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KRYSTYNA ZAWIDZKA

Stratigraphic position of the Furkaska limestones (Choč nappe, the Tatra Mts)

ABSTRACT: On the basis of conodont studies, the conclusions concerning the age of some members of the western part of Choč nappe in the Tatra Mts are given. The Furkaska limestones appear to be of Upper Anisian/Lower Ladinian age. Three new conodont species, *Neospathodus tatricus* sp. n., *Ozarkodina budurovi* sp. n. and *Cornudina neospathodides* sp. n., found in these limestones, are paleontologically described.

INTRODUCTION

The Choč nappe in the western Tatra Mts is most completely developed on the area bordered by the Lejowa Valley and the Polish-Czechoslovak frontier. The Triassic of the Choč nappe is represented primarily by dolomites and limestones with shale intercalations. The tectonic sequence and stratigraphic position of particular lithological members of the Triassic is still not adequately documented.

The present author studied limestone complexes of the Choč nappe, situated on the area bordered by the Chochołowska Valley and the state frontier (Fig. 1). In this area Guzik (1959) distinguished two tectonic-lithofacial units, *viz.* Furkaska and Koryciska units, assigning their limestone members to the Rhaetian; however, Guzik admitted that some of these members may represent Reifling-Partnach elements. Subsequently, Kotański (1965, 1967), on the basis of the macrofauna and communities of calcareous algae found in limestones and dolomites of both these units, assigned limestones and shales outcropping on northern slopes of Mt. Furkaska to the Upper Anisian (Pelson-Illir) and dolomites of the Koryciska unit to the Lower Ladinian (Fassan).

The present studies show that, microfacially, Furkaska limestone complex has numerous features in common with the Reifling limestones; both are micritic or grained limestones with micritic matrix, occasionally pseudo-breccial in character (*cf.* Andrusov 1959, p. 32). Filaments and sponge spicules predominate, being accompanied by ostracods, foraminifers (mainly Lagenidae), holothurian sclerites (*cf.* Zawidzka 1971), echinoderm fragments, fish teeth and scales, pellets, intraclasts and occasional chalcedone concentrations (*cf.* Mišík 1959, Pl. 3, Fig. 7; 1966, Pl. 8, Fig. 1). The limestones become markedly marly upwards and ultimately pass into shaly-limestone complex (Partnach Beds — *cf.* Kotański 1965, 1967). The Partnach membres of the Bavarian Alps are microfacially almost identical to the limestones under discussion (*cf.* Hagn 1955, Pl. 6). The organodetrital limestones of the calcarenite and calcirudite type, occurring in the top of Furkaska limestones yield numerous intraclasts, pellets, crinoidal stems; and occasionally, are of algal limestone character, with *Solenopora* and *Teutloporella?*, bryozoans and sponges. Shales co-occurring with the organodetrital limestones yield extremely abundant foraminiferal detritus, where single chambers and whole individuals of the genus *Frondicularia* (*Frondicularia* cf. *woodwardi* — *cf.* Hagn 1955, Pl. 2; Aegip Mineraria 1959, Pls 7 and 32; Cuvillier 1961, Pl. 1; Perconig 1968, Pls 10—11; Radwański 1968, Pls 6 and 34) constitute the rock-forming components. Moreover, ostracods, filaments and carbonized plant remains were found. Occasionally, coal intercalations 1 to 20 mm thick were found in the shales.

