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ON *SPONGIOPHYTON* FROM THE LOWER DEVONIAN OF POLAND*

Spongiophyton z dolnego dewonu Polski

ABSTRACT. Fragments of land plants determined as *Spongiophyton* are described. The material consists of one fragment of a dichotomously branching thallus showing cellular reticulum as well as characteristic circular pores (*Spongiophyton* sp. 1), and of several smaller fragments showing similar structure (*Spongiophyton* sp. 2). The material originates from the boreholes at Andrychów and Suskowola in Poland from horizons dated as Emsian.

INTRODUCTION

The described plant remains originate from the Lower Devonian sediments from the boreholes at Andrychów in the West Carpathians and Suskowola near Radom in Central Poland. The age of samples from Andrychów was determined as Emsian on the evidence of geological investigations (Konior 1965, 1966, 1968, 1969) and spore analysis (Konior & Turnau 1973; Turnau 1974). The Lower Devonian age of the samples is confirmed by fragments of *Drepanophycus spinaeformis* and *Dawsonites* sp. determined by the author. The same samples contain fragments of a plant belonging to a new genus of *Zosterophyllaceae* (Zdebska 1975, 1976). The age of sample II from Suskowola is also Emsian. This sample contained *Sporogonites chapmanii* (Brzyski 1974).

The fragments of *Spongiophyton* were freed from the rock with hydrofluoric acid. The cellular structure and pores are visible without maceration with nitric acid.

The plant remains were investigated with a light microscope and scanning microscope type S-M-35 "Jeoly" in the Scanning Microscope Laboratory in the Institute of Zoology of the Jagellonian University.

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The determination and terminology is based mainly on the paper of Chaloner *et al.* (1973) which contains an emended diagnosis of the genus *Spongiophyton* and two species, as well as a comparison of *Spongiophyton* with other genera of thalloid plants of a similar structure.

Up to now, *Spongiophyton* is known from the Devonian of Parana, Brazil

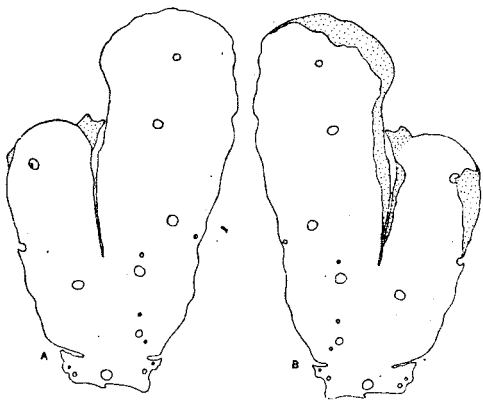

Fig. 1. *Spongiophyton* sp. 1. × 20. Fragment of dichotomously branching thallus; A — outer side of upper surface; B — inner side of upper surface showing margin of lower surface (stippled)

Ryc. 1. *Spongiophyton* sp. 1. × 20. Fragment dichotomicznie rozgałęzionej plechy; A — zewnętrzna strona górnej powierzchni; B — wewnętrzna strona górnej powierzchni; wzdłuż brzegów widoczne pozostałości (zakropkowane) dolnej powierzchni

(Kräusel 1954, 1960) and from the ?Middle Devonian of Ghana (Chaloner *et al.* 1973).

According to Chaloner *et al.* (1973), *Spongiophyton* resembles in its morphology certain algae and liverworts, but it differs from them in having a thick cuticle. It represents probably an extinct group of non-vascular land plants.

SYSTEMATIC DESCRIPTION

Genus *Spongiophyton* Kräusel 1954, emend. Chaloner *et al.* 1973

Spongiophyton sp. 1

Pl. I, 4; Fig. 1

Material. One fragment of dichotomously branching thallus preserved as carbonized compression from the Lower Devonian (Emsian), borehole at Andrychów 2, depth 2300·8—2306·6 m.

Description. Fragment of dichotomously branching thallus, 2·8 mm long, with branches 0·5 and 0·8 mm wide showing rounded apices (Fig. 1).

