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ABSTRACT

A STUDY OF SELECTED GENERA OF THE FAMILIES
GONATOZYGACEAE, MESOTAENIACEAE AND
DESMIDIACEAE IN MONTANA

By

Dennis Cobian Jackson

The desmid genera included in this study, in their respective families, were:

Family Gonatozygaceae:
Gonatozygon;

Family Mesotaeniaceae:
Roya, *Cylindrocystis*, *Spirotaenia*, *Netrium*;

Family Desmidiaceae:
Actinotaenium, *Penium*, *Closterium*, *Spinoclosterium*, *Pleurotaenium*, *Triploceras*, *Tetmemorus*, *Euastrum*, *Micrasterias*, *Xanthidium*, *Arthrodesmus*, *Staurastrum*, *Onychonema*, *Sphaerozosma*, *Spondylosium*, *Hyalotheca*, *Bambusina*, *Desmidium*, and *Cosmocladium*.

The primary objectives were to record the desmid taxa encountered, citing distribution; to prepare an inclusive list of these, integrating the previous records with those of the writer; and to prepare illustrations of the reported taxa indicating, wherever possible, the morphological variation found. In addition, the findings were to be compared with those of other investigators of similar and/or related problems in other parts of the United States. Related ecological data (pH, total hardness, etc.) was also to be gathered whenever feasible.

A wide range of habitats (numbering 202 collecting sites) was sampled, these occurring throughout the state, although more heavily concentrated in the northwest. They included various lakes, ranging from oligotrophic to eutrophic, reservoirs, bogs, ponds, sloughs, swamps, marshes, rivers, and other aquatic or semi-aquatic situations. Collecting techniques varied according to the conditions existing at the sites. In general, however, an effort was made to obtain such samples as plankton, scrapings from coatings on submerged vegetation, squeezings of Sphagnum, Utricularia or other aquatic plants, and bottom sediment samples.

All of the author's collections were obtained during the summer months of 1961, 62, 63 and 64, with as many as possible examined in living condition. Eventually all samples were preserved and later re-examined. Material contributed by other collectors, as well as desmid illustrations made by others was also studied.

Illustrations were made and measurements recorded for the desmid taxa, and these served as the basis of identification. Selected examples of these figures are given in 114 plates accompanying the text.

Given for the taxa, in addition to figure number(s), and measurements are: author citation; any notes, observations or comments on the taxon; distribution by county; vial collection number(s) from which illustrations and/or measurements were made; and previous reports of the taxon in the state.

A total of 557 taxa (317 species, 176 additional varieties, and 67 formae) are reported. Among these, two species, four varieties and seven formae are new, and three new combinations are made.

The majority of the taxa treated are only known from the northwest, and a short discussion of the general distribution of the desmids of Montana is given.

Maps are presented of the division of the state within general continental classification, major mountain ranges, collection localities, average annual precipitation, generalized geology, state climatic divisions, great soil groups in associations within soil regions, major water features, hardness of the surface waters, and the number of desmid species encountered at each collection locality.

Two tables are included, the first summarizing the desmid flora presented in the text; the second summarizing the number of species, by genus, encountered at each collection locality.

A STUDY OF SELECTED GENERA OF THE FAMILIES GONATOZYGACEAE, MESOTAENIACEAE AND DESMIDIACEAE IN MONTANA

By

Dennis Cobian Jackson

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Dedicated to Evelyn, David and Mari.

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Miss Margaret Shea who opened the first door.

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I. INTRODUCTION

Historical Review

Since their discovery in the early eighteen hundreds, the desmids with their remarkable symmetry, and intricate and diverse morphological form (usually unicellular), have attracted the attention of many investigators. They collectively comprise the families Gonatozygaceae, Mesotaeniaceae, and Desmidiaceae in the order Zygnematales (Chlorophyta), with the majority belonging to the last mentioned family. As a group they have never been studied in the state of Montana, and in fact have been very little investigated in the entire northwest United States.

The few published papers on Montana algae with reports of desmids include those of Gumtow (1955), Kidd (1964), Lauff (1953), Sieminska (1965), Thomasson (1962) and Vinyard (1957); and the first and third authors cite them only to the generic level (*Closterium* and *Staurastrum*). Kidd reports three species of *Staurastrum*, one of *Cosmarium* and one of *Gonatozygon*. Sieminska's paper is the most recent and although concerned with a single pond in the northwest (locality 86), contains the greatest number of desmids. She lists 84 taxa, indicating 67 as new records for the state and/or North America, and 5 varieties as new to science. Three plants are assigned to taxa with some reservations. Thomasson's paper reports 12 desmid taxa from Two Medicine Lake in Glacier National Park. Vinyard reports 26 taxa from alpine and subalpine regions primarily in Glacier National Park. Additional accounts of desmids are found in unpublished reports or manuscripts, and theses (Kidd, 1963; Schindler, 1954; and Vinyard, 1951).

Scope of the Study

Preliminary investigations undertaken during the summers of 1961 and 1962 revealed that the northwestern part of Montana had what appeared to be a rich desmid flora.

Consequently, it was believed that a study on the desmids of Montana would contribute to the body of knowledge being gathered at the time on the group, at Dr. Prescott's phycological laboratory at Michigan State University.

The presence of greatly varied physiographic regions in the state, discussed more fully later, afforded the writer an opportunity to study the desmids under a variety of ecological conditions. Thus, hopefully, a better understanding of desmid distribution might be obtained. The ecology of desmids has long been of interest to phycologists and a short discussion of the factors affecting desmid distribution is given in a later section.

The basic investigation was begun in June, 1963, with the following objectives in mind.

1. Primarily to record the desmid taxa encountered, citing their distribution.

2. To prepare an inclusive list of the desmids of Montana integrating the previous records with those of the writer.

3. To prepare illustrations of all reported taxa, indicating wherever possible the morphological variations present, since morphology is the basic criterion upon which taxonomic determinations of desmids are made.

4. To compare the findings with those of other investigators of similar and/or related problems, in other parts of the United States.

5. To gather, whenever feasible, related ecological data (pH, total hardness of water, etc.) in order to obtain a clearer understanding of desmid distribution.

II. METHODS AND PROCEDURES

Though this study is principally based on collections and data acquired by the author, samples and information were also contributed by other collectors. The techniques and processes described below were those employed by the writer.

Chemical and Physical

Water used for chemical analyses was obtained from the immediate area of, and before, algal sampling. Tests for pH and alkalinity were performed at the site. If time permitted, other tests were made there. Otherwise, a water sample was collected and the remaining tests run later that day. Samples were collected in one litre glass containers filled by allowing the water to flow in slowly and gently without turbulence or air bubbles. The size of the samples taken allowed for replication in cases where results were suspect.

Titrimetric methods employed were as outlined in "Water Analysis Procedures Cat. #8" (Hach Chemical Co.) and included the following tests:

1. Alkalinity: Titration with 0.02N solution of H_2SO_4 to phenolphthalein (pH 8.3) and methyl orange (pH 4.6) end points. Results expressed are as ppm. calcium carbonate.

2. Calcium hardness: CalVer II Method. Results expressed are as ppm. calcium carbonate.

3. Total hardness: UniVer I or II Method. Results expressed are as ppm. calcium carbonate.

The remainder of the chemical determinations were made with the use of a battery operated Hach direct reading colorimeter. The procedures followed were as given in the "Hach D.R. Colorimeter Methods Manual," fourth edition, and included:

1. Nitrate nitrogen: Chromatropic Acid Method.

2. Nitrite nitrogen: Sulfanilic Acid-1, Naphthylamine Method.

3. Phosphate (ortho): StannaVer Method.

4. Phosphate (meta or poly): StannaVer Method.

The pH determinations were made by using a Beckman Pocket pH Meter Model-180.

Information on the geology and soils present in the collecting areas was taken from the Geologic Maps of Montana, compiled by Ross, Andrews and Witkind (1955), and the soils map in "Soils of the Western United States", a joint publication by the Agricultural Experiment Stations of the Western States Land Grant Universities and Colleges (1964). In describing the general geology and soils of a certain collection locality adjacent as well as immediately occurring rocks and soils are indicated.

Data on elevation, in the majority of cases, are given as approximations, since the figures were taken from various U.S. Geological Survey contour maps. In those instances where approximations are not indicated, the figures were those cited by other collectors or given in Gannett's _A Dictionary of Altitudes in the United States_, fourth edition (1967).

Results of chemical analyses and physical data obtained, are given under site descriptions (pages 29-56).

Biological

Although desmids in general have been considered to be calciphobic, sampling was not restricted to soft water habitats, and a wide range of habitats was sampled. Collections were made throughout the state, but were more heavily concentrated in the western third. See map no. 3 on page 21.

They include various lakes (oligotrophic-eutrophic), reservoirs, bogs, ponds, sloughs, swamps, marshes, rivers and other aquatic or semi-aquatic situations. The varied conditions existing at these sites chiefly determined the techniques employed and/or the types of samples taken. In general, however, an effort was made to obtain the kinds of samples listed below, whenever possible.

1. Plankton samples taken with a no. 25 silk bolting cloth net.
2. Strip (hand) samples or scrapings from coatings on submerged vegetation.
3. Squeezings of Sphagnum, Utricularia and other plants including algal mats. A no. 25 silk bolting cloth net was employed in concentrating the samples.
4. Bottom sediment samples.
5. Surface growth samples.

All of the author's collections were obtained during the summer months of 1961, 62, 63, and 64, with living algae examined as often as possible. Eventually all samples were preserved in Transeau's Solution, (6 parts water, 3 parts ethyl alcohol, and 1 part formalin) for future study. At least three microscopic mounts were made from each sample, and supplementary slides were examined until no additional taxa appeared to be present. Semi-permanent slides were prepared from all collections studied. More than seven thousand camera lucida drawings were made, and measurements recorded, for the desmid taxa. The objective was not only to illustrate the species present, but also to record any significant mophological variation the plant exhibited. These illustrations serve as the basis for identification and were compared with the type illustration of the taxon, and/or with drawings published by other authors. Selected illustrations of the taxa will be found beginning on page 376. There are a few localities from which illustrations made by other collectors were studied by the author, and these are indicated with an asterisk under the collection localities. The asterisk also appears following the name of the illustrator in the taxonomic section of the text.

The entire algal collection upon which the study is based is presently with the author.

III. GENERAL DESCRIPTION OF MONTANA

Physiography

Montana lies in the northwest Rocky Mountain region of the United States, and is the fourth largest state in the union having an area of 147,138 square miles. The state has an extreme length of 280 miles and an extreme breadth of 560 miles.[1] Within general continental classification, the state may be divided into three general regions: Montane (mountains and valleys), Piedmont (along the foot of the mountains), and Midland (relatively flat lands of the interior of the continent.)[2] The piedmont and midland regions, collectively form part of the Great Plains. See map no. 1 on page 18.

The montane region which comprises approximately the western third of the state, stands in dramatic contrast to the rolling and flat plains of the central and eastern region, and may be further divided into a northern and southern sections. In the north, the mountain ranges, and narrow valleys run parallel to each other in a north-west-southeast direction with the eastern edge of the region beginning at the foot of the Lewis range, and extending southward to the Blackfoot River. Westward, are the Swan, Whitefish, and Mission ranges and one of the wider valleys, the Kootenai-Flathead Lake Valley (part of the Great Rocky Mountain trench which estends south from British Columbia). Further west the

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[1]"Montana", Collier's Encyclopedia, 1963, XVI, 486.

[2]Nicholas Helburn, Milton J. Edie, and Gordon W. Lightfoot, Montana in Maps (Bozeman: The Research and Endowment Foundation at Montana State College, 1962), pp. 1-85.

mountain ranges are rather lower, with frequent valleys, and include the Flathead, Purcell and Cabinet Mountains as well as the upper end of the Bitteroot Mountains. In the southern montane region where the mountains are higher, as are the valley floors, there is no clear cut orientation to the mountain ranges. The region has instead an irregular assemblage of ranges with generally wider valleys. At the eastern edge of the southern montane region are the Little Belt Mountains, and southward the Castle Mountains, Crazy Mountains, and Beartooth Plateau. Between these and the lofty Bitteroot Mountains which form most of the state's western boundary, are located the Bridger, Absoroka and Gravelly Ranges as well as the Big Belt, Sapphire and Pioneer Mountains. The Physiographic Map, No. 2 on page 20, indicates the position of all the above named ranges and some others.

The relief of the piedmont region is, by contrast, much less varied, the region being characterized by gently rolling or flat terrain which is interrupted only locally by isolated mountain groups (Bear Paw, Little Rocky, Highwood, Judith, Big Snowy and Pryos Mountains) and river valleys.

The midland region is characterized by its lack of mountains, the area being primarily flat or rolling plains interrupted by deeply incised river valleys. Glaciation of the region north of the Missouri River has resulted in a flattening of hills and filling in of valleys, forming a broad glaciated plain, a condition which likewise exists in the northern area of the piedmont. Thus, the midlands northern glaciated area differs from that of the unglaciated southern region, which is characterized by sharply cut stream beds and high arid benchland.

The average altitude of Montana is 3400 feet[3] and between a

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[3]"Montana", Encyclopedia Americana, 1962, XIX, 383.

quarter and a half the state lying under 3000 feet.[4] This low average altitude, make Montana the lowest Rocky Mountain state, and somewhat compensates for its more northerly position and tempers its climate. The lowest elevation (1800 feet) occurs along the Kootanae river valley at a point near Troy in the extreme northwest corner of the state. The highest point is Granite Peak (Park county) in the southwest. In general the mountains range from 6000 feet to 10000 feet with valley floors set from 2000 to 6000 feet below the crest of the surrounding ranges.[5] Approximately 10000 square miles, or seven percent of the state has an elevation greater than 8000 feet.[6] From the mountain front across the Great Plains Region and towards the northeast, there is a progressive lowering of altitude, from 4000-5000 to 2000-3000 feet.

Climate

In general, Montana has a variable as well as changeable climate. Differences in elevation and influences of the Pacific Ocean and eastern continental land mass contribute to the marked dissimilarities in the climatic conditions of the western mountaious region and the eastern Great Plains area.

The moisture-laden air masses which provide Montana with most of its precipitation, come from the Pacific coast. Consequently, precipitation over the western montane region is considerably greater than that in the central and eastern regions. The average annual precipitation for the state is 15.48 inches,[7] ranging from less than ten inches in the

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[4]"Montana", Encyclopaedia Britannica, 1966, XV, 771.

