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Freshwater algae of the Thala Hills oasis (Enderby Land, East Antarctic)

NOTE: It was in 1977 that Professor Starmach finished studying the Antarctic materials entrusted to him, and made the documentation published here. He told me then that he had sent the typescript entitled "The freshwater algae of Antarctica, collected by Dr. S. Rakusa-Suszczewski and Mr. K. Opaliński during the participation of Polish biologists in the 14th and 17th Russian expeditions to Antarctica (SAE)" to the editors of the journal "Ekologia Polska"; unfortunately, for unknown reasons, this manuscript was abandoned for years. Under the above title the elaboration is mentioned in the obituary published in Pol. Arch. Hydrobiol. (vol. 36: 176–194, 1989) after the Professor's death (2.III.1988). Years later the typescript was found, and Professor K. Jażdżewski, the editor of the present journal, sent it to me to prepare for print. It turned out that Professor Starmach had not had at his disposal a description of the area from which the material was collected, nor the closer data concerning the particular samples. After communicating with Professor K.W. Opaliński, one of the two polar explorers who collected the materials, I received from him the necessary data which are given here in place of the provisional text by Professor Starmach. Also the title of the elaboration was defined more precisely.

I am very grateful to my friend Mrs. Constantia Strelley Acheson-Waligórska and also to Dr. Paul Broady for correcting and polishing the English text.

The original typescript written in Polish, is kept in the bibliographical collection concerning Polish phycology, which has been completed by myself in the Phycological Department of the W. Szafer Institute of Botany of the Polish Academy of Sciences in Cracow.

The following chapters were written by Krzysztof W. Opaliński: Introduction, Description of the area, Material.

Jadwiga Siemińska

ABSTRACT: Some 20 samples of bottom sediments of freshwater lakes collected in the Antarctic Thala Hills oasis (Enderby Land) were soaked in laboratory cultures. 85 taxa of algae were identified in these cultures: Cyanophyceae — 54, Chrysophyceae — 1, Xanthophyceae — 10 and Chlorophyceae — 20 taxa. Most of these taxa are illustrated.

Key words: Antarctic, Enderby Land, freshwater algae, Cyanophyceae, Chrysophyceae, Xanthophyceae, Chlorophyceae.

Introduction

The development of living organisms in the Antarctic continent is possible only in so-called oases — land areas not covered with snow or ice where the water in summer is in a liquid state. The flora of Antarctic oases is very poor, being composed of algae, mosses and lichens (Dodge 1965, Golubkova 1969, Savič-Ljubitskaja and Smirnova 1969). Blue-green algae, diatoms, xanthophytes, green algae, glaucophytes, and mosses occur in the water bodies of the oases (Wille 1924, Hirano 1959, 1965, Lavrenko 1966, Opaliński 1972 a, b, 1973). Moreover, the floristic composition of the Antarctic oases is still little known, especially the cosmposition of soil microflora and that of the bottom sediments of temporary or permanent water bodies.

In contrast to the Antarctic marine ecosystems, the age of which is estimated as over 20 million years, the terrestrial ecosystems of the Antarctic are fairly young, since the age of the oases in which they developed is believed to be only several thousand years (Llano 1959, Różycki 1960, Simonov 1970). There is no doubt, therefore, that the species dominant in the flora and fauna of the Antarctic oases are cosmpolitan and pioneer, occurring in all of the studied lands. They reached the oases in the form of spores and are carried by atmospheric currents or by birds (Gressitt 1965, Tilbrook 1967, Matsuda 1968).

Professors S. Rakusa-Suszczewski and K.W. Opaliński, took advantage of their 1969 – 1970 stay at the Soviet Molodezhnaya Antarctic Station located in the Thala Hills oasis in East Antarctica to collect materials which might be used to determine the species of algae occurring in the soil and sediments of freshwater bodies. On their return to Poland they gave the material to the author for further study.

Description of the area

The Antarctic Thala Hills oasis (67'40'S, 45'50'E) is located in Enderby Land in eastern Antarctic. This is a small strip of land with an area of 9 km^2 free of ice and situated at the junction of the Campbell Glacier in the east and the Hays Glacier in the west and washed by the waters of the Alasheyev Bight in the north. The geographic description of the Thala Hills oasis has been given by Simonov (1970).

Three ranges of hills transect the oasis in a north-westerly direction; about 40 freshwater bodies are located in the valleys between the hills and each covers from several hundred to thousands of square meters (Fig. 1). They are from 0.3 to 27 m deep. Those water bodies which have a depth of up to 2 m freeze to the bottom during winter. In summer they thaw for a period of 50 days, whereas the ice cover of the water bodies whose depth is 3 – 5 m is about 2 m in winter, so that about 2/3 of their volume is ice. At the bottom the water temperature decreases to 0 – 3°C.

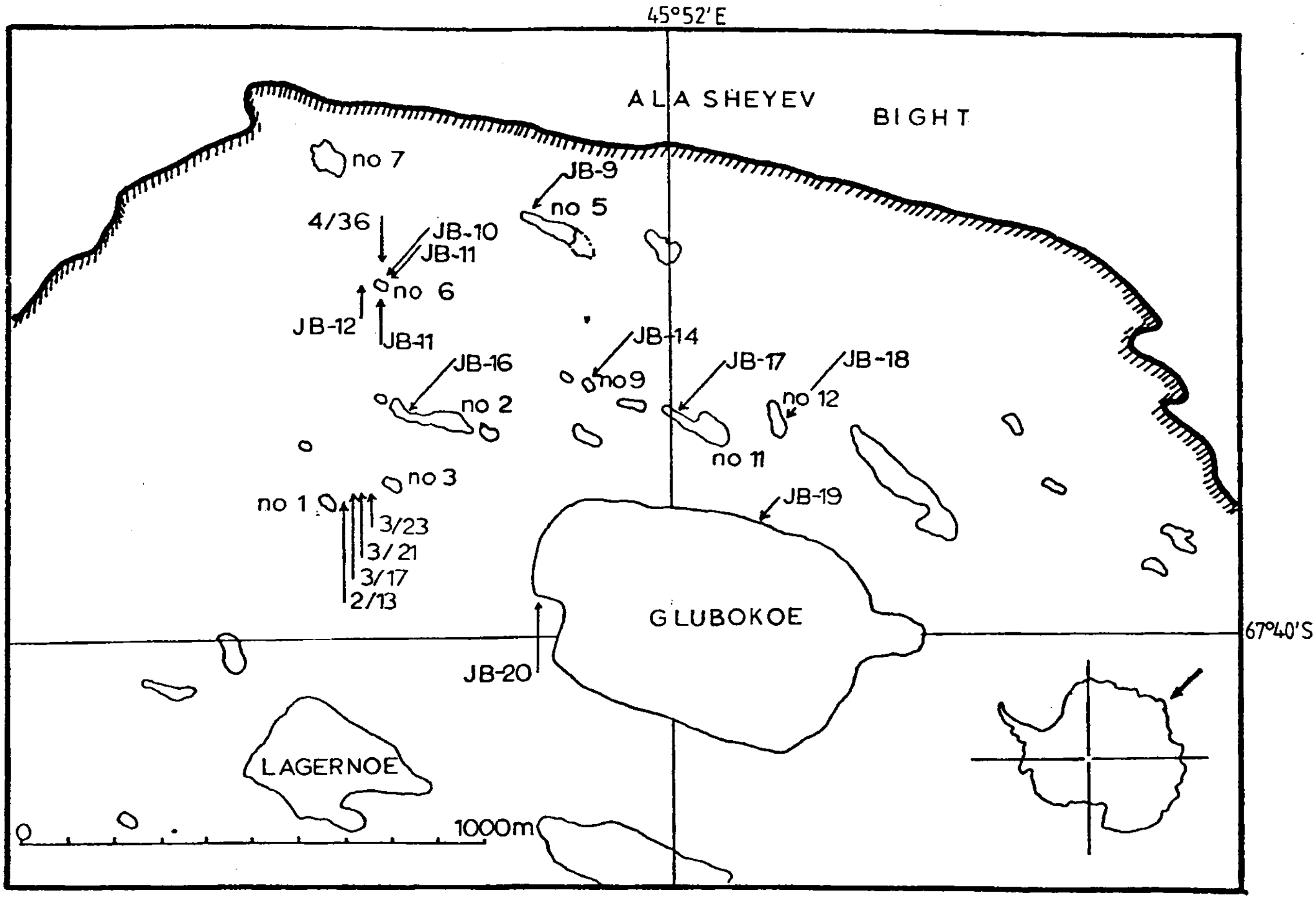

Fig. 1. Thala Hills oasis, freshwater bodies studied. Sampling places of sediment and soil are indicated

The large lakes do not thaw in summer, only a narrow moat of thawed water near the shore being formed. The bottom of all the lakes is stony, more rarely muddy, and covered with a microbial mat which is characteristic of most of the Antarctic freshwater lakes (Korotkevič 1969). This layer may be from 1 cm to 100 cm thick, depending on the depth of the lake.

Table 1.

Chemistry of Lake Lagernoe (Thala Hills oasis), in mg l^{-1}, February 1967 (according to V. Klokov, *unpubl.*)

Component	Amount
ammonia nitrogen	traces
nitrate nitrogen	undetectable
nitrite nitrogen	undetectable
Fe^{2+}	traces
chlorides	4.30
Ca^{2+}	28.08
Mg^{+}	38.98
CO_3^{2-}	1.3
HCO^{3-}	128.1
oxygenation	5.6

Basic data on water chemistry of Lake Lagernoe are given in Table 1. Conspicuous are the undetectable levels of biogenic compounds (nitrogen and phosphorus compounds), giving evidence of a low trophy of these waters. This is undoubtedly connected with the absence in the Thala Hills oasis of bird colonies, which are the main source of biogens in the land ecosystems of polar regions. A fuller limnological description of water bodies of the Thala Hills oasis is given by MacNamara (1969).

The occurrence of Protozoa, Rotatoria, Tardigrada, Nematoda and Cyanophyta, Bacillariophyta, and Chlorophyta (including Oedogoniales) has been recorded in the bacteria-algae layer of the water bodies of the Thala Hills oasis by Opaliński (1972a, 1973).

Material

The samples of bottom sediments were collected from lakes Nos 1 and 2 (Pl. 1, fig. 1), Nos 5 and 6 (Pl. 1, fig. 2), Nos 9 and 11 (Pl. 2, figs. 1 and 2), No 12 and Lake Glubokoe (see Fig. 1). The morphological, thermal, and ice analyses of these water bodies are given in Tab. 2. Apart from bottom sediment material (samples JB-9, JB-2, JB-11, JB-14, JB-16, JB-17, JB-18, JB19) samples were also collected from the littoral of lake No 6 (JB-12) and Lake Glubokoe (JB-20), temporarily flooded, and from the immediate vicinity of lakes Nos 1, 2 (samples 2/13, 3/17, 3/21 and 3/23), and lake No 6 (sample 4/36) (see Fig. 1) which were not flooded.

Table 2.

Characteristics of some lakes of the Thala Hills oasis, according to Opaliński 1972 a. (– no data)

Lake no.	Dimensions length × width (m)	max. depth (m)	Ice conditions	Max. ice thickness (cm)	pH	Bottom t °C max.	min.	Remarks
1	35×50	1.2	freezes	120	6.5	3.8	0.3	without outflow
2	114×200	2.3	does not freeze	196	–	3.7	0.0	outflow to Glubokoe
5	30×60	1.9	does not freeze	–	–	1.8	0.5	outflow to No. 7
6	16×22	0.3	freezes	32	6.2	3.2	–	without outflow
9	20×24	0.5	freezes	48	6.5	3.4	–	outflow to No. 7
11	100×150	4.2	does not freeze	170	6.5	4.4	1.8	outflow to No. 9
12	100×150	2.0	does not freeze	–	–	2.6	–	outflow to No. 7
Glubokoe	850×450	26.5	does not thaw in summer	245	6.5	4.2	3.2	ouftlow to the sea

A soil sample was collected from Adélie (Myall) Island which is located 5 km north of the oasis and inhabited by a small colony of Adélie penguins (sample 15).

Cultures

In the laboratory the dried mud and soil samples were soaked with the culture fluid or inoculated into agar. Standard Knop culture medium was used with Pringsheim's modification: to 1000 ml water 0.1% KNO_3, 0.01% $Ca(NO_3)_2$, 0.02% K_2HPO_4, 0.01% $MgSO_4 \cdot 7\ H_2O$, and 0.0001% $FeCl_3$ was added. Favourable results were obtained by diluting the medium by half with well-water filtered through a membrane filter (pore size 0.45 μm). The same medium was used for preparing agar: 5 g powdered agar, 500 ml of the medium, 500 ml filtered well-water. The culture fluids and glassware were sterilised.

Ca. 1 g of dried material was placed in 5 cm diameter Petri dishes and soaked in culture medium so that there was no more than 0.5 cm of fluid above the sediment. The dishes were kept, two of each sample, under a special transparent plastic cover, carefully protected from contaminants. At the same time, ca. 0.25 g of the dried and powdered material was inoculated onto agar poured into identical Petri dishes.

The cultures were kept at room temperature (15 – 18 – 20°C) on a table near a north window. The algae already appeared on the agar cultures after 10 days, and in fluid ones slightly later, sometimes only after one month. Checking under the microscope, however, was not begun until 4 weeks had passed; at the same time, as uniform as possible groups of algae (if not species) were transplanted to fresh agar dishes. Cultures were carried out for 6 months and checked, at first every 2 weeks and then once a month.

It was assumed that the investigation would be floristic only, therefore when the occurring species had been identified, they were of no further interest.

Of course, in the material which developed in water and agar media it was impossible to determine all the algae in the individual samples in the defined time of investigation. Especially difficult are always the developing small spherical green algae whose identification often requires a very long and laborious period of study. The large amount of material and the necessity of numerous transplantations and repetitions are beyond the possibilities of a single investigator. In this case a well organized laboratory for unialgal cultures and technical assistance are essential.

The following list of algae determined in the material collected by Professors Rakusa-Suszczewski and Opaliński therefore does not fully illustrate the whole, quite rich, flora of algae in the investigated area. The investigations carried out, however, indicate the full possibility of studying the algal flora of Antarctica by methods using simple, uncomplicated cultures. Obviously, this does not mean that it is impossible to obtain interesting floristic data from samples collected directly in the field by an experienced and inquiring algologist.

From the material, both in water and agar media, a certain number of diatoms developed which were, however, not identified.

All drawings of this paper are original, made with the aid of a camera lucida. The bar included in each drawing denotes 10 μm.

The following papers were consulted in determination of the material: Collins (1909, 1912, 1918), Carlson (1913), Fritsch (1917), Geitler (1932, 1966), Tschermack (1941), Fritsch and John (1942), Smith (1950), Starr (1955), Korotkevič (1958), Hollerbach and Syroečkovskij (1960), Vischer (1960), Vialov and Zdobnikova (1961), Schwabe (1962), Holm-Hansen (1964), Likens (1964), Kol (1968, 1970), Kol and Flint (1968), Fott (1974) and Broady (1976, 1977).

