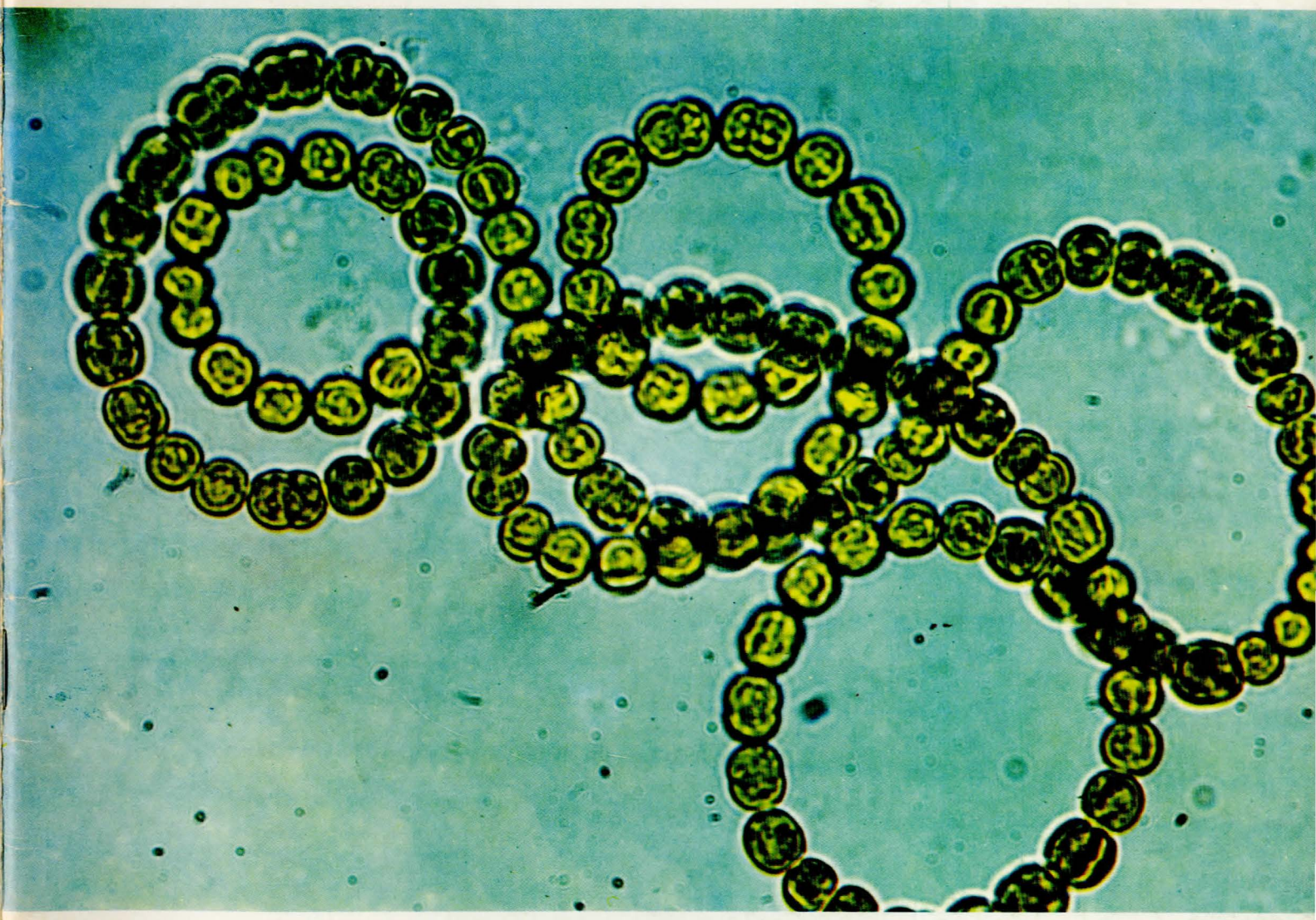
TR 106

REPUBLIC OF SOUTH AFRICA

DEPARTMENT OF WATER AFFAIRS,
FORESTRY AND ENVIRONMENTAL CONSERVATION

Common algae found in South African impoundments

S. N. Shillinglaw



DEPARTMENT OF WATER AFFAIRS
FORESTRY AND ENVIRONMENTAL CONSERVATION
Hydrological Research Institute

Technical Report TR 106

COMMON ALGAE FOUND IN SOUTH AFRICAN IMPOUNDMENTS

by

S.N. Shillinglaw*

July 1980

Directorate of Water Affairs
Private Bag X313
PRETORIA
0001

*Present address:

Institute for Environmental Sciences
University of the Orange Free State
P.O. Box 339
BLOEMFONTEIN
9300

ISBN 0 621 05843 2

CONTENTS

INTRODUCTION

Algae are the primary producers in all water bodies - forming the basis of the food chain. Therefore it is obvious that knowledge should be gained on the algal species occurring in a water body. A lot of knowledge has been gained on the algal species occurring in lakes and rivers in the U.K., Europe and U.S.A. The Republic of South Africa has very few natural lakes but has many man-made impoudments. Very little knowledge is available on the algal species occurring in these impoundments.

Most South African limnological endeavours have been limited to chemical and physical surveys of rivers and impoundments. Algal identification has been grossly neglected in limnological studies. The main reason for this is that few ecological scientistis are either prepared to go through the laborious taks of identifying and counting algae or are well versed in algal taxonomy. The only group of algae which has received attention is the diatoms but this has mainly been confined to river environments. At present there is no published work on algal species occurring in any South African impoundment.

Due to eutrophication, algal blooms often occur in South African impoundments causing water quality problems and Department of Water Affairs officials have to make recommendations as to the prevention or eradication of these algal blooms. Most officials have had no formal algal taxonomic training and therefore find it difficult to identify the bloom forming algae.

This report has been written to try and help Department of Water Affairs officials and others to identify the commonest algae found in South African impoundments. This report is not a scientific handbook on algal taxonomy but merely a guide for people with no or little taxonomic training.

The photographs in this report are of algal species which were found in samples collected from impoundments throughout the country. There are many species that were not photographed but these were never in large enough numbers to be of any importance in the algal populations.

All the algae included in this report are of microscopic dimensions and therefore require the use of a microscope for identification. All other equipment for sampling and identification are minimal and are mentioned under the materials and methods of this report. Viewed under a low quality compound microscope the algae will not be as well defined as in the photographs but they should be sufficiently clear for identification.

Diatoms except for *Melosira*, have been left out of this report as their identification required specialized techniques and a good knowledge of diatom taxonomy. Also diatoms with the exception of *Melosira*, seldom appear to be dominant in the phytoplankton of South African impoundments.

MATERIALS AND METHODS

If the algal concentration in the water is high, colouring the water, then a fresh sample can be collected for species identification. The sample can be collected either with a Van Dorn sample bottle at different depths or with a hose-pipe sampler. Rembember that the algae must be identified soon after collection in fresh samples as the algae die and the cells rupture in a short time making identification impossible.

When the water of an impoundment is not coloured by algal growth a large sample must be taken and concentrated to make algal identification possible. These samples must have a preservative added to them so that the algal cells remain intact during the concentrating procedures. Sample collection is the

same as for fresh sampling.

Preserved sampling

Collect 100 ml of impoundment water and immediately add 2 ml of Lugols' solution (Vollenweider, 1969). In the laboratory place the sample bottles in a position where they will not be disturbed to facilitate sedimentation of the algal cells. The length of time allowed for the algal cells to sediment out is calculated on the basis of one day for every centimetre of height of sample in the bottle. After sedimentation the excess sample water is decanted in such a way that the sedimented cells are not disturbed. The sedimented cells are identified with the aid of a light microscope.

Use of the compound light microscope

Firstly a wet mount is made by taking a drop of sedimented algal cells or fresh sample and placing this on a glass slide. A coverslip is placed over the drop by placing one end on slide and resting the other end on a pencil placed between coverslip and slide. The pencil is withdrawn slowly allowing the coverslip to squeeze out all air bubbles in the drop of water. A lot of air bubbles on the slide makes identification impossible.

Once the slide is prepared it is placed over the hole in the specimen stage of the microscope. Use a low magnification objective lens at first to get the speciment into the field of view and for coarse focussing. Once the specimen is in the field of view and in focus, a higher magnification objective lens can be used. Remember to only use the fine focus adjustment with these objectives. If the coarse focus adjustment is used the lens may break the coverslip and possibly damage the lens.

Note that the photographs in this report were taken with a 35 mm camera fit-

ted to a Zeiss Axiomat compound microscope. All photographs are of material stained with Lugols' solution, hence the colour of the algal cells are not their natural colour.

DESCRIPTIONS OF ALGAL SPECIES

The first group of algae are three species which have been found to be most dominant in South African impoundments and which are responsible for water quality problems.

Dominant algal species

1. *Anabaena circinalis* Rabenhorst. (Figs. : 1, 2 & 3).

   Trichomes planktonic, flexuous and contorted; solitary or entangled to form floating clots which are easily visible to the unaided eye.

   Cells spherical or depressed-globose from contact between cells 8-12-(14) µm in diameter. Heterocysts spherical or compressed, 8-10 µm in diameter. Akinete remote from the heterocysts, rarely adjacent; cylindric, straight or curved; (14)-16-18 µm in diamter, 22-30-(32) µm long (Prescott, 1973).

   This species is one of most common and widely distributed algal species in South African impoundments, and is a conspicuous component of algal blooms during summer in many impoundments. *A. circinalis* can cause blooms which are detrimental to recreation in impoundments. This species is considered to a indicator of eutrophic conditions but it has been identified in impoundments which would not normally be considered to be eutrophic.

2. *Microcystis aeruginosa* Kuetz; *emend.* Elekin (Figs. 4, 5 & 6)

A free floating colony of numerous spherical cells closely and irregularly arranged within copious mucilage, forming ovate, globose, or irregularly shaped masses which are often lacerate or perforate; cell contents blue-green, highly granular and with conspicuous pseudovacuoles; cells 3-4,5 µm in diamter (Prescott, 1973).

This species is a frequent component of algal blooms, especially in impoundments with eutrophic characteristics, although it is also found in more oligotrophic waters. *M. aeruginosa* is especially abundant during late summer periods and appears in such dense growths in favourable habitats as to colour the water. This discolouration of water cuases severe recreation problems. Dense blooms of this alga can cause fish kills due to oxygen depletion in surface waters. *M. aeruginosa* is also known to produce a toxin (Toerien, Scott and Pitout, 1976) which can be poisonous to animals drinking infected water. This alga can cause bad tastes and odours in drinking water which are difficult to remove by conventional treatment methods.

3. *Melosira granulata* (Eht) Ralfs. (Fig. 7)

The cells of *Melosira* are cylindrical with the length greater than the breadth; cells are attached end to end in filaments; polar margins with denticulations. Girdles of the half-cells often have a shallow annular constriction a short distance from where two girdles overlap (Smith, 1950).

Common algal species

1. *Anabaena planctonica* Brunnthaler (Fig. 8)

Trichomes solitary, straight, free-floating, inclosed in a wide gelatinous sheath; cells barrel-shaped or spherical, 9-15 µm in diameter,

6,5 µm long, with pseudovacuoles; heterocysts spherical, 9-11 µm in diameter; akinete ellipsoid, 10-14 µm in diameter, 15-30 µm long, near or remote from the heterocysts (Prescott, 1973).

This species was identified in a few of the impoundment investigated and was co-dominant in some. This species was found on some occasions in the same sample as that of *A. circinalis*.

2. *Ceratium hirundinella* (O.F. Muell.) Dujarding (Fig. 9)

Cells broadly or narrowly fusiform in outline, depending upon the degree of divergence of the horns; very much flattened dorsi-ventrally; epitheca with sharply converging margins from just above the transverse furrow, then narrowed more gradually to form a long horn, transverse furrow, relatively narrow; body of the hypoteca broad and short below the transverse furrow, divided into a varying number of posterior horns, usually 3, sometimes only 1, the central or median horn the longest and formed by the antapical plates; plates coarsely reticulate, cells varying in size depending upon environmental conditions, 100-400 µm long (Prescott, 1973).

This species is very common and is sometimes dominant. Such blooms develop and disappear suddenly. This algal is often found in silty impoundments and was especially frequent in the Transvaal.