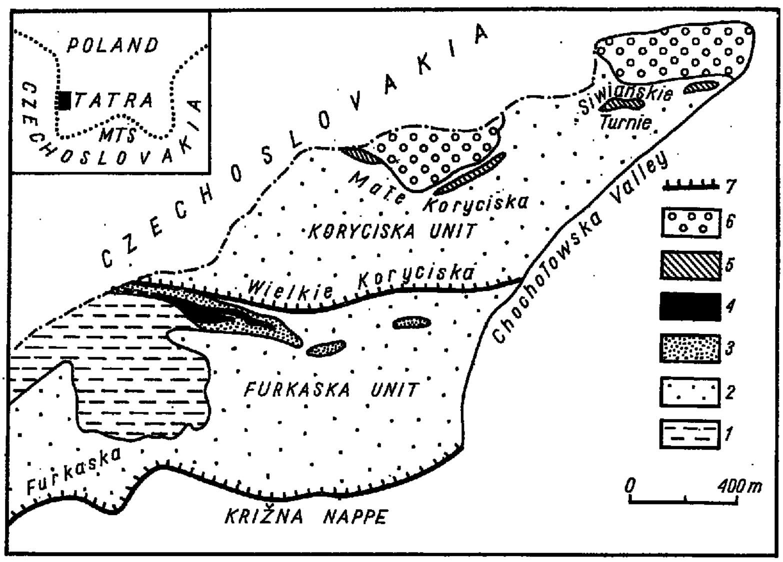

Fig. 1

Geological sketch-map of the investigated area (inset shows its position in the Tatra Mts); taken from Guzik & Guzik (1958) and others

1 conodont-bearing limestones, *2* Anisian/Ladinian dolomites, *3* Anisian(?)/Ladinian(?) limestones, *4* Ladinian(?) shales, *5* Rhaetian/Liassic limestones, *6* Eocene conglomerates, *7* boundaries of tectonic units

The tectonics of Furkaska and Koryciska units is complicated; contacts between particular lithological members are commonly tectonical in character and the same dislocational zones cut both units as a rule (Bac 1971).

During the present studies, aimed at establishing the conodont stratigraphy, the following facts were noted:

a) Limestones outcropping at the foot of Siwińskie Turnie are undoubtedly of Rhaetian age, what is evidenced by occurrence of members characteristic for this stage, *viz.* limestones with corals, oolitic limestones and *Triassina hantkeni* microfacies, the latter hitherto known in the Tatra Mts exclusively from the Rhaetian of the Križna nappe, Lejowa Valley (Gaździcki 1970).

b) Limestones from Małe Koryciska are also of Rhaetian (*Triassina hantkeni* microfacies) or, even, of Upper Liassic age (spongiolites and mottled limestones with sponge spicules). However, the majority of elements of this limestone complex were not found in situ (*cf.* Guzik 1959, p. 185). The Eocene of Małe Koryciska seems to begin with polymictic conglomerates (Roniewicz 1969), thus the members identified by the present author may be derived from the conglomerate. Two interpretations are hence possible: 1) Conglomerate material is derived directly from the substrate; in such a case it should be assumed that, prior to the Eocene transgression, the Koryciska unit comprised members of Ladinian to Liassic age, and that the Rhaetian and Liassic of the Choč and Križna nappes had numerous features in common (which has already been noted by Guzik 1959); 2) The material of polymictic Eocene conglomerates was derived from the Križna nappe underlaying the Furkaska unit (Roniewicz 1969).

c) Limestones from the northern slope of Mt. Furkaska are the only ones from the Triassic of the Tatra Mts, in which conodonts were found. Only samples of platy, somewhat knobby, and cherty limestones underlaying marly-shale complex from Wielkie Koryciska appeared to be positive. Conodonts were found neither in marly, brecciated limestones yielding detritus of carbonized plants nor in organodetrital limestones intercalating shales and in shales.