Cellular structure indistinct except for apparently naturally macerated basal part of thallus (Pl. I, 4). Fragment has pores and apparently represents the upper surface of a tubular thallus (cf. Chaloner *et al.* 1973); fragments of the damaged lower surface of thallus visible on the other side along margins (Fig. 1B). Upper surface with approximately circular pores, in most cases 50—100 μm in diameter but a few pores 12—31 μm in diameter were observed. In the basal part of the thallus distinct outlines of isodiametric cells 10—25 μm in diameter, indistinct cell outlines also on inner side of remaining, carbonized part of the thallus.

Discussion. The specimen from Andrychów is different from other genera of Palaeozoic thalloid plants, such as *Foerstia* (Kräusel 1941), *Aculeophyton* and *Orestovia* (Kräusel & Venkatachala 1966). It has pores which are not present in *Foerstia*. *Aculeophyton* shows characteristic papillae (cf. Kräusel & Venkatachala 1966, Taf. 28—30) which were not observed on our specimen. *Orestovia*, of which the author had the original material from Kuznetzk Basin (USSR), is different in having a much wider thallus and a different structure of cells and pores (cf. Kräusel & Venkatachala 1966, Taf. 26, figs. 13—18).

The structure of the fragment from Andrychów allows its attribution to the genus *Spongiophyton*, because it shows the characters of this genus (Chaloner *et al.* 1973). It has a dichotomously branching thallus with rounded apices. The thallus shows approximately circular pores and a cellular structure similar to the cellular reticulum described by Chaloner *et al.* (1973).

The comparison of this specimen with the descriptions of *Spongiophyton nanum* and *S. lenticulare* showed differences in structure. The thallus from Andrychów is smaller, having branches only 0·5 and 0·8 mm wide, while in *S. nanum* their width is 2—5 mm and in *S. lenticulare* up to 12 mm. The pore diameter in *S. nanum* is from 200 to 300 μm, and in *S. lenticulare* up to 0·8 mm. These pore diameters are considerably larger, than in the specimen from Andrychów. *Spongiophyton* sp. 1 differs also from these two species in the shape and size of its cells. It has isodiametric cells 10—25 μm in diameter, while the cells of those species are elongated. In *S. nanum* they are 40×20—30 μm and in *S. lenticulare* they are up to 100×50 μm.

As a result our specimen cannot be attributed to either of these two species. The limited amount of material and its fragmentation does not allow a more exact determination.

Spongiophyton sp. 2

Pl. I, 1—3; Pl. II, 1—4; Pl. III, 1—4

Material. Eight fragments from the Lower Devonian (Emsian) from the boreholes at Andrychów 2 (depth 2300·8—2306·6 m) and Suskowola (sample II, depth 2001·8 m).

Description. Thallus fragments 2—5 mm in diameter showing cellular structure and pores. Cells isodiametric, with protruding anticlinal cell walls forming

reticulum, cell diameter 10—26 μm. Diameter of pores 10—32·5 μm, similar to that of cells. Pores with vertical or funnel-like walls. Occasionally when a pore wall is seen tilted at 45° it looks as if it were built of up to three layers one above the other (Pl. III, 1, 2).

Some fragments of thallus with additional anastomosing structure of darker substance, penetrated by pores, and showing outlines of cells on the cuticle below (Pl. I, 3).

Discussion. The described fragments were included in *Spongiophyton* because they show pores and a cellular reticulum characteristic for this genus. They have isodiametric cells of the same size as *Spongiophyton* sp. 1 and small pores of a diameter similar to that of cells, but they are different in having only small pores. Therefore on this basis they are described as *Spongiophyton* sp. 2.

The funnel-like pore walls are in general similar to these found in *S. nanum* from Ghana (cf. Chaloner *et al.* 1973, Pl. 121, fig. 5), but the pore diameter is much smaller than in *S. nanum*. The SEM micrograph of one of the pores shows the details of structure of the pore wall (Pl. III, 1, 2). The wall consists of two or three protruding rings one above the other. However, the limited amount of material and its fragmentary preservation did not allow a more detailed observation and interpretation of the pore structure.

Pl. I, 1, 2 show a fragment of *Spongiophyton* sp. 2 seen in the light microscope in two planes of focus. In phot. 1 only pores can be seen, but no cell outlines. In phot. 2 both pores and cells outlines are visible. It appears that phot. 1 represents the outer side of thallus which has pores, but does not show cellular structure (cf. Chaloner *et al.* 1973, Pl. 121, fig. 5). Phot. 2 probably represents the inner side of thallus which shows also the cellular reticulum.

