; Fig. 6 — IGPUW-V-69, depth 124.70 m, x 370, Fig. 7 — IGPUW-V-73, depth 124.70 m, x 430; Fig. 8 — IGPUW-V-54, depth 124.00 m, x 400; Fig. 9 — IGPUW-V-87, depth 124.70 m, x 420; Fig. 10 — IGPUW-V-5, depth 128.00 m, x 400; Fig. 11 — IGPUW-V-16, depth 114.00 m, x 400; Fig. 12 — IGPUW-V-94, depth 124.70 m, x 420

Figs. 4, 5, 13, 14. *Cavaspongia* sp.

Fig. 4 — IGPUW-V-95, depth 124.00 m, x 435; Fig. 5 — IGPUW-V-49, depth 124.00 m, x 450; Fig. 13 — IGPUW-V-125, depth 131.20 m, x 390; Fig. 14 — IGPUW-V-114, depth 131.20 m, x 430

Fig. 15. Gen. et sp. indet. A.

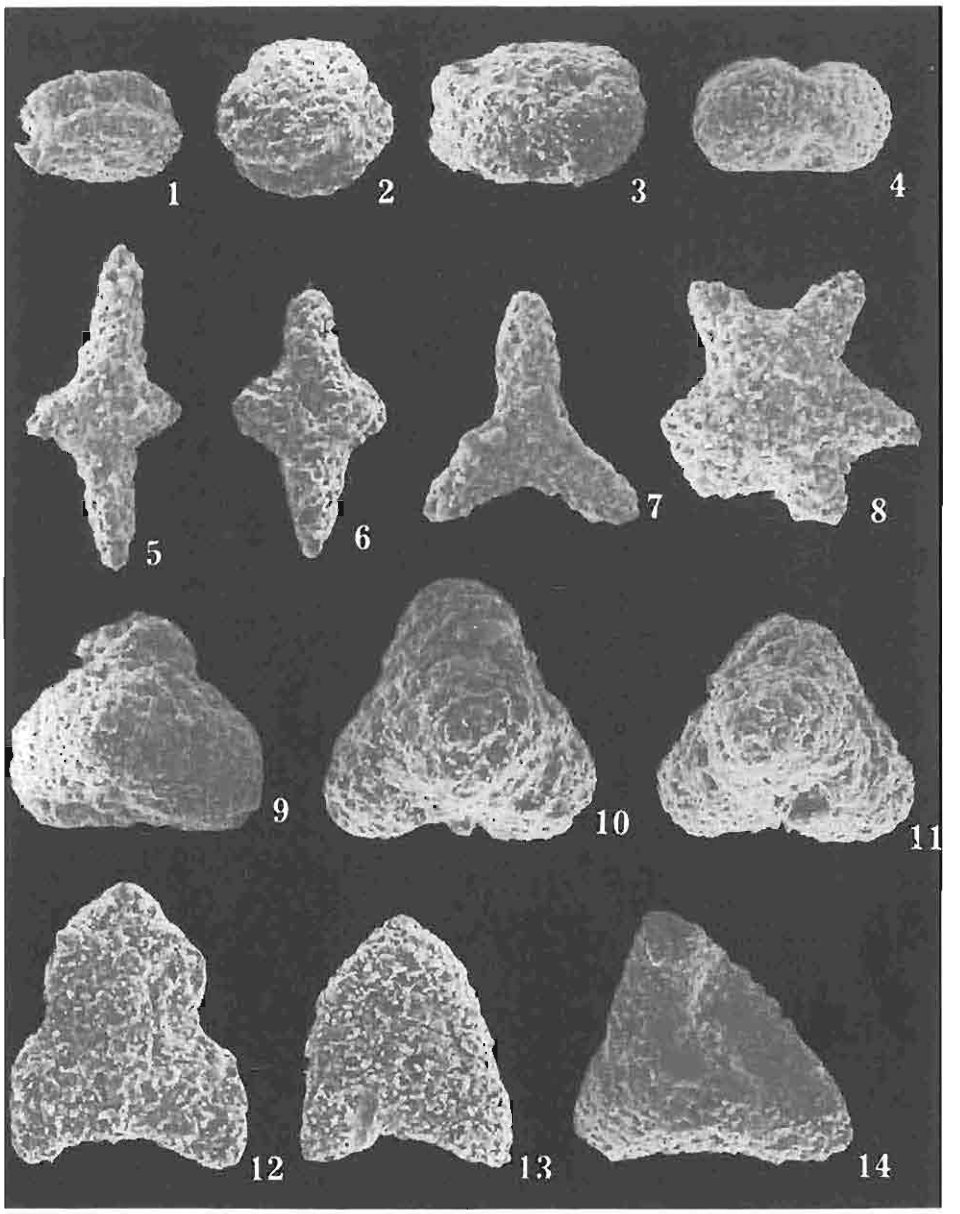
IGPUW-V-80, depth 124.70 m, x 360



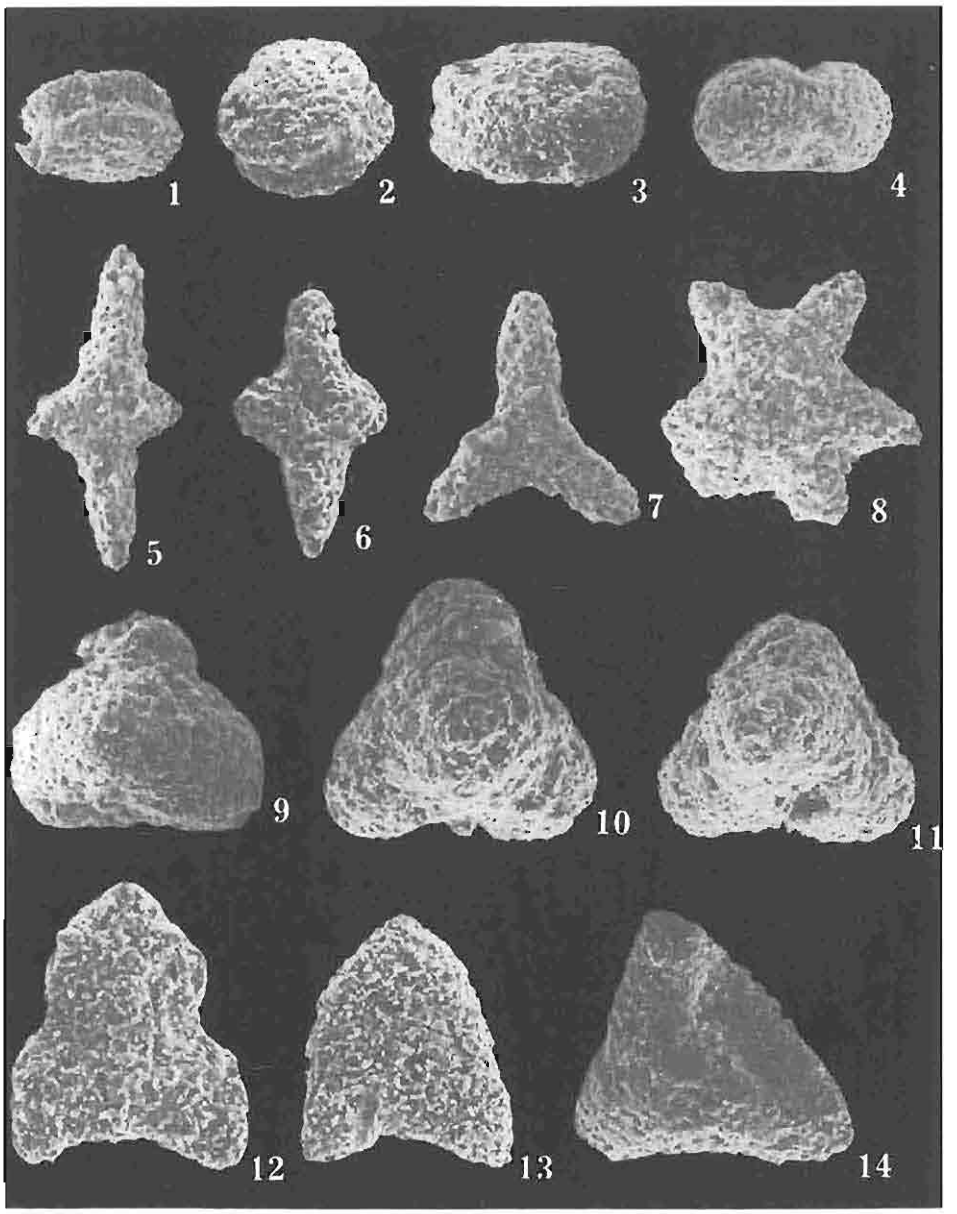
Hanna GÓRKA — Lower Turonian radiolarians (Polycystina) from borehole Władysławowo IG 1 (Baltic region)