3. *Clamydonomas globoas* Snow (Fig. 10)

Cells broadly ovoud to globose, enclosed in a hyaline, gelatinous sheath; anterior papilla absent. Chloroplast a dense parietal cup with a basal pyrenoid; 1 contractile vacuole in the anterior end of cell; pigment-spot lens-shaped, supramedian in position and lateral.

Cells 5-7 µm in diameter, 10-19 µm long (Prescott, 1973)

This species is very common and numerous in South African impoundments but is seldom dominant. Other species of *Clamydononas* have been noted in South African impoundments.

4. *Chorella vulgaris* Beyerinck (Fig. 11)

Cells spherical, scattered among other algae or sometimes occurring in almost pure growths; chloroplast a parietal cup, sometimes without a pyrenoid; cells 5-8 µm in diameter (Prescott, 1973).

Occurs in many impoundments normally with other species of algae and is often co-dominant. Often occurs in impoundments with high concentrations of organic matter.

5. *Cosmarium* sp. Corda (Fig. 12)

Most species of this unicellular desmid genus have small compressed cells, with a length only slightly greater than the breadth, and a deep median constriction. The cell wall is smooth, or ornamented with granules of minute verrucae that are usually arranged in a definite pattern. Cell walls of *Cosmarium* are without spines.

Most species have semicells that are cicular in outline when viewed from the side. Each semicell usually contains a single axial chloroplast with four radiating plates and the pyrenoids localized in the axial portion (Smith, 1950).

This algal was found frequently in impoundment samples but seldom appeared to be dominant. It was more abundant in oligotrophic impoundments.

6. *Cryptomonas* sp Egrenberg (Fig. 13)

Cells are broadly ellipsoid or ovate, the left hand margin (as seen from the ventral side) symmetrically convex, the right nearly straight; apex unsymmetrically bilobed, the apical depression broad and shallow, gullet extending about ¾ the length of the cell; chromatophores 2 elongate parietal plates, brown; cells 5-18 µm in diameter, 20-80 µm long.

A common species in many South African impoundments but seldom dominant usually more important in winter.

7. *Dinobryon* sp Ehrenberg (Fig. 14)

Free-swimming or attached; rarely solitary, usually forming arborescent colonies of conical or vase-like loricas, each inclosing a single ovoid or spindle-shaped, pigmented protoplast which is attached by a slender stalk to the base of the envelope; loricas variously tapering at the base in different species, with smooth or undulate margins; arranged in forked chains, 1 or 2 cones fitting into the wide mouth of the lorica below; envelope colourless or brownish, 2 flagella of different lengths attached apically (Prescott, 1973).

This alga was only found in oligotrophic impoundments and was seldom dominant. It was particularly evident in the Transvaal.

8. *Euglena* sp Ehrenberg (Fig. 15)

Cells mostly free-swimming, rarely creeping, fusiform cylindrical, or ovate, usually circular in cross section but rarely slightly flattened; the posterior end either rounded or sometimes extending into a fine point or caudus; anterior end usually narrowed and sometimes conspicuously 2-lipped; periplast either firm, giving the cell a rigid

shape, or soft and pliable; cell constantly changing shape in its movements; when firm, the periplast decorated with fine spiral striations or rows of granules; a gullet and a reservoir in the anterior end from which arises a single flagellum of variable length (Prescott, 1973).

This alga is common in impoundments both eutrophic and oligotrophic, and is especially prevalent in waters with high concentrations of organic matter. This alga is impossible to identify to species level in Lugols' solution because when the cell dies it assumes a variety of shapes and is densely stained.

9. *Gonium sociale* (Duj) Warming (Fig. 16)

A free-swimming, plate-like, quadrangular colony of 4 ovoid cells, all directed outward enclosed by colonial mucilage which has a central rectangular perforation. Cells interconnected by fine proto-plasmic processes. Flagella 2, attached in the narrow anterior end just above 2 contractile vacuoles. Chlorplast a parietal cup with 1 or 2 pyrenoids; pigment-spot usually large and conspicuous, lying laterally in the anterior end. Cells 10 - 15 µm long (Prescott, 1973).

This is a common species in impoundments but never noted to be dominant. Prescott (1973) mentions that this species occurs in waters where the nitrogen content is high. This is true in South Africa as *Gonium sociale* has been identified in sewage maturation ponds (Shillinglaw and Pieterse, 1980).

10. *Oscillatoria* sp. Vaucher (Fig. 17)

Filamentous and elongate, without a sheath; straight, or twisted and

entangled; the mature plant showing a polarity with an apical region, which is often attenuated, the basal end truncate; usually showing an oscillating or gliding movement, especially active in the anterior portion of the trichome; apical cell smoothly rounded or swollen and capitate sometimes with a distinct sheath-like membrane, the calyptra; most species having cells much shorter than their width, with or without constrictions at the cross walls (Prescott, 1973).

This alga was only found in a few impoundments and was never present in large numbers.

11. *Pediastrum Boryanum* (Turbp) Meneghine (Fig. 18)

Colony entire; cells 5-6 sided with smooth or granular walls; peripheral cells with outer margins extended into 2 blunt-tipped processes cells up to 14 µm in diameter, 21 µm long; 36-celled colony 85-90 µm wide (Prescott, 1973).

Found in eutrophic and oligotrophic impoundments but never dominant.

12. *Pediastrum simplex* var. *duodenarium* (Baily) Rabenhorst

Colony perforate, composed of 36-48-64 cells with their inner margins concave, the outer margin of inner cells forming a long process, peripheral cells forming a single stout process; cells 11-15 µm in diameter, 27-28 µm long, 36 celled colony 137 µm in diameter (Prescott, 1973).

Found in a few impoundments but never dominant. Often occurring in silty impoundments.

13. *Peridinium* sp. Ehrenberg (Fig. 20)

Cells globose, subglobose, or broadly ovoid in ventral view, very slightly flattened dorsiventrally as seen in polar view; transverse furrow broad, spiral, dividing the cell almost equally on the left side (as seen ventrally) but spiralling to a supramedian position on the right; plates thick and coarsely reticulate; epicone high and broadly rounded, epitheca with 4 apicals, 3 intercalary, and 7 percingular plates; hypocone broadly rounded posteriorly, hypotheca with 5 postcingular and 2 antapical plates; cells 35-55 µm in diameter, 40-60 µm long (Prescott, 1973).

Common in impoundments but seldom dominant.

14. *Scenedesmus* spp

(a) *Scenedesmus quadricauda* var. *longispina* (Chod) G.M. Smith (Fig. 21)

Colony consisting of 2-4-8 oblong-cylindric cells usually in 1 series; outer cells with a long curved spine at each pole; inner cells without spines or with mere papillae at the apices; cells variable in size, 3,5-5 µm in diameter, 8-11 µm long; spines 7,5-10 µm long (Prescott, 1973).

This species was present in only a few impoundments and was never dominant. *Scenedesmus bijuga* was more frequent in samples but was also never dominant. *Scenedesmus obliquus* was present on a few occasions in small numbers.

(b) *Scenedesmus bijuga* (Turp) Lagerheim

Colony composed of 2-8 cells in a single (rearely alternate)

flat series; cells ovate or oblong, without teeth or spines; cells 4-8 µm in diameter, 8-16 µm long (Prescott, 1973).

(c) *Scenedesmus obliquues* (Turp) Kuetzing

Colony composed of 2-8 (usually 4 or 8) fusiform cells arranged in a single series; apices of cells apiculate; wall smooth; cells 4,2-9 µm in diameter, 14-18-(21) µm long (Prescott, 1973).

15. *Staurastrum* spp Meyen (Figs. 22 & 23)

The range in size and shape among the multitude of species belonging to this genus is extremely varied. A majority of the species have cells that are radially symmetrical and usually triangular in end view; but there are many species with strongly compressed bilaterally simmetrical cells. Practically all species are deeply constricted.

The cell wall may be smooth or it may be ornamented with granules, denticulations, simple to emarginate verrucae, or spines. Species with ornamented walls have the ornamentation arranged in a symmetrical pattern. The front view of semicells may be elliptical, semi-circular, cyathiform, triangular, quandrangular, or polygonal in outline . In many species, the superior angles of semicells are continued in processes, usually quite long, that are variously ornamented and terminate in truncate ends with short divergent spines (Smith, 1950).

Species of this genus are common in South African impoundments. On occasions species can be dominant. They appear to occur in eutrophic and oligotrophic waters. Often a number of different species occur in one sample while in other cases a single species occurs.

The next algal species does not cause problems in impoundments but does cause problems in irrigation canals leading off impoundments.

Problem alga in irrigation canals

*Cladophora glomerata (*L*)* Kuetzing (Figs. 24 & 25)

A repeatedly branched filamentous thallus with basal-distal differentiation, attached, forming dark green, fluffy or streaming arbuscular thalli, usually in flowing water. Filaments successively and regularly branched, the branches usually croweded in the upper limits. Cells very slightly attenuated toward the apices of the branches, which are bluntly pointed. Main axis 75-100 µm in diameter, cell length is 6-7 times the diameter; cells in the branches 35-50 µm in diameter, cell lengths is 3-6 times the diameter (Prescott, 1973).

This alga grows profusely in irrigation canals during the early summer months. The filaments grow longer and eventually break off in the flowing water. It is this drifting mass of filaments which block weirs in the canals causing overflowing and preventing farmers further down the canals from receiving their full quota of water. Manual removal of filaments from blocked weirs is extremely wasteful as far as manpower and cost is concerned. Treatment with copper sulphate is not very successful as it is difficult to maintain a long enough contact period of the toxic concentration of copper in a flowing system and also the pH of the water has to be lowered to below seven to prevent the copper ion from precipitating.

CLASSIFICATION OF LISTED ALGAE

(Prescott, 1973 and Smith, 1950)

1. CHLOROPHYTA (Green algal)

CLASS : Chlorophyceae

ORDER : Volvocales

FAMILY : Chlamydomonadaceae

GENUS : *Chlamydomonas*

FAMILY : Volvocaceae

GENUS : *Gonium*

ORDER : Cladophorales

FAMILY : Cladophoraceae

GENUS : *Cladophora*

ORDER : Clorococcales

FAMILY : Hydrodictyaceae

GENUS : *Pediastrum*

FAMILY : Scenedesmaceae

GENUS : *Scenedesmus*

ORDER : Zygnematales

FAMILY : Desmidiaceae

GENERA : *Cosmarium*
Staurastrum

2. CHRYSOPHYTA (Yellow-green algae)

CLASS : Chrysophyceae

ORDER : Chyrsomonadales

SUBORDER : Ochromonadineae

FAMILY : Ochromonadaceae

GENUS : *Dinobryon*

CLASS : Bacillarophyceae (Diatoms)

ORDER : Centrales

SUBORDER : Coscinodiscineae

FAMILY : Coscinodiscaceae

GENUS : *Melosira*

3. EUGLENOPHYTA (Flagellates)

CLASS : Euglenophyceae

ORDER : Euglenales

FAMILY : Euglenaceae

GENUS : *Euglena*

4. PYRROPHYTA (Dinoglagellates)

CLASS : Dinophyceae (Dinoglagellates)

ORDER : Peridinales

FAMILY : Peridiniaceae

GENUS : *Peridinium*

FAMILY : Ceratiaceae

GENUS : *Ceratium*

CLASS : Cryptophyceae

ORDER : Cryptomonadales

FAMILY : Cryptomonadeae

GENUS : *Cryptomonas*

5. CYANOPHYTA (Blue-green algae)

CLASS : Myxophyceae

ORDER : Chroococcales

FAMILY : Chroococcaceae

GENUS : *Microcystis*

ORDER : Hormognales

SUBORDER : Homocystineae

FAMILY : Oscillatoriaceae

GENUS : *Oscillatoria*

SUBORDER : Heterocystineae

FAMILY : Nostoceaceae

GENUS : *Anabaena*

GLOSSARY

1. AKINETE - A thick-walled, non-motile spore, containing oil or other food reserves, formed singly within a cell, with the spore wall indistinct from the cell wall. Refered to in the Cyanophyceae - blue-green algae.