Composition of the assemblages of algae in particular samples

The best growth of algae was obtained from samples of the sediment (mud) collected in the lakes, and sometimes on their shores. Soil samples gave rather poor results. One might expect that there would be algae in numerous samples of mosses and lichens which, however, were not investigated.

In the list below the particular samples are ordered according to the symbols given them by the collectors and the species of algae identified in them. Only those samples are included from which the algae grew. The symbol is followed by the date of collection.

Sample JB-9, 22.III.1969, Mud from lake No 6 dried at room temperature. Algae found: *Synechococcus cedrorum, Aphanothece saxicola, Chlorogloea microcystoides, Calothrix gracilis, Phormidium boryanum, Lyngbya erebi, L. conradii, Schizothrix lenormandiana, Dictyochloropsis splendida, Monoraphidium griffithii, Coccomyxa lacustris.*

Sample JB-10/2, 22.III.1969. Mud from lake No 6, dried at room temperature. Algae found: *Chroococcus turgidus, Phormidium foveolarum, Ph. ambiguum, Ph. valderiae, Coccomyxa lacustris, Chlorocloster terrestris.*

Sample JB-11/2, 22.III.1969. Mud from lake No 6, dried at room temperature. Algae found: *Chroococcus turgidus, Chlorogloea microcystoides, Palmellopsis gelatinosa, Dictyochloropsis splendida, Botryochloris minima, Chlorocloster terrestris.*

Sample JB-11/3, 22.III.1969. The shore of lake No 6, in the zone of low water level. Algae found: *Chlorococcus turgidus, Gloeocapsa dermochroa, G. magna, Calothrix gypsophila, Nostoc punctiforme, Oscillatoria articulata, O. acutissima, Phormidium cebennense, Ph. frigidum, Lyngbya antarctica, Characiopsis borziana, Hypnomonas ellipsoidea, H. tuberculata, Trochiscia sp.* (cf. *aciculifera* forma).

Sample JB-12, 22.III.1969. A sand hollow in the vicinity of lake No 6 in which water collects during the summer. Algae found: *Chlorococcus minutus, Ch. turgidus, Tolypothrix conglutinata, Pseudanabaena papillaterminata, Oscillatoria grunowiana, Phormidium curtum, Ph. cebennense, Ph. foveolarum, Ph. fragile, Lyngbya aestuarii* fo. *antarctica, L. fusco-vaginata, Symploca fuscescens, Schizothrix lacustris, Monoraphidium pusillum.*

Sample JB-14/2, 23.III.1969. Mud from lake No 6 taken at the depth of 50 cm, dried at room temperature. Algae found: *Nostoc kihlmanii, Phormidium foveolarum, Lyngbya antarctica, L. aerugineo-coerulea, L. lagerheimii, Chrysosaccus membranigerum, Chlorocloster pyreniger, Excentrosphaera viridis, Cosmarium laeve.*

Sample JB-16/1, 2.IV.1969. Mud from lake No 2 taken at a depth of 230 cm. Algae found: *Nostoc linkia, N. cuticulare* fo. *polymorphum, Phormidium fragile, Ph. autumnale, Pleurochloris commutata, Monodus fusiformis, Chlorococum* sp. (*Ch. humicolum*?).

Sample JB-17/2, 3.IV.1969. Lake No 11, mud taken at a depth of 375 cm. Algae found: *Oscillatoria grunowiana, Chlorococcum* sp., *Microcystis wesenbergii, Aphanothece clathrata.*

Sample JB-18/2, 4.IV.1969. Lake No 12, depth 200 cm, mud dried at room temperature. Algae found: *Aphanothece saxicola, Lyngbya attenuata, L. limnetica, Botryochloris minima, Borodinella polytetras.*

Sample JB-19/2, 15.IV.1969. Lake Glubokoe, mud from a depth of 27 m. Algae found: *Oscillatoria terebriformis, O. terebriformis* fo. *tenuis, O. terebriformis fo. amphigranulata, O. amphibia, Pseudanabaena catenata, Phormidium ambiguum, Botryochloris minima, Chlorella saccharophila.*

Sample JB-20, 20.I.1969. Near the shore of Lake Glubokoe, after a 5 m fall in the water level. Collected by A. Tarand. Algae found: *Nostoc linkia, N. cuticulare* fo. *polymorphum, Oscillatoria tenuis, Phormidium frigidum, Lyngbya aerugineo-coerulea, Chlamydomonas debaryana, Chloroplana terricola, Closterium moniliferum.*

Sample 2/13, 20.III.1969. Coating on stones at the western shore of lake No 1. Algae found: *Aphanothece clathrata, Oscillatoria acutissima, Phormidium foveolarum, Chloroplana terricola.*

Sample 3/17, 20.III.1969. From the rocky ridge between lakes No 1 and 3; soil among the rocks. Algae found: *Microcoleus vaginatus, Desmococcus vulgaris.*

Sample 3/21, 20.III.1969. From the rocky ridge between lakes No 1 and 3; among the rocks. Algae found: *Nostoc commune, Heterococcus chodatii, Desmococcus vulgaris.*

Sample 3/23, 20.III.1969. From the rocky ridge between lakes No 1 and 3; among the rocks. Algae found: *Nostoc commune, Oscillatoria formosa, O. homogenea, O. agardhii, Ankistrodesmus gracilis, Monoraphidium braunii.*

Sample 4/36, 21.III.1969. From the slope near lake No 6, protected from the wind. Algae found: *Nostoc commune, Oscillatoria sancta, Tribonema vulgaris.*

Sample 15, 3.XI.1969. Myall Island. Algae found: *Lyngbya lagerheimii, Microcoleus vaginatus, Ilsteria lobata.*

Sample 19 c. Phytoplankton from Lake Glubokoe. Algae found: *Lynbgya limnetica, Chroococcus turgidus, Chlorogloea microcystoides.*

Composition of the flora

In this kind of analysis the number of species developing depends on the way of preparation and storage of samples and on the conditions of culture (media, light, temperature, duration of incubation). Thus the number of species found will be an underestimate of total algal flora. Nevertheless, in the elaborated material there emerged distinct differences between samples collected from water environments and from soil. From the samples taken from the former more species were obtained than from the latter. In all cases the blue-green algae prevailed. These are, as is generally known, the most resistant to extreme conditions such as drying, freezing, or heating. It is also known that most of the blue-green species survive in dried soil samples even for several years. The small, unicellular green algae are remarkably resistant to drought, especially those appearing abundantly in the soil. It appeared that also xanthophytes survive quite well in dried samples of mud collected from water bodies.

The flora comprises:

Cyanophyceae	— 54 species
Chrysophyceae	— 1 species
Xanthophyceae	— 10 species
Chlorophyceae	— 20 species.

Detailed descriptions of species

Cyanophyceae

Synechococcus cedrorum Sauvageau 1892 (Fig. 2: 1). Cells blue-green, 6.8 µm long, 4.0 µm wide, occurring singly or in twos, sometimes forming small groups among other algae. In mud in lake No 5 (JB-9).

Microcystis wesenbergii Komárek 1958 (Fig. 2: 2). (=*Diplocystis wesenbergii* Komárek). Colonies oval, sometimes irregular, 30–44.4 µm in diameter, having a distinct (not dissolving), colourless, gelatinous envelope. Cells 5.5–6.6 µm in diameter, blue-green, with small gas vacuoles. Occurring singly among other algae in cultures of soil collected between lakes Nos 1 and 3 (3/21).

Aphanothece saxicola Naegeli 1849 (Fig. 2: 3). Colonies irregular, loose. Cells 3.5 µm long, 1.6 µm wide, greyish blue-green. Found among other algae in mud from lakes Nos 5 and 12 (JB-9, JB-18/2).

Aphanothece clathrata W. et G.S. West 1906 (Fig. 2: 4). Colonies oval or irregular, enclosed in colourless mucilage, mostly 35–40 µm in diameter. Cells rodlike, 2–3 µm long, 0.5 µm wide. Among other algae at the western shore of lake No 1 (2/13).

Gloeocapsa magna (Bréb.) Hollerbach 1938 (Fig. 2: 5). Colonies irregular, lumpy, composed of cells 3–6.6 µm in diameter, surrounded by reddish-brown

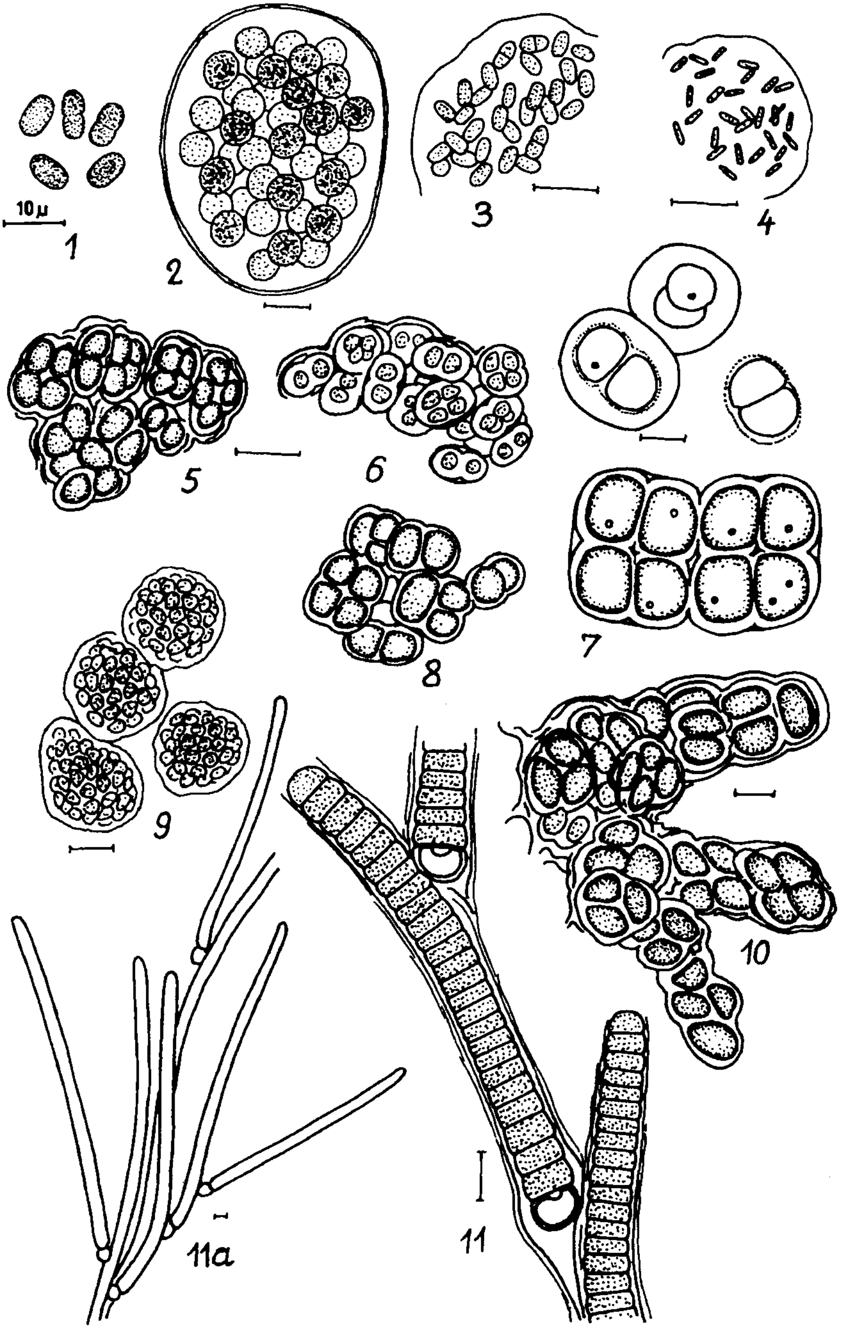

Fig. 2: 1 — *Synechococcus cedrorum*; 2 — *Microcystis wesenbergii*; 3 — *Aphanothece saxicola*; 4 — *A. clathrata*; 5 — *Gloeocapsa magna*; 6 — *G. dermochroa*; 7 — *Chroococcus turgidus*; 8 — *Ch. minutus*; 9 — *Chlorogloea microcystoides*; 10 — *Stigonema minutum*; 11, 11a — *Tolypothrix conglutinata*

tightly adhering envelope. Occurring in clusters among other algae on the shore of lake No 6 (JB-11/3).

Gloeocapsa dermochroa Naegeli 1849 (Fig. 2: 6). Colonies composed of 4 – 16 cells 7 – 12 μm in diameter, surrounded by yellowish-brown envelopes, concentrated in clusters of a few to several. Cells 2.5 – 3.0 μm in diameter. Found at the shore of lake No 6 (JB-11/3). The species is common in Europe mainly in wet places in the mountains.

Chroococcus turgidus (Kuetz.) Naegeli 1849 (Fig. 2: 7). Colonies mostly flat, 1 – 2 – 8 – (16) celled. Cells blue-green, 13 – 15 μm in diameter, surrounded by colourless laminated or not laminated envelopes. Occurring in clusters among other algae in lake No 6 and on its shore (JB-11/2, JB-11/3, JB-12) and in the plankton of lake No 10 (JB-10).

Chroococcus minutus (Kuetz.) Naegeli 1849 (Fig. 2: 8). Cells 6 – 6.5 μm in diameter concentrated in small, irregularly constructed colonies. Found among other algae in the sample from the sand hollow in the vicinity of lake No 6 (JB-12).

Chlorogloea microcystoides Geitler 1925 (Fig. 2: 9). Colonies bulbous, diverse in size, composed of blue-green cells 3.6 μm in diameter, concentrated closely in the colourless, yellowish or yellowish-brown mucilage. Occurring in groups among other algae in mud from lake No 6 (JB-9) and (only occasionally) in the plankton of lake No 10 (JB-10).

Stigonema minutum (Ag.) Hassal 1845 (Fig. 2: 10). Brownish fragments of the thalli were found in material taken from the shore of lake No 6 (JB-11/3), but the species did not develop in the cultures. Thalli composed of short, 1 – 4 rows of filaments, 23 – 30 μm in diameter, heterocysts lateral.

A species occurring commonly in various parts of the world, on damp, and even on fairly dry places.

Tolypothrix conglutinata Borzi 1879 (Figs. 2: 11 and 11a). (Fritsch 1912: p. 38, Tabl. III, 145, 146). Thalli profusely apparently branched, more than 1 mm high, occur among other algae singly or in groups. Filaments 16 – 18 μm wide. Sheaths brownish, laminated; layers parallel or sometimes slightly oblique, in the upper part more or less ragged. Trichomes 10 – 13 μm wide; cells 3.3 – 5.5 μm long, yellowish blue-green, small, or sometimes thickly granular, at the transversal walls slightly constricted, without granulations. Heterocysts are the base of side branches, shallow hemispherical, 10 – 12.6 μm wide, 5.5 – (6) μm high.