[5]"Montana", Collier's Encyclopedia, 1963, XVI, 486.

[6]"Montana", Encyclopedia Americana, 1962 XIX, 383.

[7]"Montana", Encyclopaedia Britannica, 1966, XV, 771.

plains to 80-100 inches in the mountains (Hebeck, 1967). That of approximately half the state ranges between 13 and 16 inches and the heaviest rains fall in the higher mountain ranges of the northwest where the annual average is over 25 inches.[8] The driest areas almost exclusively occur east of the divide, averaging between 10-13 inches annually. Reviewing these figures, and comparing the state with the midwest, which receives on the average from 30-50 inches annually (Helburn et. al. 1962), one concludes that Montana is comparatively dry. Map no. 4 on page 22, shows the average annual precipitation in inches. Listed below are the climatic regions of the state in order of decreasing mean annual total precipitation (inches) received: Northwest, 19.04; South Central, 14.50; Southwest, 14.28; Central, 14.13; Southeast, 13.58; Northeast, 13.27; and North Central 13.07.[9] See Map no. 6 on page 24 .

The state's average mean temperature is about 43°F, ranging from 46°F in the Yellowstone Valley to 35°F in the mountain valleys.[10] Differences in the temperature, on a regional basis, are clearly evident, when comparing the average summer (July) and/or winter temperatures, over the entire state. In July most areas of the mountains average temperatures between 50°F and 60°F, while those of the middle of the Great Plains region range from 60°F to 70°F, and those of the lower eastern section range from 70°F to 80°F.[11] The lower temperatures in the west are in part the result of elevation, but are also due to the region's closer proximity to the Pacific Ocean. Average January temperatures indicate

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[8]U.S., Department of Agriculture, Climate and Man:The Yearbook of Agriculture, 1941 (Washington,D.C.: Government Printing Office, 1941.), p. 966.

[9]U.S., Environmental Data Service, Climatic Atlas of the United States, 1968 (Washington, D.C.: Government Printing Office, 1968), p. 48.

[10]"Montana", Encyclopedia Americana, 1962, XIX, 384.

[11]"Montana", Collier's Encyclopedia, 1963, XVI, 488.

that, with the exception of a few scattered areas in the central region of the plains, the valleys of the extreme west have the mildest winters. Here, in the Flathead, Bitterroot and Clark Fork valleys, January temperatures average over 24°F (Holburn _et_. _al_ 1962). Winter is progressively colder toward the east, with the northeast corner of the state averaging less than 8°F.

The prevailing winds are westerly and the state annually has an average of 158 clear days, 106 partly cloudy days.[12] On the whole it may be concluded that the western third of Montana has milder winters, cooler summers, greater cloudiness and more frequent and abundant precipitation.

Vegetation

A species list of the terrestial plants present at individual collecting sites is not given, and for more detailed information on the flora of Montana and/or the plant association present, the reader is directed to the publications of Booth, 1950; Booth and Wrigth, 1959; Daubenmire, 1943; Habeck, 1967; and Larsen, 1930. A bibliography concerning this subject has also been published by Habeck and Hartley, (1965). Over-all, Montana's mountainous, western third (montane) is dominated by forest, while the eastern two-thirds (Great Plains) is dominated by grassland.

Geology

The generalized geology of Montana is illustrated on Map no. 5 page 23. The map indicates the areas occupied by crystalline and sedimentary rocks in relation to their geological age, and refers to those rocks at the earth's surface, immediately below the soil. The rocks are

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[12] _Climate and Man_, _op_. _cit_.

listed in the map legend with the oldest placed at the bottom. Inspection of the map reveals that sedimentary rocks cover most of the state, while crystalline rocks are principally confined to the mountainous regions of the southwest.

More detailed geological information in reference to a particular location will found under the description of individual collecting sites and in Appendix I.

Soils

In this presentation of the soils of Montana, only the great soil groups and land types are treated, the occurrence and distribution of these being principally controlled by the interaction of climate (precipitation and temperature), elevation and vegetation. The soils are listed below under eleven regions within which are grouped soils having similarities due to the regional impact of the above mentioned factors. In addition intermingling or associations formed between or among the various kinds of soils, within the regions, are also indicated.[13]

Light Colored Soils of the Arid Region

Sierozem, Lithosol, Regosol.

Moderately Dark Colored Soils of the Semi-Arid Regions

Brown, Regosol.
Brown, Regosol, Lithosol.
Brown, Regosol, Solonetz.

Dark Colored Soils of the Semi-Arid Regions

Chestnut, Chernozem, Solonetz.
Chestnust, Lithosol.
Chestnut, Lithosol, Alluvial.
Chestnut, Regosol.

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[13]The named regions and inclusive associations of great soil groups, are those used in: "Soils of the Western United States", Joint Publication by the Agricultural Experiment Stations of the Western States Land-Grant Universities and Colleges with Cooperative Assistance by the Soil Conservation Service of the U.S. Dept. of Agriculture, 1964, pp. 1-69.

Dark Colored Soils of the Sub-Humid Regions

Chernozem, Prairie, Lithosol.
Chernozem, Regosol.
Chernozem, Regosol, Alluvial.

Soils of the Cool to Cold, Sub-Humid and Humid Forested Regions

Brown Podzolic, Lithosol, Regosol
Gray Wooded, Brown Podzolic, Rockland.
Gray Wooded, Chernozem, Lithosol.

Soils of the Cold Non-Forested Mountain Regions

Alpine Turf, Rockland, Alpine Meadow, Alpine Bog.

Swelling, Clayey, Soils

Grumusol.

Saline and Sodic Soils

Solonetz, Brown.

Recent Alluvial Soils

Alluvial, Brown.
Alluvial, Humic Gley.

Immature Soils on Unconsolidated Upland Materials and Aeolian Sands

Regosol, Grumusol.
Regosol, Lithosol, Brown, Chestnut.

Immature Shallow Soils on Consolidated Upland Materials and Miscellaneous Land Types

Lithosol, Badlands, Regosol.
Lithosol, Regosol, Alluvial.

Because of the sharply contrasting physiography of the western mountainous region and the lowlands of the Great Plains, a few general remarks regarding the soils of these areas seem appropriate.

In western Montana the distribution of the great soil groups, in general, is an altitudinal progression of Chestnut, Chernozem, Gray Wooded, Brown Podzolic and Alpine Turf soils. The Chestnut and Chernozem are the two extensive great soils of the grasslands, while the Gray Wooded and Brown Podzolic soils, dominate the forested areas (Nimlos, 1963).

Alpine Turf soils occur above the upper timberline.

Available soil moisture, which is usually associated with altitude in the west, is the primary factor determining the sequence (Nimlos, 1963). Consequently, as mentioned by Nimlos(1963), a progression from Chernozem to Brown Podzolic may likewise be encountered with decreasing elevation, but with increasing moisture. Cox (1957), states that Brown Podzolic soils may occur at elevations as low as 2400 feet, in areas of higher precipitation accompanied by lower temperatures. Not all the above mentioned soils are inevitably present along the gradient. Thus, for example, Chestnut and Gray Wooded soils may border each other directly, the Chernozem soils being absent (Cox, 1957). In addition, as a result of several variable influences (e.g. microclimate, vegetation, drainage, etc.) associated with divergent relief, local areas may possess grassland related soils (Chernozem on a southern slope and a forest related soil (Gray Wooded) on a northern exposure (Cox, 1957). Complex pattern and intergradations between the great soil groups also occur in this region.

Soils of the eastern two-thirds of the state (Great Plains)have developed principally under grassland vegetation and in arid to semi-humid climatic conditions. Here, the dominant great zonal soils are Brown, Chestnut and Chernozem, with Brown soils occurring in the driest parts and Chernozem occupying the most humid areas.[14] Intermingled with the above, as well as occurring over a large area of east-central Montana, are axonal Regosol and Lithosol soils.

In the isolated mountain groups (e.g. Bear Paw) of the Piedmont

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[14]E.B. Norum, B.A. Krantz and H.J. Haas, "The Northern Great Plains: Soil, The Yearbook of Agriculture, 1957 (Washington, D.C.; Government Printing Office, 1957) pp. 494-505.

region, the dominant soils present are Chernozem, Gray Wooded and Lithosols.

See the soil association map no. 7 on page 26, and refer to Appendix II for additional information on the great soil groups and land types named in the discussion.[15]

Water

Resources Inasmuch as precipitation, the continuing source of virtually all fresh water, is most abundant in the mountainous western third of the state, it is not surprising that most of Montana's water comes from, or exists in, that region. The state has numerous lakes and springs and thousands of miles of rivers and streams. These water resources are so distributed however, that not all areas are well supplied, and in some regions of the Great Plains many of the smaller rivers carry no water except during rare floods.

Uniquely, Montana's rivers drain into the Pacific Ocean, Hudson Bay and the Gulf of Mexico. See map no. 8 page 27.

West of the Continental Divide, the tributaries of the Columbia River system drain to the Pacific. Of these, the Clark Fork is the main river and though it drains less than fifteen percent of Montana, it has as large a total flow as the Missouri and Yellowstone Rivers combined (Halburn et. al, 1962). The major tributaries of the Clark Fork include the Blackfoot, Bitterrot and Flathead. The Kootenai River, another important tributary of the Columbia River system, drains a small portion of the northwestern corner of the state.

East of the Divide, draining a small triangular area along the

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[15]Unless otherwise indicated, the descriptive notes which are presented in the text for each of the eleven soil regions, have been extrapolated and condensed from "Soils of the Western United States", op. cit., the soil association map located at the end of this section is also from this source.

northern border of the state, is the St. Mary's River. It rises in Glacier National Park and flows northward, eventually emptying into Hudson Bay, by way of the Saskatchewan River.

The Missouri and Yellowstone Rivers and their tributaries drain the remainder of the state, their waters eventually ending at the Gulf of Mexico. The Missouri River is the largest, draining not only the Great Plains area, but also that portion of the Rocky Mountains east of the Continental Divide. It is formed by the junction of the Madison, Jefferson and Gallatin Rivers, at Three Forks. The principal northern tributaries of the Missouri, in Montana, are the Sun, Teton, Marias, Milk, and Poplar Rivers. Southern tributaries include the Smith, Arrow, Judith and Musselshell Rivers. The Yellowstone River rises in Wyoming as do most of its tributaries. It joins the Missouri in North Dakota. The major tributaries of the Yellowstone include, the Clark Fork (not to be confused with previously mentioned Clark Fork River), Big Horn, Tongue and Powder Rivers.

A number of reservoirs have been built along some of the rivers, fifty eight of which have a capacity of 5,000 acre feet or more.[16] The largest of these, located in northeast Montana, is Fork Peck Reservoir on the Missouri, formed by the world's largest earth-fill dam. Other major reservoirs are the Canyon Ferry Reservoir in central Montana, also on the Missouri River, and Hungry Horse Reservoir on the South Fork of the Flathead River in the northwestern part of the state.

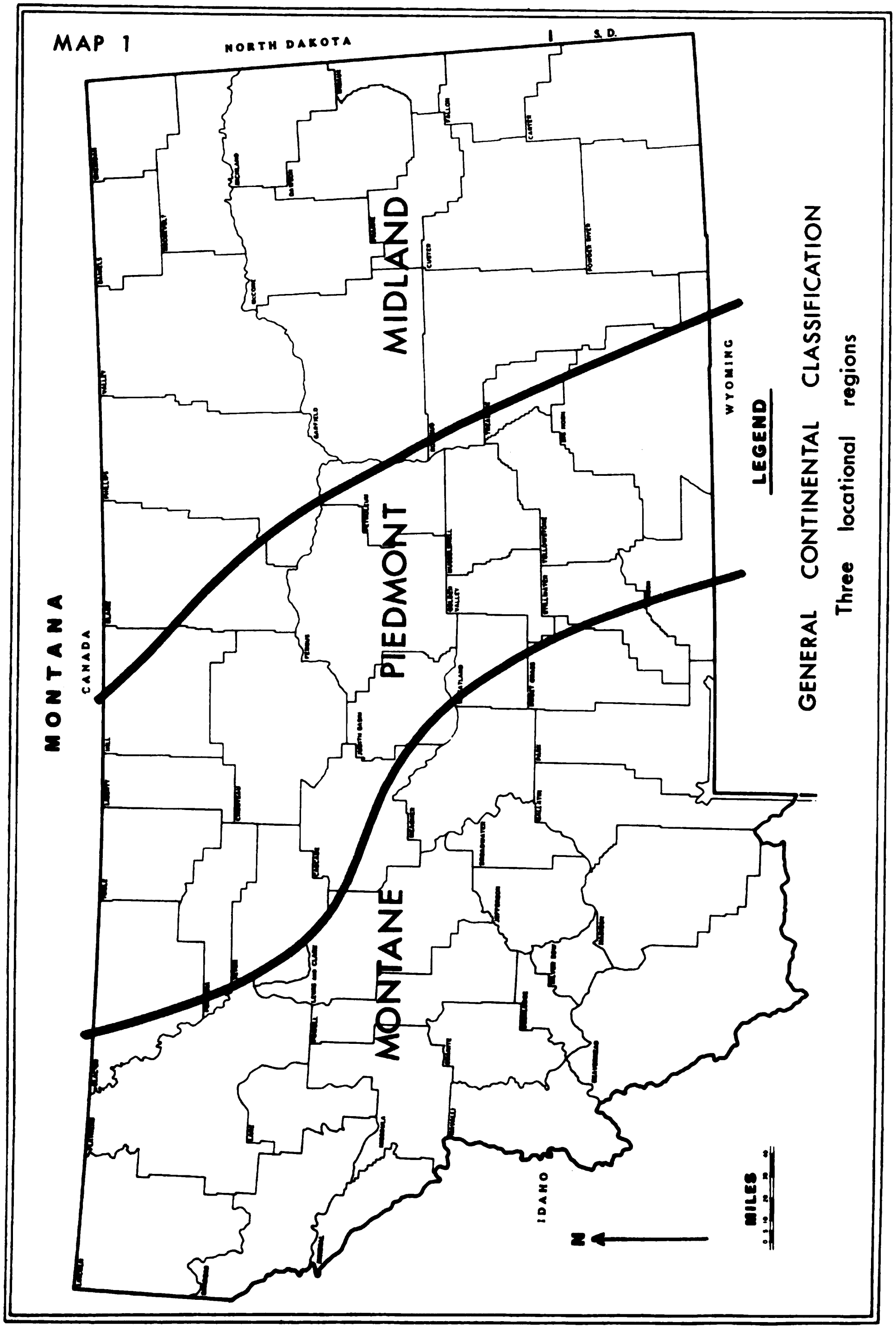
Of the state's natural lakes, Flathead Lake is the biggest, being approximately 200 square miles (Howard, 1968). The remaining lakes are generally small. There are an innumerable number of these in the mountains and valleys of the Montane, remmants of valley or piedmont glaciers,

[16]"Montana", Encyclopedia Americana, 1962, XIX, 383.

and also a number in the northern glaciated regions of the Great Plains.