PLATE IV

Figs. 1–4. *Spongodiscus multus* Koslova
Fig. 1 — IGPUW-V-93, depth 124.70 m, x 420; Fig. 2 — IGPUW-V-13, depth 114.00 m, x 400; Fig. 3 — IGPUW-V-56, depth 124.00 m, x 420; Fig. 4 — IGPUW-V-45, depth 121.00 m, x 445
Figs. 5, 6. *Hagiastrum* sp.
Fig. 5 — IGPUW-V-97, depth 124.00 m, x 380; Fig. 6 — IGPUW-V-28, depth 121.00 m, x 420
Fig. 7. *Cavaspongia californiensis* Pessagno
IGPUW-V-71, depth 124.70 m, x 380
Fig. 8. *Pentinastrum subbotinae* Lipman
IGPUW-V-40, depth 121.00 m, x 390
Figs. 9–11. *Pyramispongia glascockensis* Pessagno
Fig. 9 — IGPUW-V 37, depth 121.00 m, x 400; Fig. 10 — IGPUW-V-38, depth 121.00 m, x 390; Fig. 11 — IGPUW-V-43, depth 121.00 m, x 430
Fig. 12. Gen. et sp. indet. B
IGPUW-V-30, depth 121.00 m, x 406
Fig. 13. Gen. et sp. indet. C
IGPUW-V-34, depth 121.00 m, x 390
Fig. 14. *Cavaspongia antelopensis* Pessagno
IGPUW-V-48, depth 124.00 m, x 400



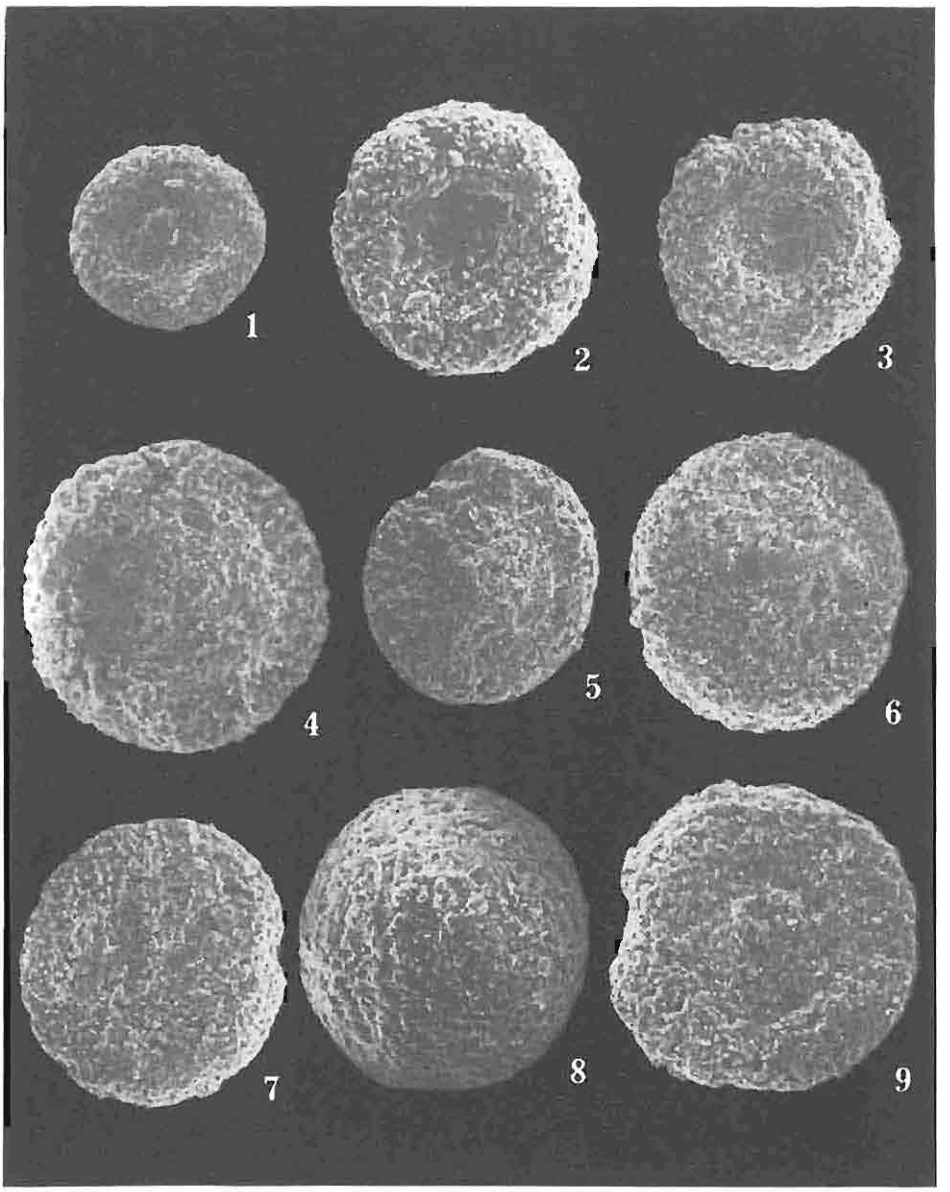
Hanna GÓRKA — Lower Turonian radiolarians (Polycystina) from borehole Władysławowo IG 1 (Baltic region)