An interesting feature is the anastomosing structure composed of a dark substance which can be seen on three fragments of *Spongiophyton* sp. 2. It appears to be similar to the "spongy structure" observed by Kräusel (1954) in *Spongiophyton* from Brasil.

Acknowledgments

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STRESZCZENIE

SPONGIOPHYTON Z DOLNEGO DEWONU POLSKI

Opisane są fragmenty rośliny oznaczonej jako *Spongiophyton*. Materiał pochodzi z wierceń na stanowiskach Andrychów i Suskowola z poziomów, których wiek został oznaczony jako ems.

Materiał składa się z dichotomicznie rozgałęzionego fragmentu plechy o budowie komórkowej z charakterystycznymi otworami (*Spongiophyton* sp. 1) oraz z szeregu drobnych fragmentów o podobnej budowie (*Spongiophyton* sp. 2).

Szczątki *Spongiophyton* znane są dotychczas z dewonu Parany (Brazylia) i ?środkowego dewonu Ghany. Stanowiska z Polski mają dokładnie oznaczony wiek (ems).

Budową morfologiczną *Spongiophyton* przypomina niektóre glony i wątrobowce, ale posiada grubą kutykulę nieznaną w tych grupach roślin. Reprezentuje prawdopodobnie wymarłą grupę roślin lądowych o plechowatej budowie.

PLATES

TABLICE

Plate I

× 200

Material from the borehole Andrychów

1. *Spongiophyton* sp. 2. Higher plane of focus showing outer side of thallus with visible pores; slide No. 10/2
2. *Spongiophyton* sp. 2. Lower plane of focus showing cellular structure and pores; slide No. 10/2
3. *Spongiophyton* sp. 2. Thallus fragment showing cellular structure, small pores and dark anastomosing structures; slide No. 10/3
4. *Spongiophyton* sp. 1. Basal part of thallus fragment (Fig. 1A, B) showing outlines of isodiametric cells and large (to the left) and small pores (to the right); slide No. 10/1

Tablica I

× 200

Materiał z wiercenia w Andrychowie

1. *Spongiophyton* sp. 2. Górny poziom ostrości; zewnętrzna strona plechy z widocznymi otworami; preparat Nr 10/2
2. *Spongiophyton* sp. 2. Dolny poziom ostrości; widoczne zarysy komórek i otwory; preparat Nr 10/2
3. *Spongiophyton* sp. 2. Fragment plechy ukazujący budowę komórkową, małe otwory i siatkę utworzoną z ciemnej substancji; preparat Nr 10/3
4. *Spongiophyton* sp. 1. Nasadowa część fragmentu plechy (z ryc. 1A, B); widoczne zarysy, izodiametrycznych komórek, duży otwór (na lewo) i małe otwory (na prawo); preparat Nr 10/1


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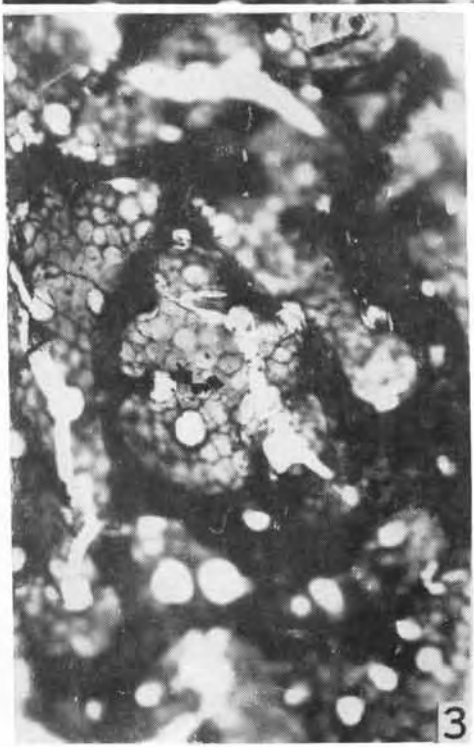
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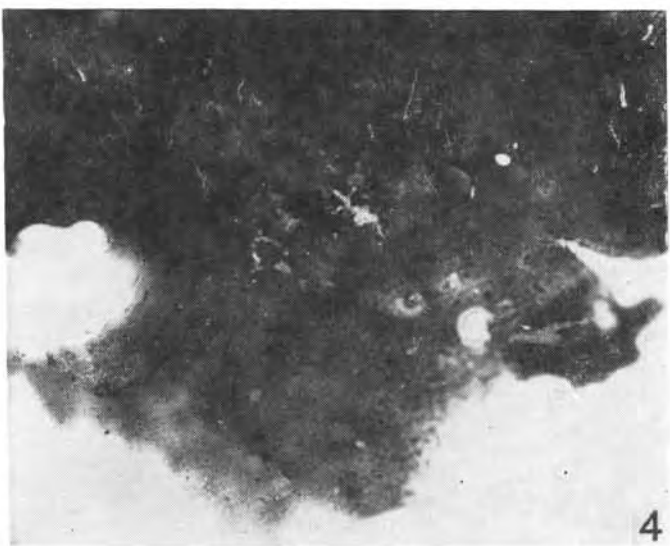
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Plate II