CHARACTERISTICS OF THE CONODONT ASSEMBLAGE FROM THE FURKASKA LIMESTONES

The association of conodont genera and species found in the limestones under discussion is characteristic of the Middle Triassic (*cf.* Huckriede 1958, Mosher 1968, Kozur 1971, Kozur & Mostler 1971, Mock 1971, and others). This association comprises the following genera and species (*cf.* Zawidzka 1970):

Chirodella dinodoides (Tatge, 1956)
Chirodella triquetra (Tatge, 1956)
Cornudina sp.
Cornudina neospathodides sp. n.
Corundina tortilis Kozur & Mostler, 1970
Cratognathodus kochi (Huckriede, 1958)
Cratognathodus sp. B (*in* Mosher, 1968)
Cypridodella muelleri (Tatge, 1956)
Cypridodella spengleri (Huckriede, 1958)
Cypridodella unialata Mosher, 1968

Cypridodella venusta (Huckriede, 1958)
Didymodella alternata Mosher, 1968
Enantiognathus ziegleri (Diebel, 1956)
Gladigondolella tethydis (Huckriede, 1958)
Hibbardella lautissima (Huckriede, 1958)
Hibbardella magnidentata (Tatge, 1956)
Hibbardella meissneri (Tatge, 1956)
Hindeodella (Metaprioniodus) benderi Kozur & Mostler, 1970
Hindeodella (Metaprioniodus) multihamata (Huckriede, 1958)
Lonchodina cf. *festiva* Bender & Stoppel, 1965
Neohindeodella aequiramosa Kozur & Mostler, 1970
Neohindeodella triassica (Müller, 1956)
Neospathodus cf. *cristagalli* (Huckriede, 1958)
Neospathodus tatricus sp. n.
Ozarkodina budurovi sp. n.
Ozarkodina tortilis Tatge, 1956
Ozarkodina turgida Bender, 1967
Parachirognathus sp.
Paragondolella excelsa Mosher, 1968
Paragondolella navicula (Huckriede, 1958)
Prioniodella boncevi Spasov & Ganev, 1960
Prioniodella decrescens Tatge, 1958
Prioniodina latidentata Tatge, 1956
Prioniodina petraeviridis (Huckriede, 1958)

On the basis of statistical analysis of conodont assemblages from the Eastern Alps, Hirsch (1969) distinguished a number of zones differing in percentage of conodont faunas.

The conodont material from the Furkaska limestones is not rich in individuals and particular specimens are poorly preserved. However, it seems that it justifies correlation of these limestones with Zones *I*, *II* and *III* of Hirsch (1969), *i.e.* with the Paraceratites trinodosus Zone of the Upper Anisian and the Protrachyceras reitzi Zone of the Lower Anisian. Such correlation supports earlier assumptions concerning the age of the Furkaska limestones (Guzik 1959; Kotański 1965, 1967).

SYSTEMATIC DESCRIPTION

Genus *NEOSPATHODUS* Mosher, 1968

Type species: *Spathognathodus cristagalli* Huckriede, 1958

Neospathodus tatricus sp. n.

(Pl. 1, Figs 1—3 and 5)

Holotype: the specimen numbered *T55y*, presented in Pl. 1, Fig. 1.
Type horizon: basal part of cherty Furkaska limestones, Anisian.
Type locality: Mt. Furkaska, Tatra Mts.
Derivation of name: from the Tatra Mts.

Material. — Eleven specimens.

Description. — The form laterally flattened, generally symmetrical. Cusp prominent, markedly larger than other denticles. Close to base, the inclination of cusp is the same as other denticles, higher up it increases so rapidly that, ultimately, its upper margin is almost parallel to the base. Change of inclination of the cusp in longer and lower specimens is slight or not marked (Fig. 2). Anterior bar has 5 to 7 rather wide, triangular denticles, discrete only at their top. Their inclination towards posterior gradually decreases in the anterior part. Behind cusp, small triangular denticle occurs. Base straight or slightly arcuate upwards. Basal cavity always ter-