2. ANTAPICAL PLATE - One of the plates found at the posterior end of the Peridinales.

3. ARCUATE - Like an arc; bent like a bow.

4. CAUDUS - A tail-like appendage.

5. CHLOROPLAST - A variously-sahped organelle containing chlorophyll. They are embedded in the cytoplasm of a cell.

6. EPITHECA - The outer, and older layer of the half-wall of diatoms and dinoglagellates.

7. FUSIFORM - Elongated, and tapering towards each end.

8. HETEROCYST - A special type of cell produced in most filamentous Cyanophytes. Cell walls are thickened around the polar pores. Protoplast is transparent. These cells may function in reproduction or in nitrogen fixation.

9. HYPOTHECA - The inner of the two half-walls of the cell-wall of diatoms, and dinoflagellates.

10. LORICA - Outer sheath of euglenoids.

11. LUNATE - Half-moon shaped.

12. PARIETAL - Joined to the wall.

13. PLANKTON - The more or less free-floating animals and plants living near the surface of a sea or lake. *Phytoplankton* is the plant component.

14. PYRENOID - A small round protein granule which stores tarch around it as a sheath. They are found singly or in numbers embedded in the chloroplats of various algae.

15. RETICULATE - Lattice like or having the surface marked by a network of fine upstanding ridges.

16. STRIATE - Marked with parallel, longitudinal lines, furrows or ridges.

17. TAXONOMY - The science of classifying living things.

18. THALLUS - A simple plant body, being unicellular, multicellular, and even large, but never differentiated into stem, leaf and root.

19. TRICHOMES - In the Cyanophyta, a single row of cells which with their sheath make up the filament.

REFERENCES

1. PRESCOTT, G.W. (1973) Algae of the Western Great Lakes area. WM. C. Brown, 977 p.

2. SHILLINGLAW, S.N. and PIETERSE, A.J.H. (1980) The effects of aeration and recirculation of pond water on algal populations in experimental maturation pond systems. *Water S A.* (In press).

3. SMITH, G.M. (1950) The fresh-water algae of the United States. Mc. Graw-Hill. 719 pp.

4. TOERIEN, D.F., SCOTT, W.E. and PITOUT, M.J. (1976). Microcystis toxins : isolation, identification, implications. *Water S A. 2 : 160-162.*

5. VOLLENWEIDER, R.A. (1969) : A manual on methods for measuring primary production in aquatic environments. *IBP Handbook No. 12.* Blackwell Scientific Publications. 213 pp.

ACKNOWLEDGEMENTS

I thank Prof. A.J.H. Pieterse (Department of Botany, University of Orange Free State), for giving so many ideas and correcting the manuscript. I

thank Prof. D.F. Toerien (Director of the Institute of Environmental Science, University of the Orange Free State) and other members of the Institutes staff for assistance. I convey my thanks to Messrs. C.A. Bruwer and D.C. Grobler as well as other members of the Hydrological Research Institute for collecting many algal samples. Finally I thank Dr. W. Hattingh (Director of Hydrological Research Institute) for assistance and permission to publish this report.

FIGURES

FIGURE 1 : *Anabaena circinalis* Rabenhorst from Roodeplaat dam.

FIGURE 2 : *Anabaena circinalis* Rabenhorst from Bloemhof dam. The heterocyst is indicated by arrow.

FIGURE 3 : *Anabaena circinalis* Rabenhorst with akinete arrowed.

FIGURE 4 : *Microcystis aeruginosa* Kuetz; emend Elenkin colony from Bloemhof dam.

FIGURE 5 : High magnification photograph of *Microcystis aeruginosa* showing cellular structure.

FIGURE 6 : *Microcystis aeruginosa* colony together with *Pseudanabaena* sp. A common occurrence in Roodeplaat dam.

FIGURE 7 : *Melosira granulata* (Ehr) Ralfs. from Nwanedzi dam.

FIGURE 8 : *Anabaena planktonica* Brunnthaler from Koster River dam.

FIGURE 9 : *Ceratium hirundinella* (O.F. Muell) Dujardin from Groot Marico dam.

FIGURE 10 : *Chlamydomonas globosa* Snow from Roodeplaat dam.

FIGURE 11 : *Chlorella vulgaris* Beyerinck from Erfenis dam.

FIGURE 12 : *Cosmarium* sp Corda from Clanwilliam dam.

FIGURE 13 : *Cryptomonas* sp Ehrenberg from Gamkapoort dam. Flagella are indicated by arrow.

FIGURE 14 : *Dinobryon* sp Ehrenberg from Witklip dam.

FIGURE 15 : *Euglena* sp Ehrenberg from Hendrik Verwoerd dam. Note the various shapes that cells assume once dead.

FIGURE 16 : *Gonium sociale* (Duj) Warming from Boskop dam.

FIGURE 17 : *Oscillatoria* sp Vaucher from Nooitgedacht dam.

FIGURE 18 : *Pediastrum Boryanum* (Turp) Menghini from Westoe dam.

FIGURE 19 : *Pediastrum simplex* var *duodenarium* (Baily) Rabehorst from Klein Marico dam.

FIGURE 20 : *Peridinium* sp Ehrenberg from Loskop dam.

FIGURE 21 *Scenedesmus quadricauda* var *longispina* (Chod) G.M. Smith from Allemanskraal dam.

FIGURE 22 : *Staurastrum* sp Meyen from Albert Falls dam.

FIGURE 23 : *Staurastrum* sp Meyen from Fanie Botha dam. A = apical view of cell, B = lateral view of cell.

FIGURE 24 : *Cladophora glomerata* (L) Kuetzing, showing branching filaments. From Hartbeespoort dam irrigation canals.

FIGURE 25 : *Cladophora glomerata* (1) Keutzing, showing epiphytes attached to cells.

TABLE 1 : List of 75 impoundments sampled in which the recorded algal species were either dominant, present or absent.

Dominant = ■, Present = ▨ and

Absent = □

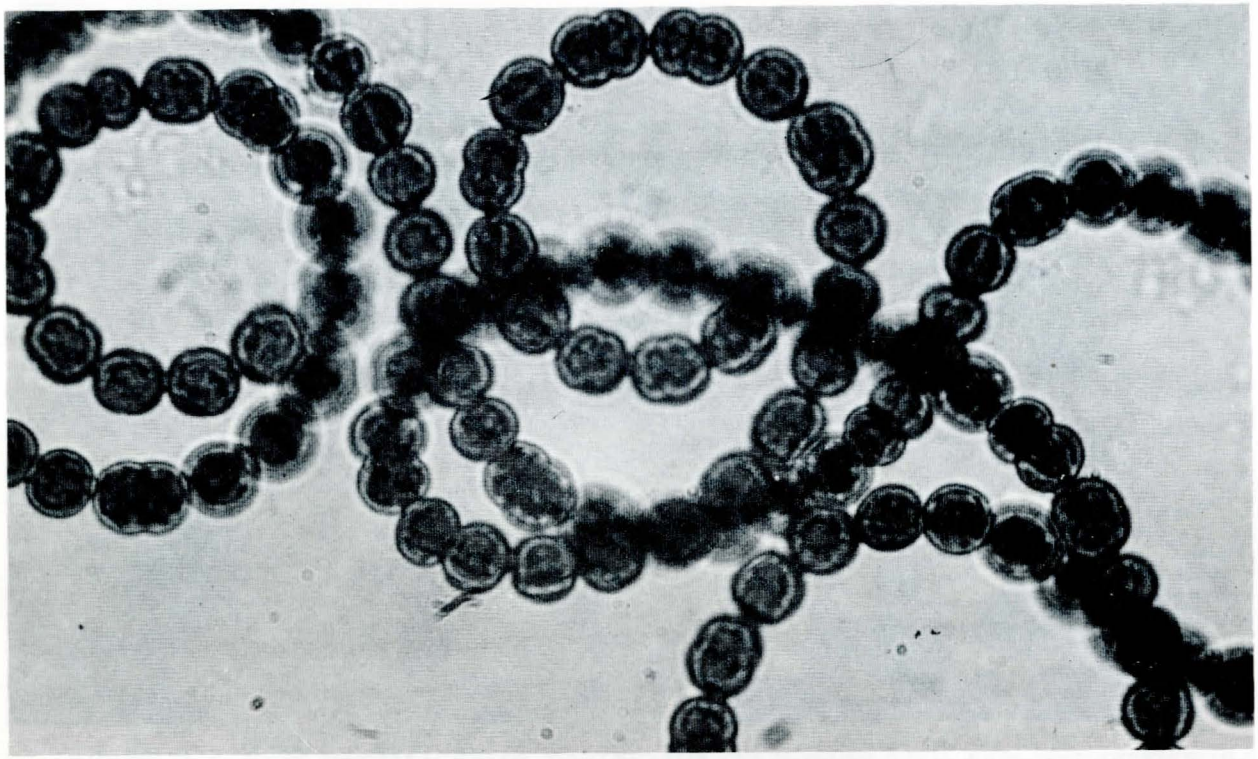


FIGURE 1 : *Anabaena circinalis* Rabenhorst from Roodeplaat dam.

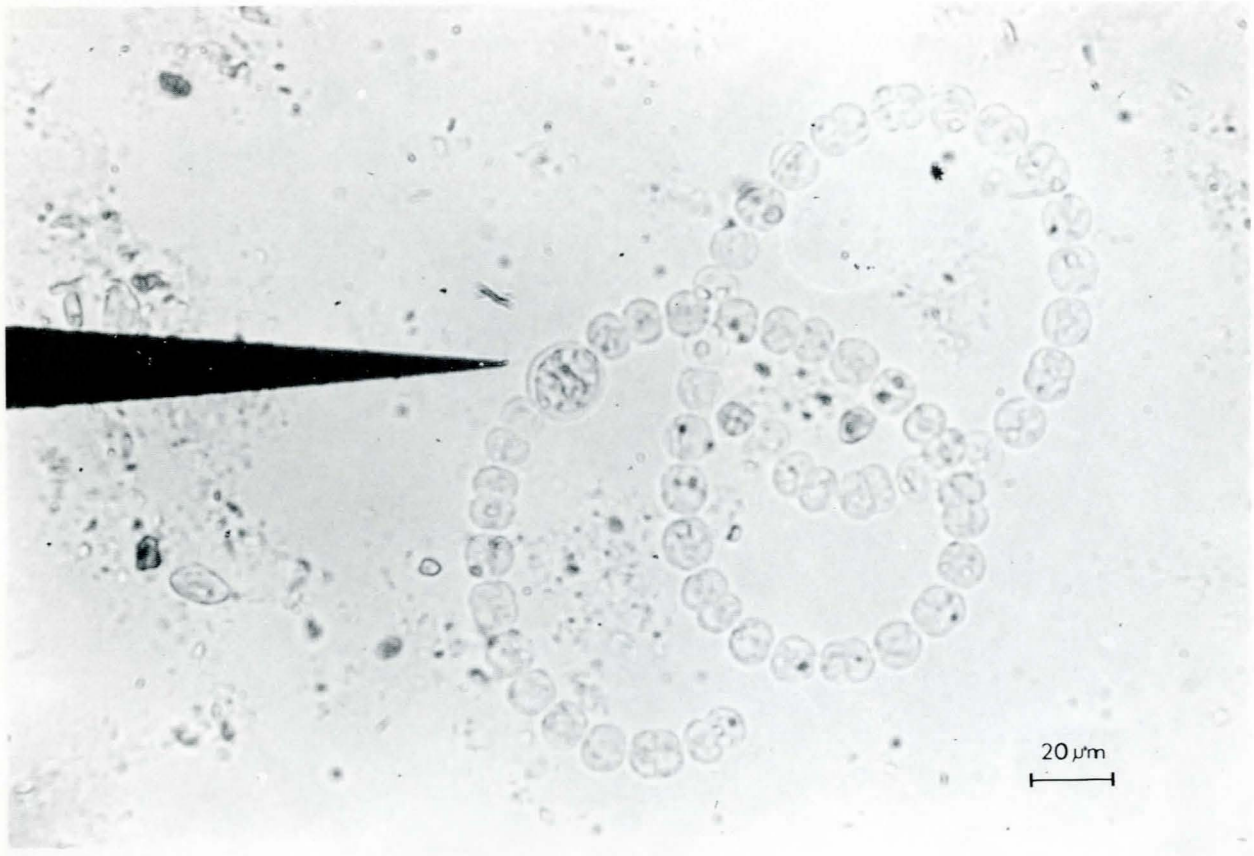


FIGURE 2 : *Anabaena circinalis* Rabenhorst from Bloemhof dam. The heterocyst is indicated by arrow.