Spongiophyton sp. 2

Scanning electron micrographs

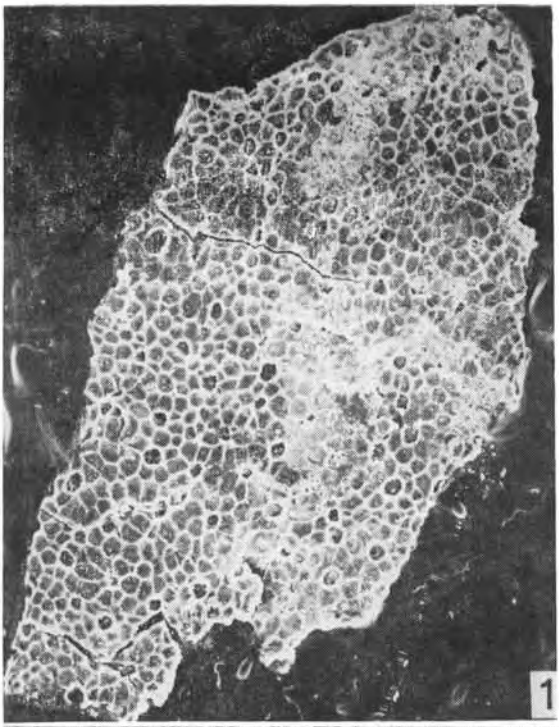
1. Fragment of thallus showing ?inner side, visible cellular reticulum and small pores; Suskowola; × 150
2—3. The same fragment showing funnel-like walls of pores; Suskowola; 2 — × 860, 3 — × 1500
4. Fragment of thallus showing ?outer side with pores; Andrychów; × 260