A species described by Borzi from damp rocks in Italy, then reported by Fritsch from Antarctica. The description given by Fritsch was not, except for dimensions, quite consistent with Borzi's diagnosis, and likewise the above description does not precisely accord with that of Fritsch. The differences lie in the shape and colour of the sheaths. According to Fritsch, the sheaths are very wide (up to 5 μm), colourless, not laminated. Other features, judging from his description and drawings, are similar. Because the formation of the sheaths, and especially their colour, depends in great measure on the environmental conditions, consequently, on the basis of the features of the trichome, I suppose that the specimens found in the sample (JB-12) coming from the sand hollow in the vicinity of lake No 6 correspond with *T. conglutinata*.

Calothrix gypsophila (Kuetz.) Thuret 1875 fo. *orsiniana* (Kuetz.) V. Poljanskij 1934 (Fig. 3: 12). (= *Dichothrix orsiniana* (Kuetz.) Bornet et Flahault). Thalli up to 2 mm high. Filaments in the central part of the thallus 16 – 21 – (27) μm wide; trichomes 7.2 – 8.1 μm wide. Cells varied in length; heterocysts at the base of branchings more or less hemispherical. Sheaths yellowish-brown, varying in width, laminated parallely, at the apices dissolving, but rather not ragged. Occurring fairly numerously on stones at the shore of lake No 6 (JB-11/3). They were found only in the soaked material; in cultures they did not develop.

Calothrix gracilis F.E. Fritsch 1912 (Fig. 3: 13). On the agar it forms blue-green, disordered colonies. Trichomes at the base to various degree bulbously thickened or not thickened, 4 – 6, occasionally up to 9 μm wide. Heterocysts 5.5 – 6 μm wide. Cells variously long; the apex of trichomes ending in a slightly elongated, conical or bluntly conical cell, but they never form hairs.

The species, described by Fritsch from the Antarctic, developed in cultures from lake No 5 (JB-9). In Europe a similar species, *Calothrix elenkinii* Kossinskaja 1924, often occurs in stagnant and running waters and on damp soil.

Nostoc linkia (Roth) Bornet et Flahault 1880 (Fig. 3: 14, Pl. 5, fig. 10). Thalli irregular, rather small, composed of coiled, yellowish-grey or brownish filaments. Trichomes with or without indistinct sheaths which are just visible ony at the edges of the colony. Cells mostly more or less spherical or barrel shaped, 3.5 – 5 μm wide. Heterocysts spherical, always narrower than the vegetative cells, mostly 3 μm wide. Spores spherical or oval, (5) – 6 μm wide, 6 – 7 μm long. Thalli developed in small numbers on the bottom and on the walls of the dishes with fluid culture. The type and dimensions of the trichomes agree best with the features of *N. linkia*, but contrary to the diagnosis of that species, the heterocysts are always smaller than the vegetative cells. It may be that this is a separate form. It occurs on the shore of Lake Glubokoe (JB-20) and in lake No 2 (Jb-16/1).

Nostoc kihlmani Lemmermann 1900 (Fig. 3: 15). Colonies spherical or almost so, often irregular, of various size. Trichomes fairly tightly coiled, without sheaths, usually 4.0 – 5.8 μm wide, pale blue-green. Heterocysts 6 – 7 μm wide, spherical. No spores were seen. It developed not very numerously on mud from lake No 9 (JB-14/2).

Nostoc punctiforme (Kuetz.) Harriot 1891 (Pl. 5, fig. 12). Colonies irregular, rather elongated, with tightly concentrated trichomes composed of more or less spherical cells 2 – 5 μm in diameter. Heterocysts up to 6 μm in diameter. No spores were seen. On the shore of lake No 6 (JB-11/3).

Nostoc cuticulare Born. et Flah. fo. *polymorphum* (Kukk) Kondratieva 1968. Colonies occurred on agar in the form of small, sometimes irregularly spherical spots. Trichomes tightly concentrated; cells 5.5 – 6.6 μm wide. The shape of the thalli in principle similar to *N. punctiforme*, but the cell dimensions are greater

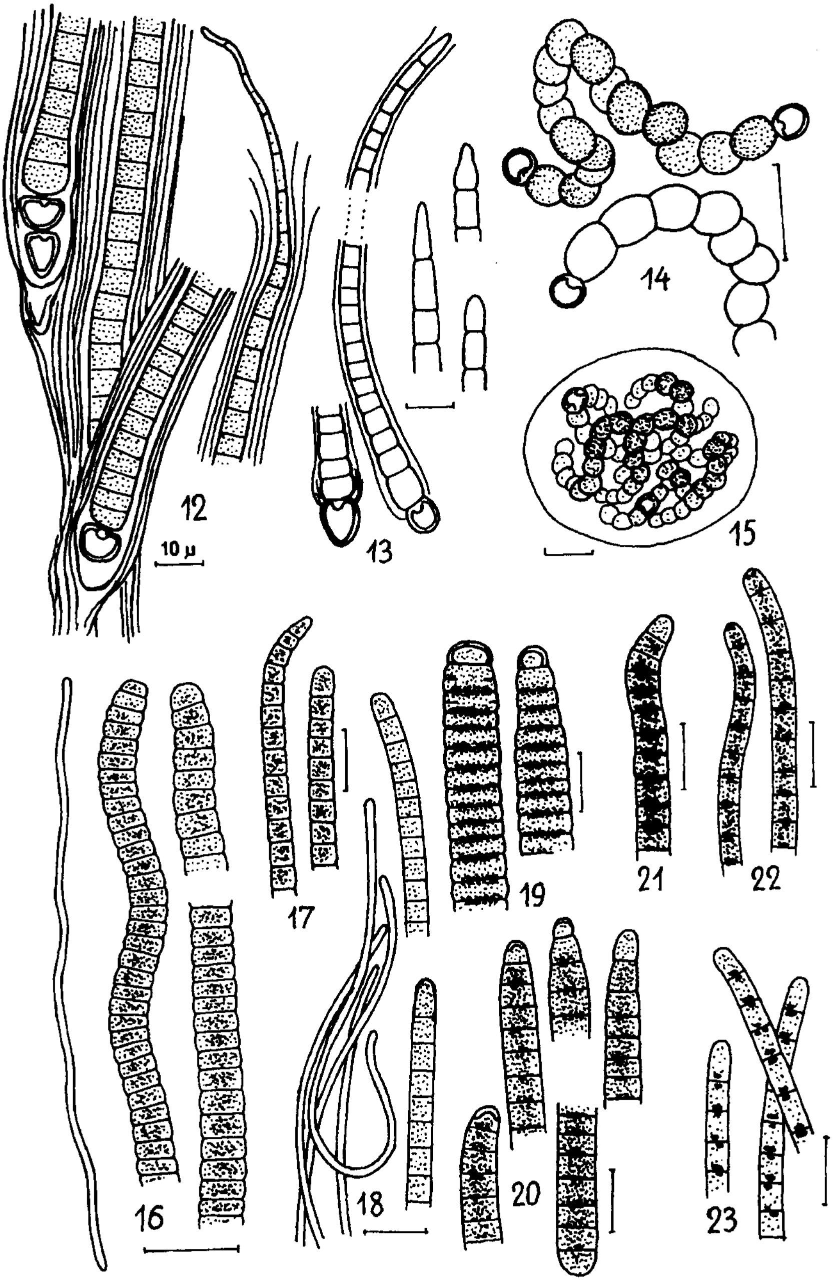

Fig. 3: 12 — *Calothrix gypsophila* fo. *orsiniana;* 13 — *C. gracilis;* 14 — *Nostoc linkia;* 15 — *N. kihlmani;* 16 — *Oscillatoria grunowiana;* 17 — *O. formosa;* 18 — *O. homogenea;* 19 — *O. sancta;* 20 — *O. agardhii;* 21 — *O. terebriformis* fo. *amphigranulata;* 22 — *O. terebriformis* fo. *tenuis*; 23 — *O. amphibia*

(in *N. punctiforme* the cells are 2.4 – 3.2 – (5.4) μm wide). It occurs on mud from lake No 2 and at the shore of Lake Glubokoe (JB-16/1, JB-20).

Nostoc commune Vaucher 1803. Small fragments of the thalli were found in the material collected from the rocky ridge between lakes Nos 1 and 3 and from the rise near lake No 6 (3/21, 3/23, 4/36).

The species did not develop in the cultures.

Oscillatoria grunowiana Gomont 1892 (Fig. 3: 16) [= *O. terebriformis* Ag. fo. *grunowiana* (Gom.) Elenkin 1949]. Trichomes dark blue-green, on their whole length regularly widely wound spirally, at the apex not attenuated. Apical cell rounded, without calyptra. Cells at the transverse cell walls clearly constricted, not granulated, 3.8 – 4.4 μm wide, 1.3 – 1.8 – 2.7 μm long. Larger granules are found in the protoplasm, but they do not concentrate at the transverse cell walls. It occurred in the sand hollow in the vicinity of lake No 6 (JB-12) and in mud from lake No 11 (JB-17/2).

Elenkin (1949), and after him Kondratieva (1968), included this species to *O. terebriformis* as a form; in my opinion, however, this is not justified. *O. terebriformis* is only at the ends spirally bent, its trichomes are distinctly attenuated at the ends, and they are 4 – 6.5 μm wide; the cells are 2.5 – 6 μm long, at the transversal walls not constricted, granulated. Instead, the specimens found in our samples, have features consistent with Gomont's (1892) diagnosis and clearly differ from *O. terebriformis.*

Oscillatoria formosa Bory 1827 (Fig. 3: 17). Trichomes blue-green, long, bent, 4.0 – 5.1 μm wide. Cells 3 – 3.5 – (4) μm long, at the transversal walls not granulated; apical cell bluntly conical, narrower than the others. It occurs in the soil samples from among the rocks on the rocky ridge between lakes Nos 1 and 3 (3/23).

Oscillatoria homogenea Fremy 1930 (Fig. 3: 18). Trichomes single, greyish (pale) blue-green, bent or straight, they do not form compact thalli but at most occur in small groups. Cells 3.0 – 3.5 – (4) μm wide, at the transversal walls not constricted, at the apices not attenuated; apical cell rounded. In the soil samples from the rocks on the ridge between lakes Nos 1 and 3 (3/23).

Oscillatoria sancta (Kuetz.) Gomont fo. *tenuis* (Woron.) Elenkin 1949 (Fig. 3: 19). Trichomes greyish blue-green, straight or bent, at the transversal walls slightly constricted and granulated, at the apex slightly attenuated or sometimes not, slightly capitate, with thickened or almost unthickened wall, 8.5 – 8.75 μm wide. Cells 1.3 – 2.5 μm long. It occurs in the soil samples from the slope near lake No 6 (4/36).

This form was described by Woronichin from moist places in the northern Ural Mts.

Oscillatoria agardhii Gomont 1892 (Fig. 3: 20). Trichomes mostly single, or in small concentrations, of various length, greyish blue-green, at the transversal walls not constricted, at the apex slightly attenuated or not, 5.2 – 5.6 – 6.0 μm wide. Apical cell slightly narrower, conically rounded, sometimes not distinctly capitate, covered with a hemispherical calyptra (fo. *gomonti* Elenkin), or also not attenuated, widely rounded, without calyptra or thickened wall (fo. *aequicrassa* Elenkin). At the transversal walls granulations were seen variously developed; thicker granulations appeared also in the middle part of cells. Found in the soil samples from the rocks on the ridge between lakes Nos 1 and 3 (3/23).

Elenkin gives 5 forms of this species from which in our material only two were more distinct: fo. *gomonti* (=fo. *typica*) and fo. *aequicrassa* (= *O. agardhii* sensu Wisłouch).

Oscillatoria tenuis Agardh 1813. Trichomes bright blue-green, 6–8 μm wide. Cells about two times shorter than their width, at the transversal walls slightly constricted, granulated. Apical cell hemispherical. At the shore of Lake Glubokoe (JB-20).

Oscillatoria terebriformis Agardh emend. Elenkin 1949. Trichomes steely-green, 4–5 μm wide, at the apex attenuated, bent, and ca. 3.1 μm wide, at the transversal walls not constricted, with more or less distinct granulations. Apical cell rounded, usually with two grains at the apex. Cells 3–4–5 μm long. Lake Glubokoe (JB-19/2).

Oscillatoria terebriformis fo. *amphigranulata* Elenkin et Kossinskaja 1949 (Fig. 3: 21). Trichomes 4.5–5.0–5.5 μm wide, greyish blue-green, at the apex slightly or almost not attenuated. Cells 3–4–5 μm long, at the transversal walls not constricted, with diversely developed granulations, usually distinct, but sometimes only faintly marked. Apical cell rounded, sometimes with slightly thickened wall. From the typical form (fo. *terebriformis*) it differs above all in the presence of granulations at the transversal walls and smaller width of the trichomes. In the mud of Lake Glubokoe (JB-19/2).

Oscillatoria terebriformis fo. *tenuis* (Woronichin) V. Poljanskij (Starmach 1966) (Fig. 3: 22). Trichomes greyish blue-green, at the end not attenuated, slightly bent, motile, 3–3.8 μm wide. Cells 2.5–3.7–4.0 μm long, at the transversal walls not constricted, with rather rare granulations. It differs from the type in its dimensions. In the mud of Lake Glubokoe (JB-19/2).

It was described from the neighbourhood of Leningrad (St. Petersburg).

Oscillatoria amphibia Agardh 1827 (fig. 3: 23). Trichomes straight or bent, blue-green, 2–2.8 μm wide. Cells 4.6–6.4 μm long, at the transversal walls not constricted, with single grains at both sides; apical cell rounded, without calyptra. In the mud of lake No 11 (JB-17/2) and of lake Glubokoe (JB-19/2).

A cosmopolitan species usually occurring in stagnant waters, also on damp soil.

Oscillatoria articulata Gardner 1927 (Fig. 4: 24). Trichomes on the agar surface tangled, blue-green, 2.25–2.5–3.0 μm wide. Cells 1.8–2.5 μm long, at the transversal walls not constricted, not granulated, with sparse grains in the protoplasm and clearly visible layer of the chromoplasm. Characteristic are the distinct side walls and transversal ones having uniform thickness. Grown from the sample taken at the shore of lake No 6 (JB-11/3).