Small ponds, non-permanent lakes, sloughs, seasonally flooded marshes and field depressions add to the number of aquatic habitats present.

Quality A resume of the quality of the waters of the state, both physical and chemical, though ideal, is not feasible here, but because of the generally considered calciphobic nature of the desmids, a general indication of the hardness of the surface water is given. See map no. 9 page 28. It should be kept in mind that the areas delineated on the map represent average conditions on a highly generalized basis. The map has been adapted from Ackerman and Lof (1959). As a point of reference, water containing 60 parts per million or less of calcium carbonate is considered soft; 60-120 p.p.m. moderately hard; and 120 p.p.m. or more, hard (Miller et al., 1963). It is thus noted from the map that the surface waters become progressively harder from west to east. Consequently, one might expect that the greatest abundance of desmids would be in the northwest region of the state. For more detailed information of the physico-chemical qualities of the waters sampled, see the general descriptions of the collection localities.

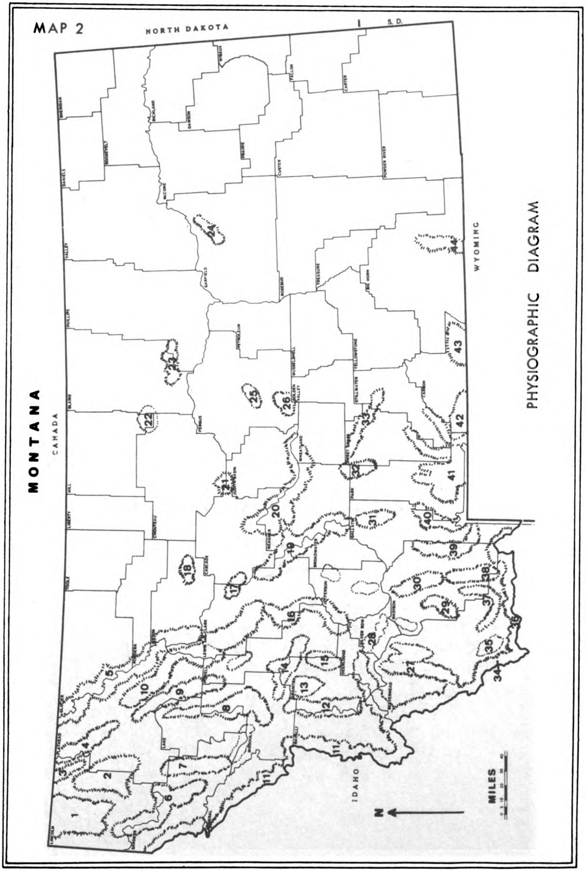

MAP 1
NORTH DAKOTA
S.D.
MONTANA
CANADA
WYOMING
IDAHO
MIDLAND
PIEDMONT
MONTANE
LEGEND
GENERAL CONTINENTAL CLASSIFICATION
Three locational regions
MILES
N

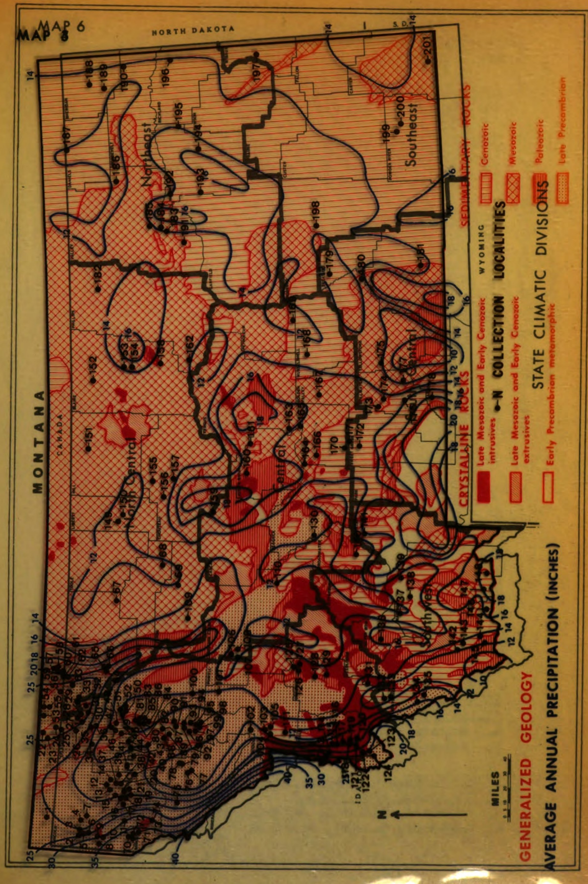
LEGEND

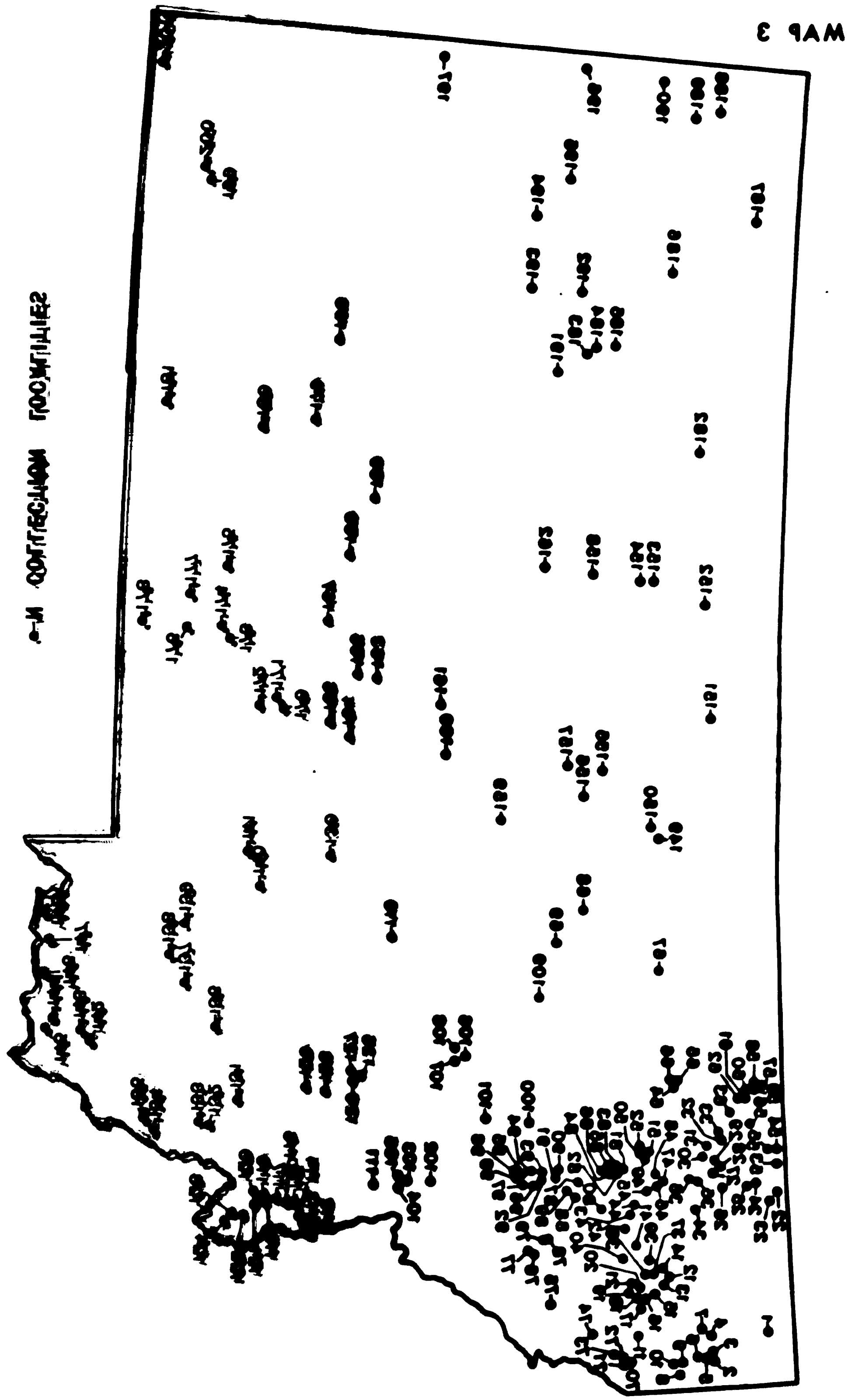
PHYSIOGRAPHIC DIAGRAM

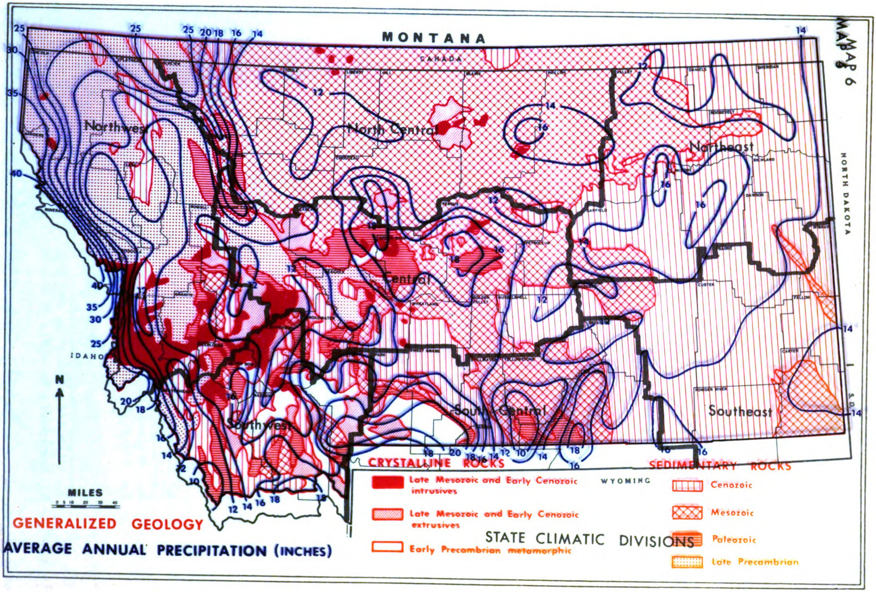
Major Mountains and Ranges

1. Purcell Mountains
2. Flathead Mountains
3. Galton Range
4. Whitefish Mountains
5. Lewis Range
6. Cabinet Mountains
7. Salish Mountains
8. Mission Range
9. Swan Range
10. Flathead Range
11. Bitterroot Range
12. Sapphire Mountains
13. John Long Mountians
14. Garnet Range
15. Flint Creek Mountains
16. Deerlodge Mountains
17. Bird Tail Divide
18. Teton Ridge
19. Big Belt Mountains
20. Little Belt Mountains
21. Highwood Mountains
22. Bearpaw Mountains
23. Little Rocky Mountains
24. Piney Buttes
25. Judith Mountains
26. Big Snowy Mountains
27. Pioneer Range
28. Butte Highlands
29. Ruby range
30. Tobacco Root Mountains
31. Bridger Range
32. Crazy Mountains
33. Cayuse Hills
34. Beaverhead Mountains
35. Tenddy Mountains
36. Centennial Mountains
37. Snow Crest Range
38. Gravelly Range
39. Madison Range
40. Gallatin Range
41. Absaroka Range
42. Beartooth Plateau
43. Pryor Mountains
44. Wolf Mountains


MAP 2
MONTANA
CANADA
NORTH DAKOTA
S. D.
WYOMING
IDAHO
N
MILES
PHYSIOGRAPHIC DIAGRAM


MAP 6
NORTH DAKOTA
MONTANA
CANADA
S. D.
WYOMING
IDAHO
North Central
Northeast
Central
Southeast
South Central
Northwest
SEDIMENTARY ROCKS
Cenozoic
Mesozoic
Paleozoic
Late Precambrian
CRYSTALLINE ROCKS
Late Mesozoic and Early Cenozoic intrusives
Late Mesozoic and Early Cenozoic extrusives
Early Precambrian metamorphic
•–N COLLECTION LOCALITIES
STATE CLIMATIC DIVISIONS
MILES
N
GENERALIZED GEOLOGY
AVERAGE ANNUAL PRECIPITATION (INCHES)


MAP 3
•-N COLLECTION LOCALITIES


MAP 6
MAP 5
MONTANA
CANADA
NORTH DAKOTA
S.D.
WYOMING
IDAHO
Northwest
North Central
Northeast
Central
Southwest
South Central
Southeast
N
MILES
CRYSTALLINE ROCKS
Late Mesozoic and Early Cenozoic intrusives
Late Mesozoic and Early Cenozoic extrusives
Early Precambrian metamorphic
SEDIMENTARY ROCKS
Cenozoic
Mesozoic
Paleozoic
Late Precambrian
STATE CLIMATIC DIVISIONS
GENERALIZED GEOLOGY
AVERAGE ANNUAL PRECIPITATION (INCHES)

MAP 8
AVERAGE ANNUAL PRECIPITATION (INCHES)
GENERALIZED GEOLOGY
SEDIMENTARY ROCKS
Cenozoic
Mesozoic
Paleozoic
Late Precambrian
CRYSTALLINE ROCKS
Late Mesozoic and Early Cenozoic intrusives
Late Mesozoic and Early Cenozoic extrusives
Early Precambrian metamorphic
•–N COLLECTION LOCALITIES

LEGEND

Indicating predominance of occurrence of Great Soil Groups in associations with soil regions.

A <u>LIGHT COLORED SOILS OF THE ARID REGIONS</u>
- 16. Sierozem, Lithosol, Regosol.

B <u>MODERATELY DARK COLORED SOILS OF THE SEMI-ARID REGIONS</u>
- 11. Brown, Regosol.
- 12. Brown, Regosol, Lithosol.
- 14. Brown, Regosol, Solonetz.