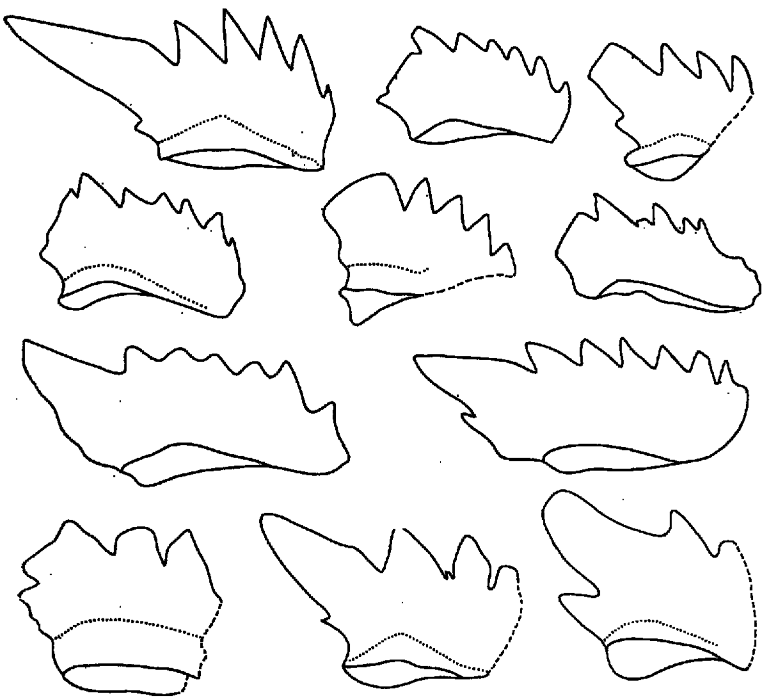

Fig. 2
Specific variability of *Neospathodus tatricus* sp. n.; × 100

minal, posteriorly placed, passing into furrow towards anterior; generally deep, flaring, occasionally narrow, less swelled. Seen from above, from the side of oral margin, the outline of base of *N. tatricus* sp. n. is somewhat similar to that of *Spathognathodus homeri* Bender, 1967.

Remarks. — *Neospathodus tatricus* sp. n. differs from other representatives of this genus in presence of prominent cusp.

Occurrence. — Tatra Mts, Anisian.

Genus *PARACHIROGNATHUS* Clark, 1959
Type species: *Parachirognathus ethingtoni* Clark, 1959
Parachirognathus sp.
(Pl. 1, Fig. 9)

Material. — Two specimens.

Description. — Short, high form with 6 to 7 slender, flattened teeth; cusp, *i.e.* second anterior tooth, distinctly larger than the remaining 4—5 posterior teeth and somewhat more prominent than first anterior tooth. Anterior part together with first anterior tooth strongly twisted inward; whereas posterior part — outward. Aboral margin straight; basal cavity lacking.

Remarks. — *Parachirognathus* sp. differs from all other species of this genus and may represent a new species. It seems closest to *P. jungi* Mosher, 1968, from which it differs in presence of cusp, in outlines of blade and aboral margin, and in lack of lateral rib.

Occurrence. — Tatra Mts, Anisian-Ladinian.

Genus *OZARKODINA* Branson & Mehl, 1933
Type species: *Ozarkodina typica* Branson & Mehl, 1933
Ozarkodina budurovi sp. n.
(Pl. 2, Fig. 2)

1960. *Ozarkodina* n. sp.; K. Budurov, pp. 117 and 126, Pl. 3, Fig. 8*a*—*b*.

Holotype: the specimen numbered *T23A*, presented in Pl. 2, Fig. 2.

Type horizon: platy limestones, Anisian-Ladinian.

Type locality: Wielkie Koryciska, Tatra Mts.

Derivation of name: in honour of K. Budurov, who was the first author to have described and figured the specimen attributable to this species.

Material. — Two specimens.

Description. — The form somewhat twisted, with prominent cusp, a few times larger than other teeth and somewhat inclined posteriorly. Anterior bar close in length to posterior one, with three teeth, the middle of which is perpendicular to aboral margin. Posterior teeth variable in size, inclined to posterior at the same angle as cusp. Aboral margin slightly bent upwards. Basal cavity triangular, situated beneath the cusp, passing into furrow toward anterior and posterior.