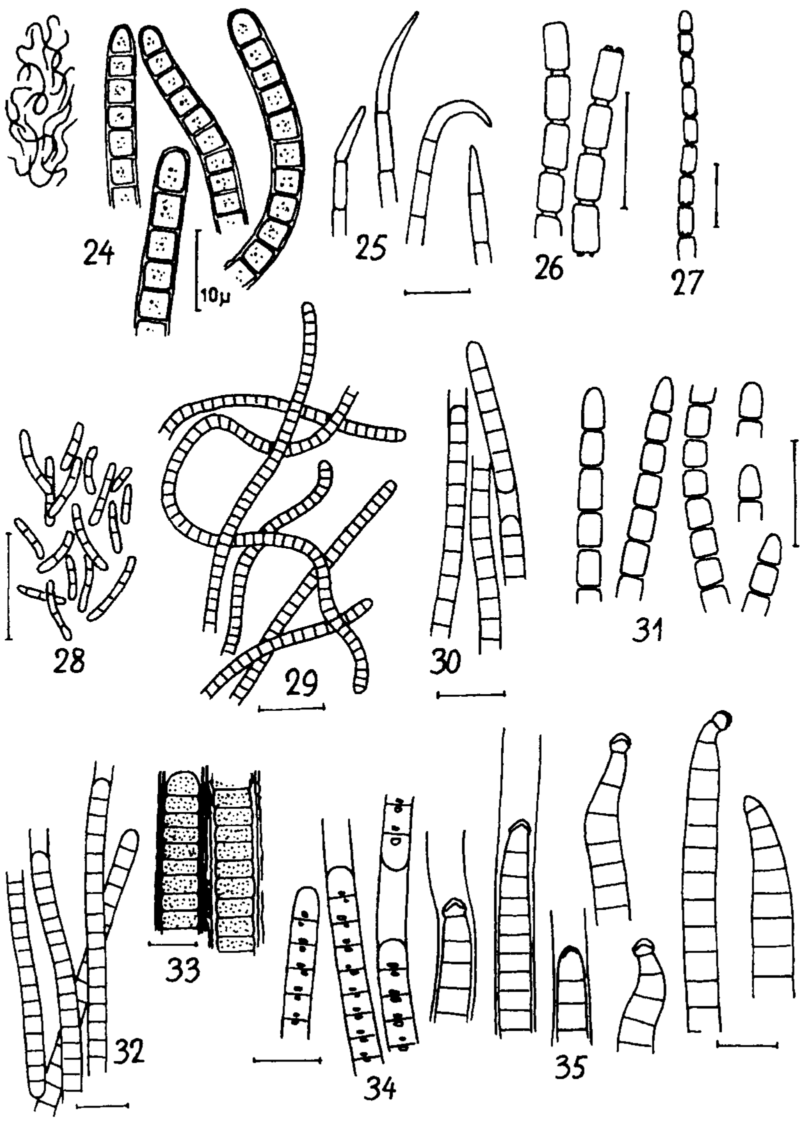

Fig. 4: 24 — *O. articulata;* 25 — *O. acutissima;* 26 — *Pseudanabaena papillaterminata;* 27 — *P. catenata;* 28 — *Phormidium curtum;* 29 — *Ph. cebennense;* 30 — *Ph. foveolarum;* 31 — *Ph. fragile;* 32 — *Ph. boryanum;* 33 — *Ph. ambiguum;* 34 — *Ph. valderiae;* 35 — *Ph. autumnale*

The species has been described from damp rocks and standing waters on the island of Puerto Rico.

Oscillatoria acutissima Kufferath 1914 (Fig. 4: 25). Trichomes single, blue-green, mobile, especially at the apex, (1.2)−1.5−2.0 µm wide, at the transversal walls not constricted, at the apex attenuated and bent at various angles. Cells 3.4−5.6 µm long, without granules at the transversal walls or, in older filaments, sometimes with single granules. On the agar it forms blue-green, rather compact coatings. Found on the western shore of lake No 1 (2/13) and on the shore of lake No 6 (JB-11/3).

Pseudanabaena papillaterminata (Kisselev) Kukk 1959 (Fig. 4: 26; Pl. 5, fig. 14). Single fragments of trichomes were found, 2.5 – 3.0 µm wide and composed of cells 3 – 3.5 µm long. The apical cells terminating in one or two nodules or rounded. Found in the hollow near lake No 6 (JB-12).

It corresponds best to the dimensions of *P. papillaterminata*, not, however, a quite certain species.

Pseudanabaena catenata Lauterborn 1914 – 17. (Fig. 4: 27). Trichomes pale blue-green, 1,8 – 2 µm wide; cells 2.5 – 3.84 µm long, apical cell rounded. In Lake Glubokoe (JB-19/2).

Phormidium curtum Hollerbach 1934/35 (Fig. 4: 28). Filaments short, composed of 2 – 6 cells, which are mostly 0.64 µm wide, pale blue-green, 2 – 3 times longer than their width. On the agar they form spots up to 2 mm in diameter. Found in the hollow near lake No 6 (JB-12).

Hollerbach cultivated the species from sandy soil in the neighbourhood of Leningrad (St. Petersburg).

Phormidium cebennense Gomont 1899 (Fig. 4: 29). Thalli more or less yellowish-brown; they form a dense film on the wall of the Petri dishes with fluid medium. Trichomes tangled, 1.5 – 1.8 – 2.5 µm wide. Cells as long as wide or slightly shorter, at the transversal walls not constricted and not granulated, apical cell rounded. It occurs on the shore of lake No 6 (JB-11/3 and JB-12).

The species is known from damp places in equatorial Africa.

Phormidium frigidum F.E. Fritsch 1912. Trichomes delicate, 0.8 – 1.2 µm wide, cells as long as wide or a little longer, at the transversal walls constricted, usually with one shiny grain. Apical cell rounded. Filaments twisted, and tangled, forming a delicate, yellowish film. On the shore of lake No 6 (JB-11/3) and on that of Lake Glubokoe (JB-20).

Phormidium foveolarum Gomont 1892 (Fig. 4: 30). Trichomes 1.5 – (2 – 2.5) µm wide, forming rather pale blue-green concentrations. Cells 1.5 – 3 – (5) µm long, at the transversal walls not granulated, slightly constricted. Apical cells rounded, without calyptra. Sheaths dissolving. Occurring in lake No 6 (JB-10/2), in lake No 9 (JB-14/2), in a sand hollow near lake No 6 (JB-12), and on the shore of lake No 1 (2/13).

A cosmopolitan species.

Phormidium fragile (Mengh.) Gomont 1892 (Fig. 4: 31; Pl. 5, fig. 13). Trichomes yellowish blue-green, forming on the agar fairly extensive, flat thalli. Cells 1.5 – 2.0 µm wide, 1.5 – 2.5 µm long, not granulated, separated from each other by thick transversal walls. Apical cells acutely conical or domelike conical, more rarely widely rounded. Sheaths dissolving. It was found in lake No 2 (JB-16/1) and in the hollow in the vicinity of lake No 6 (JB-12).

Phormidium boryanum Kuetzing 1843 (Fig. 4: 32). Filaments form loose, blue-green or greyish-green concentrations. Trichomes 2.5 – 3.0 – 3.2 µm wide; cells 3.0 – 3.8 – 4.0 µm long; apical cell not attenuated, rounded, more rarely bluntly conical. It occurred in lake No 6 (JB-9).

The species is known from Europe and the polar regions of the Ural Mts and Siberia.

Phormidium ambiguum Gomont 1892 (Fig. 4: 33). Filaments bent, tangled, blue-green. Sheaths colourless, thin or fairly thick, at the edges partly dissolving and uneven, becoming blue from $ZnCl_2$+JKJ. Cells 5.6 – 6.2 – 6.4 µm wide, 1.8 – 2.3 µm long, violet-grey. Apices of the trichomes slightly mobile, apical cell rounded. It occurred in lake No 6 (JB-10/2) and in Lake Glubokoe (JB-19/2).

A species known from various environments, common.

Phormidium volderiae (Delp.) Gomont 1892 (Fig. 4: 34). In the fluid cultures it forms compact, membrane-like, greyish blue-green thalli; on agar it grows within it and forms concentrations of tangled filaments which are 2.5 – 2.7 µm wide. Sheaths permanent or dissolving, becoming blue from $ZnCl_2$+JKJ. Trichomes 2.5 µm wide. Cells 2.5 – 3.5 – 5.0 µm long, at the transversal walls not constricted, with one or two shiny grains. Apical cell rounded. Found in lake No 6 (JB-10/2).

A cosmopolitan species occurring in various environments.

Phormidium autumnale (Ag.) Gomont 1892 (Fig. 4: 35). Thalli dark blue-green, composed of trichomes attenuated at the top. Trichomes 4.4 – 5.5 – 6.6 µm wide, at the transversal walls not constricted, with granulations only in the middle of the cells, surrounded by delicate, colourless sheaths, which are not always visible. Cells 3.5 – 4.5 µm long, rarely longer; apical cells capitate with more or less conical calyptra, or rounded, with slightly thickened wall. It occurred in great numbers in the soil sample collected among rocks on the slope between lakes Nos 1 and 3 (4/23), in the sample from lake No 2 (JB-16/1), and in the one from Lake Glubokoe (JB-19/2).

A cosmopolitan species previously known also from Antarctic.

Lyngbya antarctica Gain 1911 (Fig. 5: 36). Filaments single, bent, 7 – 7.6 – (8.5) µm wide. Sheaths colourless, permanent, up to 1 µm thick. Trichomes blue-green with brownish shade, (5) – 6 – 7.3 µm wide. Cells 1 – 1.8 – (4) µm long, at the apex attenuated, sometimes fairly distinctly capitate, without calyptra, with a flat, faint calyptra, or with slightly thickened wall. The apex is mobile. It occurred at the shore of lake No 6 (JB-11/3) and in lake No 9 (JB-14/2).

A species described from the Antarctic, known also from the Tatra Mts. in Poland.

Lyngbya aestuarii Liebm. fo. *antarctica* (F.E. Fritsch) Elenk. (Starmach 1966) (Fig. 5: 37). Filaments 8 – 12 µm wide. Sheaths colourless, not laminated. Trichomes 7 – 10 – (10.5) µm wide, yellowish blue-green. Cells 1.8 – (2) µm long, at the transversal walls not constricted and not granulated; apical cell flatly rounded or capitate with a calyptra. It occurred in the sand hollow in the vicinity of lake No 6 (JB-12).

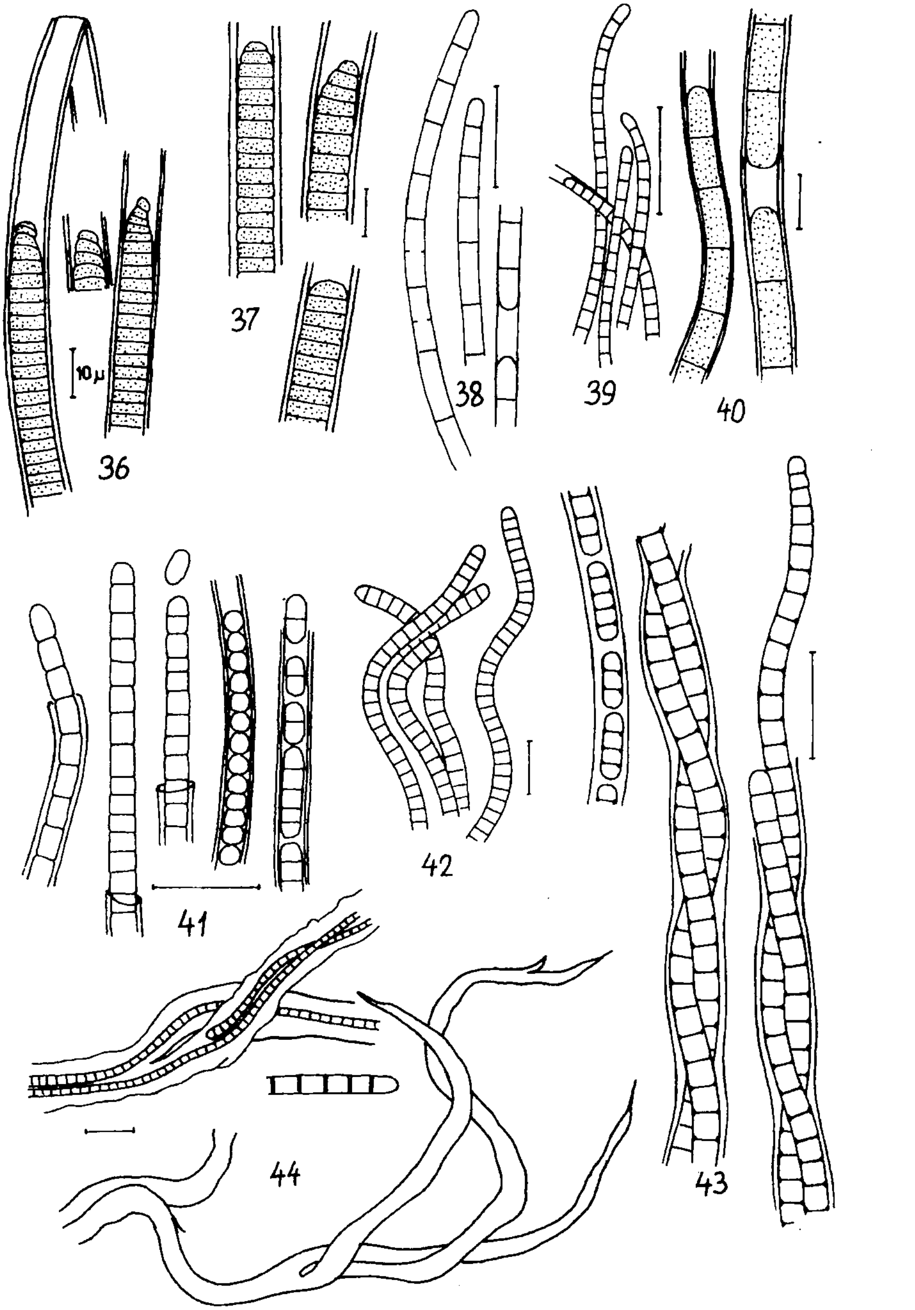

Fig. 5: 36 — *Lyngbya antarctica;* 37 — *L. aestuarii* fo. *antarctica;* 38 — *L. limnetica;* 39 — *L. erebi;* 40 — *L. conradii;* 41 — *L. fusco-vaginata;* 42 — *Symploca fuscescens;* 43 — *Schizothrix lenormandiana* fo. *maior;* 44 — *S. lacustris*

The form was described by Fritsch from a pond in Antarctica; known also from the Tatra Mts. in Poland.

Lyngbya limnetica Lemmermann 1898 (Fig. 5: 38). Filaments blue-green, single or in groups, straight or bent, mostly 1.4 μm wide. Cells 2 – 2.8 – 4 – (5) μm long, at the transversal walls not constricted, sometimes with single grains. Apical cell rounded. It occurred in lake No 12 (JB-18/2), and in the plankton from Lake Glubokoe.

A commonly known species.

Lyngbya lagerheimii (Möb.) Gomont 1892. Filaments curled up, tangled. Sheaths ca. 2 μm wide, colourless, strong. Trichomes pale blue-green, composed of cells nearly as wide as long, at the transversal walls not constricted. Apical cell rounded. It occurred in the mud of lake No 9 (JB-14/2).

Given from the Antarctic by Fritsch (1912 a, b).

Lyngbya aeruginoso-coerulea (Kuetz.) Gomont 1892. Filaments set in thin, strong sheaths not becoming blue from Zn_2Cl+JKJ. Trichomes pale blue-green, 4 – 6 μm wide, cells slightly longer than their width, at the transversal walls variously granulated. Apical cell rounded or elliptically conical. It occurs at the shore of Lake Glubokoe (JB—20).