C <u>DARK COLORED SOILS OF THE SEMI-ARID REGIONS</u>
- 3. Chestnut, Chernozem, Solonetz.
- 4. Chestnut, Lithosol.
- 5. Chestnut, Lithosol, Alluvial.
- 8. Chestnut, Regosol.

D <u>DARK COLORED SOILS OF THE SUB-HUMID REGIONS</u>
- 4. Chernozem, Prairie.
- 5. Chernozem, Regosol.
- 6. Chernozem, Regosol, Alluvial.

F <u>SOILS OF THE COOL TO COLD, SUB-HUMID AND HUMID FORESTED REGIONS</u>
- 2. Brown Podzolic, Lithosol, Regosol.
- 7. Gray Wooded, Brown Podzolic, Rockland.
- 8. Gray Wooded, Chernozem, Lithosol.

H <u>SOILS OF THE COLD NON-FORESTED MOUNTAIN REGIONS</u>
- 1. Alpine Turf, Rockland, Alpine Meadow, Alpine Bog.

I <u>SWELLING, CLAYEY SOILS</u>
- 1. Grumusol.

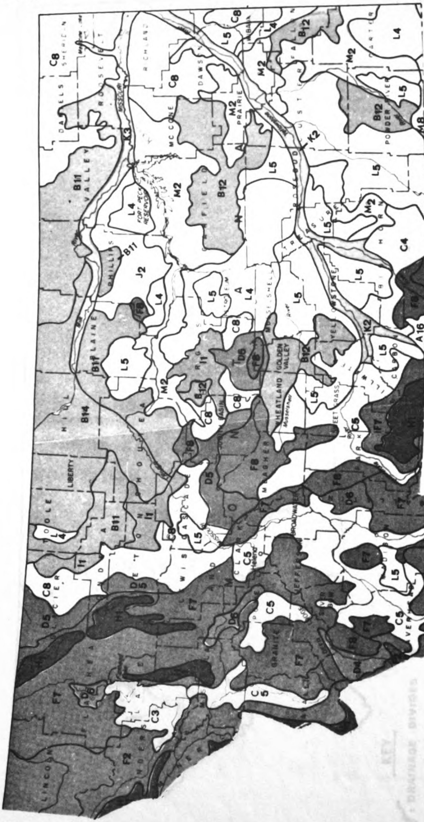
J <u>SALINE AND SODIC SOILS</u>
- 2. Solonetz, Brown.

K <u>RECENT ALLUVIAL SOILS</u>
- 2. Alluvial, Brown.
- 3. Alluvial, Humic Gley.

L <u>IMMATURE SOILS ON UNCONSOLIDATED UPLAND MATERIALS AND AELIAN SANDS</u>
- 4. Regosol, Grumosol.
- 5. Regosol, Lithosol, Brown, Chestnut.

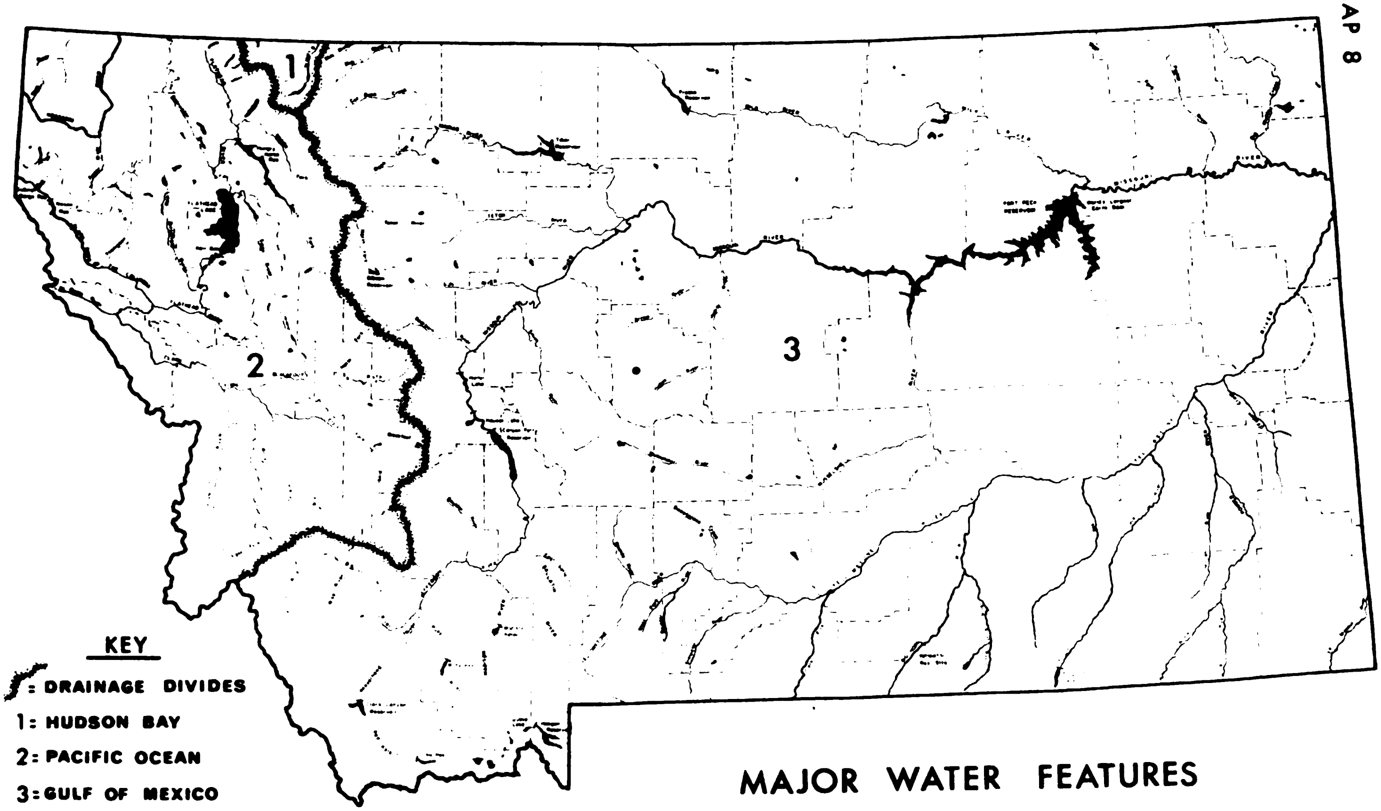
M <u>IMMATURE SHALLOW SOILS ON CONSOLIDATED UPLAND MATERIALS MISCELLANEOUS LAND TYPES</u>
- 2. Lithosol, Badlands, Regosol.
- 8. Lithosol, Regosol, Alluvial.

MAP 7



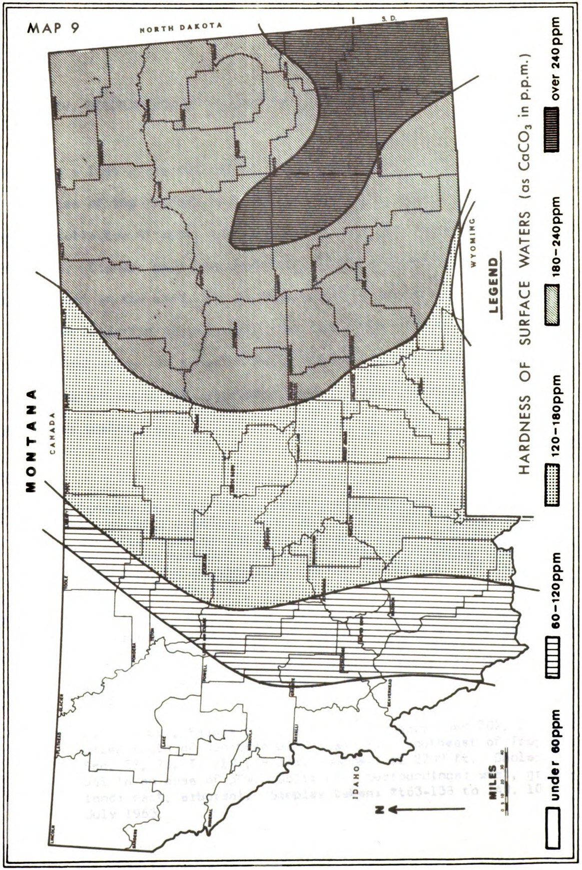
Great Soil Groups in Associations
Within Soil Regions

MAP 8



MAJOR WATER FEATURES

AND DRAINAGE PATTERN


MAP 9
MONTANA
CANADA
NORTH DAKOTA
S.D.
WYOMING
IDAHO
MILES
N
LEGEND
HARDNESS OF SURFACE WATERS (as $CaCO_3$ in p.p.m.)
under 60ppm
60–120ppm
120–180ppm
180–240ppm
over 240ppm

IV. DESCRIPTION OF COLLECTION LOCALITIES

Below is a list of my collection localities together with some descriptive notes of the habitat, collection numbers of samples taken and/or studied, collector if other than the author, and any physicochemical data obtained. Ciphers have been used to indicate the geology and types of soils present in the area, and an explanation of these will be found in the appendices beginning on page 623. The localities are enumerated according to their map dots. An asterisk following the map dot number denotes a locality for which desmid illustrations, made by other collectors, were studied by the author.

MAP DOT

No. 1 Lincoln Co., Yaak Lake, about 1 mile east of Yaak. A lake in low hill country. Sec. 36, T. 36N., R. 32W. Approx. el. 3000 ft. Geology: Qal in an area of pCw. Soil: F2. Surroundings: arboreal. Dominant aquatics: Scirpus, Nuphar, Nymphaea, and Utricularia. Sample taken: 4184, 30 July 1965. Coll. M. Mooar.

No. 2 Lincoln Co., Milnor Lake, on the west side of secondary road 202, about 3 miles south of junction U.S. 2 and 202 (southeast of Troy). Sec. 28, T. 31N., R. 32W. Approx. el. 2200 ft. Geology: Qal in an area of pCw. Soil: F2. Surroundings: grassland. Samples taken: MT63-141 to 144. 10 July 1963.

No. 3 Lincoln Co., Savage Lake, east of secondary road 202, 3 miles south of junction U.S. 2 and 202 (southeast of Troy). Sec. 27, 28, T. 31N., R 33W. Approx. el 2200 ft. Geology: Qal in an area of pCw. Soil: F2. Surroundings: west, grassland; east, arboreal. Samples taken: Mt63-138 to 140. 10 July 1963.

No. 4 Lincoln Co., Treasure Lake, northeast of U.S. 2 and about 5 miles north of Libby. Sec. 30, T. 31N., R. 31 W. Approx. el. 2000 ft. Geology: pCw and some Qg. Soil: F2, Surroundings: arboreal and grassland, Dominant aquatics: Nymphaea, and Utricularia. Samples taken: Mt63-129 to 135, 9 July 1963.

No. 5 Lincoln Co., pond 6 miles south of Troy on state secondary road 202. Sec. 33, t. 31N., R. 33W. Approx. el. 2000 ft. Geology: Qgl in an area of pCw. Soil: F2. Surroundings: Arboreal. Samples taken: Mt63-136,137. 10 July 1963.

No. 6 Lincoln Co., pond on east side of secondary road 202, approx. 2 miles south of Savage Lake (southeast of Troy). Sec. 4(?) T. 30 N., R. 33W. Approx. el. 2400 ft. Geology: Qgl to the west, pCw to the east. Soil: F2. Surroundings: arboreal. Samples taken: Mt63-145-149. 10 July 1963.

No. 7 Lincoln Co., pond along U.S. 2, within 1 mile and southeast of Libby. Sec. 10, T. 30N., R. 31W. Approx. el. 2000 ft. Geology: Qg in an area of pCw. Soil: F2. Surroundings: arboreal. Samples taken: Mt63-127,128. 9 July 1963.

No. 8 Lincoln Co., Spar Lake, at the end of a gravel road which intersects state secondary road 202, 1.5 miles north of Bull Lake (south of Troy). Sec. 21, T. 29N., R. 34W. Approx. el. 3400 ft. Geology: pCw. Soil: F2. Surroundings: arboreal. Samples taken Mt63-150 to 152, 10 July 1963.

No. 9 Lincoln Co., Swamp west of secondary road 202, within a mile of the northern end of Bull Lake (south of Troy). Sec. 8, T. 29N., R. 33W. Approx. el. 2200 ft. Geology: Qgl, pCr to the west, pCm to the east. Soil: F2. Surroundings: arboreal. Dominant aquatics: Carex and Scirpus. Sample taken: Mt63-154. 10 July 1963.

No. 10 Lincoln Co., Bull Lake, west of state secondary road 202, (south of Troy), in thickly wooded foothills of the Cabinet Mountains. Sec. 32, T. 29N., R. 33W. Approx. el. 2200 ft. Geology: Qgl, pCw to the west, pCr to the east. Soil: F2 Surroundings: arboreal. Chemical data: pH 6.8; total alkalinity 178 ppm. Samples taken: Mt63-153, 155 to 158, 10 July 1963.

No. 11 Lincoln Co.: Schrieber Lake, 20 miles south of Libby along U.S. 2. Sec. 13, T. 27N., R. 30W. Approx. el. 4200 ft. Geology: Qgl in an area of pCm. Soil: F2. Surroundings: semi-arboreal. Samples taken: Mt63-122 to 126, 9 July 1963.

No. 12 Lincoln Co., Island Lake, east side of State 24 (Pleasant Valley Road), 22 miles northwest of Marion. Sec. 30, 31, T. 29N., R. 26W. Approx. el. 3600 ft. Geology: Qal in an area of pCp. Soil: F2. Surroundings: arboreal and shrubland. Chemical data: pH 6.8-6.9; total alkalinity 146 ppm. Samples taken: Mt 61-3,4, Summer 1961. Mt62-6, Summer 1962. Mt63-67-72, 8 July 1963. Mt63-187A, 6 July 1963. Coll. M. Whelan.

No. 13 Lincoln Co., swamp 23 miles northwest of Marion on State 24 (Pleasant Valley Road). Sec. 30, 31, T.29N., R. 26W. Approx. el. 3600 ft. Geology: Qal in an area of pCp. Soil: F2. Surroundings: arboreal and grassland. Samples taken: MT63-73 to 75, 8 July 1963.