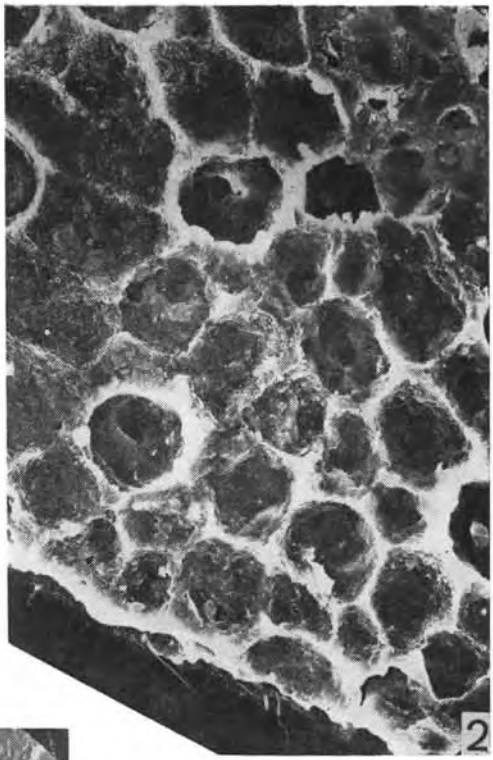
Tablica II

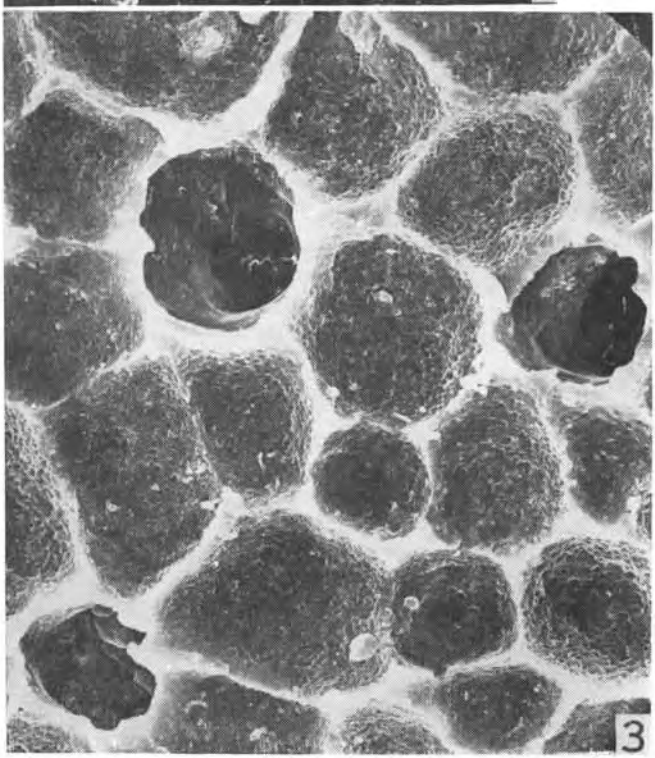
Spongiophyton sp. 2

Fotografie z mikroskopu skaningowego

1. Fragment plechy z widoczną ?wewnętrzną stroną ukazującą budowę komórkową i małe otwory; Suskowola; × 150
2—3. Ten sam fragment z widocznymi lejkowatymi otworami; Suskowola; 2 — × 860, 3 — × 1500
4. Fragment plechy ukazujący ?zewnętrzną stronę z otworami; Andrychów; × 260







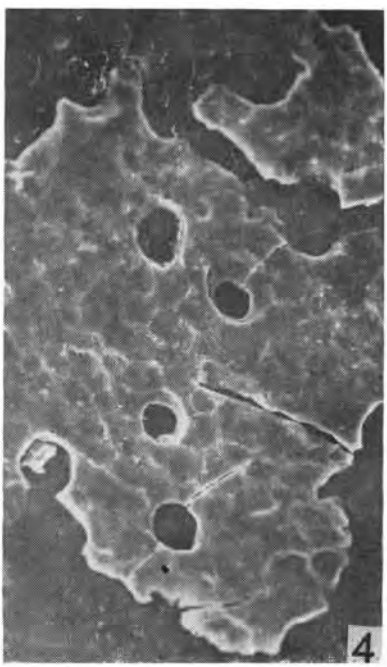


Plate III

Spongiophyton sp. 2

Scanning electron micrographs

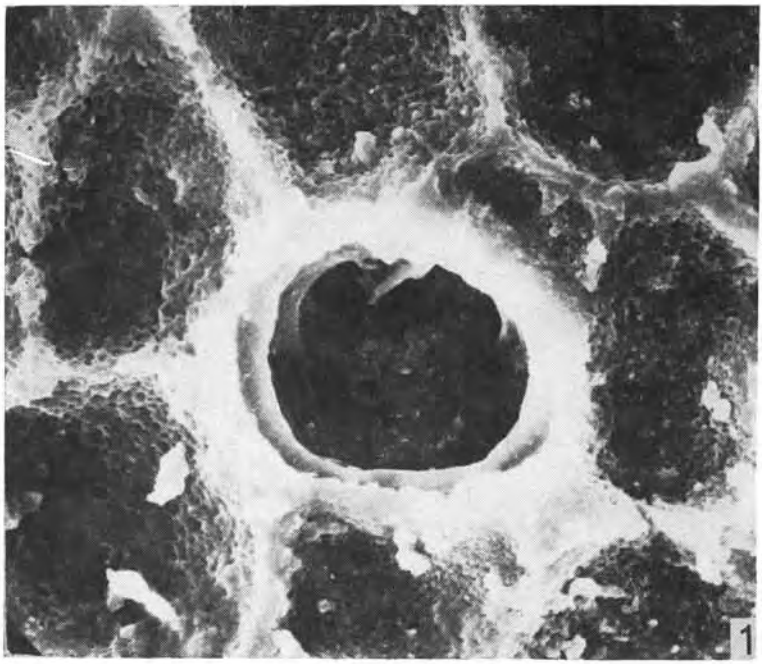
1. Funnel-like walls of a pore; × 2600
2. The same pore tilted at 45° showing wall consisting of ?three layers one above the other; × 2600
3. Pore; × 2600
4. Same specimen as Pl. II, 4; pore seen from ?outer side; × 1000