Occurrence. — Tatra Mts, Anisian-Ladinian.

Genus *CORNUDINA* Hirschmann, 1959
Type species: *Cornudina breviramulis* (Tatge, 1956)
Cornudina neospathodides sp. n.
(Pl. 2, Fig. 4*a*—*b*)

Holotype: the specimen numbered *T25y*, presented in Pl. 2, Fig. 4*a*—*b*.

Type horizon: limestones with cherts, Anisian.

Type locality: Mt. Furkaska, Tatra Mts.

Derivation of name: after its similarity to the genus *Neospathodus* Mosher, 1968.

Material. — One specimen.

Description. — Form with anterior bar quite high and with three conical, short teeth anteriorly inclined. Cusp prominent, significantly larger than anterior teeth, bent toward posterior. Basal cavity deep, flaring, terminal, occupying two--thirds of the base.

Remarks. — *Cornudina neospathodides* sp. n. differs from known species of this genus in high bar and in size, shape and location of basal cavity.

Occurrence. — Tatra Mts, Anisian.

Cornudina sp.
(Pl. 2, Fig. 5)

Material. — One specimen.

Description. — Symmetrical, inclined tooth with sharp anterior and posterior edges extending over flaring basal cavity. Basal cavity deep, almost conical, screened with thin wall.

Remarks. — *Cornudina* sp. is extremely similar to the Paleozoic genus *Drepanodus*. The phenomenon of homeomorphy is quite frequent in the case of Triassic conodont faunas (*cf.* Kozur & Mostler 1970, 1971). *Cornudina* sp. generally resembles *C. unidentata* Kozur & Mostler, 1970, markedly differing in the type of base, lack of auxiliary projections or denticles in front or behind cusp; it may represent a new species.

Occurrence. — Tatra Mts, Anisian-Ladinian.

Institute of Geology
of the Warsaw University
Warszawa 22, Al. Żwirki i Wigury 93
Warsaw, March 1972

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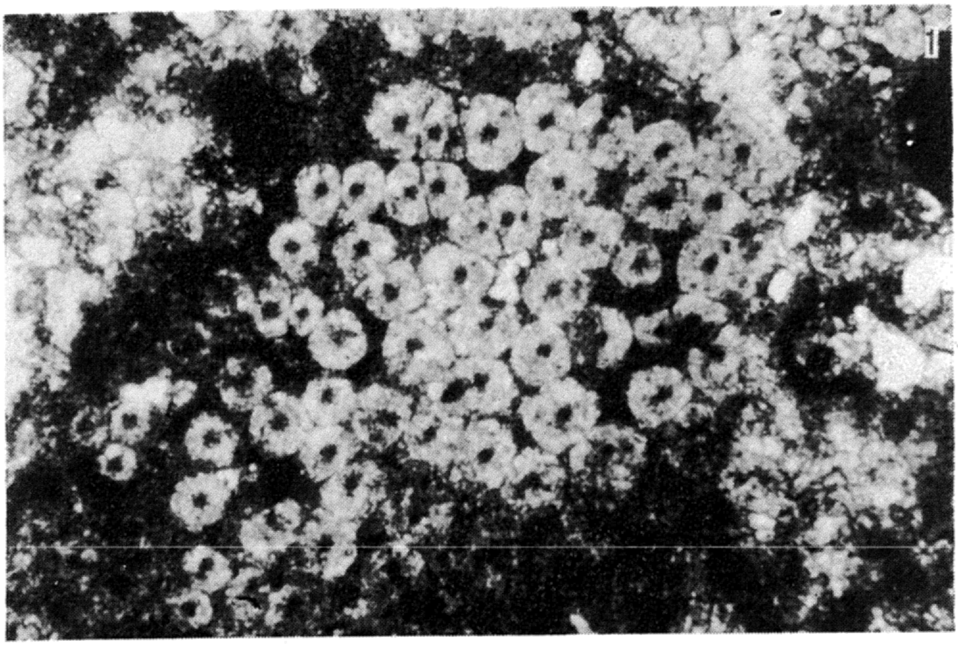
K. ZAWIDZKA