FIGURE 3 : *Anabaena circinalis* Rabenhorst with akinete arrowed.

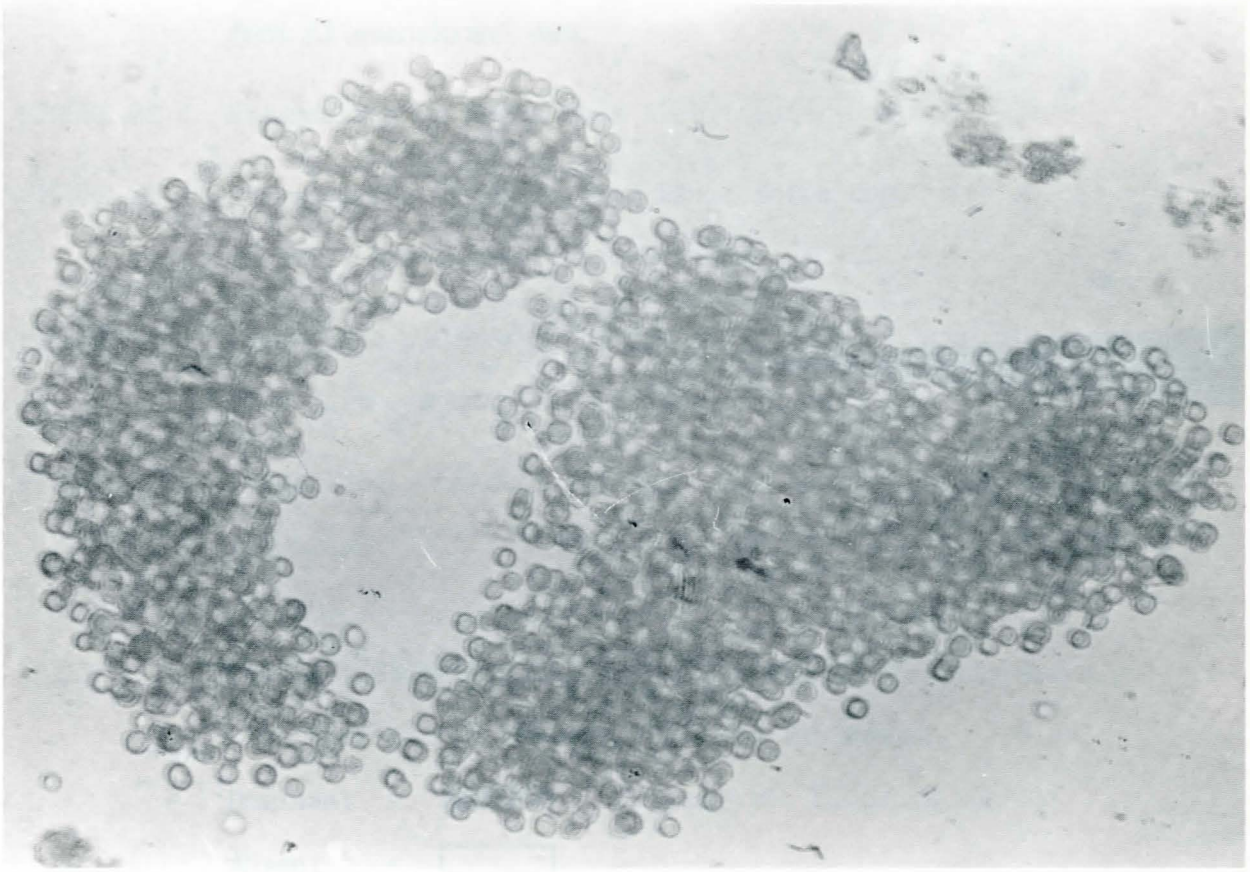


FIGURE 4 : *Microcystis aeruginosa* Kuetz; emend Elenkin colony from Bloemhof dam.

FIGURE 5 : High magnification photograph of *Microcystis aeruginosa* showing cellular structure.

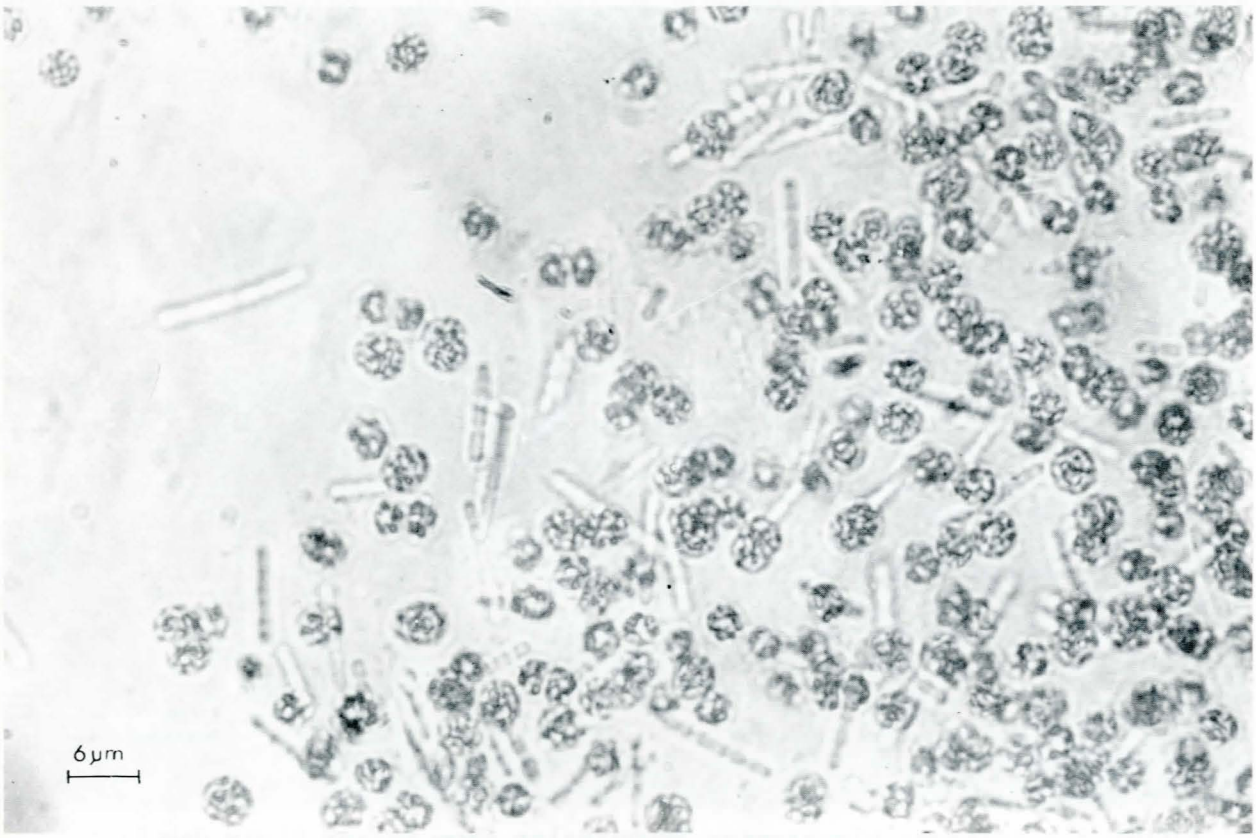


FIGURE 6 : *Microcystis aeruginosa* colony together with *Pseudanabaena* sp A common occurrence in Roodepoort dam.

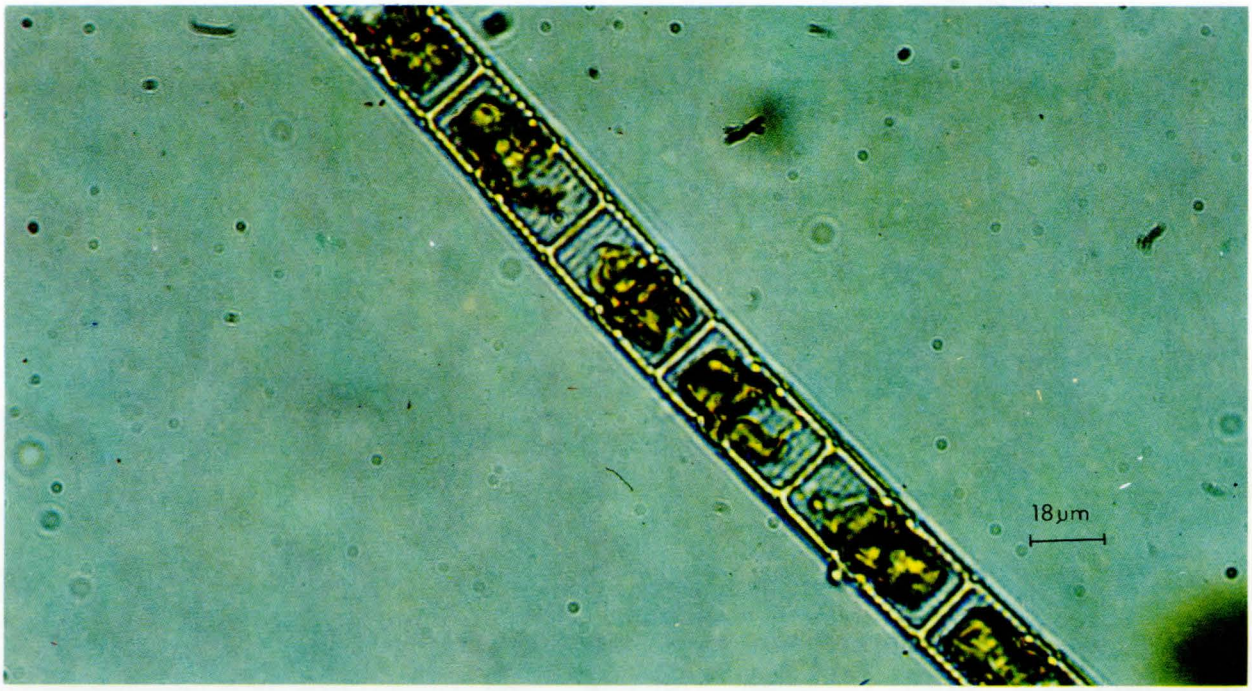


FIGURE 7 : *Melosira granulata* (Ehr) Ralfs. from Nwanedzi dam.