No. 14 Lincoln Co., pond within a mile of the southern end of Island Lake (22 miles north of Marion). Sec. 31. T. 29N., R.26W. Approx. el. 3600 ft. Geology: Qal in an area of pCp. Soil: F2. Surroundings: arboreal. Dominant aquatics: pond completely covered with *Spirodela polyrhiza*. Chemical data: pH 5.7; total alkalinity 37 ppm. Sample taken: MT63-76, 8 July 1963.

No. 15 Lincoln Co., Lynch Lake, about 19 miles northwest of Marion on State 24 (Pleasant Valley Road). Sec. 14, T.28N., R27W. Approx. el. 3400 ft. Geology: Qal in an area of pCr. Soil: F2. Surroundings: arboreal. Samples taken: MT62-26 to 28, Summer 1962.

No. 16 Lincoln Co., Rainbow Lake, a small lake north of U.S. 2, near Horseshoe Lake (West of Happy Inn). Sec. 23, T.27N., R.28W. Approx. el. 3700 ft. Geology: Qal in an area of pCr. Soil: F2. Surroundings: arboreal. Dominant aquatics: *Scirpus* and *Chara*. Chemical data: pH 6.6; total alkalinity 306 ppm. Samples taken : MT63-113,114, 9 July 1963.

No.17 Lincoln Co., Loon Lake, south side of U.S. 2, 3 miles west of Happy Inn. Sec. 22, 23, 27, T.27N., R.28W. Approx. el. 3700 ft. Geology: Qal in an area of pCw and pCr. Soil: F2. Surroundings: arboreal. Dominant aquatics: *Nuphar* and *Potamogeton*. Samples taken: MT63-115 to 121, 9 July 1963.

No. 18 Lincoln Co., Horseshoe Lake, south side of U.S. 2, about 1.5 miles west of Happy Inn. Sec. 23, 24, T27N., R.28W. Approx. el. 3700 ft. Geology: Qal in any area of pCr. Soil: F2. Surroundings: shrubland and arboreal. Samples taken: MT63-105 to 107, 9 July 1963.

No. 19 Lincoln Co., pond on opposite side of dirt road along east side of Horseshoe Lake, (1.5 miles west of Happy Inn). Sec. 24, 25, T.27N., R.28W. Approx. el. 3700 ft. Geology: Qal in an area of pCr. Soil: F2. Surroundings: arboreal. Dominant aquatics: *Fontinalis*, *Carex*, *Alisimachia*, and *Potamogeton*. Chemical data: pH 6.5; total alkalinity 226 ppm. Samples taken: MT63-108 to 112, 9 July 1963.

No. 20 Lincoln Co., Lower Thompson Lake, on south side of U.S. 2, 7 miles south of Happy Inn. Sec. 11, 12, 13, T.26N., R27W. Approx. el. 3200 ft. Geology: Qal in an area of pCr. Soil: F2. Surroundings: arboreal. Dominant aquatics: *Scirpus*, *Chara*, and *Myriophllum*. Chemical data: pH 6.8;

total alkalinity 288 ppm. Samples taken: MT63-90 to 96, 8 July 1963.

No. 21 Lincoln Co., Middle Thompson Lake, on south side of U.S. 2, 5 miles south of Happy Inn. Sec. 3,4, 10, 11, T.26N. R.27W. Approx. el. 3200 ft. Geology: Qal in an area of pCr. Soil: F2. Surroundings: arboreal, grassland, and shrubland. Dominant aquatics: *Fontinalis*, *Carex*, *Eleocharis*, *Scirpus*, *Sparganium*, *Equisetum*, *Potamogeton*, and *Chara*. Chemical data: pH 6.8; total alkalinity 286 ppm. Samples taken: MT63-97 to 104, 9 July 1963.

No. 22 Flathead co., bog at southwestern end of Kintla Lake, in the northwestern corner of Glacier National Park. Sec. 32. T. 37N., R.21W. Elevation 4000 ft. Geology: Qg in an area of Ts. Soil: F7. Samples taken: 6 Mon. 4, 5, 21, 31, 32, Summer 1955. Coll: G. W. Prescott.

No. 23 Flathead Co., Tepee Lake, about 10.5 miles north of Polebridge, on forest service road that goes south to Columbia Falls and north to the Canadian boundary. Sec. 3, 10, T. 36N., R.22W. Approx. el. 4000 ft. Geology: Qg in an area of pCpi. Soil: F7. Surroundings: arboreal. Dominant aquatics: *Scirpus* and *Carex*. Chemical data: pH9; total alkalinity 172 ppm. Samples taken: MT63-398 to 402, 30 July 1963.

No. 24* Flathead Co., Bowman Lake, on winding road 6 miles from Polebridge Ranger Station, in northwest area of Glacier National Park. Sec. 5, T.35N., R.20W. Elevation 4020 ft. Geology: Qg in an area of Ts. Soil: F7. Surroundings: arboreal. Samples taken: MT63-406, 411, 30 July 1963.

No. 25 Flathead Co., flooded area adjacent to the southern end of Bowman Lake, Glacier National Park. Sec. 5, T.35N., R.20W. Approx. el. 4000 ft. Geology: Qg in an area of Ts. Soil: F7. Samples taken: MT63-407 to 410, 30 July 1963.

No. 26 Flathead Co., Mud Lake, 3 miles northwest of ranger station located at the intersection of Big Creek and the forest service road, where the creek runs south to the Columbia Falls and north to the Canadian boundary. Sec. 7, 17, 18, T.33N., R.20W. Approx. el. 3600 ft. Geology: pCm. Soil: F7. Surroundings: arboreal. Dominant aquatics: *Sagittaria* and *Potamogeton*. Chemical data: total alkalinity 136 ppm. Samples taken: MT63-403-405, 30 July 1963.

No. 27* Flathead Co., pond along east side of Pioneer Road, just north of Camas Creek, Glacier National Park. Sec. 27, T. 33N., R.19W. Approx. el. 3800 ft. Geology: pCm

Chemical data: pH 6.9; total alkalinity 84 ppm. Samples taken: MT63-450, 451, 10 August 1963; Mon 25, Coll: G. W. Prescott.

No. 28 Flathead Co., McGee Meadow, 5 miles north of Apgar, along Pioneer Road, Glacier National Park. Sec. 21, 22, 27, T.33N., R.19W. Elevation 3885 ft. Geology: Qg in an area of Ts. Surroundings: grassland. Chemical data: pH 6.5; total alkalinity 58 ppm. Samples taken: MT63-442 to 499, 500, 501. 10 August 1963.

No. 29 Flathead Co., Little Howe Lake, about 1.5 miles on road which intersects the eastern side of Pioneer Road, at 5.5 miles north of Apgar, Glacier National Park. Sec. 24, T.33N., R.19W. Approx. el. 4100 ft. Geology: Ts. Soil: F7. Surroundings: arboreal. Sample taken: H. L. 1, Summer 1965. Coll: M. Mooar.

No. 30* Flathead Co., Lake McDonald, largest lake in Glacier National Park, 10 miles long, along Going to the Sun Highway. T.32N., T.33N., R.18W. Elevation 3144 ft. Geology: Ts. Soil: F7. Surroundings: arboreal. Chemical data: pH 7.1-7.7. Samples taken: Summers 1961 and 1962. Coll: D. Kidd.

No. 31* Flathead Co., John's Lake, a shallow pool, surrounded by a sphagnum bog, east end of Lake McDonald, Glacier National Park. T.33N., R.18W. Approx. el. 4000 ft. Geology: Ts. Soil: F7. Surroundings: arboreal. Dominant aquatics: Sphagnum and Nuphar. Samples taken: 4181-4183. Summer 1965. Coll. M. Mooar.

No. 32 Flathead Co., collection from mosses growing above fossil, algal display along Going to the Sun Highway, Glacier National Park. Sec. 36(?), T.34N., R.17W. Geology: pCsi. Soil: F7. Sample taken: MT63-217, Summer 1963. Coll: E. Bowman.

No. 33* Flathead Co., small pool at Logan Pass, Going to the Sun Highway, Glacier National Park. Terraced meadows. Cuts the Continental Divide between the summits of Clements Reynolds and Oberlin Mountains and Fiegan and Pollock Mountains. Samll ponds of snow melt in alpine meadow. Approx. e. 7000 ft. Geology: pCm. Coll: W. Vinyard.

No. 34 Flathead Co., Upper Whitefish Lake, approximately 22 miles northwest of Whitefish. Sec. 21, 28, T.34N., R.23W. Geology: Qal in an area of pCpi and pCga. Soil: F7. Surroundings: arboreal. Samples MT62-3, Summer 1962. Coll: B. Vallett. This map dot is placed too far southeast on map.

NO. 35 Flathead Co., Bailey Lake, north of Columbia Falls along forest service road, which runs north to Polebridge. Sec. 10, 11, T.31N., R.20W. Approx. el. 3400 ft. Geology: Qg in an area of pCm. Soil: F7. Dominant aquatics: Carex, Potamogeton, and Myriophyllum. Chemical data: pH 8.8; total alkalinity 148 ppm. Samples taken : MT63-390 to 392, 30 July 1963.

No. 36 Flathead Co., pond near Bailey Lake (north of Columbia Falls). Sec. 2, T.31N., R.20W Approx. el. 3400 ft. Geology: Qg in and area of pCm. Soil: F7. Dominant aquatics: Potamogeton and Polygonum. Chemical data: pH 8.9; total alkalinity 142 ppm. Samples taken: MT63-393 to 397, 30 July 1963.

No. 37 Flathead Co., Dahl Lake, about 12 miles north of Marion, on state 24, south side of raod. Sec. 24, T.28W., R.26W. Approx. el. 3400 ft. Geology: Qal in an area of pCp. Surroundings: grassland. Chemical data: pH 6.3; total alkalinity 179 ppm. Samples taken: MT63-82 to 85, 8 July 1963.

No 38 Flathead Co., pond southwest of Dahl Lake (south of Pleasant Valley). T.28N., R.26W. Approx. el 3400 ft. Geology: Qal in an area of pCp. Soil: F7. Samples taken: MT63-86 to 88, 8 July 1963.

No. 39 Flathead Co. pond east of Pleasant Valley, 1 mile north of Little Bitterroot Lake, (northwest of Marion). Sec. 26, T.28N.m R.25W. Approx. el. 4200 ft. Geology: Qal in an area of pCp. Soil: F7. Surroundings: arboreal. Chemical data: pH 5.8; total alkalinity 166 ppm. Samples taken: MT63-77 to 81, 8 July 1963.

No. 40 Flathead Co., McGregor Lake, 15.2 miles east of Happy Inn along U.S. 2, south side of road. Sec. 6, T.26N., R.25W. Approx. el. 4000 ft. Geology: pCr to the north and south, Qg to the east, and Qal to the west. Soil: F7. Surroundings: arboreal. Chemical data: pH 6.8; sample taken: MT63-89, 8 July 1963.

No. 41 Flathead Co., Little Bitterroot Lake, 1 mile northwest of Marion, west side of State 24, a clear water lake. Sec. 16, T.27N.m R.24W. Elevation 3947 ft. Geology: Qal to the east, pCr to the west. Soil: F7. Surroundings: arboreal. Chemical data: pH 6.4; total alkalinity 108 ppm. Samples taken: MT63-57 to 61, 7 July 1963.

No. 42 Flathead Co,, Lake Rogers, southeast of Marion. Sec. 30, 31, T.27N., R.23W. Approx. el. 4000 ft. Geology: Qg in in an area of pCw. Soil: F7. Surroundings: grassland and arboreal. Sample taken: Mont. 16, 21 July 1950. Coll: G. W. Prescott.

No. 43 Flathead Co., Ashley Creek, southwestern end of Smith Lake (southwest of Kalispell). Sec. 17, T.27N., R.22W. Approx. el. 3000 ft. Geology: Qal in an area of pCr. Soil: D6. Surroundings: grassland. Samples taken: MT63-48 to 50, 7 July 1963.

No. 44 Flathead Co., Smith Lake, 8 miles southwest of Kalispell along U.S. 2, a clear water lake, marl present. Sec. 7,8, 9, T.27N., R.22W. Approx. el. 3000 ft. Geology: Qal; pCpi to the east, pCr to the south, pCw to the north and west. Soil: D6. Surroundings: grassland. Dominant aquatics: Scirpus, Carex, Potamogeton, Nuphar, and Myriophyllum. Chemical data: pH 8.4; total alkalinity 200 ppm. Samples taken: MT63-51 to 56, 7 July 1963.

No. 45 Flathead Co., pond 3 miles south of Kalispell along U.S. 3. Sec. 33, T.28N.m R.21W. Approx. el. 2900 ft. Geology: Qg in an area of pCpi. Soil: D6. Surroundings: grassland. Samples taken: MT63-42, 43, 28 June 1963.

NO. 46 Flathead Co., McWinniger's Slough, about 3 miles east of Kalispell along U.S. 2. Sec. 31, T.29N., R.20W. Elevation 2946 feet. Geology: Qal in an area of pCpi. Soil: D6. Surroundings: grassland. Dominant aquatics: Nuphar, Nymphaea, and Scirpus. Sample taken: MT62-1, 5 July 1962.

No. 47 Flathead Co., Lake Blaine, 6 miles east on road which junctions with U.S. 2 and State 35, northwest of Creston. Sec. 26, 27, 35, 36, T.29N., R.20W. Approx. el 3000 ft. Geology: Qg, pCap to the east. Soil: D6. Surroundings: semi-arboreal. Chemical data: pH 8.6; total alkalinity 196 ppm. Samples taken: MT63-412 to 415, 4 July 1963.

No. 48 Flathead Co., pond near Lake Blaine, saml1 pond with silted bottom and clear water. Sec. 26, T.29N.m R.20W. Approx. el. 3000 ft. Geology Qg in an area of pCap (?). Soil: D6. Surroundings: grassland. Dominant aquatic: Ranunculus. Chemical data: pH 8.6-8.8; total alkalinity 278 ppm. Samples taken: MT63-416 to 418, 4 July 1963.

No. 49 Flathead Co., Picnic Lake 1, on Mt. Aeneas, Swan Range northeast of Big Fork. Sec. 30, T.28W., R.18W. Approx. el. 7000 ft. Geology: pCpi. Soil: H1. Surroundings: alpine tundra. Samples taken: MT63-435 to 437, 10 August 1963.

No. 50 Flathead Co., stream between Picnic Lake 1 and 2 on Mt. Aeneas, (northeast of Big Fork. Sec. 30, T28N., R18W. Approx. el. 7000 ft. Geology: pCpi. Soil: H1. Surroundings: alpine tundra. Sample taken: MT63-438, 10 August 1963.