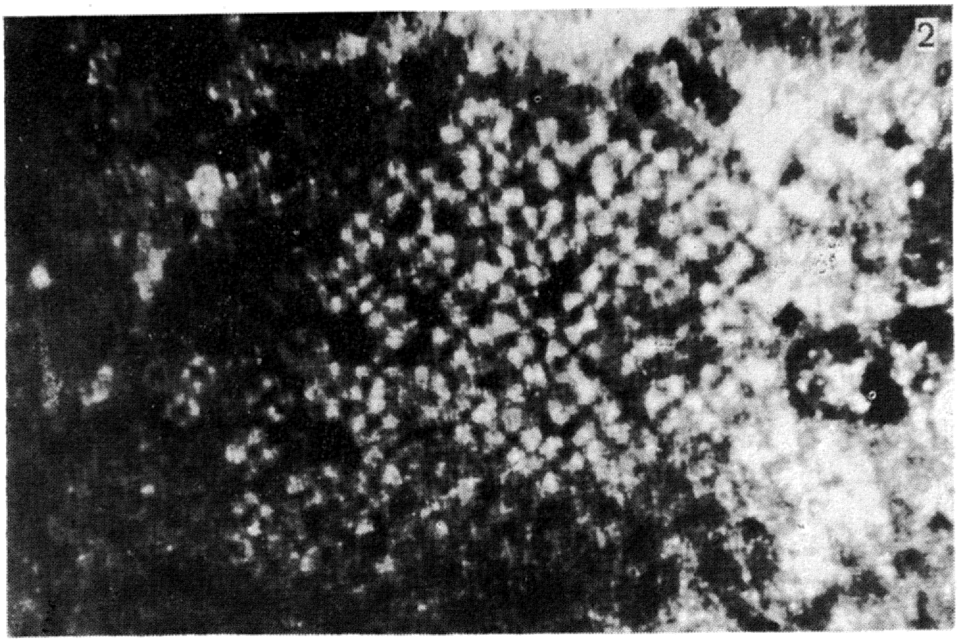
POZYCJA STRATYGRAFICZNA WAPIENI FURKASKI PŁASZCZOWINY CHOCZAŃSKIEJ TATR W ŚWIETLE BADAŃ MIKROFAUNISTYCZNYCH

(Streszczenie)

Badania mikrofaunistyczne poszczególnych ogniw zachodniej części płaszczowiny choczańskiej Tatr Polskich pozwoliły ustalić ściślej wiek tych ogniw. Zespół konodontów stwierdzony w wapieniach północnego zbocza Furkaski (Fig. 1) wskazuje na górny anizyk (illir) i dolny ladyn (fassan), co w pełni odpowiada facji wapieni z Reifling, z którymi kompleks wapieni Furkaski porównywany był wcześniej w oparciu o analogie litofacjalne i makrofaunę (Guzik 1959; Kotański 1965, 1967). Ustalono ponadto, że wapienie leżące pod Siwiańskimi Turniami reprezentują niewątpliwy retyk, a na kontakcie dolomitu choczańskiego i eocenu w Małych Koryciskach istnieją (lub istniały tutaj przed eocenem) ogniwa retyckie i liasowe. W zespole konodontów pochodzących z wapieni północnego zbocza Furkaski stwierdzono obecność trzech gatunków nowych: *Neospathodus tatricus* sp. n., *Ozarkodina budurovi* sp. n., oraz *Cornudina neospathodides* sp. n.