Given from the Antarctic by Fritsch.

Lyngbya attenuata F.E. Fritsch 1912. Filaments pale blue-green, sheaths colourless. Trichomes mostly 5 μm wide, composed of cells more or less as long as wide, at the transversal walls constricted, not granulated. Apical cells diverse, rounded, narrowed, sometimes slightly capitate. It occurred in lake No 12 (JB-18/2).

A species described by Fritsch from the Antarctic.

Lyngbya erebi W. et G.S. West 1911 (Fig 5: 39). Trichomes bent, tangled, vivid blue-green, 1 – 1.25 μm wide (in the West's diagnosis 0.9 μm wide), at the apex not attenuated. Cells as long as wide or up to 2 μm long. Sheaths very delicate, visible only at the apices of the trichomes, or in places where the later have burst. In the mud from lake No 5 (JB-9).

A species described from the Antarctic.

Lyngbya conradii Kufferath 1914 (Fig. 5: 40). Filaments fairly straight or slightly bent, arranged in strands or in small concentrations, faintly blue-green, rather pale. Sheaths colourless, strong, up to 1 μm thick, not becoming blue from Zn_2Cl—JKJ, 8 – 9 μm wide. Trichomes 7 – 7.8 – (8) μm wide, cells at the transversal walls not constricted, not granulated, 8 – 11 – 14 μm long. Apical cell rounded. It occurrs in the mud of lake No 5 (JB-9).

The specimens found are most similar to *L. conradii* which was, unfortunately, not clearly described from the bottom of a water body in Luxemburg. The species is characterized by especially long cells in which they distinctly differ from the related species, e.g. *L. aestuarii* and *L. corbierrei*. This identification must be regarded as provisional.

Lyngbya fusco-vaginata Starmach n. sp. (Fig. 5: 41: Pl. 5, fig. 9). *Fila elongata, recta vel flexuosa, 2.4–2.8–3.0 μm crassa, vaginae firme, obscure fusco-violaceae, non lamellosae, chlorozinzico iodurato vix coerulescentes. Trichomata dilute coeruleo-aeruginosa, ad genicula constricta. Cellulae ad disseptimentis non granulatae, 2.0–2,2–2,4 μm crassae. 2,0–3,5 μm longae. Cellula apicalis rotundata, vel leviter subconica. Calyptra nulla.*

Habitus: prope lacuum No. 6 (JB-12), Antarctica. Inonotypus: Figura nostra 5: 41, Pl. 5, fig. 9.

Filaments more or less straight or bent, 2.4–2.8–3.0 μm wide. Sheaths dark brownish-violet or nearly black-violet, strong, not laminated, becoming blue from Zn_2Cl—JKJ. The apices of the trichomes protrude from the sheaths; the trichomes are greyish or pale blue-green, 2.0–2.2–2.4 μm wide, composed of cells which are 2.0–3.5 μm long, at the transversal walls distinctly constricted, without granulations. Apical cells not attenuated, rounded at the end, rarely slightly conical; sometimes they become spherical and separate as unicellular gonidia. 2–4-cellular hormogonia are also formed; they flow out of the sheaths. In older filaments the cells first become rounded, then degenerate. In the fluid cultures the species makes membranous, greyish-violet thalli; when in mass they are dark, nearly black. On the agar they form greyish-violet spots also sinking into the medium. It was found in the sand hollow in the vicinity of lake No 6 (JB-12).

Iconotypus: Fig. 5: 41, Pl. 5, fig. 9.

The species is closest to *L. lagerheimii* (Moe.) Gom. from which it differs in the dimensions of the filaments and the trichomes, the form and colour of the sheaths, and the cells constricted at the transversal walls and without granulations.

Symploca fuscescens (Kuetz.) Rabenhorst 1865 (Fig. 5: 42). Thalli turf-like, composed of bent, tangled filaments, partly raised, yellowish-green when in mass. Trichomes 2.0–2.5 μm wide. Cells 1.8–2 μm long; apical cell rounded. Sheaths very delicate, dissolving. In the sand hollow in the vicinity of lake No 6 (JB-12).

It is a rare species occurring in the soil in Europe and in North America.

Microcoleus vaginatus (Vaucher) Gomont 1892. Trichomes pale blue-green, 4.5–6 μm wide. Cells slightly shorter than wide or as long as wide, at the transversal walls with small granules. Apical cell capitate, slightly conical, with a calyptra. Trichomes twisted, several together in a common sheath; the sheaths from outside more or sometimes less dissolving. It occurs among small green algae in the material from Adelie Island (sample No 15 collected November 3rd 1969).

Schizothrix lenormandiana Gomont fo. ***maior*** Starmach n. fo. (Fig. 5: 43: Pl. 5, fig. 11). *Stratum tenue, pallide aeruginosum, fila elongata, 5,0–7,2 μm crassa, vaginae cylindricae, chlorozinzico iodurato vix coerulescentes. Trichomatis sparsis, varie contortis et conduplicatis, 3,0–3,6–4,0 μm crassis, cellulis 2,7–3,0–4,5–(5,4) μm longis, ad disseptimenta vix constrictis.*

Habitus: in lacuum No. 5. Antarctica. Iconotypus: Figura nostra 5: 43. Pl. 5, fig. 11.

Thalli film-like, pale blue-green, composed of tangled, wavy filaments 5.0–7.2 μm wide. Sheaths colourless, thin, not laminated, on the exterior often dissolving, not becoming blue from Zn_2Cl+JKJ, or only slightly. The dissolving of the outer layer of the sheaths is best seen after staining with diluted methylene blue. Usually the apices of the sheaths dissolve and disappear, hence the ends of the trichomes are nearly always free. In the sheath the trichomes are single or double and then twisted together. Cells at the transversal walls very slightly constricted, not granulated, 3.0–3.6–4.0 μm wide, 2.7–3.0–4.5–(5.4) μm long, apical cells rounded. Some trichomes form 3–5 cellular hormogonia arranged in rows in the opened sheaths. The specimens found in the mud of lake No 5 (JB-9) may therefore be treated as a new form.

As regards the shape of the sheaths trichomes, and thalli, the specimens described correspond with the features of *S. lenormandiana*, but the dimensions of the filaments and trichomes are much greater (in the type specimens the trichomes are 1.5–3 μm wide and cells 1–2.4 μm long).

Schizothrix lacustris A. Braun in Kuetzing 1849 (Fig. 5: 44). Filaments typical, characteristically branched. Sheaths yellowish; trichomes 1–1.8 μm wide. Cells rounded at the apex. Thalli of this species were found in the sodden material collected from stones on the shore of lake No 6 (JB-12). In the cultures they did not develop.

Chrysophyceae

Chrysosaccus membranigerum Starmach n.sp. *(Fig. 6: 44 a, Pl. 3, figs. 1, 2). Cellulae ellipsoideo-cylindricae, 7–8 μm longae, 4–4,8 μm crassae, glabre, bini*

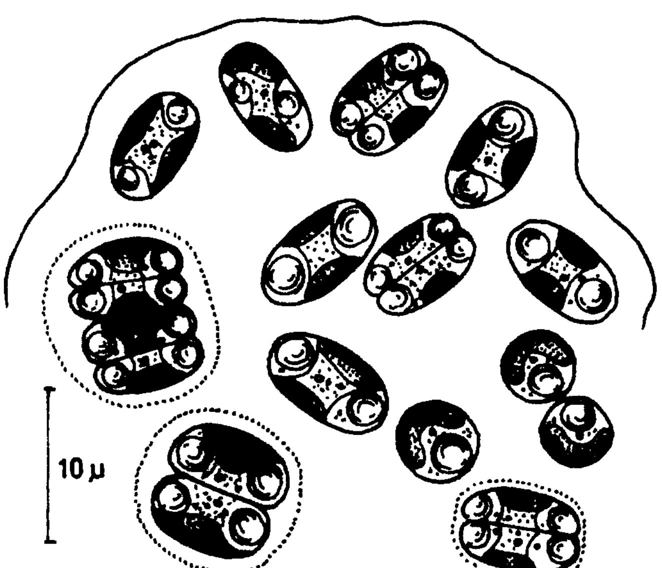

Fig. 6: 44A — *Chrysosaccus membranigerum*

in muco amorpho locatae. Chromatophora bina, lateralia, alveformia, fusco-lutea, sine pironoidibus. Nucleus fere centralis. Vacuolo contractilo uno, fere aequatorialiter locato. Sat magna gutta chrysolaminaria in apicibus cellularum positi sunt. Multiplicatur divisione longitudinali.

Habitus: in lacuum No. 9 (JB-14/2), Antarctica. Iconotypus: Figura nostra 6: 44a, Pl. 3, figs. 1,2.

Cells elliptically cylindric, round in cross-section, 7–8 μm long, 4–4.8 μm wide, bare, arranged tightly, usually in twos, in the amorphous mucilage; in cultures on the surface of the fluid medium they form delicate, yellow-brown membranes. The edges of the colonies are not sharply deliminated, the mucilage is partly dissolving. In the cell there is one yellowish-brown chromatophore trough-like or broadly ribbonlike with folded edges. No stigma was observed. Nucleus small, visible only after staining, situated more or less in the centre or slightly shifted to the side of the cell. There appears to be only one pulsatile vacuole situated at the side of the cell, clearly visible only in very young, just divided cells. There are two chrysolaminarine grains in the cell, placed at both sides of the chromatophore; in older cells they are placed at both poles of the cell in the form of quite large, spherical outgrowths. No oil drops were noted, though rare shiny grains occurred. Reproduction takes place by longitudinal division of cells. Two daughter cells are first enclosed in a distinct, thin layer of mucilage, which with time dissolves in the common mass of mucilage, forming a colony. The membranous colonies are compact, not disintegrating under the pressure of a cover galss. In some cultures they covered several square centimeters of surface.

This species developed from the air-dried sample of mud from lake No 9 (JB-14/2) collected in the vicinity of the Soviet Molodezhnaya Antarctic Station.

Iconotypus: Fig. 6: 44a and Pl. 3, figs. 1 and 2.

Pascher (1925) described the genus *Chysosaccus* together with the species *Ch. incompletus* occurring in the form of mucilaginous membranes, in which were placed elliptic, elongated cells. The cells were 6–9 μm long and up to 4 μm wide, concentrated in fours, at first enveloped by a thin layer of delicate mucilage which later dissolved. Each cell had two chromatophores, one of which had a stigma. Reproduction was observed by cell division only. The newly described species (*Ch. membranigerum*) forms similar membranous colonies containing cells of a similar shape. They are, however, always arranged in twos, and not in fours, they have one chromatophore, and not two, and they also have slightly different dimensions and characteristically placed spherical grains of chrysolaminarine. Moreover in the chromatophore no stigma was discovered.

Xanthophyceae

Pleurochloris commutata Pascher 1925 (Fig. 7: 45). Cells spherical or oval, 7.5–8.75 μm in diameter. Cell membrane thin. Chromatophore bowl-shaped or

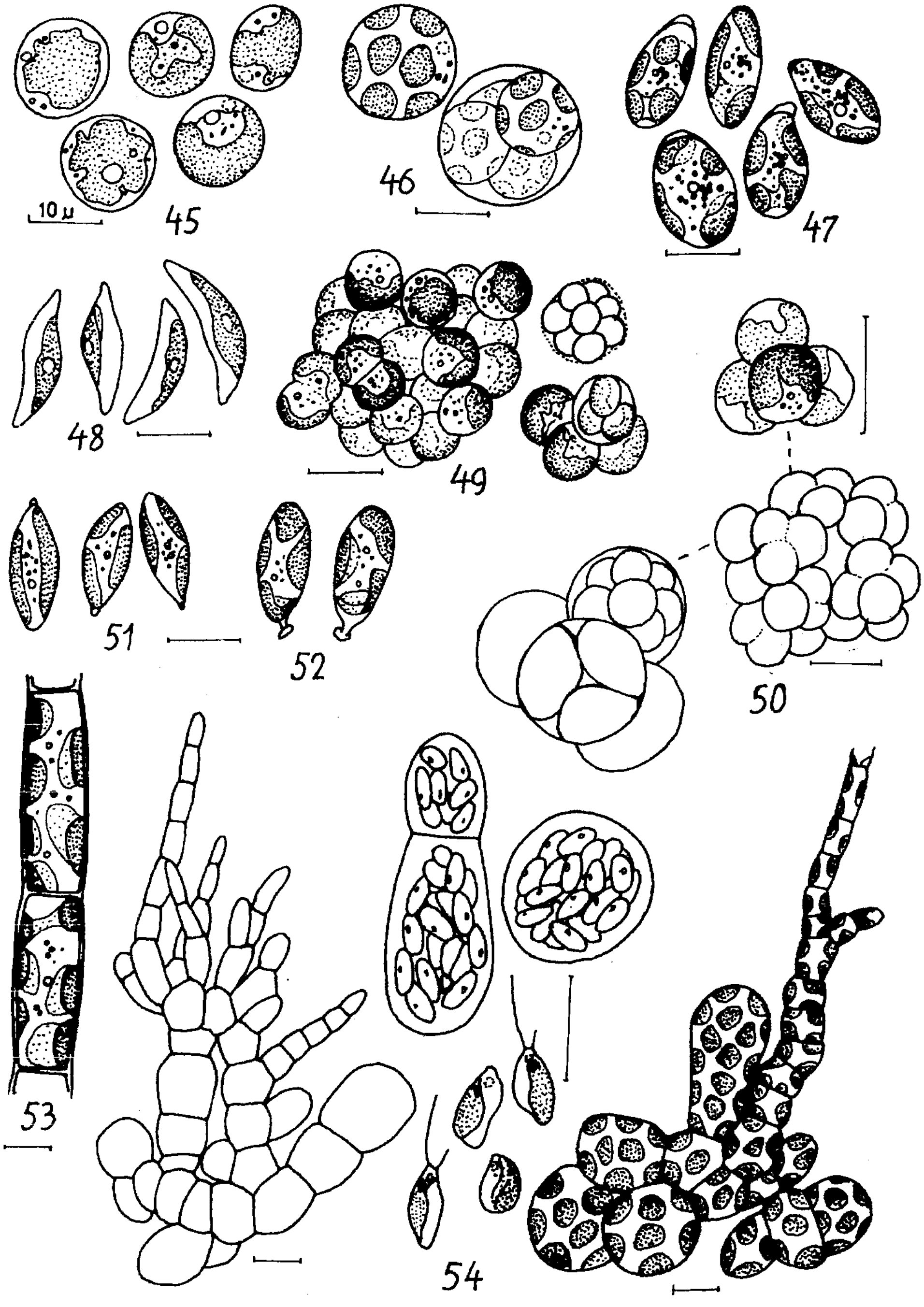

Fig. 7: 45 — *Pleurochloris commutata;* 46 — *P. polychloris;* 47 — *Monodus fusiformis;* 48 — *Chlorocloster pyreniger* var. *minor;* 49 — *Botryochloris minima;* 50 — *Ilsteria lobata;* 51 — *Chlorocloster terrestris;* 52 — *Characiopsis borziana;* 53 — *Tribonema vulgare;* 54 — *Heterococcus chodatii*

cup-shaped, notched at the edge, without pyrenoid. In the protoplasm small shiny fat drops were visible. The forming of two autospores was observed in which, however, pulsating vacuoles were not noted. No zoosporangia were observed. In the mud from lake No. 2 (JB-16/1).