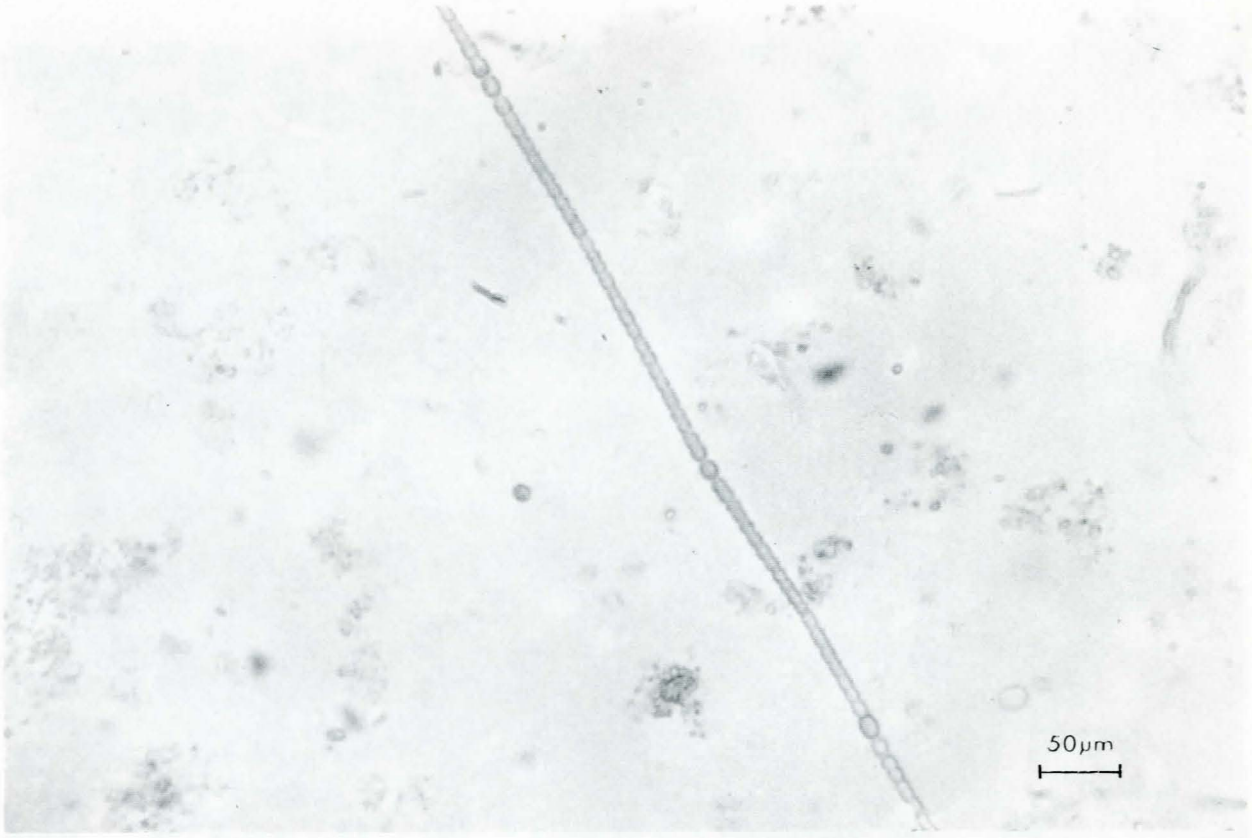


FIGURE 8 : *Anabaena planktonica* Brunnthaler from Koster River dam.

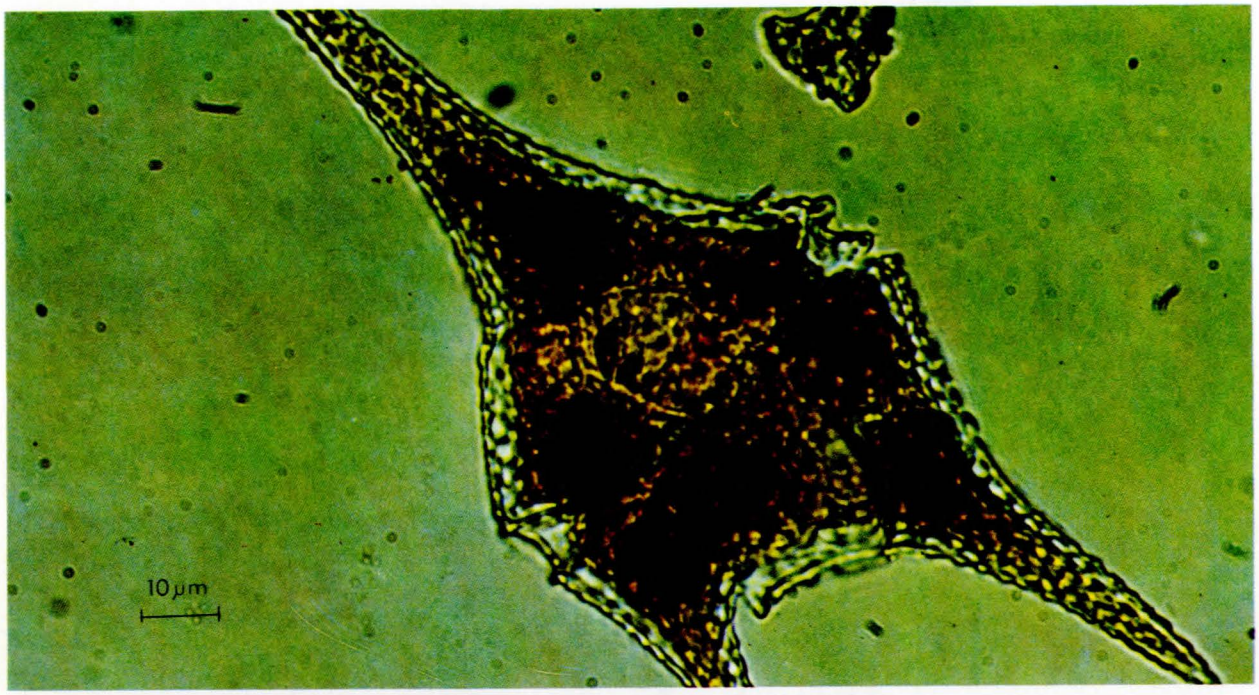


FIGURE 9 : *Ceratium hirundinella* (O.F. Muell) Dujardin from Groot Marico dam.

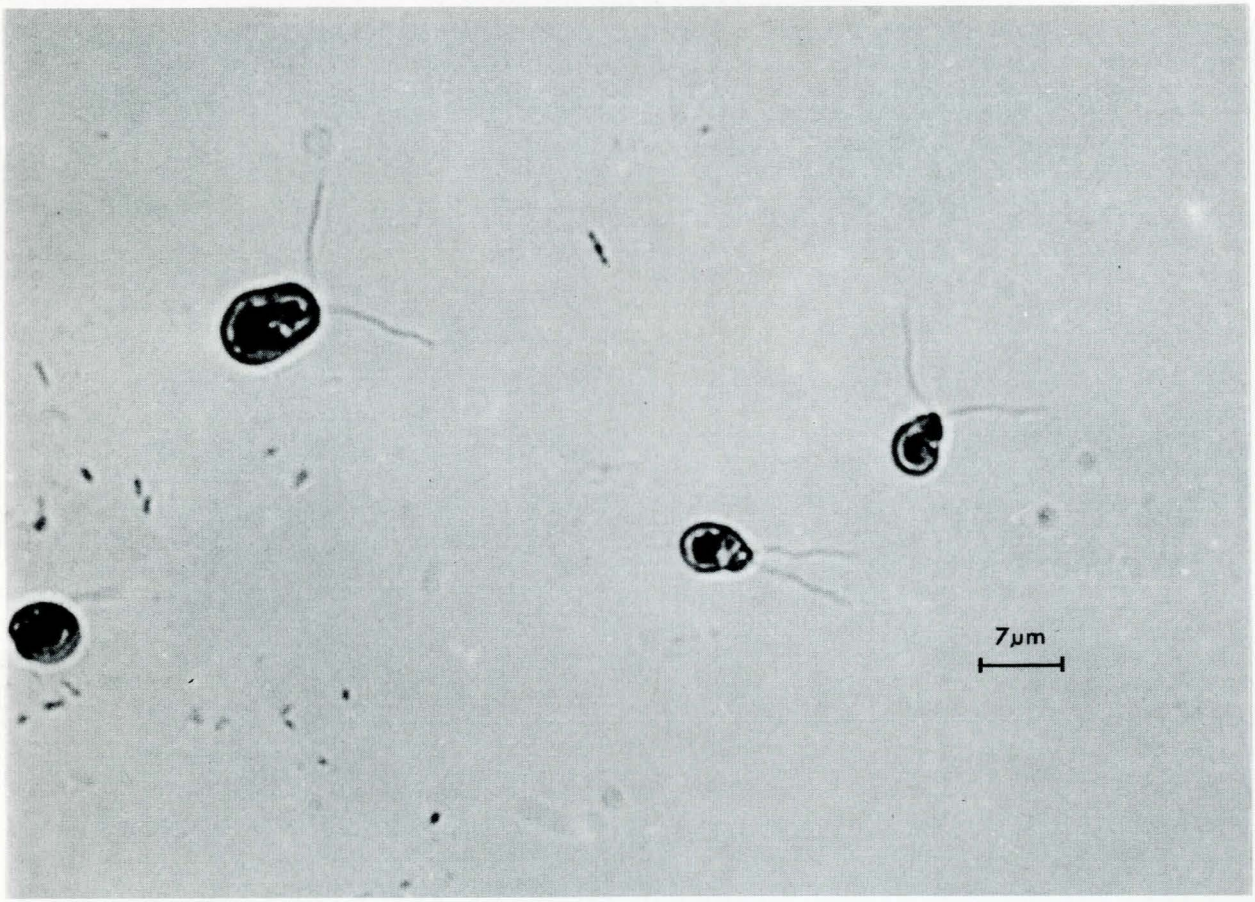


FIGURE 10 : *Clamydomonas globosa* Snow from Roodeplaat dam.

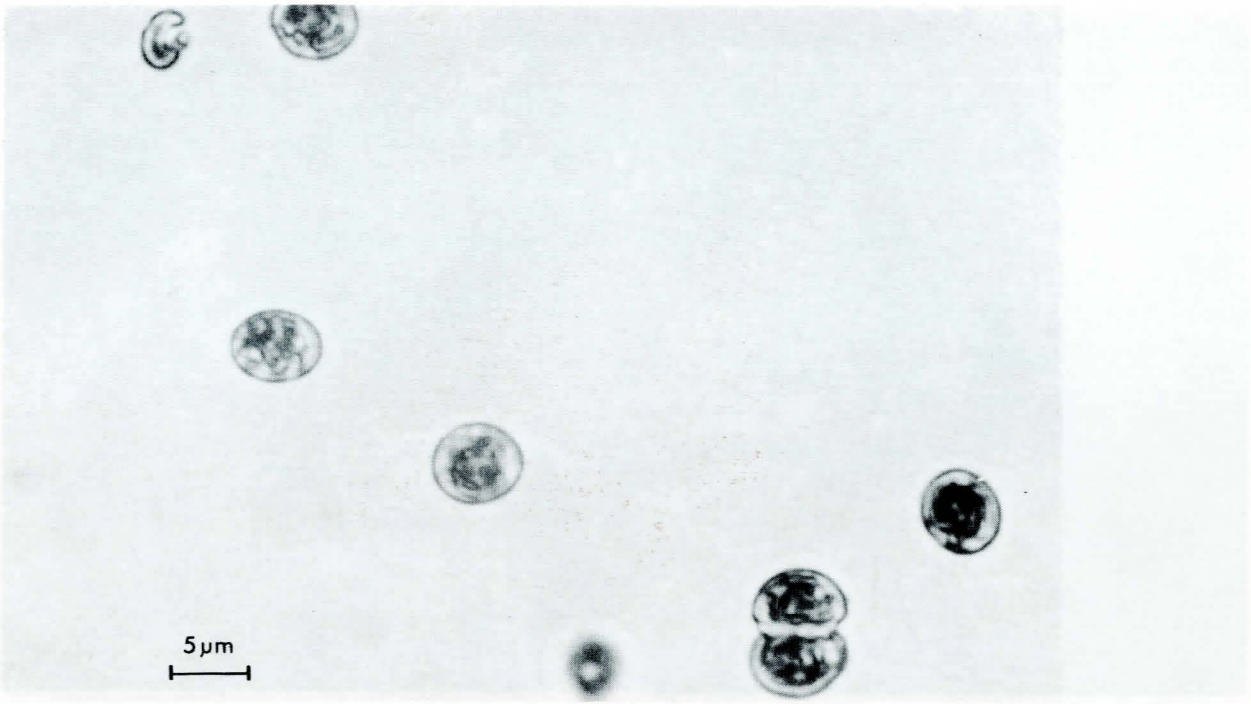


FIGURE 11 : *Chlorella vulgaris* Beyerinck from Erfenis dam.