No 51 Flathead. Co., Black Lake, north of Mt. Aeneas, northeast of Big. Fork. Sec. 29, 30, T.28N., R.18W. Approx. el. 5000 ft. Geology: pCpi. Soil: F7. Surroundings: arboreal. Chemical data: pH 7.2; total alkalinity 108 ppm. Samples taken: MT63-440, 441, 10 August 1963.

No. 52 Flathead Co. Picnic Lake 11, on Mt. Aeneas, Swan Range northeast of Big Fork. Sec. 30, T.28N., R.18W. Approx. el. 7000 ft. Geology: pCpi. Soil: H1. Surroundings: alpine tundra. Sample taken: MT63-439, 10 August 1963.

No. 53* Glacier Co., Tarn, below Thunderbird Glacier and Logan Falls, Glacier National Park, T.37N., R.19W. Elevation 6000 ft. Geology: pCsi. Samples taken: Summer 1950 (?). Coll: W. Vinyard.

No. 54 Glacier Co., Rainbow Bog, south of Waterton Lake, northern end of Glacier National Park. T.37W., R.18W. Approx. el. 4400 ft. Geology Qg in an area of pCap. Soil: F7. Surroundings: arboreal. Sphagnum bog surrounding arboreal. Samples taken: MT62-11, 12, 14 to 20, Summer 1962; MT62-13, 22, Summer 1962. Coll: H. Andrews; MT62-21, 23 to 25, Summer 1962. Coll: R. Raymond; 2 Mon 8, 9. Coll: G. W. Prescott.

No. 55 Glacier Co., Upper Kootenai Lake, Glacier National Park. T.37N.m R.18W. Approx. el. 4370 ft. Geology: Qg, pCga to the west. Soil: F7. Surroundings: arboreal. Dominant aquatics: Nuphar and Potomageton. Sample taken: Mon. 27, 28, 25 July 1950. Coll: G. W. Prescott.

No. 56* Glacier Co., Swift Current Lake, in front of Many Glacier Hotel. Northeastern section of Glacier National Park. T.35N., R.16W. Elevation 4861 ft. Geology: pCag. Soil: F7. Surroundings: arboreal. Chemical data: pH 7.1-7.7. Samples taken: Summers 1961, 1962. Coll: D. Kidd.

No. 57 Glacier Co., Duck Lake, about 4 miles east on secondary road. A clear water lake with rocky bottom. Sec. 21, T.36N., R.13W. Approx. el. 5000 ft. Geology: Ku to the north, east and west; Qg to the south. Soil: D5/F7. Surroundings: arboreal. Dominant aquatics: filamentous algae. Chemical data: pH 8.6; total alkalinity 772 ppm. Samples taken: MT63-421 to 426, 8 August 1963.

No. 58 Glacier Co, pool off Duck Lake (east of Babb). Sec. 20, T.36N., R.13W. Approx. el. 5000 ft. Geology: Qg in an area of Ku. Soil: D5/F7. Surroundings: arboreal. Dominant aquatics: filamentous algae. Samples taken: MT63-427, 428, 8 August 1963.

No. 59 Glacier Co., pond about 2 miles south of Duck Lake (east of Babb). Sec. 36, T36W., R.14W. Elevation 4780 ft.

Geology: Ku. Soil: D5. Surroundings: grassland. Sample taken: MT63-429, 8 August 1963.

No. 60 Glacier Co., pond south of Duck Lake (east of Babb). Sec. 35, T.36N., R.14W. Approx. el. 4700 ft. Geology: Qg in an area of Ku. Soil: D5. Surroundings: semi-arboreal and grassland. Sample taken: MT63-430, 8 August 1963.

No. 61 Glacier Co., pond south of Duck Lake (east of Babb). Sec. 35, T.36N., R14W. Approx. el. 4700 ft. Geology: ku. Soil: D5/F7. Surroundings: semi-arboreal. Samples taken: MT63-431, 432, 8 August 1963.

No. 62* Glacier Co., Lower St. Mary Lake, west side of U.S. 89, between Babb and St. Mary. Elevation 4462. Geology: Ku. Soil: F7. Surroundings: arboreal. Chemical data: pH 7.2-7.8. Samples taken: Summers 1961, 1962. Coll: D. Kidd.

No. 63* Glacier Co., Lost Lake, 9.7 miles west of St. Mary along Going to the Sun Highway, Glacier National Park. A small circular lake, dark brown in color. T.43N., R.15W (?). Approx. el. 4700 ft. Geology: pCap. Soil: F7. Surroundings: arboreal. Dominant aquatic: a few Potamogeton. Chemical data: pH 7.2-7.6. Samples taken: Summers 1961, 1962. Coll: D. Kidd; MT63-218, 219, Summer, 1963. Coll: E. Bowman.

No. 64 Glacier Co., pond at Maria's Pass, entrance to Glacier National Park. Sec. 31, T.30N., R.13W. Elevation 5216 ft. Geology: Qg, Ku to the north and west, Kk to the east and south. Surroundings: subalpine. Sample taken: MT61 1,2. Summer, 1961.

No. 65* Glacier Co., Summit Creek, Maria's Pass in the Lewis Range Glacier National Park. Elevation 5380 ft. Geology: Qg, Ku to the north and west, Kk to the east and south. Surroundings: subalpine. Samples taken: Summer 1950 (?). Coll: W. Vinyard.

No. 66* Glacier Co., pond, Maria's Pass along slowly moving stream, Glacier National Park. Approx. el. 5200 ft. Geology: Qg, Ku to the north and west, Kk to the east and south. Surroundings: subalpine. Samples taken: Summer 1950 (?). Coll: W. Vinyard.

No. 67 Pondera Co., Lake Frances, at Valier along secondary road 216. A clear water lake with rock to sandy bottom. Sec. 5, 6, T.29N., R.5W. Elevation 3818 ft. Geology: Ktm. Soil: I1. Surroundings: grassland. Dominant aquatic: Chara. Chemical data: pH 8.2; total alkalinity 182 ppm; calcium hardness 104 ppm; total hardness 166 ppm.

Samples taken: MT64-55 to 57, 16 August 1964.

No. 68 Teton Co., pond at Dutton, junction of U.S. 91 and state secondary road 221. A small pond with mucky bottom and yellowish water. Sec. 10, T.24N., R.1W. Approx. el. 3600 ft. Geology: Kc. Soil: I1. Surroundings: grassland. Dominant aquatics: Potamogeton, Sagittaria, Eleocharis, and Typha. Chemical data: pH 8; total alkalinity 266 ppm; calcium hardness 120 ppm; total hardness 196 ppm; nitrogen (nitrate) .058 ppm; nitrogen (nitrate) .022 ppm; phosphate (ortho) .08 ppm; phosphate (meta) .24 ppm. Samples taken: MT64-51 to 54, 16 August 1964.

No. 69 Teton Co., Greenfield's Lake, about 1 mile north of state secondary road 408 before it intersects with U.S. 89 at Fairfield. A highly odoriferous lake with mucky bottom and large quantities of decaying algae. Sec. 6, 7, 8, 17, 18, 19, 20, 30, T.22N., 3W., 4W. Elevation 3776 ft. Geology: Kc. Soil: I1/C8. Surroundings: grassland. Chemical data: pH 8.8; total alkalinity 322 ppm; calcium hardness 154; total hardness1114 ppm; nitrogen (nitrate) .8 ppm; nitrogen (nitrate) below recordable number; Phosphate (ortho) .05 ppm; phosphate (meta) .15 ppm. Samples taken: MT64-85, 86, 23 August 1964.

No. 70 Sanders Co., pond at Noxon, along U.S. 10A. Sec. 19, T.26N., R.32W. Elevation 2181 ft. Geology: Qal in an area of pCw. Soil: F2. Sample taken: MT63-161, 11 July 1963.

No. 71 Sanders Co., pond at Noxon, along U.S. 10A. Sec. 19, T.26N.m R.32W. Elevation 2181 ft. Geology: Qal in an area of pCw. Soil: F2. Samples taken: Mt63-164,165,11. July 1963.

No. 72 Sanders Co., pond at Noxon, along U.S. 10A. Sec. 19, T.26N., R.32W. Elevation 2181 ft. Geology: Qal in an area of pCw. Soil: F2. Samples taken: MT63-162,163, 11 July 1963.

No. 73 Sanders Co., pond approximately 10 miles south of Noxon, along U.S. 10A. Sec. 23, T.25N., R.32W. Approx. el. 2200 ft. Geology: Qal, pCw to the west, pCr to the east. Soil: F2. Surroundings: semi-arboreal and grassland. Samples taken: MT63-166 to 169, 11 July 1963.

No. 74 Sanders Co., pond 4 miles north of Whitepine, along U.S. 10A. Sec. 1, T.23N., R.31W. Approx. el. 2600 ft. Geology: Qal, pCr to the east, pCw to the west. Soil: F2. Samples taken: MT63-170-171, 11 July 1963.

No. 75 Sanders Co., pond 5 miles southeast of Thompson Falls, along U.S. 10. Sec. 13, T.21N., R.29W. Approx. el. 2400 ft. Geology: Qal, pCr to the east, pCw to the west.

Soil: F2. Samples taken: MT63- 172 to 174, 11 July 1963.

No. 76 Sanders Co., Rainbow Lake, about 9 miles northeast from Plains, along State road 28. Sec. 3, T.20N.m R.25W. Elevation 3800 ft. Geology: pCp to the east and south, pCr to the north, Qal to the west. Soil: F2. Surroundings: arboreal. Dominant aquatics: Carex, Eleocharis, Ranunculus, Potamogeton, and Myriophyllum. Samples taken: MT63-159, 160, 175 to 177, 190 to 193, 11 July 1963; MT63-498, 499, Summer 1963.

No. 77 Sanders Co., pond near Rainbow Lake, about 10.5 miles northeast from Plains, along State road 28. Sec. 2, T.20N., R.25W. Approx. el. 3800 ft. Geology: pCp. Soil: F2. Surroundings: arboreal. Dominant aquatics: Sagittaria, Potamogeton, and Utricularia. Samples taken: MT63-194, 195, 20 July 1963.

No. 78 Sanders Co., pond at Welcome Spring, 2 miles east of Rainbow Lake, along State road 28. (See collection locality No 76.) Sec. 31, T.21N., R.24W. Approx. el. 3800 ft. Geology: pCp. Soil: C3. Surroundings: arboreal. Dominant aquatics: Nuphar and Ranunculus. Samples taken: MT63-181 to 183, 11 July 1963.

No. 79 Sanders Co., pond 2 miles north of Welcome Spring. Sec. 28, T.21N., R.24W. Approx. el. 3400 ft. Geology: pCp. Soil: C3. Surroundings: grassland. Samples taken: MT63-178 to 180, 11 July 1963.

No. 80 Lake Co., Lake Mary Roanan, 4. 5 miles north of Proctor on road which runs southeast to Dayton. Sec. 11, 13, 14, 15, 22, 23, 24, T.25N., R.22W. Elevation 2889 ft. for Dayton. Geology: pCr to the north, west, and south, small portion of Qg to the east. Soil: C3. Surroundings: grassland. Dominant aquatics: Typha and Potamogeton. Sample taken: 4 Mon. 52, 29 July 1953. Coll: G.W. Prescott.

No. 81 Lake Co., Estes Lake,on road which intersects State 35 above Woods Bay (Flathead Lake), and runs northeast. Sec. 21, T.26N., R.19W. Approx. el. 3400 ft. Geology: pCap. Soil: F7. Surroundings: arboreal. Samples taken: MT63-206 to 213, 16 July 1963.

No. 82 Lake Co., Estes Pond I, along road which intersects State 35 at Woods Bay, (Flathead Lake), and runs northeast. Sec. 20, T.26N., R.19W. Approx. el. 3400 ft. Geology: pCap. Soil: F7. Surroundings: arboreal. Samples taken: MT63-199 to 201, 16 July 1963.

No. 83 Lake Co., Estes Pond II, on road which intersects State 35 at Woods Bay, (Flathead Lake), and runs northeast. Sec. 21, T.26N., R.19W. Approx. el. 3400 ft. Geology:

pCap. Soil: F7. Samples taken: MT63-202 to 205, 16 July 1963.

No. 84 Lake Co., Tykeson Pond, about 2.5 miles northeast of Woods Bay, (Flathead Lake). Sec. 15, T.26N., R.19W. Approx el. 3200 ft. Geology: Qal in an area of pCap. Soil: F7. Surroundings: arboreal. Dominant aquatics: Potentilla, Nuphar, Menyanthes, Utricularia. Chemical data: pH 7.4-8.2. Samples taken: MT62-67, 81, 26 June 1962; 86, C3, C4, Q1, X8, Summer 1965. Coll: R. Hoham.

No. 85 Lake Co., Loon Lake, on the road to Crane Lookout, overlooking Swan Lake, (Swan Valley). Lake has rocky bottom and shore appears a dark brown. Sec. 10, T.26N., R. 19W. Approx. el. 3200 ft. Geology: Qal in an area of pCap. Soil: F7. Surroundings: arboreal. Dominant aquatics: mosses, Scirpus, Myriophyllum, Typha, Potamogeton, and Ranunculus. Chemical data: pH 6.3; total alkalinity 139 ppm. Sample taken: MT63-47, Summer 1963. Coll: V. Gilliland.

No. 86* Lake Co., Mission Well, approximately 4.5 miles northwest of Yellow Bay, Flathead Lake, Montana. Sec. 24, T. 25N., R.19W. Elevation: 5275 ft. Geology: pCap. Soil: F7. Surroundings: arboreal. Dominant aquatics: Carex, Nuphar, and Menyanthes. Chemical data: pH 7.2-8.3. Samples taken: MT62-63, 64, 66, 68, 72 to 77, 79, 88, 186 to 188, 26 June 1962; MT63-186 to 188, Summer 1963; Y1, Summer 1965. Coll: R. Hoham.

No. 86A Lake Co., Carex Bog, location of this bog is unknown, it is on the east side of the road leading to Mission Well, (northeast of Yellow Bay, Flathead Lake). Sec. 24 (?), T.25N., R.19W. Geology: pCap. Soil: F7. Surroundings: arboreal. Samples taken: MT62-65, 69 to 71, 78, 26 June 1962; Mon 206, 18 July 1959. Coll: G. W. Prescott.