The species is known from western and central Europe, including Poland, where it occurs among other algae on damp soil and in ditches.

Pleurochloris polychloris Pascher 1939 (Fig. 7: 46). Cells spherical, 10 – 13.5 μm in diameter, surrounded with a fairly thick membrane. Chromatophores yellowish-green, usually 5 – 6, plate-shaped, without pyrenoids. In the protoplasm fat drops were visible. In larger cells 2 – 4 autospores are formed, each having two pulsating vacuoles which in older cells, however, disapper. In culture large cells occasionally occurred, they were up to 25 μm in diameter, surrounded by a thick membrane, and containing numerous (ca. 64) oval cells, probably zoospores, whose release, however, was not observed. From the rocky ridge between lakes Nos 1 and 3 (3/21).

In Europe, including Poland, the species occurs among damp mosses on rocks.

Monodus fusiformis Starmach n.sp. *(Fig. 7: 47, Pl. 4, fig. 5). Cellulis late fusiformibus, rarius ovoideis, apice leviter extractis et subcrassis, rectis vel interdum leviter incurvatis, extremo rotundatis, 8 – 13 μm longis, 5 – 6 μm crassis. Chromatophoris 3 – 5, tabulatis, sine pirenoidibus, flavo-viridis. Granula et gutta oleosa in plasmate sparsa. Multiplicato autosporis binis.*

Habitus: in lacuum Nr. 2 (JB-16/1). Iconotypus: Figura nostra 7: 47, Pl. 4, fig. 5.

Cells widely spindle-shaped, occasionally ovoid, on the fore end with an elongated and thickened membrane, usually straight but sometimes at the fore end slightly bent, at the rear end narrowed and rounded, occasionally not narrowed. 3 – 5 chromatophores yellowish-green, plate-shaped or short ribbon-like, without pyrenoids. In the protoplasm small, spherical or rod-shaped grains and fat drops are visible. Reproduction takes place with the aid of two autospores originating in the cells by slightly diagonal division. Cells 8 – 13 μm long, 5 – 8 μm wide. On the agar it forms yellowish-green, slightly convex coatings. It developed from mud collected in lake No 2 (JB-16/1) in the vicinity of the Soviet Molodezhnaya Antarctic Station.

Iconotypus: Fig. 7: 47, Pl. 4, fig. 5.

In shape the species is similar to *Monodus unipapillatus* Gerneck, which was cultured from soil collected in the Alps at an altitude of 3460 m. It differs from it in its dimensions, especially the width of the cells and larger number of chromatophores (*M. unipapillatus* has only one chromatophore).

Chlorocloster pyreniger Pascher var. **minor** Starmach n. var. *(Fig. 7: 48). Cellulis fusiformibus, elongatis, rectis vel curvatis, non-numquam simoidalis, 6.3 – 12 μm longis, 2 – 3 μm latis. Chromatophorum unum, parietalum, con pirenoidum.*

Habitus: in lacuum No 9 (JB-14/1), Antarctica. Iconotypus: Figura nostra 7: 48.

Cells elongated, spindle-shaped, straight or bent, sometimes S-shape twisted, 6.4 – 12 μm long, 2 – 3 μm wide. Chromatophore single, parietal, trough-shaped, with a pyrenoid (without starch). It differs from the nominal variety in its smaller size, but the shape of the cells and the arrangement of the chromatophores with the pyrenoids is the same.

It occurred in the mud collected from lake No 9 (JB-14/1). *Ch. pyreniger* var. *pyreniger* occurs in Europe at the shores of ponds in Czech Republic.

Chlorocloster terrestris Pascher 1925 (Fig. 7: 51). Cells short spindle-shaped, 12.5 – 15 μm long (in Pascher's diagnosis 12 – 25 μm long), 4.4 – 5.0 μm wide, on one or on both ends slightly sharpened, on the fore end as if with a small short beak. Chromatophores 2 – 3, trough-shaped, at the edges slihtly uneven. In the protoplasm there occur small, shiny grains and fat drops, usually red. In the mud of lake No 6 (JB-10/2).

It occurs in Europe on wet meadow soils and in drying up roadside ditches.

Botryochloris minima Pascher (Fig. 7: 49). Cells spherical, 4 – 6 – 8 μm in diameter (exceptionally up to 12 μm in diameter), concentrating in irregular aggregates, not connected by means of mucilage, easily distintegrating under cover glass pressure. Larger cells divide into 4 – 8 – 16 autospores which are released after the maternal cell wall becomes mucilaginous. Chromatophore single, bowl-shaped, with uneven edges. In larger cells, before division, sometimes two chromatophores occur. In the protoplasm small shiny grains occur, fat drops, and sometimes larger yellowish spheres. No zoospores were observed. In the mud of lake No 12 (JB-18/2) and at the shore of Lake Glubokoe (JB-19/2).

Ilsteria lobata Pascher 1939 (Fig. 7: 50). Colonies tetrahedral, four-cellular, occur singly or in larger aggregates not surrounded with mucilage. Cells 5.3 – 9 – 11 μm in diameter in a rather thin, sometimes reddish wall. In the young cells a bowl-shaped chromatophore, at the edges unevenly notched;' in the older cells (before they divide) two chromatophores may be found, without pyrenoids. Reserve material in the form of mainly red fat drops. Reproduction by means of autospores originating in four or more rarely in eights. Adelie Island (Myall), in the sample No 15 collected on November 3 rd, 1969.

This species, characterized by the tetrahedral disposition of its cells, was first described from a peatbog in Czech Republic, and, as far as I know, not found anywhere else. From the type described by Pascher it differs slightly in the dimensions of the cells (Pascher's cells were 8 – 11 – (14) μm in diameter). Smaller sizes in our material are connected with the fact that the cells were probably not entirely mature.

Characiopsis borziana Lemmermann 1914 forma (Fig. 7: 52). Cells elliptic or elliptic-ovoid, set on a short holdfast with a small shield, 16 – 25 μm long, 6.9 μm wide. Cell wall thin. Chromatophores 3 – 4, plate-shaped, yellowish-green, without pyrenoids. Germination not observed. It occurred in the mud of lake No 6 (JB-11/2).

The specimens are similar to those of Lemmermann and fit the dimensions given in the diagnosis for *Ch. borziana*, but they have a much shorter holdfast and the habit is different.

Tribonema vulgare Pascher 1925 (Fig. 7: 53). Filaments are typical, 6.25 – 7.5 µm wide; cells 13 – 15 µm long, with 4 – 6 chromatophores.

From the samples of soil collected near lake No 6 (4/36).

Heterococcus chodatii Vischer 1936 (Fig. 7: 54; Pl. 4, fig. 6). Irregular groups of cells of various size grew on the agar, forming at the sides short, branched filaments. Cells 8 – 23 µm in diameter; at the apex cells 3.5 – 4 µm in diameter, up to 12.5 µm long, with 2 – 4 plate-shaped chromatophores. In the large, oval cells chromatophores were plate-shaped or short ribbon-like, varying in number. In large, oval, ovoid or pear-shaped sporangia zoospores originate, 8 – 64 in number. Zoospores have 2 equal flagella, one parietal chromatophore with a stigma, 1 – 2 apical vacuoles, and are up to 8 µm long and 2 – 2.6 µm wide. Some zoospores had an amoeboid shape and lacked flagella. The species developed from the soil sample collected between lakes Nos 1 and 3 (3/21).

The species was originally grown from soil collected in the Swiss Alps (Vischer 1936) and then in England (Fritsch and John 1942).

Chlorophyceae

Chlamydomonas debaryana Goroschankin 1890 (Fig. 8: 55). Cells elliptic or elliptic-ovoid, 11 – 14 µm long, 6 – 8.7 µm wide, rounded at the back, at the front slightly narrowed, and with a hemispherical papilla. Filaments more or less as long as the cell. Cell membrane closely adherent to the protoplast. Chromatophore bowl-like with a rounded pyrenoid in the rear, thickened part; stigma elliptic, situated at the front of the protoplast; nucleus central; 2 pulsating vacuoles at the base of the flagella. Cell divides into 4 – 16 ovoid gametes. At the shore of Lake Glubokoe (JB-20).

A cosmopolitan species occurring in various water bodies and in most places.

Palmellopsis gelatinosa Koršikov 1953 (Fig. 8: 56; Pl. 4, fig. 7). Cells spherical, 7.5 – 11.5 – (12.3) µm in diameter, with a cup-shaped chromatophore havin a thickened base with a pyrenoid with a starch envelope. Cells are concentrated in irregular groups; they reproduce mainly by 2 – 4 endospores originating from the mother cell, or by 4 – 8 – (16) zoospores, which are more or less ovoid, have one parietal chromatophore with a pyrenoid, a stigma, and two pulsating vacuoles. In the mud of lake No 6 (JB-11/2).

The species was described from the neighbourhood of Kharkov, where it used to appear during some years in early spring on the surface of a shallow pool.

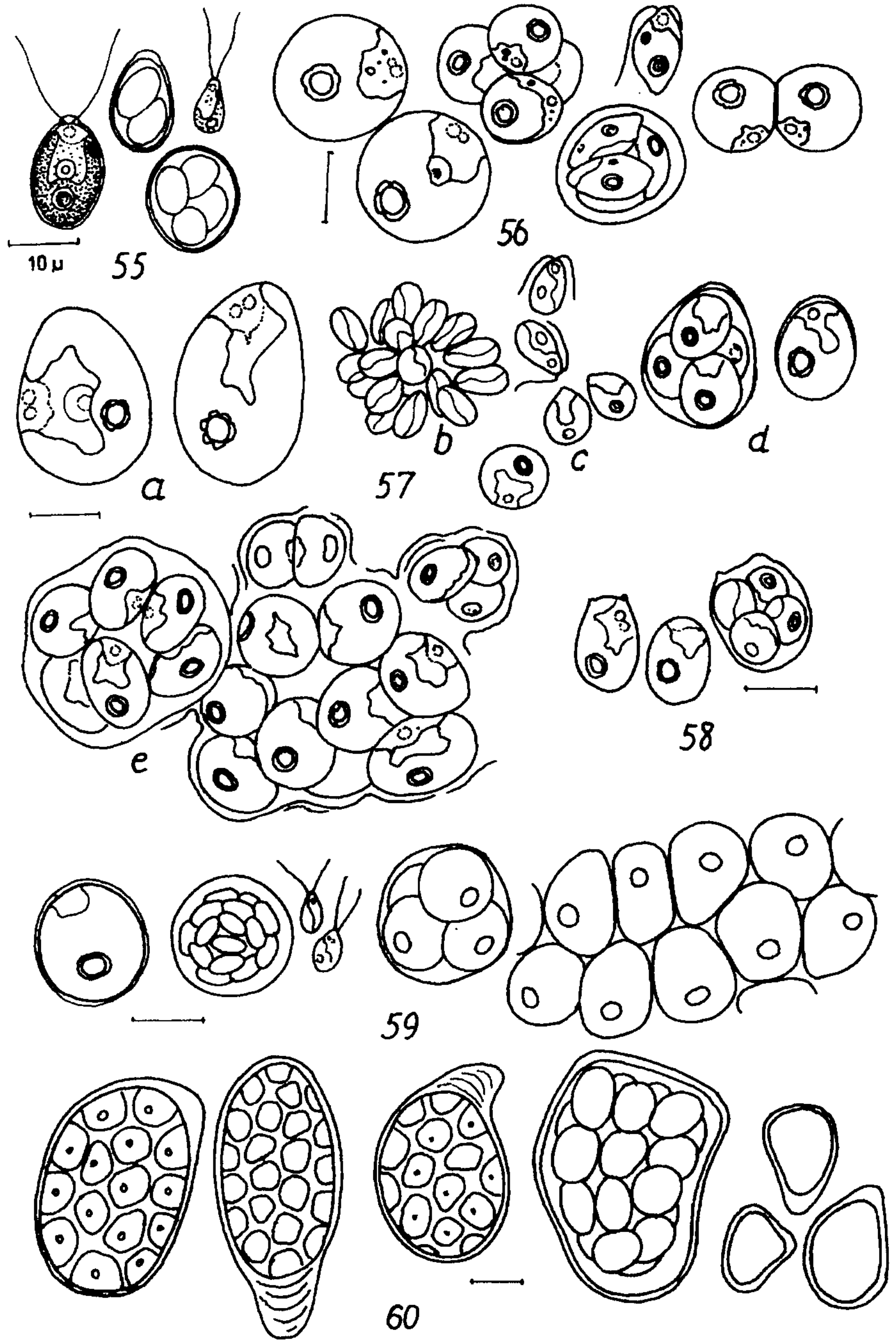

Fig. 8: 55 — *Chlamydomonas debaryana;* 56 — *Palmellopsis gelatinosa;* 57 — *Hypnomonas ellipsoidea:* a — vegetative cells, b — release of zoospores, c — free and germinating zoospores, d — autospores, e — colonies of autospores; 58 — *Hypnomonas tuberculata;* 59 — *Chlorococcum* sp. 60 — *Excentrosphaera viridis*

Hypnomonas ellipsoidea Koršikov 1953 (Fig. 8: 57 a – e, Pl; 3, figs 3, 4). Cells elliptic or ovoid, 16 – 17.5 μm long, 10 – 11 μm wide, occurring in groups of 4 – 8 – 32, enveloped by dissolving membranes of the mother cells. Groups of cells often gather in large aggregates of palmelloid type (Pl. 3, figs 3 and 4) forming on the agar green spots with an uneven surface. As a rule the cells have a cup-shaped chromatophore; in mature cells the thicker part with a pyrenoid is situated in the wider part of the cell and its openig, with irregular edges, at the opposite side. Young cells, however, often have the chromatophore placed in the widest, rear side of the cell. Therefore, the situation of the chromatophores in relation to the longitudinal axis of the cell changes with the growth of the cell and its age. Not observed, however, even in the young autospores, was oscillation of the chromatophores, nor movement of the protoplasm. Together with the translocation of the chromatophore, also pulsating vacuoles are translocated, placed, as a rule, under the cell membrane opposite the opening of the cup-shaped chromatophore. Pulsating vacuoles, 1 – 2 in number, are visible in the young cells only. In rare cases, besides the two frontal vacuoles, other vacuoles situated in various places of the cell were also seen. Reproduction takes place with the aid of autospores and zoospores. The autospores are released after breaking or partly dissolving of the mother cell membrane. When the autospores reach more or less normal size (16 – 17 × 10 – 11 μm), small fat drops appear in them. Besides the autospores, zoospores similar in size originate, (5.5 – 7.5 × 10 – 13.5 μm). They have two flagella as long as the cell length, a cup-shaped chromatophore with an elliptic or angular stigma, and two vacuoles at the base of the flagella. The process of formation of the zoospores is similar to that of autospores. In both cases the protoplast divides into 4 – 8 – 32 parts from which more or less spherical cells are formed. Zoospores are quickly released from the maternal cell membranes; they are motile. Instead, the autospores, are immobile, they remain comparatively long within the mother cell membranes, and there they grow; they have pulsating vacuoles vanishing with time; however, no stigma was observed. Zoospores and autospores can originate from every cell of the colony. Interesting is the resemblence of immobile autospores (aplanospores) to the zoospores. These immobile cells without flagella are called by Koršikov hemizoospores.