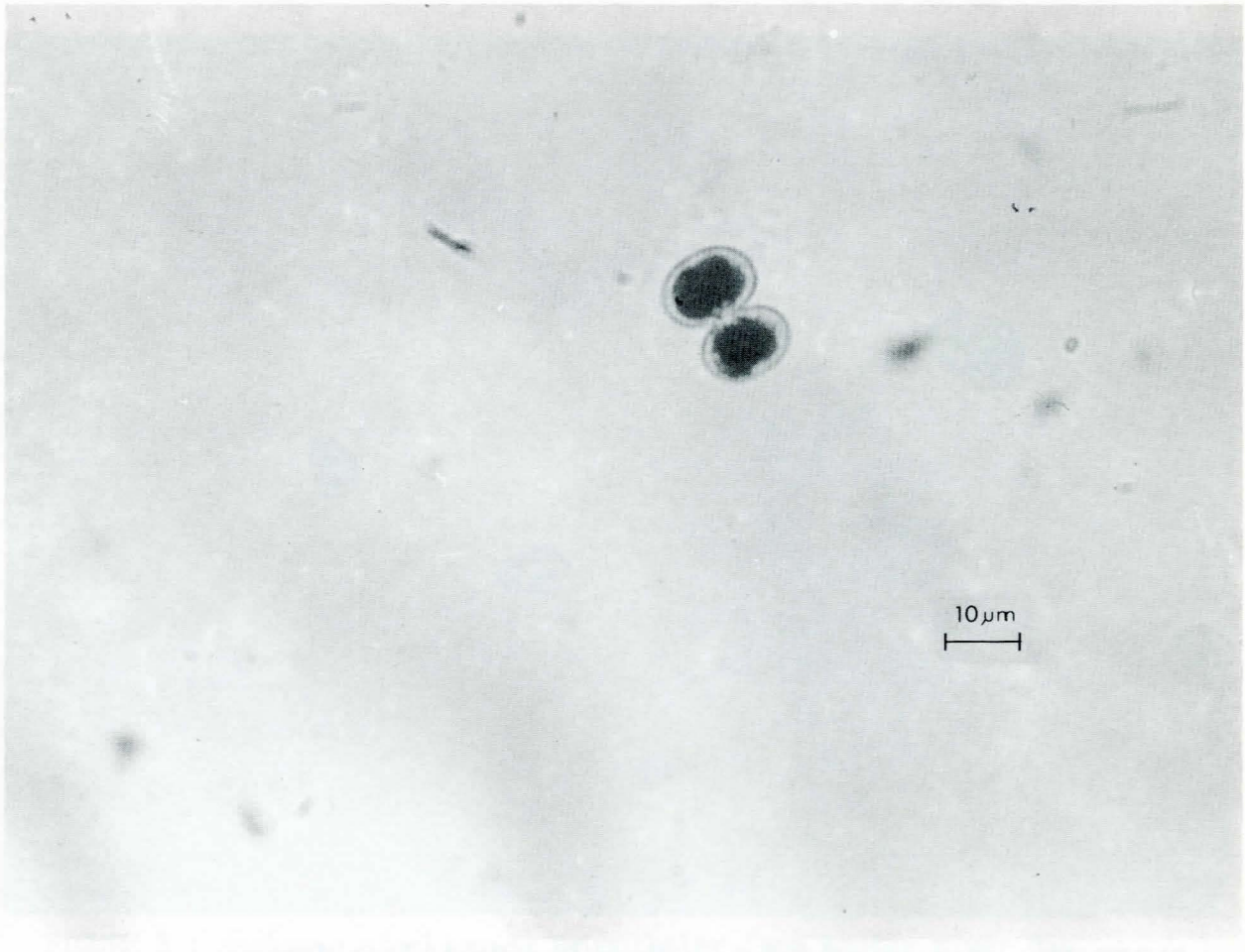


FIGURE 12 : *Cosmarium* sp Corda from Clanwilliam dam.

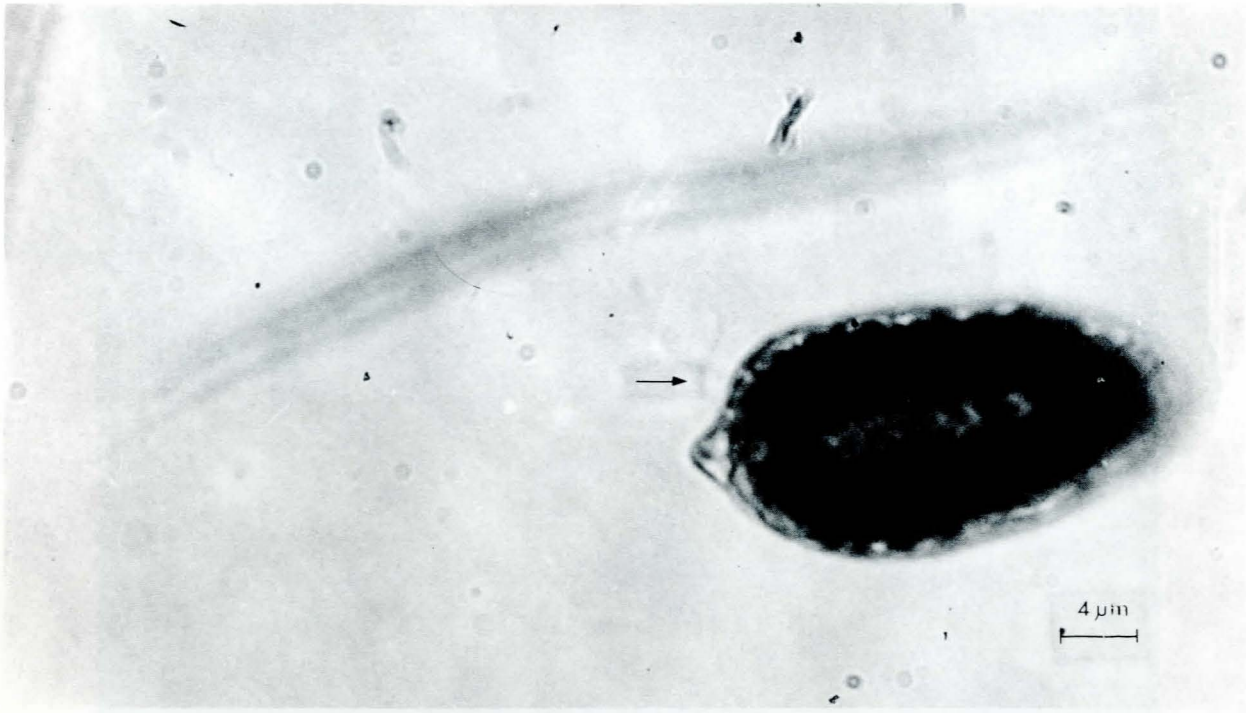


FIGURE 13 : *Cryptomonas* sp Ehrenberg from Gamkapoort dam. Flagella are indicated by arrow.

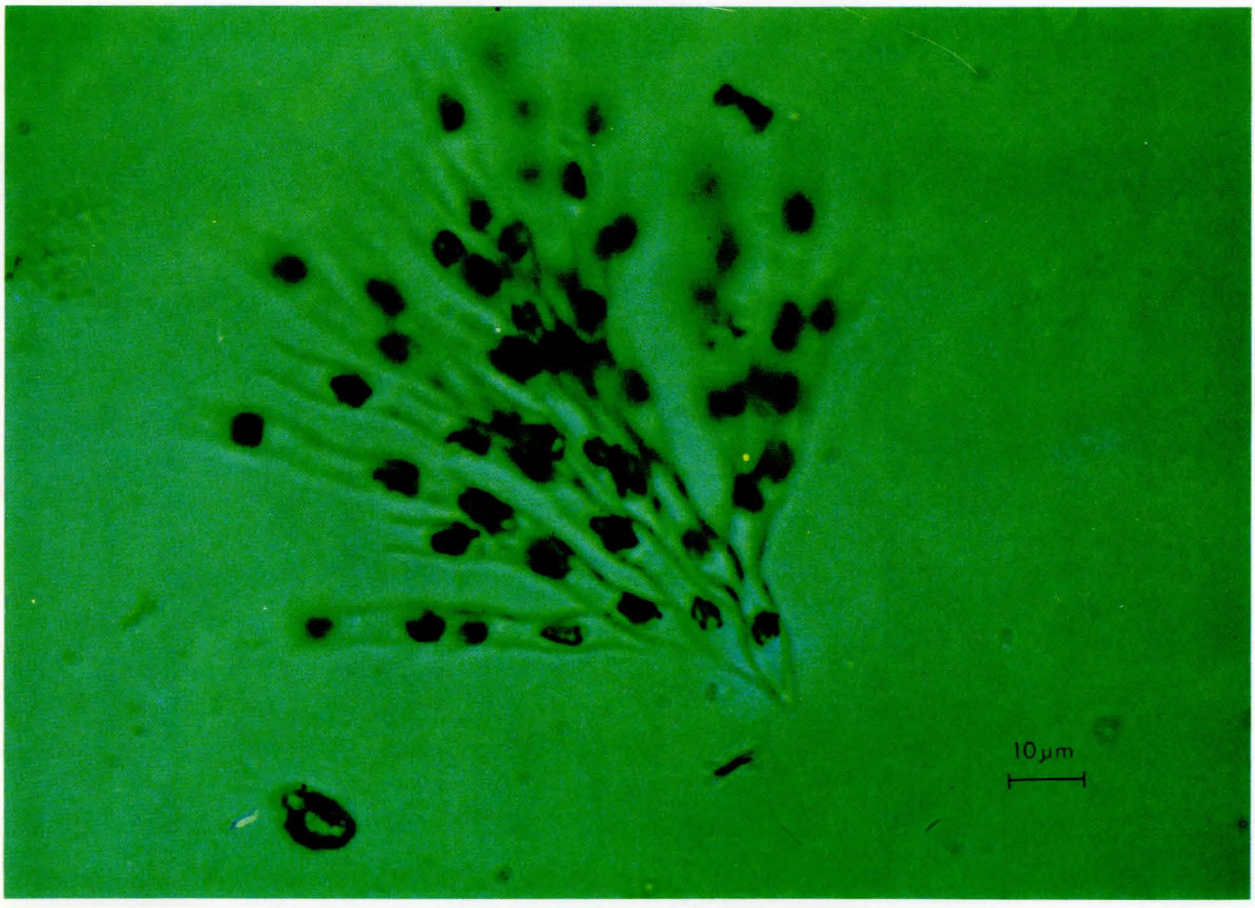


FIGURE 14 : *Dinobryon* sp Ehrenberg from Witklip dam.

FIGURE 15 : *Euglena* sp Ehrenberg from Hendrik Verwoerd dam. Note the various shpaes that cells assume once dead.

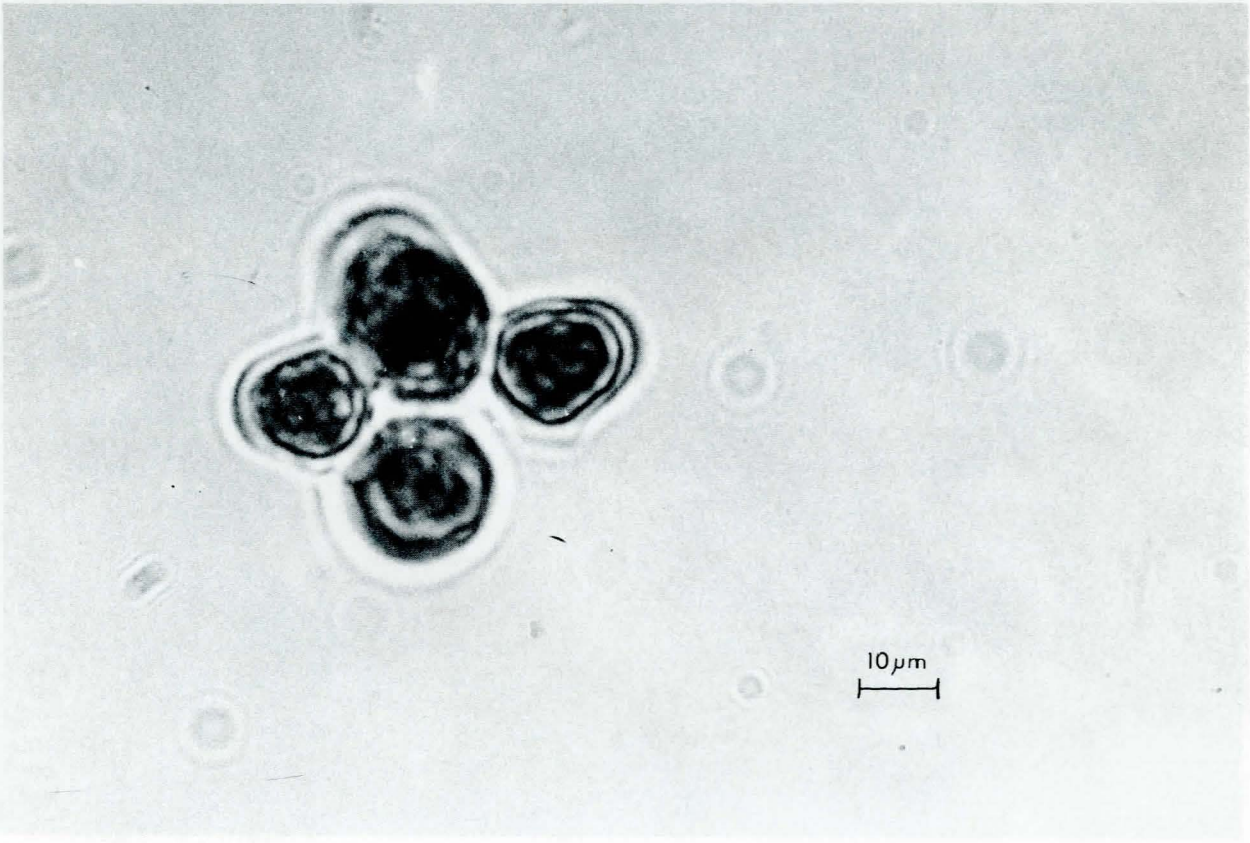


FIGURE 16 : *Gonium sociale* (Duj) Warming from Boskop dam.