No. 87 Lake Co., Rocky Point Slough, (Flathead Lake), southern end of the lake (west shore) directly opposite Finley Point. Artificial empoundment with musky bottom, water yellow but clear. Sec. 3, T.23N., R.20W. Approx. el. 2800 ft. Geology: pCpi. Soil: C3. Surroundings: arboreal. Dominant aquatics: Typha, Polygonum, Scirpus, Utricularia. Chemical data: pH 7.6; total alkalinity 224 ppm; calcium hardness 126 ppm; total hardness 200 ppm; nitrogen (nitrate) .797 ppm; nitrogen (nitrate) .003 ppm; phosphate (ortho) .04 ppm; phosphate (meta) .08 ppm. Samples taken: MT64-64 to 69, 18 August 1964.

No. 88 Lake Co., Jetee Lake, amall lake approximately one mile west of U.S 93, on road which intersects 93, about 7.5 miles south of Big Arm, Sec. 14, T.23N., R.21W. Approx. el. 3800 ft. Geology:pCr. Soil: C3. Surroundings: grassland and semi-arboreal. Dominant aquatics:

Polygonum, Potamogeton, Typha, and Ceratophyllum. Samples taken: MT62-29 to 35, Summer 1962; MT63-197, 198, 17 July 1963. Coll: M. Mooar.

No. 89 Lake Co., pond on the way to Jetee Lake Tower. Sec. 10, T.23N., R.21W. (See collection locality No. 88). Approx. el. 5000 ft. Geology: pCr. Soil: C3/F7. Surroundings: arboreal and grassland.. Dominant aquatic: Ricciocarpus. Samples taken: MT63-388, 389, Summer 1963. Coll: M. Mooar.

No. 90* Lake Co., Upper Twin Lake, small private lake about 6 miles eastof Polson. Sec. 9, T.22N., R.19W. Approx. el. 2900 ft. Geology: Qg to the west, pCap to the east. Soil: C3/F7. Surroundings: semi-arboreal. Dominant aquatics: Chara and algae. Chemical data: pH 8.4-8.9. Coll: J. Schindler.

No. 91* Lake Co., Lower Twin Lake, one quarter-mile southwest of Upper Twin Lake, east of Polson. Sec. 8, 17, T.22N., R.19W. Approx. el. 2900 ft. Geology: Qg to the west, pCap to the east. Soil: C3. Surroundings: semi-arboreal. Chemical data: pH 7.9-8.8. Coll: J. Schindler.

No. 92 Lake Co., pond on west side of Route 93 south of Ronan. Sec. 23, T.20N., R.20W. Approx. el. 3000 ft. Geology: Qg in an area of Qgl, pCr to the west, pCap to the east. Soil: C3. Surroundings: grassland. Samples taken: MT63-38 to 40, 4 July 1963.

No. 93 Lake Co.,pond on east side of Route 93, south of Ronan. Sec. 24, T.20N., R.20W. Approx. el. 3000 ft. Geology: Qg in an area of Qgl, pCr to the west, pCap to the east. Soil: C3. Surroundings: grassland. Samples taken: MT63-35 to 37, 41, 4 July 1963.

No. 94 Lake Co., pond in woods near Kicking Horse Res. (Miss. Mt.). Sec. 19, T.20N., R.19W. Approx. el. 3100 ft. Geology: Qg to the east, pCap to the west. Soil: C3/F7. Surroundings: arboreal. Sample taken: 7 Mon. 15, 25 July 1956. Coll: G. W. Prescott.

No. 95 Lake Co., pond in woods south of Ronan near Kicking Horse Res. (Miss. Mt.). Sec. 20, T.20N., R.19W. Approx. el. 3100 ft. Geology: Qg to the east, pCap to the west. Soil: C3/F7. Surroundings: arboreal. Samples taken: MT62-56 to 60, 28 June 1962.

No. 96 Lake Co., Nine Pipe Reservoir, 6 miles south of Ronan on U.S. 93. Sec. 34, 35, 36, T.20N., R.20W, and T.19N., R. 20W. Approx. el. 3100 ft. Geology: Qg surrounded by Qgl, in an area of pCr. Soil: C3. Surroundings: grassland. Dominant aquatic: Typha. Samples taken: MT62-36 to 42

28 June 1962; MT63-44 to 46, 7 July 1963.

No. 97 Lake Co., pond on road side, 2 miles east of Allentown. Sec. 1, T.19N., R.20W. Approx. el. 3100 ft. Geology: Qg surrounded by Qgl, in an area of pCr. Soil: C3. Surroundings: grassland. Samples taken: MT63-33, 26 June 1963. Coll: M. Mooar. MT63-34, 26 June 1963. Coll: E. Jackson.

No. 98 Lake Co., McDonald Lake, in Mission Mountains, east of Ninepipes Reservoir (south of Ronan). Clear water lake. Sec. 11, T. 19N., R.19W. Approx. el. 3800 ft. Geology: pCap to the west, pCag to the east. Soil: F7. Surroundings: arboreal. Samples taken: MT63-62 to 64, 23 June 1963.

No. 99 Lake Co., pond across from spillway of McDonald Lake. (See collection locality No. 98). Approx. el. 3800 ft. Geology: pCap. Soil: F7. Surroundings: arboreal. Samples taken: MT63-65,66, 23 June 1963.

No. 100 Missoula Co., bog in Bob Marshall wilderness, near Woodward Lake. Sec. 18, T.20N., R. 15W. Approx. el. 6800 ft. Geology: pCp. Soil: F7. Samples taken: MT63-419, 420, Summer 1963. Coll: V. Gilliland.

No. 101 Missoula Co., Seely Lake, west side of state secondary road 299 at Seely Lake. Clear water lake with rocky bottom. Sec. 21, T. 17N., R.15W. Approx. el. 4000 ft. Geology: Qal in an area of pCm, Qg to the south. Soil: F7. Surroundings: arboreal. Dominant aquatics: Elodea and Potamogeton. Chemical data: pH 7.8; total alkalinity 54 ppm; calcium hardness 40 ppm; total hardness 52 ppm; nitrogen (nitrate) .05 ppm; nitrogen (nitrate) .04 ppm; phosphate (meta) .03 ppm Samples taken: MT64-70 to 73, 21 August 1964.

No. 102 Missoula Co., Blackfoot River, about 6 miles east of Missoula, on State 20. Sec. 19 (?), 17 (?), T.13N., R.18W. Approx. el. 3300 ft. Geology: Qal in an area of pCm. Soil: C5. Surroundings: grassland. Samples taken: MT62-4, 5, Summer 1962. Coll: V. Gilliland.

No. 103 Missoula Co., pond 1.5 miles south of Lolo on U.S. 93. Sec. 2, T.11N., R.20W. Approx. el. 3100 ft. Geology: Qal, Ts to the east and west. Soil: C5. Surroundings: grassland. Samples taken: MT63-299 to 236, 23 July 1963.

No. 104 Missoula Co., pond east side, 4 miles south of Lolo, along U.S. 93. Sec. 23, T.11N., R.20W. Approx. el. 3200 ft. Geology: Qal, Ts to the east and west. Soil: C5. Surroundings: grassland. Samples taken: MT63-237 to 241, 263, 264, 23 July 1963.

No. 105 Missoula Co., pond west side, 4 miles south of Lolo, along U.S. 93. Sec. 23, T.11N., R.20W. Approx. el. 3200 ft. Geology: Qal, Ts to the east and west. Soil: C5. Surroundings: grassland. Samples taken: MT63-242 to 247, 23 July 1963.

No. 106 Powell Co., Copper Lake, about 10 miles north on unnamed road which intersects State 20, 4 miles southeast of Ovando. Crystal clear lake with rocky bottom. Sec. 6, 7, T.15N., R.10W. Approx. el. 4600 ft. Geology: Qg in an area of pCs. Soil: F7. Surroundings: arboreal. Chemical data: pH 7.6; total alkalinity 84 ppm; calcuim hardness 70 ppm; total hardness 80 ppm; nitrogen (nitrate and nitrite) not recordable on instrument; phosphate (ortho) .02 ppm; phosphate (meta) .18 ppm. Samples taken: MT64-74 to 78, 21 August 1964.

No. 107 Powell Co., Pond I, 1.3 miles south of Cooper Lake. Appears to be dammed river. Water clear. (See collection locality No. 106). Sec. 18, T.15N., R.10W. Approx. el. 4400 ft. Geology: Qal in an area of pCs. Soil: F7. Surroundings: semi-arboreal and grassland. Chemical data: pH 7.2; total alkalinity 92 ppm; calcium hardness 58 ppm; total hardness 74 ppm. Sample taken: MT64-79, 21 August 1964.

No. 108 Powell Co., Pond II, 1.3 miles south from Cooper Lake. Small pond with mucky bottom and clear water. (See collection locality No. 106. Sec. 18, T.15N., R.10W. Approx. el. 4400 ft. Geology: Qal in an area of pCs. Soil: F7. Surroundings: arboreal and shrubland. Dominant aquatic: Equisetum. Chemical data: pH 6.6; total alkalinity 88 ppm; calcium hardness 60 ppm; total hardness 96 ppm. Samples taken: MT64-80 to 83, 21 August 1964.

No. 109 Lewis & Clark Co., Willow Creek Reservoir, 6 miles northwest of Augusta on Division Dam. In area of collection. water muddy, rocky bottom. Sec. 23, 24, 25, T.21N., R.7W. Approx. el. 4200 ft. Geology: Qg in an area of KTm. Soil: C8. Surroundings: arboreal and shrubland. Chemical data: pH 7.5; total alkalinity 146 ppm; calcium hardness 114 ppm; total hardness 150 ppm. Sample taken: MT64-84, 23 August 1964.

No. 110 Lewis & Clark Co., Lake Helena, 7 miles north of East Helena. Lake appeared a murky green. T.11N., R.2 and R.3W. Approx. el. 4000 ft. Geology Qal, pCg to the north. Soil: C5. Surroundings: grassland. Chemical data: pH 8.4; total alkalinity 384 ppm. Samples Taken: MT63-462, 463, 475, 476, 13 August 1963.

No. 111 Ravalli Co., small lake outside of Stevensville. Lake with silty bottom. Water clear and pale yellow. Sec. 21 or 22, T.9N., R.20W. Approx. el. 3300 ft. Geology: Qal in an area with Ts to the east and west. Soil: C5. Surroundings: arboreal. Dominant aquatics: Potamogeton and Utricularia. Chemical data: pH 8.2; total alkalinity 106 ppm. Samples taken: MT63-248 to 254, 23 July 1963.

No. 112 Ravalli Co., Twin Lake, end of gravel road west of and intersecting U.S. 93, 7 to 8 miles north of Darby. A clear water lake. Sec. 29, T5N., R.23W. Approx. el. 6600 ft. Geology: Ki. Soil: F7. Surroundings: arboreal and subalpine. Dominant aquatics: Eleocharis along shore and some Sphagnum. Chemical data: pH 8.5-8.6 total alkalinity 8 ppm. Samples taken: MT63-257 to 262, 23 July 1963.

No. 113 Ravalli Co., Lost Horse Creek, 2 miles from Twin Lake along gravel road. (See collection locality No. 112). Sec. 5, T.4N., R.23W. Approx. el. 6400 ft. Geology: Qal in an area of Ki. Soil: F7. Surroundings: arboreal. Sample taken: MT63-255, 23 July 1963.

No. 114 Ravalli Co., Lost Horse Creek, 5 miles from Route 93 toward Twin Lake. (See collection locality No. 112). Sec. 36, T.5N.m R.23W. Approx. el. 5600 ft. Geology: Qal in an area of Ki. Soil: F7. Surroundings: arboreal. Sample taken: MT63-256, 23 July 1963.

No. 115 Ravalli Co., pond adjacent to Lake Como Camp Ground, 4 miles west on road which intersects U.S. 93, 4 miles north of Darby. Small pond within woods. Sec. 30, T.4N., R21W. Approx. el. 4400 ft. Geology: Qg in an area of Kib. Soil: F7. Dominant aquatics: Elodea, Myriophyllum, Nuphar, and Nymphaea. Chemical data: pH 8.2; total alkalinity 32 ppm. Samples taken : MT63-265 to 274, 24 July 1963.

No. 116 Ravilli Co., Lake Como, 3.5 miles on road which intersects U.S. 93, 4 miles north of Darby. A clear water lake with rocky bottom. Sec. 29, T4N., R.21W. Approx. e. 4400 ft. Geology: Qg in an area of Kib. Soil: F7. Surroundings: arboreal. Chemical data: pH 8.9; total alkalinity 12ppm. Samples taken: MT63-275, 276, 24 July 1963.

No. 117 Ravalli Co., pond 2 miles south of Darby on U.S. 93. Pond with clear, pale yellow water. Sec. 23, T.3N., R.21W. Approx. el. 3800 ft. Geology: Qal in an area of Ki. Soil: C5. Surroundings: grassland and shrubland. Dominant aquatics: Typha and filamentous algal mats. Chemical data: pH 8.2; total alkalinity 120ppm. Samples taken: MT63-277 to 282, 24 July 1963.

No. 118 Ravallie Co., pond adjacent to West Fork River at Brown

Road #374. Sec. 27, T.2N., R.21W. Approx. el. 4600 ft. Geology: Qal in an area of Ki. Soil: F7. Surroundings: arboreal. Sample taken: Mt63-300, 24 July 1963.

No. 119 Ravalli Co.: Pond IA, West Fork River at Brown Road #374. Sec. 27, T.2N., R.21W. Approx. el. 4600 ft. Geology: Qal in an area of Ki. Soil: F7. Surroundings: arboreal. Samples taken: MT63-301 to 307, 24 July 1963.

No. 120 Ravalli Co., East Fork River at Spring Gulch Campsite, off U.S. 93, northwest of Sula, Sec. 1, T.1N., R.20W. Approx. el. 4000 ft. Geology: Qal in an area of Ki. Soil: F3. Surroundings: semi-arboreal and grassland. Chemical data: pH 8.4; total alkalinity 88ppm. Samples taken: MT63-308 to 313, 24 July 1963.

No. 121 Ravalli Co., pool at West Fork Campsite, Painted Rock Lake, 5 miles north of Alta. Map dot misplaced, should be adjacent to No. 123. Sec. 2, T.2S., R.22W. Approx. el. 4800 ft. Geology: Qal in an area of pCr. Soil: F7. Surroundings: arboreal. Samples taken: MT63-288 to 290, 24 July 1963.