The specimens collected at the shore of lake No 6 (JB-11/3) were slightly smaller than the Koršikov ones.

The species was described from the Gorkov region in the former Soviet Union, then Geitler (1932) found it in raw cultures of algae coming from the Lake Lunz littoral in Austria.

Hypnomonas tuberculata Koršikov 1953 (Fig. 8: 58). Cells elliptically elongated or elliptic; forming small groups. Young cells truncated at the apex, mostly with two nodes on the cell membrane, older ones, however, mostly regularly rounded. Chromatophores more or less cup-shaped with a large lateral pyrenoid. Zoospores not observed. Young cells are 8.5 μm long, 3.4 μm wide, older ones up to 12 μm long and 5 – 6 mm wide. In the mud of the lake No 6 (JB-11/2).

Chlorococcum sp. (*Ch. humicolum* (Naeg.) Rabenhorst 1869 ?). (Fig. 8: 59). Cells spherical or nearly so, up to 20 μm in diameter. Cell membrane at first thin, thickening with time. Chromatophore parietal, cup-shaped, with an excentrically placed pyrenoid. In the opening of the chromatophore, in some of the cells, two pulsating vacuoles are visible. Nucleus situated in the centre. Starch gathers round the pyrenoids; oil drops absent. Zoospores are formed sucessively in the mature cells, 16 in number. Zoospores have a cell membrane, and are 4.8 – 5.6 μm long and 3 μm wide, have two flagella, one parietal, lateral chromatophore with a pyrenoid, and one vacuole at the front. Aplanospores are formed in twos-eights; after release they concentrate in palmelloid groups, and the tightly compressed cells become angular. In the dimensions of the cells and the zoospores, the shape of the chromatophore, and the occurrence of only one nucleus, the specimens are close to *Ch. minutum* Starr 1955.

In the mud of lake No 2 (JB-16/1) and of lake No 11 (JB-17/2).

Excentrosphaera viridis Moore 1901 (Fig. 8: 60). Cells oval, pear-shaped, elliptic or irregular, with thick cell membrane which, at one side, is more strongly thickened, often in the forms of a layered process. Cells 20 – 50 – 80 μm long, 14 – 30 μm wide. Cells forming the aplanospores are strongly dilated. Chromatophores numerous, parietal, tightly concentrated — so that they are angular in form — each with one pyrenoid. Nucleus single, oval, more or less in the centre of somewhat shifted to the fore-part of the cell (as the fore-part of the cell is considered the process in the cell membrane). Reproduciton by mean of autospores (aplanospores) originating from successive divisions mostly in large number and released after breaking of the mother cell membrane. Autospores are irregular and have smaller chromatophores than the nature cells. It occurred in the mud sample taken from lake No 9 (JB-14/2).

The species described by Moore from North America is also known in Europe but rarely reported. Our specimens are in accordance with the drawings given by Smith (1950) rather than with the original ones by Moore.

Borodinella polytetras Miller 1927 (Fig. 9: 61). Cells spherical or broadly elliptic, 11 – 12 – (16) μm in diameter. Cell membrane thin, without mucilaginous envelope. Chromatophore central, lobulate, with indistinct radial construction, with a large pyrenoid in the centre. Nucleus at the side of the cell. Cells closely concentrated in groups, thus becoming angular. During reproduction they divide into 4 – 8 – 16 parts, which become rounded and remain for some time within the stretched mother cell membrane, which, however, in the end disappears. By successive divisions groups of cells are formed that are not surrounded by the common mucilage; they easily distintegrate under pressure. Zoospores were not observed.

It occurred in the mud of lake No 12 (JB-18/2).

The species described by Miller (1927 cit. after Koršikov 1953) from soil cultures was later given by Fritsch and John (1942) from soil in England. Dimensions of the cell described by Miller are similar to ours but the groups of

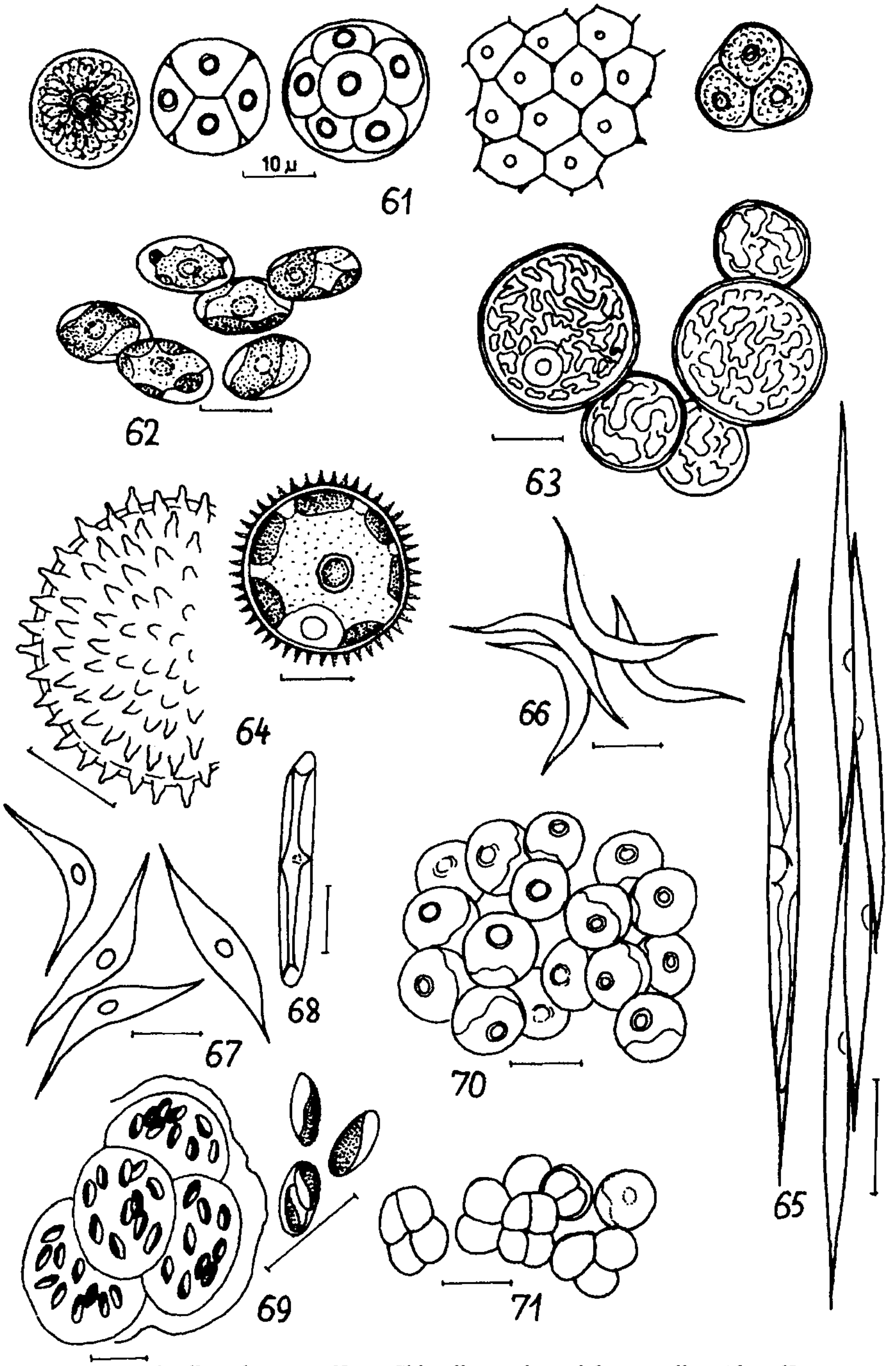

Fig. 9: 61 — *Borodinella polytetras;* 62 — *Chlorella saccharophila* var. *ellipsoidea;* 63 — *Dictyochloropsis splendida;* 64 — *Trochiscia* cf. *aciculifera;* 65 — *Monoraphidium griffithii;* 66 — *Ankistrodesmus gracilis;* 67 — *Monoraphidium pusillum;* 68 — *M. braunii,* 69 — *Coccomyxa lacustris;* 70 — *Chloroplana terricola;* 71 — *Desmococcus vulgaris*

cells are not so much compressed and angular. Characteristic are divisions in tetrads and octads. The specimens appear to be identical with the ones described by Miller and Fritsch.

Chlorella saccharophila (Krueger) Migula var. *ellipsoidea* (Gerneck) Novákova 1969 (Fig. 9: 62; Pl. 4, fig. 8). Cells longitudinally elliptic, 8 – 13 µm long, 4 – 7.5 µm wide. Chromatophore plate-shaped with uneven edges; pyrenoid large, oval, surrounded by starch grains. Small fat drops are also visible. In the mud of Lake Glubokoe (JB-19/2).

The species is known from soil (Germany, Czech Republic), pools and lakes (Switzerland).

Dictyochloropsis splendida Geitler 1966 (Fig. 9: 63). Cells spherical or nearly so form loose groups on the surface of the agar. Cell diameter is 27 – 34 – 71 – 81 µm, most frequently 34 – 54 µm. The chromatophore without pyrenoid, at the periphery of the mature cells has intricately segmented borders and lobes; in the young cells it is lobed, more or less central. The reserve material consists in starch grains connected with the chromatophore, and small fat drops. Nucleus single, large, with a nucleoid. Autospores not observed. It occurred in the mud of lakes Nos 5 and 6 (JB-9 and JB-11/2).

The genus and the species were described by Geitler (1966) as an athmophytic green alga. In general, it is similar to *Dictyochloris* Vischer 1945; the differences between the two are set down precisely by Geitler (l.c.). The specimens cultured from the mud of lakes Nos 5 and 6 are very similar to the illustration given by that author, the only difference consists in the occurrence in cultures of large cells reaching 81 µm in diameter. According to Geitler, the cell diameter was 30 – 40 µm.

Trochiscia cf. *aciculifera* (Lagerh.) Hansgirg 1866 (Fig. 9: 64). Cells spherical, surrounded by a thick membrane covered with conical mucilaginous processes 2.5 – 4 µm long; the cells have no additional mucilaginous envelope. Chromatophore irregularly lobed with a pyrenoid in its base. Nucleus central. Reproduction by means of autospores or hemiautospores; in each of these young cells one pulsating vacuole occurs. In already released autospores the vacuoles are not visible. No stigma was noted. The autospores do not concentrate in palmelloid groups. Cells beginning to divide are 28 – 29 – 30 µm in diameter; the diameter of most of the cells is 11 – 19 – 23 µm. At the shore of lake No 6 (JB-11/3).

The specimens essentially agree with the description of *T. aciculifera* (according to Koršikov 1953, p. 139), differing from it in not having the mucilaginous envelope round the cell so that the conical mucilaginous processes are free. Vegetative cells have a single nucleus which, before forming autospores, divides twice and together with this also the protoplasm divides into four parts. The released autospores become surrounded with a thickened membrane, on which those mucilaginous, conical emergences originate. The basic structure of the cell is, then, similar to that in *T. aciculifera*, although there are some differences.

Ankistrodesmus gracilis (Reinsch) Koršikov 1953 (Fig. 9: 66) (=*Selenastrum gracile* Reinsch). Cells spindle-shaped, at the ends acute, bent, 16–18 µm long, 2.2 µm wide. From the soil samples collected on the slope between lakes Nos 1 and 3 (3/23).

Monoraphidium griffithii (Berkel.) Komárkova-Legnerova 1969 (Fig. 9: 65). (=*Closterium griffithii* Berkeley; *Ankistrodesmus acicularis* (A. Braun) Korš.; *Raphidium aciculare* A. Braun). Cells straight, up to 88 µm long, 4.4 µm wide. Chromatophore parietal with an incision in the middle. Autospores 4–8. In the mud of lake No 5 (JB-9).

Monoraphidium pusillum (Printz) Komárkova-Legnerova 1969 (Fig. 9: 67). Cells broadly spindle-shaped, 25–30 µm long, 5–6.7 µm wide, nearly straight or slightly bent. Cells somewhat larger than is given in the diagnosis by Legnerova. In the sand hollow near lake No 6 (JB-12).

Monoraphidium braunii (Naegeli) Komárkova-Legnerova 1969 (Fig. 9: 68). (=*Raphidium braunii* Naegeli). Cells cylindrical, acute at the ends, 11–15–18 µm long, 2–2.5 µm wide. In the sample collected at the slope between lakes No 1 and 3 (3/23).

Coccomyxa lacustris (Chod.) Pascher in Jaag 1933 (Fig. 9: 69). Mucilaginous thalli form on the agar irregular concentrations composed of separate colonies having 8–16 cells. The mucilaginous envelopes sometimes dissolve and, at least partly, disappear. Cells elongated elliptic, 5–6 µm long, (1.5)–2–2.5 µm wide. Chromatophores parietal, without pyrenoid, occupying at most half of the cell. The autospores in twos–(fours) released after the mother cell membrane has become slimy. The specimens were cultured from the mud samples collected from lakes Nos 5 and 6 (JB-9 and JB-10/2).

In dimensions they correspond best with the features of *C. lacustris* described first by Chodat as *Dactylococcus lacustris*, emended by Pascher (1915) as *Coccomyxa lacustris*, and after a profound discussion restored by Jaag (1933) to *Coccomyxa lacustris*. The specimens from Antarctica, of course, may not be identical with those from the plankton of the Swiss lakes. The similarity is great, however, and I do not see any reason to create a new form.

Chlorhormidium flaccidum (Kuetz.) Fott 1960 (=*Hormidium flaccidum* A. Braun in Printz 1964). Filaments not branched, without envelopes, 6.0–6.7–7.8 µm wide. Cells 6–10 mm long. Chromatophore parietal with a large pyrenoid occupies ca. half of the cell circumference. In the fluid culture forms fluffy filaments at the bottom of the Petri dishes. Found at the shore of Lake Glubokoe (JB-20).

Chloroplana terricola Hollerbach 1936 (Fig. 9: 70). Cells spherical or somewhat ovoid, 9.3–10–11.2 µm in diameter. Chromatophore cup-like with a circular pyrenoid, without stigma. Forms irregular concentrations of cells. At the shores of Lake Glubokoe (JB-20) and lake No 1 (2/13).

The species was cultured of soil from the vicinity of Leningrad (St. Petersburg).