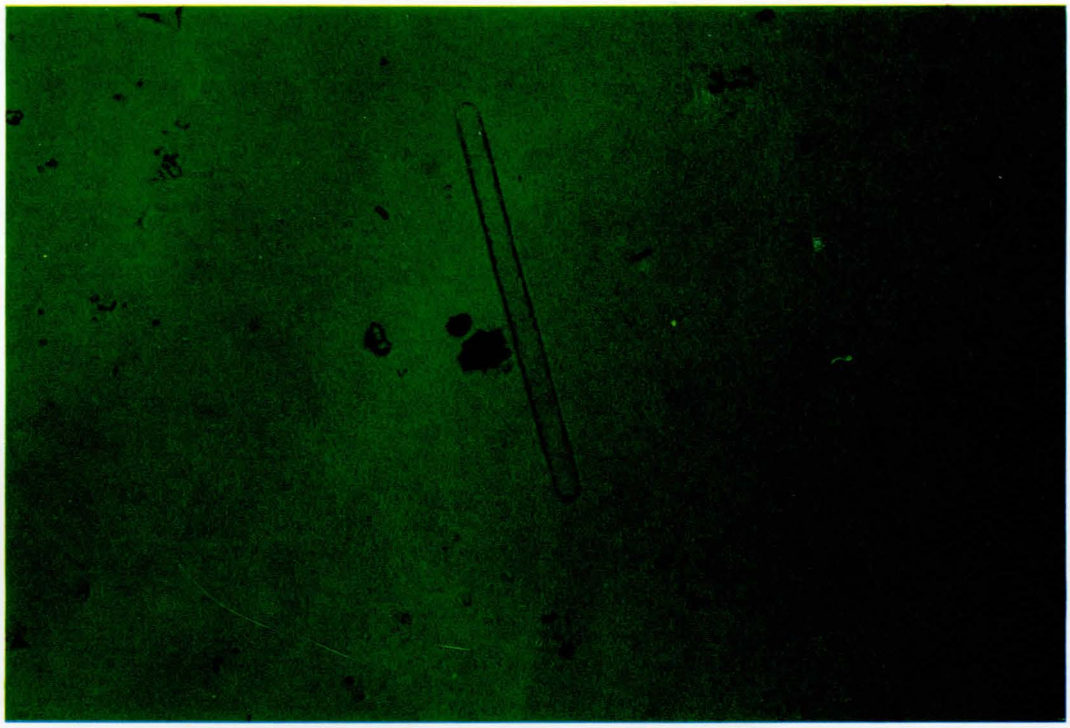


FIGURE 17 : *Oscillatoria* sp Vaucher from Nooitgedacht dam.

FIGURE 18 : *Pediastrum Boryanum* (Turp) Meneghini from Westoe dam.

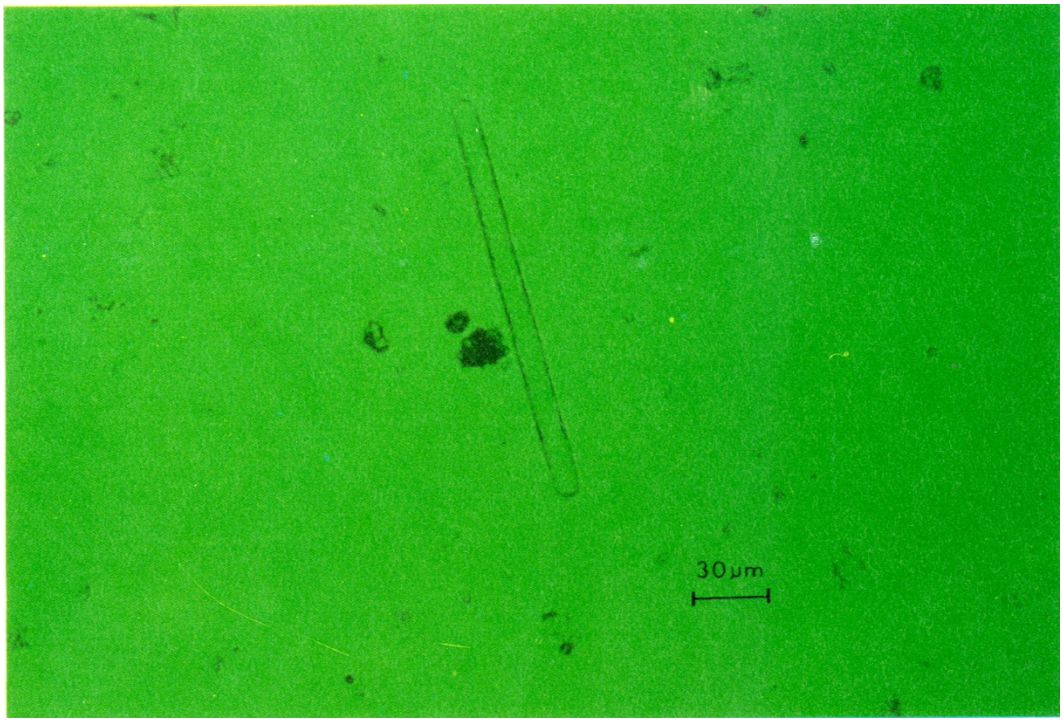


Figure 17 : *Oscillatoria* sp Vaucher from Nooitgedacht dam.

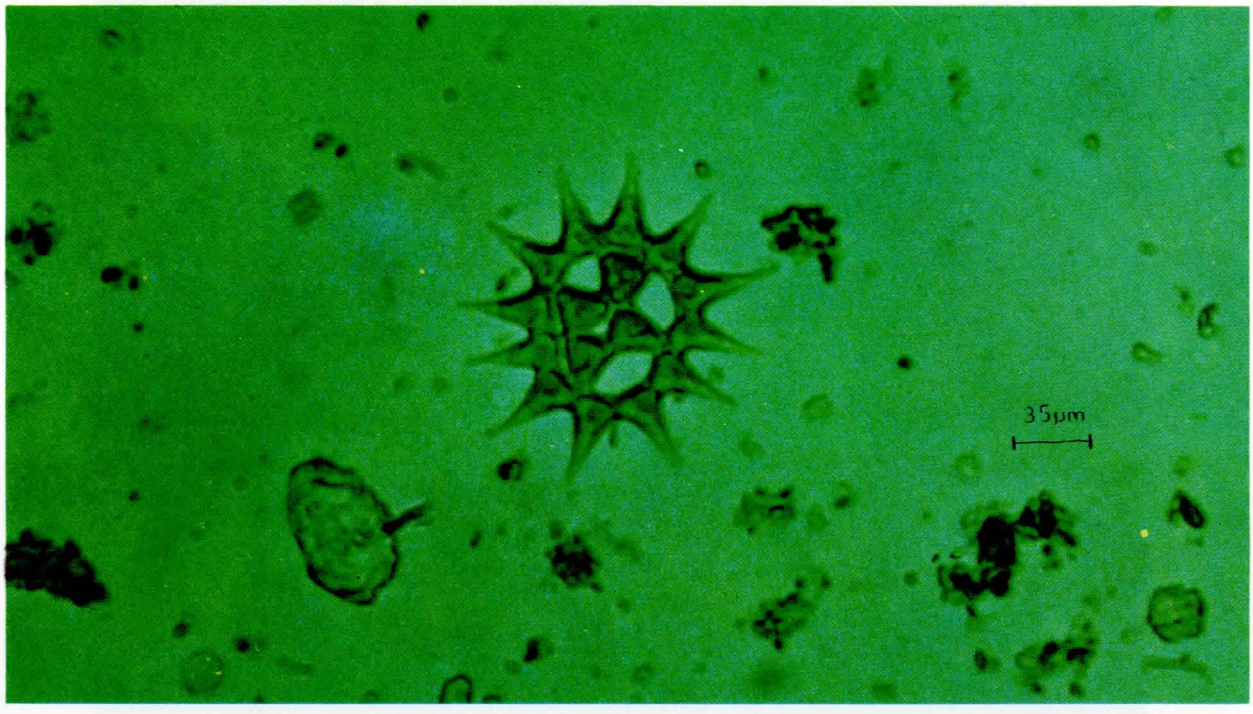


FIGURE 19 : *Pediastrum simplex* var *duodenarium* (Baily) Rabenhorst from Klein Marico dam.

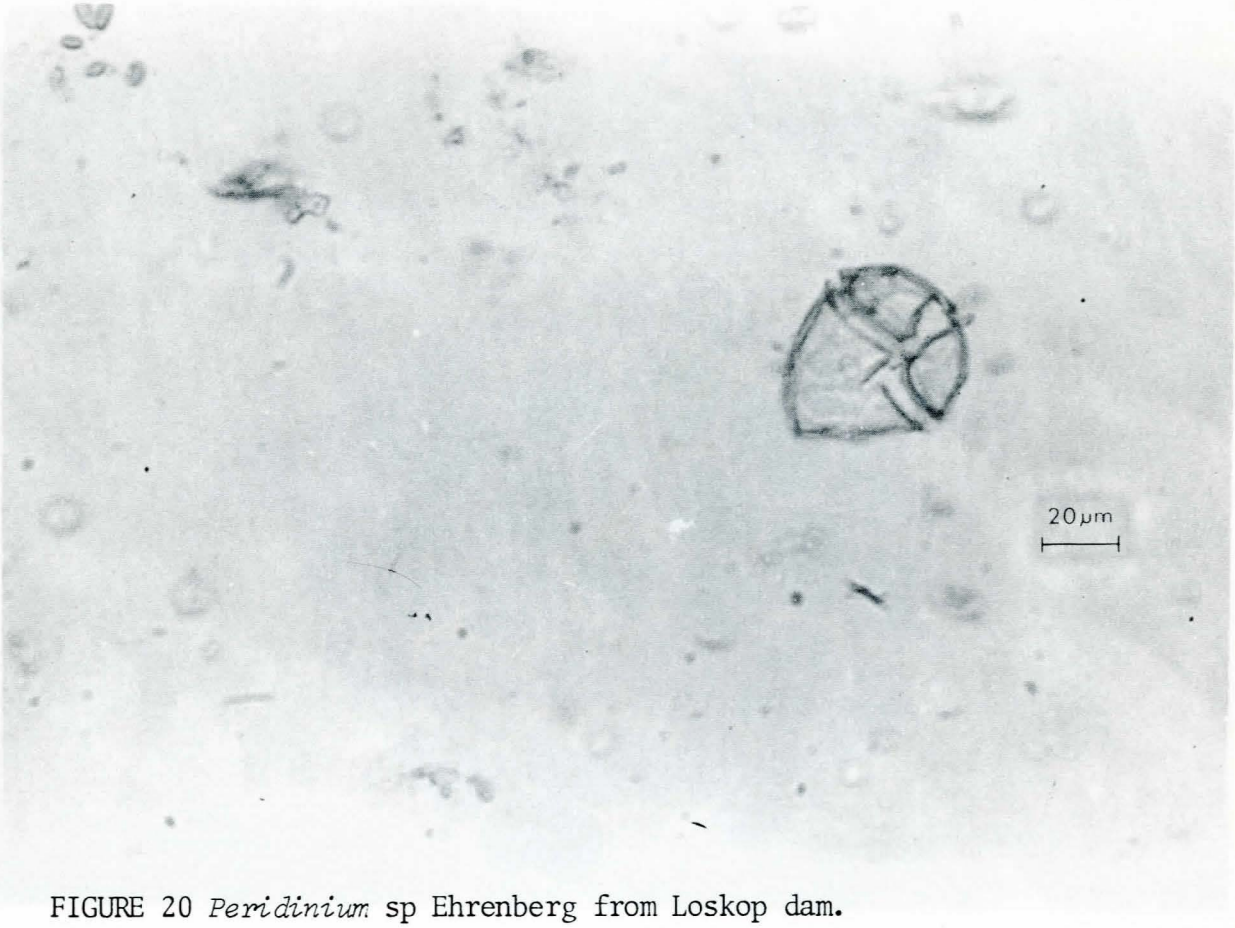


FIGURE 20 *Peridinium* sp Ehrenberg from Loskop dam.