Tablica III

Spongiophyton sp. 2

Fotografie z mikroskopu skaningowego

1. Otwór o lejkowatych ścianach; × 2600
2. Ten sam otwór oglądany pod kątem 45°; ściana zbudowana jakby z trzech warstw leżących jedna nad drugą; × 2600
3. Otwór; × 2600
4. Ten sam okaz co na Tablicy II, 4; otwór widoczny od ?zewnętrznej strony plechy; × 1000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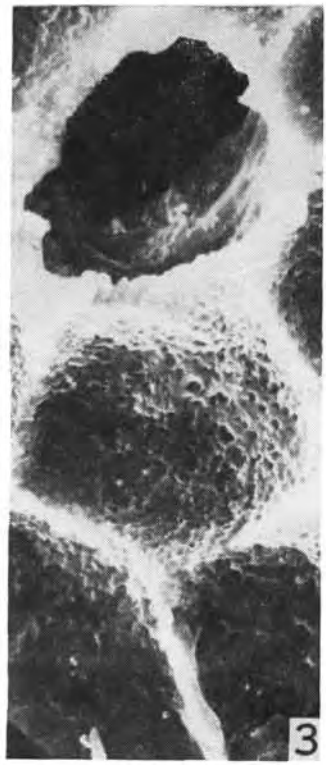
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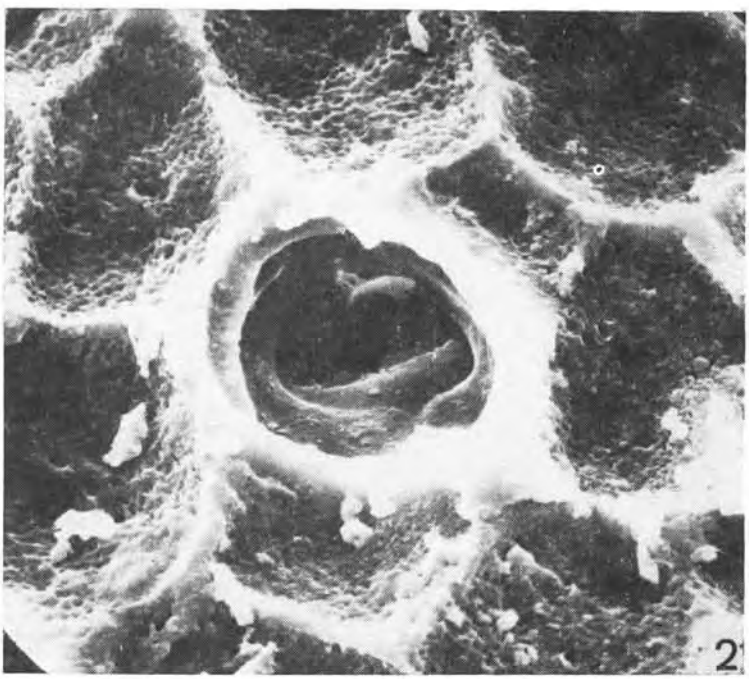
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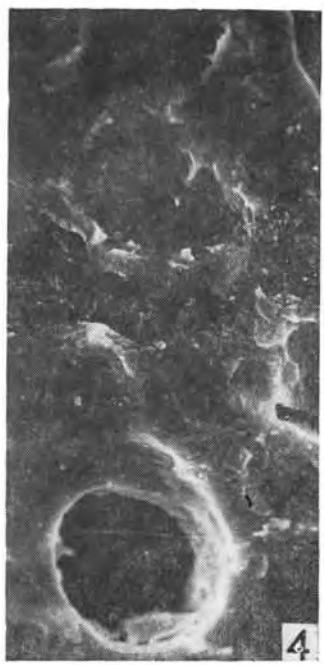
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