Desmococcus vulgaris (Naegeli) Brand 1925 (Fig. 9: 71). Cells form small bunches and irregular concentrations. Cells (5.4)–7.2–10.8 μm in diameter. Chromatophore with a small pyrenoid. On the ridge between lakes Nos 1 and 3 (3/17 and 3/21).

Closterium moniliferum (Bory) Eherenberg ex Ralfs 1848. Cells 214 μm long, 36.3 μm wide. On the ridge between lakes Nos 1 and 3 (3/17 and 3/21).

Cosmarium laeve Rabenhorst 1868 var. *laeve*. Cells 28–36 μm long, 22–24 μm wide, at the isthmus 6–8 μm wide. In the mud of lake No 9 (JB-14/22).

Komárek and Ruzička (1966) recorded the species from Antarctica, from a lake near the Soviet Novolazarevskaya Station as var. *laeve* fo. *maius* Borge with the dimensions: length 32–40–(43) μm, width 23–30–(31) μm, at the isthmus 8–12 μm, and they included drawings of some variability between specimens. In our material only 3 specimens were found, slightly smaller, concerning rather the nomenclatural variety.

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Streszczenie

Autor opracował glony słodkowodne wyhodowane z wysuszonych prób osadu dennego kilku jezior oazy antarktycznej (Thala Hills, Enderby Land) w okolicach rosyjskiej stacji Mołodiożnaja. Próby te zebrane zostały przez K.W. Opalińskiego i S. Rakusę-Suszczewskiego w czasie ich dwu pobytów na Antarktydzie w latach 1968–1972. Próby zostały zwilżone i w sterylnych warunkach, na pożywkach Knopa (płyn i agar), wyhodowano żywe glony. W kulturach stwierdzono 85 taksonów, z których 54 należało do Cyanophyceae, 1 — do Chrysophyceae, 10 — do Xanthophyceae i 20 — do Chlorophyceae. Większość tych taksonów (71) zostało zilustrowanych na zbiorczych rysunkach (Rys. 2–9) i na fotografiach (Pl. 3–5).

Editor's note:

We are publishing this paper being fully aware that some new taxa described here, after two decades that have passed, can appear to be junior synonyms and that this paper is lacking the discussion with actual literature. However, it was impossible to find a specialist who would be able and ready to undertake an extraordinary difficult task of proper preparation of this paper. Therefore we follow the opinion of Prof. J. Siemińska to publish the paper of Prof. K. Starmach in its nearly original state, taking into account the high scientific value of the text.

Krzysztof Jażdżewski

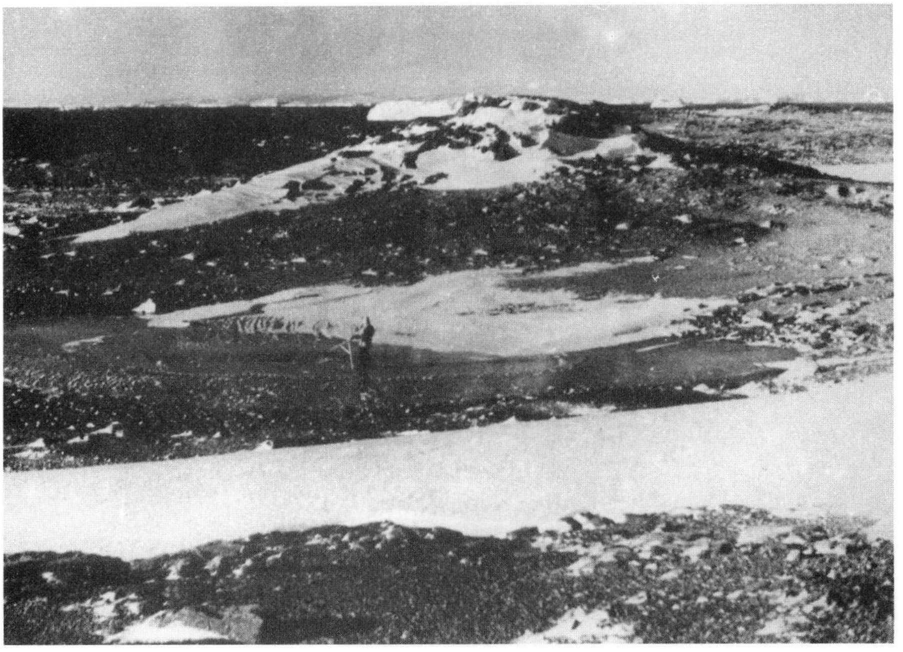
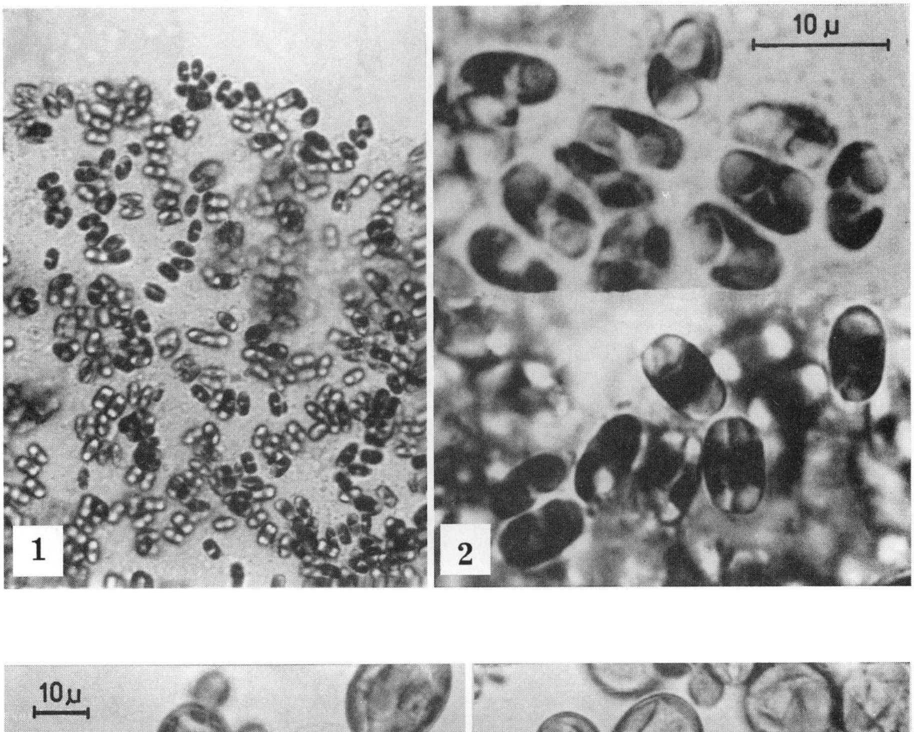


Fig. 2. Thala Hills oasis, lake No 6 frozen to the bottom (March 25, 1969). Photo by K.W. Opaliński

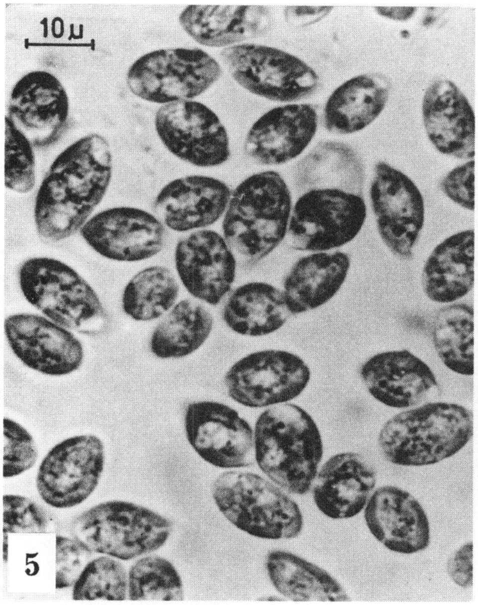
Fig. 1. Thala Hills oasis, lake No 2 covered with ice (March 25, 1969). Photo by K.W. Opaliński

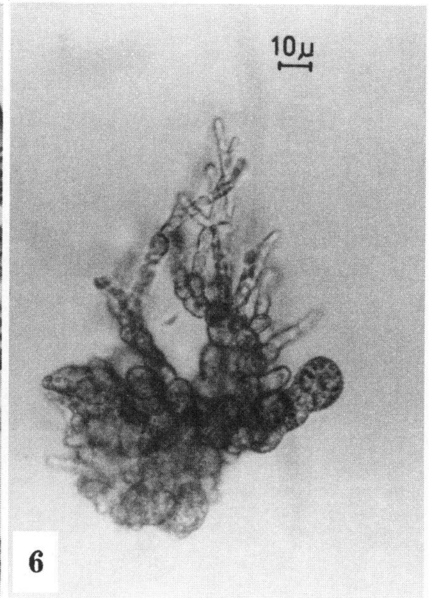
Fig. 1. Thala Hills oasis, lake No 11 free of ice (January 1969). Photo by V. Klokov

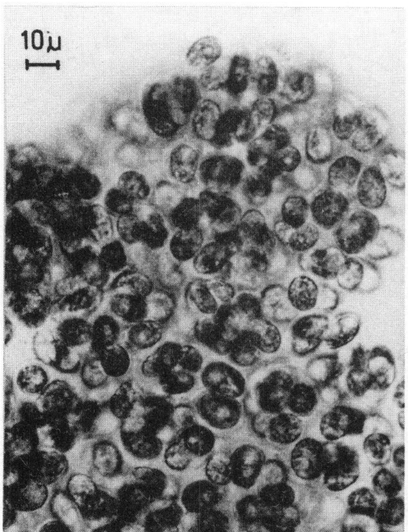
Fig. 2. Thala Hills oasis, lake No 11 covered with ice (March 25, 1969). Photo by K.W. Opaliński



Figs. 1, 2 — *Chrysosaccus membranigerum:* 1 — edge of the colony under low magnification, 2 — cells under stronger magnification; Figs. 3, 4 — *Hypnomonas ellipsoidea*







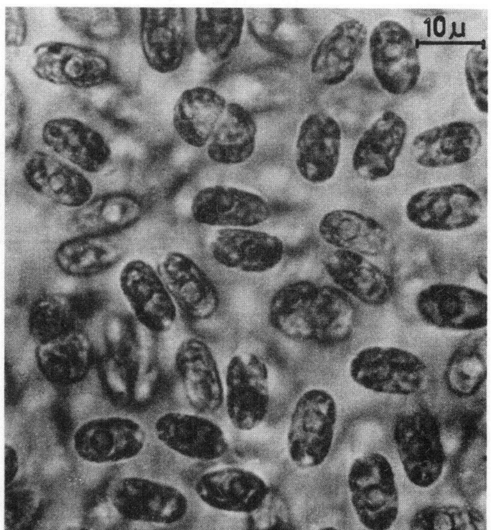


Fig. 5 — *Monodus fusiformis;* Fig. 6 — *Heterococcus chodatii*, typical thallus with sporangia; Fig. 7 — *Palmellopsis gelatinosa*, fragment of a colony; Fig. 8 — *Chlorella sacarophila* var. *ellipsoidea.*

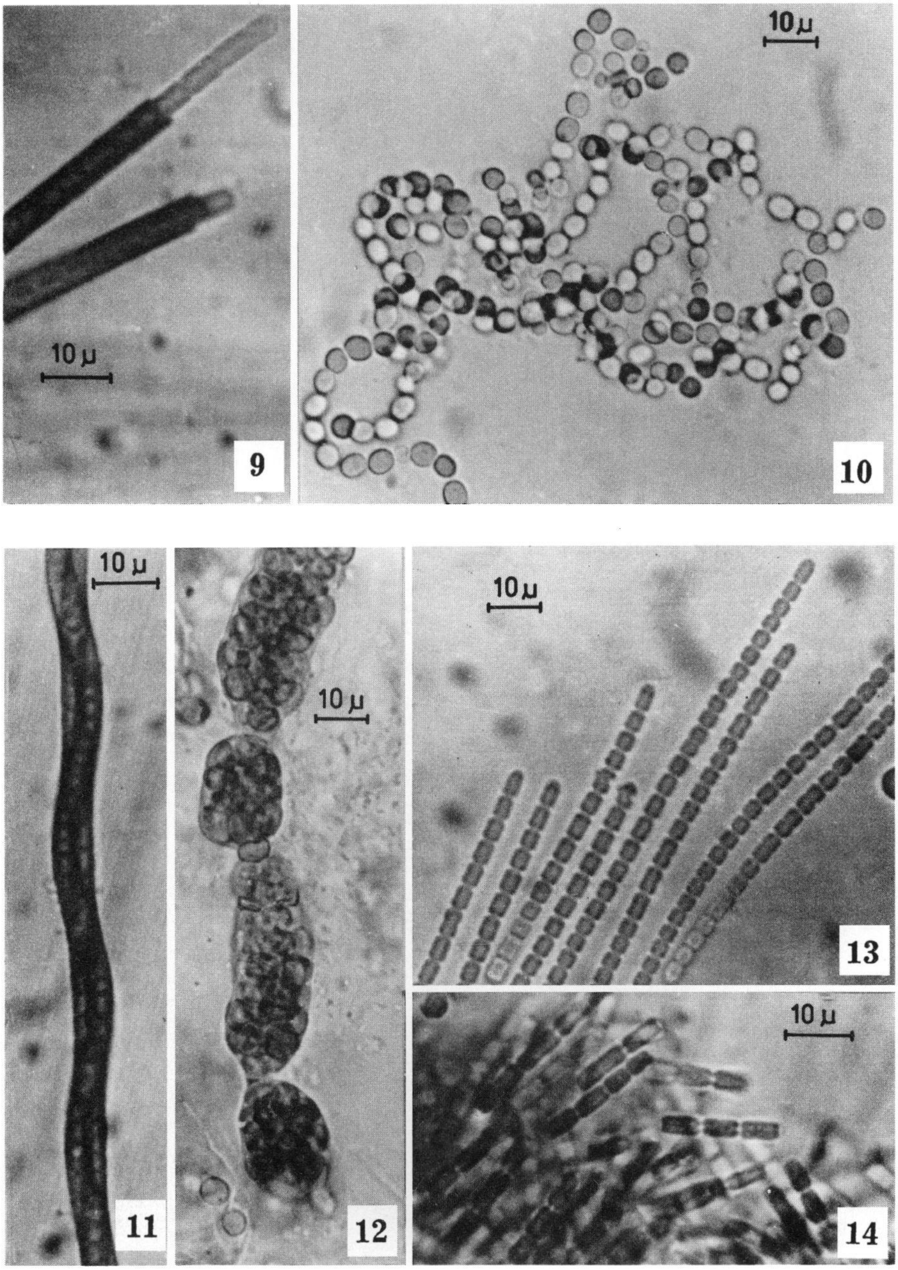


Fig. 9 — *Lyngbya fusco-vaginata*, apices of the filament; Fig. 10 — *Nostoc linkia*, fragment of a colony; Fig. 11 — *Schizothrix lenormandiana* fo. *maior*, fragment of a filament with two trichomes; Fig. 12 — *Nostoc punctiforme*; Fig. 13 — *Phormidium fragile;* Fig. 14 — *Pseudonabaena papillaterminata*, fragment of a thallus