FIGURE 21 : *Scenedesmus quadricauda* var *longispina* (Chod) G.M. Smith Allemanskraal dam.

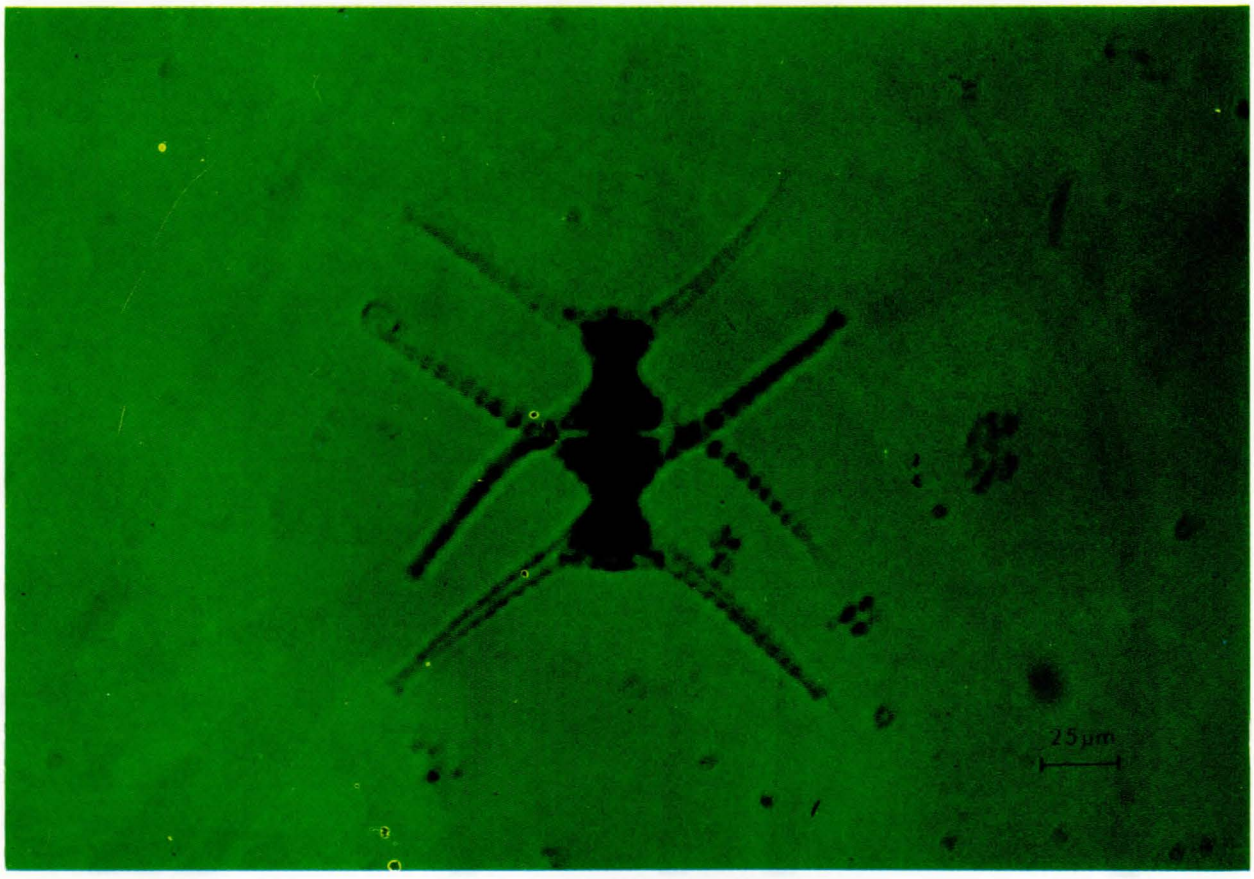


FIGURE 22 : *Staurastrum* sp Meyen from Albert Falls dam.

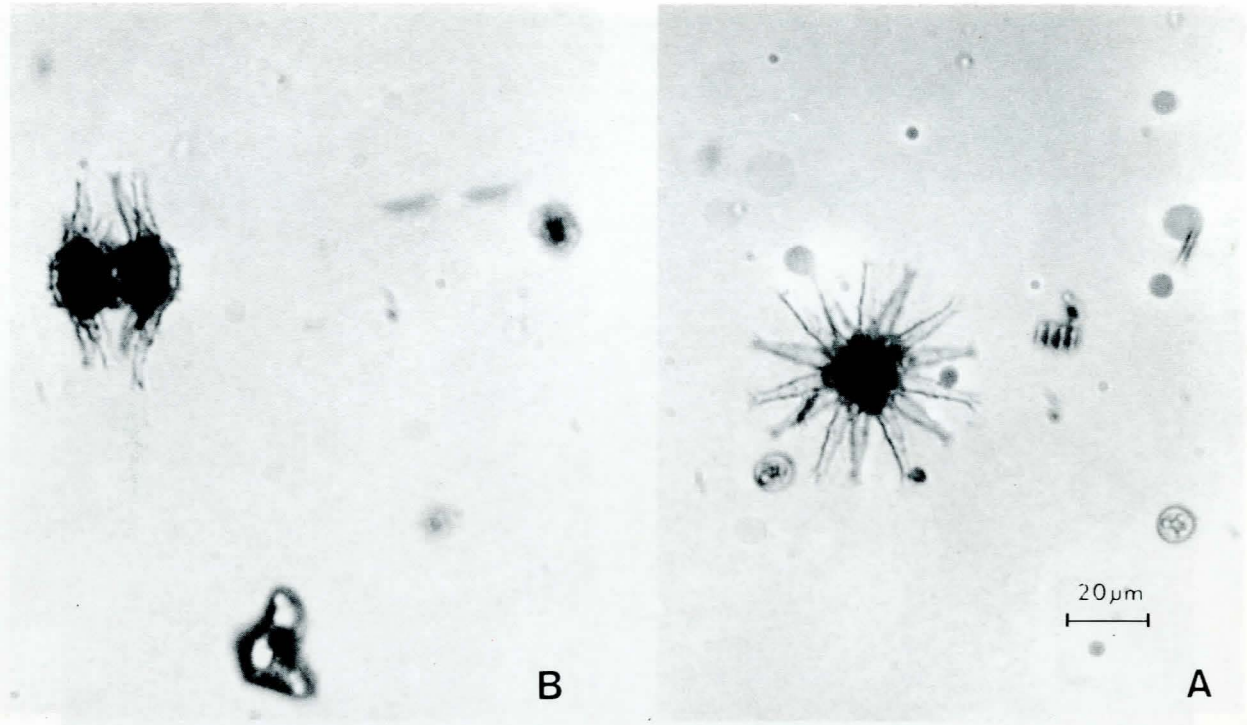


FIGURE 23 : *Staurastrum* sp Meyen from Fanie Botha dam. A = apical view of cell, B = lateral view of cell.

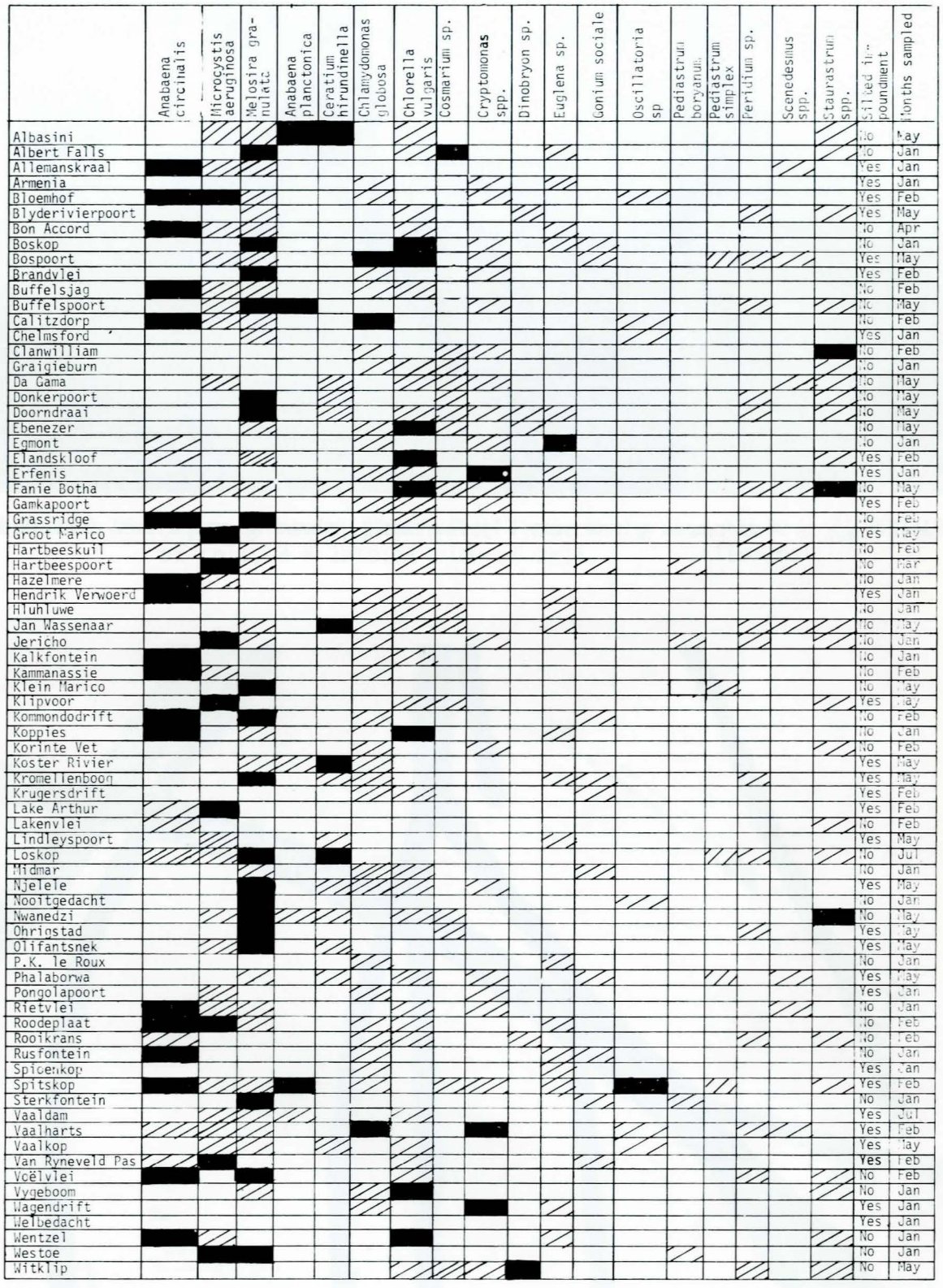
FIGURE 24 : *Cladophora glomerata* (L) Kuetzing, showing branching filaments. From Hartbeespoort dam irrigation canals.

FIGURE 25 : *Cladophora glomerata* (1) Kuetzing, showing epiphytes attached to cells.

TABLE 1 : List of 75 impoundments samples in which the recorded algal species were either dominant, present or absent.

Dominant = ■ Present = ▨ and

Absent = □



Printed in the Republic of South Africa by Perskor, for the Government Printer, Pretoria

1980