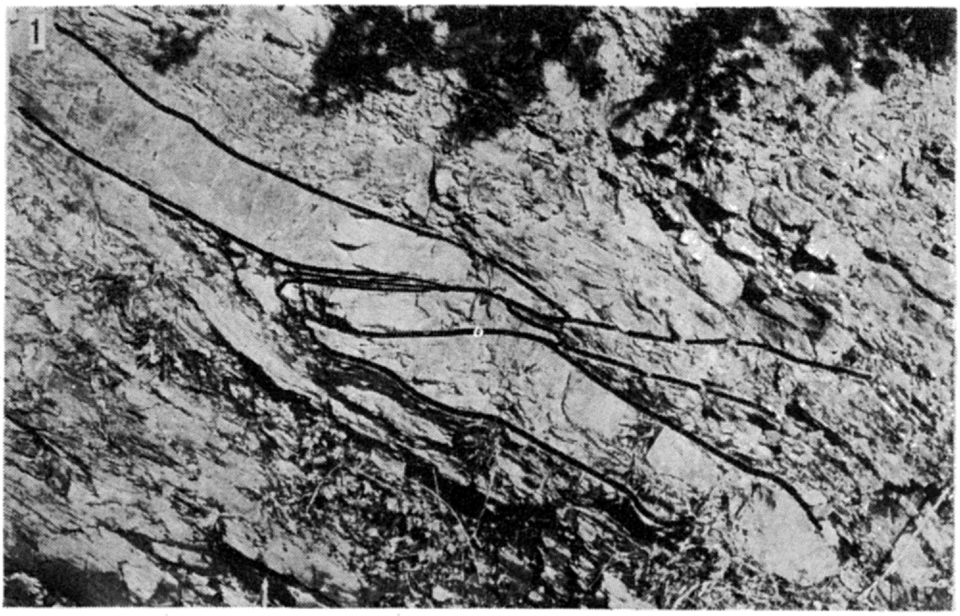
Instytut Geologii Podstawowej
Uniwersytetu Warszawskiego
Warszawa 22, Al. Żwirki i Wigury 93
Warszawa, w marcu 1972 r.





1 — Association of spores *Globochaete alpina* Lombard in biosparite of the Karchowice Beds (*cf.* Text-fig. 2), × 75.

2 — The same, nicols crossed.