Hanna GÓRKA — Lower Turonian radiolarians (Polycystina) from borehole Władysławowo IG 1 (Baltic region)

PLATE V

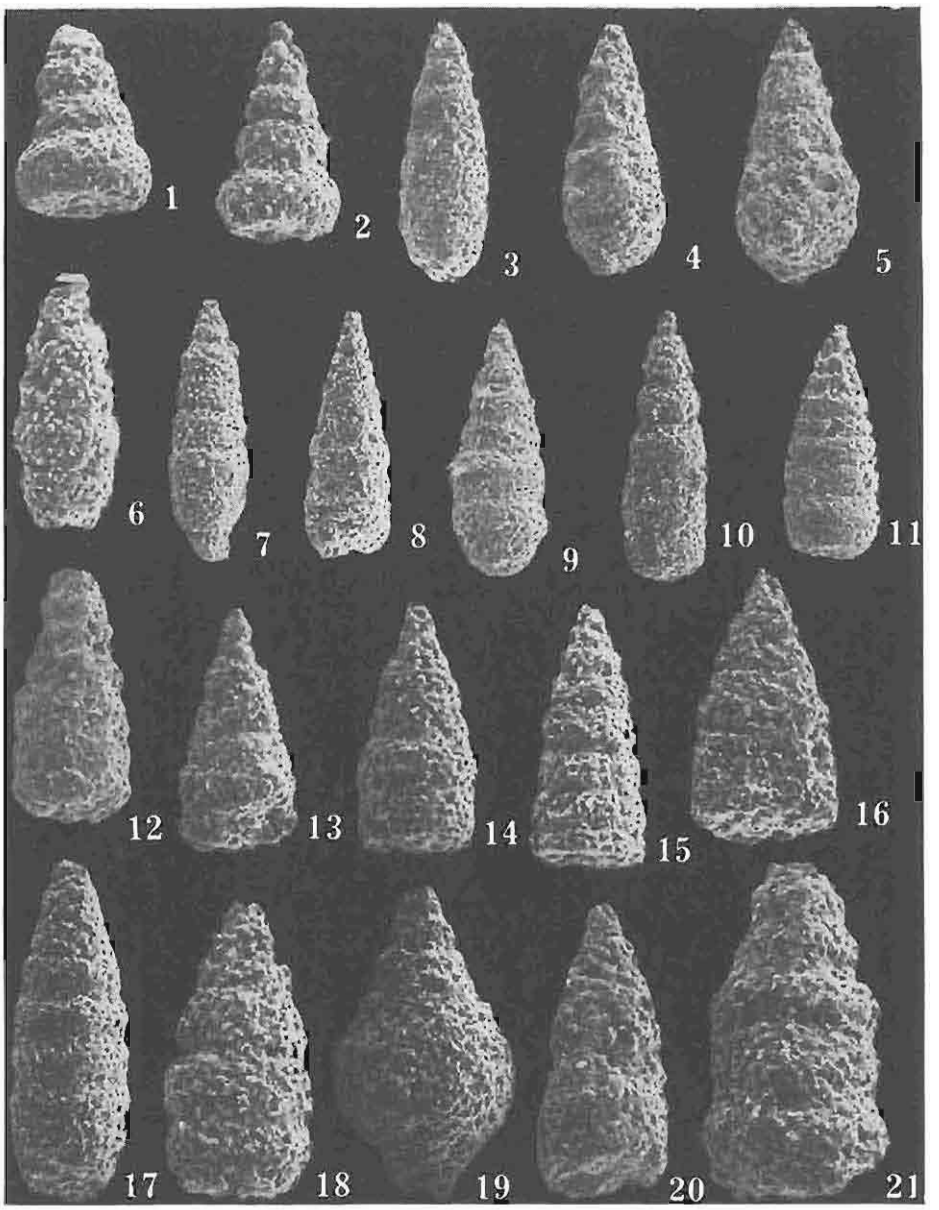
Figs. 1, 2. *Orbiculiforma vacaensis* Pessagno
Fig. 1 — IGPUW-V-76, depth 124.70 m, x 445; Fig. 2 — IGPUW-V-10, depth 114.00 m, x 400
Figs. 3, 5, 9. *Orbiculiforma renillaeformis* (Campbell et Clark) Pessagno
Fig. 3 — IGPUW-V-29, depth 121.00 m, x 430; Fig. 5 — IGPUW-V-55, depth 124.00 m, x 400; Fig. 9 — IGPUW-V-59, depth 124.00 m, x 415
Figs. 4, 6, 7. *Orbiculiforma* ex gr. *monticelloensis* Pessagno
Fig. 4 — IGPUW-V-96, depth 124.70 m, x 410; Fig. 6 — IGPUW-V-22, depth 114.00 m, x 440; Fig. 7 — IGPUW-V-57, depth 124.00 m, x 420
Fig. 8. *Orbiculiforma* sp.
IGPUW-V-42, depth 121.00 m, x 400