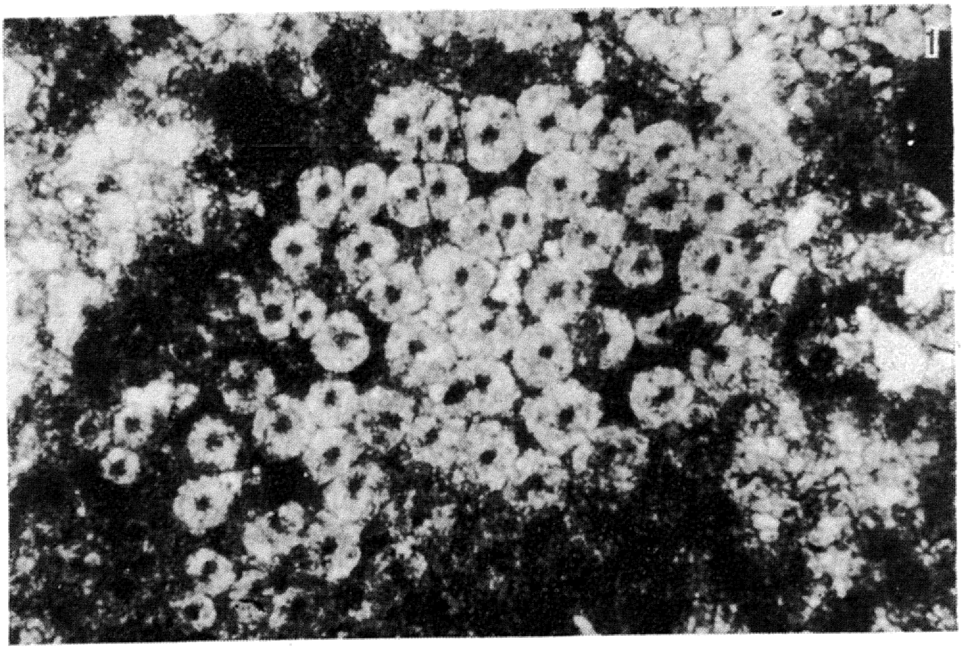


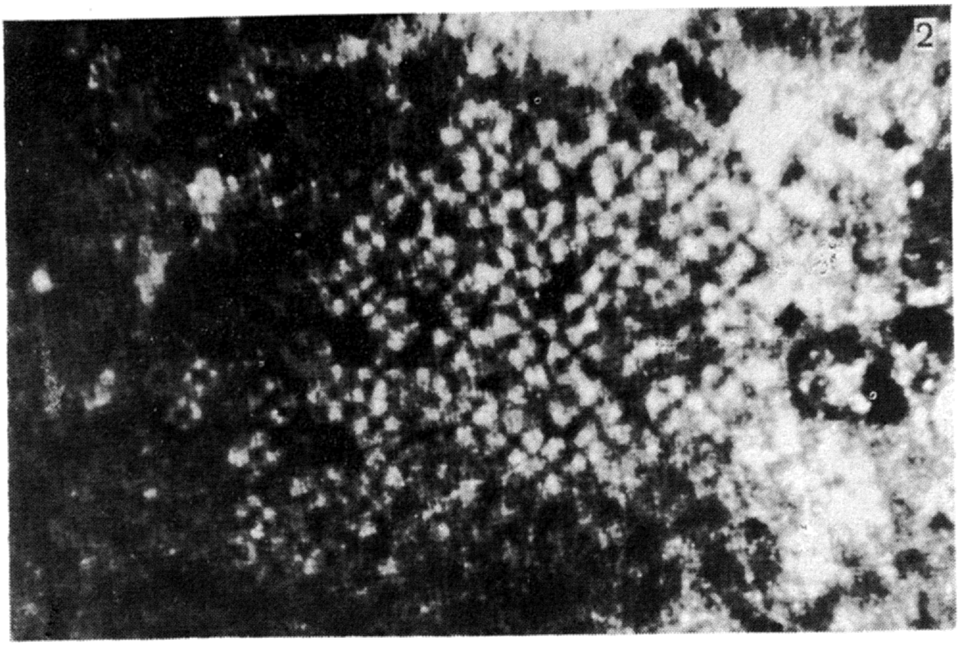
1 — Warstwa piaskowca fliszowego zgnieciona w wyniku nacisku działającego od północy (koryto Kacwińskiej Rzeki, ok. 1300 m na S od kontaktu z Pienińskim Pasem Skałkowym).

2 — Fragment złuskowania warstwy piaskowca (odsłonięcie to samo).

1 — Sandstone layer squeezed by a compression from the north (Kacwińska Rzeka bed, c. 1300 m south of contact with the Pieniny Klippen Belt).

2 — Thrust fault in a sandstone layer (the same exposure).





1 — Association of spores *Globochaete alpina* Lombard in biosparite of the Karchowice Beds (*cf.* Text-fig. 2), × 75.

2 — The same, nicols crossed.

1 — *Hibbardella lautissima* (Huckriede); *2* — *Cypridodella unialata* Mosher; *3* — *Cypridodella muelleri* (Tatge); *4* — *Hibbardella magnidentata* (Tatge); *5* — *Prioniodina latidentata* Tatge; *6* — *Cypridodella venusta* (Huckriede); *7* — *Chirodella dinodoides* (Tatge); *8* — *Enantiognathus ziegleri* (Diebel); *9* — *Didymodella alternata* Mosher; *10* — *Cypridodella spengleri* (Huckriede)

All figures × *100, taken by L. Łuszczewska, M. Sc.*