Hanna GÓRKA — Lower Turonian radiolarians (Polycystina) from borehole Władysławowo IG 1 (Baltic region)

PLATE VI

Figs. 1, 2. *Amphipyndax mediocris* (Tan Sin Hok)
Fig. 1 — IGPUW-V-14, depth 114.00 m, x 410; Fig. 2 — IGPUW-V-18, depth 114.00 m, x 390
Figs. 3, 4. *Stichocapsa* sp.
Fig. 3 — IGPUW-V-119, depth 131.20 m, x 410; Fig. 4 — IGPUW-V-68, depth 124.00 m, x 390
Fig. 5. *Obesacapsula* cf. *rotunda* (Hinde)
IGPUW-V-51, depth 124.00 m, x 450
Fig. 6. *Stichomitra* sp. A
IGPUW-V-19, depth 114.00 m, x 425
Fig. 7. *Pseudoeucyrtis* sp.
IGPUW-V-17, depth 114.00 m, x 410
Figs. 8, 11, 17. *Stichomitra communis* Squinabol
Fig. 8 — IGPUW-V-31, depth 121.00 m, x 406; Fig. 11 — IGPUW-V-2, depth 114.00 m, x 410; Fig. 17 — IGPUW-V-24, depth 121.00 m, x 400
Fig. 9. *Eucyrtidium* (?) *matsumotoi* Takeitani
IGPUW-V-39, depth 121.00 m, x 406
Fig. 10. *Amphipyndax uralica* (Gorbovetz)
IGPUW-V-24, depth 121.00 m, x 400
Figs. 12, 18, 21. Gen. et sp. indet.
Fig. 12 — IGPUW-V-78, depth 124.70 m, x 400; Fig. 18 — IGPUW-V-64, depth 124.00 m, x 415; Fig. 21 — IGPUW-V-103, depth 124.00 m, x 420
Figs. 13, 20. *Protostichocapsa stocki* (Campbell et Clark) emend. Foreman
Fig. 13 — IGPUW-V-66, depth 124.70 m, x 410; Fig. 20 — IGPUW-V-74, depth 124.70 m, x 430
Figs. 14, 16. *Stichomitra* sp. B
Fig. 14 — IGPUW-V-58, depth 124.70 m, x 425; Fig. 16 — IGPUW-V-120, depth 131.20 m, x 410
Fig. 15. *Dictyomitra* sp.
IGPUW-V-7, depth 114.00 m, x 410
Fig. 19. *Obesacapsula morroensis* Pessagno
IGPUW-V-52, depth 124.00 m, x 400



Hanna GÓRKA — Lower Turonian radiolarians (Polycystina) from borehole Władysławowo IG 1 (Baltic region)