No. 122 Ravalli Co., pond near dam at Painted Rock Lake, which is 4.5 miles north of Alta. Sec. 26, T1S., R.22W. Approx. el. 4600 ft. Geology: Ki. Soil: F7. Surroundings: arboreal. MT63-297 to 299, 24 July 1963.

No. 123 Ravalli Co., Slate Creek at campsite on eastern shore of Painted Rock Lake, 5 miles north of Alta, along West Fork road. Sec. 2, T.2S., R.22W. Approx. el. 4800 ft. Geology: Qal in an area of pCr. Soil: F7. Surroundings: arboreal. Samples taken: MT63-283 to 287, 24 July 1963.

No 124 Ravalli Co., Painted Rock Lake at Slate Creek Bay, along eastern shore of lake, 5 miles north of Alta on West Fork Road. Sec. 2,3, T.2S., R.22W. Approx. el. 4800 ft. Geology: Qal in an area of pCr. Soil: F7. Surroundings: arboreal. Chemical data: pH 8.2; total alkalinity 54 ppm. Samples taken: MT63-291 to 296, 24 July 1963.

No. 125 Granite Co., Gold Lake, in Flint Creek Range. T.8N., R.12W. Approx. el. 7000 ft. (?) Geology: Kk (?). Soil: F7. Sample taken: 6Mon. 35,44,49,51, 17 Aug. 1955. Coll. G.W. Prescott.

No. 126 Granite Co., Gold Lake Bog, in Flint Creek Range. T.8N. R.12W. Approx. el. 7000 ft. (?). Geology: Kk (?). Soil: F7. Samples taken: 6Mon. 42,43, 17 August 1955. Coll. G.W. Prescott.

No. 127 Granite Co., Uranium Bog Pool near Gold Lake, Flint Creek range. T.8N., R.12W. Approx. el. 7000 ft. (?). Geology: Kk (?). Soil: F7. Samples taken: 6Mon. 38,41, 17 August 1955. Coll. G.W. Prescott.

No. 128 Granite Co., Echo Lake, 3.5 miles north along road which intersects U.S. 10A, about 4 miles south of Porter's Cors. Sec. 31, 32, T.6N., R.13W. Approx. el 7000 ft. Geology: pCn. Foil: F7. Surroundings: arboreal. Dominant aquatic: Nuphar. Chemical data: pH 8.6-8.8; total alkalinity 112 ppm. Samples taken: MT63-385 to 387, 27 July 1963.

No. 129 Deer Lodge Co., Georgetown Lake, 5 miles south of Porter's Cors., along U.S. 10A to Anaconda. An irregularly shaped man made lake with a rocky bottom and clear water. Sec.7, 18, T.5N.m R.13W. Approx. el. 6500 ft. Geology: Qal to the east, in an area of Mu and Du. Soil: F7. Surroundings: arboreal. Dominant aquatics: Elodea, Ranunculus, and Potamogeton. Chemical data: pH 9-9.2; total alkalinity 150 ppm. Samples taken: MT63-382 to 384, 27 July 1963.

No. 130 Broadwater Co., Deep Creek, 15 miles east of Townsend on Route 12. Sec. 32, T.7N., R.4E. Approx. el. 4500 ft. Geology: pCn. Soil: F8. Surroundings: arboreal. Dominant aquatic: algae. Chemical data: pH 7.9-8.2; total alkalinity 138 ppm; calcium hardness 80 ppm; total hardness 152 ppm. Samples taken: MT63-470-474, 477-482, 13 August 1963; MT64-131 to 134, 26 August 1964.

No. 131 Beaverhead Co., pond 10 miles north of Wisdom, on State 43. Sec. 18 (2), T.1S., R.14W. Approx. el 5900 ft. Geology: Qal in an area of Ts. Soil: D4. Sample taken: MT63-184, 11 July 1963.

No. 132 Beaverhead Co., pond 5 miles south of Wisdom, along State secondary 278. Sec.28, T.3S., R.15W. Approx. el. 6100 ft. Geology: Qal in an area of Ts. Soil: D4. Sample taken: MT63-185, 11 July 1963.

No. 133 Beaverhead Co., pond 1 mile south from Wisdom on State secondary 278. Sec. 4, T.3S., R.15W. Approx. el 6100 ft. Geology: Qal in an area of Ts. Soil: D4. Surroundings: grassland. Dominant aquatic: Ranunculus. Chemical data: pH 8.6; total alkalinity 532 ppm. Samples taken: MT63-314 to 318, 25 July 1963.

No. 134 Beaverhead Co., Miner Lake, 1 mile south of Jackson, State secondary road 278 forks, continue south 11.5 miles, right on trail going north for 10 miles. Small lake. Sec. 9, T.6S., R.16W. Approx. el. 7000 ft. Geology: pCr (?). and Ts. Soil: F2. Surroundings: arboreal. Dominant aquatics: Carex, Sphagnum, and Nuphar. Chemical data: pH 8.4; total alkalinity 34 ppm. Samples taken: MT63-319 to 329, 25 July 1963.

No. 135 Beaverhead Co., VanHouten Lake, 1 mile south of Jackson, on State secondary road 278 the road forks, continue south about 11 miles. A clear water lake. Sec. 8, T7S., R.15W. Approx. el. 7000 ft. Geology: pCm. Soil: F2. Surroundings: arboreal. Dominant aquatic: Nuphar. Chemical data: pH 8.9; total alkalinity 96 ppm. Samples taken: MT63-330 to 340, 25 July 1963.

No. 136 Silverbow Co., pond at Melrose. Sec. 26, T.2S., R.9W. Elevation 4179 ft. Geology: Qal in an area of Ts. Soil: C5. Surroundings: shrubland and grassland. Dominant aquatic: Typha. Chemical data: pH 9.1; total alkalinity 298 ppm. Samples taken: MT63-379 to 381, July 27, 1963.

No. 137 Madison Co., pond 4 miles south of Twin Bridge along State 41. Sec. 19, T.4S., R.7W. Approx. el. 4600 ft. Geology: Qal in an area of Ts. Soil: C5. Surroundings: grassland. Dominant aquatic: Myriophyllum. Chemical data: pH 8.6; total alkalinity 370 ppm. Samples taken: MT63-376 to 378, 27 July 1963.

No. 138 Madison Co., pond 2 miles northwest of Nevada City, along State 34. Murky, pale yellow water. T.6S., R.3W. Approx. el. 5800 ft. Geology: pCgs. Soil: L5/C5. Surroundings: scrubland and grassland. Dominant aquatics: Typha and Ranunculus. Chemical data: pH 9.6; total alkalinity 292 ppm. Samples taken: Mt63-372 to 375, 27 July 1963.

No. 139 Madison Co., Ennis Lake, 1 mile east from McAllister. This clear water lake is merely an artificial widening of the stream. Sec. 34, T.4S., R.1W. Approx. el. 5000 ft. Geology: Ts. Soil: C5. Surroundings: Grassland and shrubland. Dominant aquatics: Potamogeton, Ceratophyllum, and Elodea. Chemical data: pH 8.6; total alkalinity 250 ppm. Samples taken: Mt63-367 to 371, 27 July 1963.

No. 140 Gallatin Co., pond 1 mile south of Three Forks along U.S. 10 Sec. 26, T.2N., R. 1E. Elevation 4661 ft. Geology: Qal in an area of Ts. Soil: C5. Surroundings: grassland and scrubland. Dominant aquatics: Typha and Chara. Chemical data: pH 9; total alkalinity 222 ppm; calcium hardness 158 ppm; total hardness 222 ppm. Samples taken: MT64-129, 130, 26 August 1964.

No. 141 Gallatin Co., pond 2 miles north of Belgrade on secondary road 290, going north. Pond with rocky bottom and shore. Sec. 27, 34, T.1N., R4E. Approx. el. 4500 ft. Geology: Qal in an area of Ts. Soil: D6. Surroundings: grassland. Dominant aquatics: Typha and filamentous algae. Chemical data: pH 8; total alkalinity 176 ppm; calcium hardness 142 ppm; total hardness 198 ppm; nitrogen (nitrate and nitrite) not recordable on instrument; phosphate (ortho) .06 ppm; phosphate (meta) .38 ppm. Samples taken: MT64-126 to 128, 26 August 1964.

No. 142 Beaverhead Co., Pond 10 miles north of Dell on U.S. 91. Water of pond a pale yellow but clear. Sec. 26, T.11S., R.10W. Approx. el. 5700 ft. Geology: QTt. Soil: C5. Surroundings: grassland. Chemical data: pH 8.2; total alkalinity 162 ppm. Samples taken: MT63-341 to 344, 25 July 1963.

No. 143 Beaverhead Co., pond 5 miles north of Dell of U.S 91. Pond with clear, pale yellow water. Sec. 18, T.12S., R.9W. Approx. el. 5800 ft. Geology: Qal in an area of QTt. Soil: C5. Surroundings: grassland. Chemical data: pH 8.6; total alkalinity 404 ppm. Samples taken : MT63-345 to 347, 25 July 1963.

No. 144 Beaverhead Co., pond 1 mile from Lima camp site, southwest of Lima. Sec. 2, T.15S., R.9W. Approx. el. 6400 ft. Geology: Pu. Soil: C5/D4. Surroundings: grassland and shrubland, sagebrush. Chemical data: pH 8.3; total alkalinity 440 ppm. Samples taken: MT63-348 to 351, 26 July 1963.

No. 145 Beaverhead Co., pond 1.5 miles from Lima camp site, which is southwest of Lima. Pond water a milky gray. Sec. 2, 8, 12, T.15S., R.9W. Approx. el. 6400 ft. Geology: Pu. Soil: C5/D4. Surroundings: grassland and shrubland. Chemical data: pH 8.2; total alkalinity 414 ppm. Samples taken: MT63-352 to 356, 26 July 1963.

No. 146 Beaverhead Co., pond 10 miles from Lower Red Rock Lake, along Red Rock Road, east of Monida. Pond visited by cattle. Sec. 24, T.14S., R.5W. Approx. el. 6600 ft. Geology: Km. Soil: C5. Chemical data: pH 9.7-9.8; total alkalinity 300 ppm. Samples taken: MT63-357 to 359, 26 July 1963.

No. 147 Beaverhead Co., Lower Red Rock Lake, 2 miles north of Red Rock Raod at the western end of lake. Lake with yellow brown water.. (See collection locality No. 146). Sec. 6, T.14S., R.2W. Approx. el. 6600 ft. Geology: Qal in an area of Tv. Soil: C5. Surroundings: grassland. Samples taken: MT63-360 to 362, 26 July 1963.

No. 148 Beaverhead Co., Upper Red Rock Lake, along Red Rock Road, eastern end of lake. Lake water clear. Sec. 21, T.14S., R.1W. Approx. el.6600 ft. Geology: Qal in an area of Tv and pCgs. Soil: C5. Surroundings: arboreal. Dominant aquatics: Ranunculus and Myriophyllum. Chemical data: pH 9.4-9.6; total alkalinity 250 ppm. Samples taken: MT63-363 to 366, 26 July 1963.

No. 149 Liberty Co., Tiber Reservoir, 8 miles north of Hagan. Sec. 28, T.29N., R.5E. Approx. el. 3100 ft. Geology: Kbi and Ktc. Soil: D11. Surroundings: grassland. Dominant aquatics: Potamogeton. Chemical data: ph 8.2; total alkalinity: 126 ppm; calcium hardness 134 ppm; total hardness 200 ppm. Samples taken: MT64-58 to 60, 63, 17 August 1964.

No. 150 Liberty Co., Maria's River, Sandford camp site near Tiber Reservoir. (See collection locality No. 149). Sec. 23, T.29N., R.6E. Approx. el. 3000 ft. Geology: KTc. Soil: B16/B14. Surroundings: semi-arboreal. Chemical data: pH8; total alkalinity 134 ppm; calcium hardness 128 ppm; total hardness 198 ppm. Samples taken: MT64-61,62, 17 August 1964.

No. 151 Hill Co., Fresno Reservoir, north of Fresno. Water is clear but green. Sec. 7,8,9,15,23,25,26, T.33N., R.13, 14E. Approx. el 2600 ft. Geology: Kjr. Soil: B14. Surroundings: grassland. Dominant aquatic: Potamogeton. Chemical data: pH 8; total alkalinity 156 ppm; calcium hardness 56ppm; total hardness 132 ppm. Samples taken: MT64-43, 44, 15 August 1964.

No. 152 Blaine Co., Milk Creek River, 6 miles east of Zurich on U.S. 2. Sec. 8, T.32N., R.22E. Approx. el. 2400 ft. Geology: Qal in an area of Kjr. Soil: K2/B11. Surroundings: grassland. Samples taken: MT63-31, 32, 20 June 1963.

No. 153 Blaine Co., People's Creek, 14 miles north of Hayes, along State secondary road 376. Creek very low resulting in a long pond. Sec. 35, T.29N., R.23E. Elevation 2750 ft. Geology: Kjr. Soil: B11. Surroundings: grassland. Dominant aquatics: Sagittaria and Scirpus. Chemical data: pH 8.2; total alkalinity 512 ppm; calcium hardness 56 ppm; total hardness 180 ppm; nitrogen (nitrate) .98 ppm; nitrogen (nitrite) .12 ppm; phosphate (ortho) .32 ppm; phosphate (meta) 1.93 ppm. Samples taken: MT64-37 to 42, 15 August 1964.

No. 154 Blaine Co., pond 10 miles north of Hayes, along state secondary road 378. Sec. 13, T.28N., R.3E. Elevation 3145 ft. Geology: Kjr. Soil: B11. Surroundings: grassland. Dominant aquatic: Scirpus. Chemical data: pH 7.9; total alkalinity 228 ppm; calcuim hardness 120 ppm; total hardness 324 ppm; nitrogen (nitrate) .018 ppm; nitrogen (nitrite) .002 ppm; phosphate (ortho) .06 ppm; phosphate (meta) not recordable on instrument. Samples taken: MT64-32 to 35, 15 August 1964

No. 155 Chateau Co., Maria's River, at Lomas. Sec. 112, T.25N., R.9E. Approx. el. 2700 ft. Geology: Kc. Soil: B14. Surroundings: grassland and shrubland. Chemical data: pH 8; total alkalinity 146 ppm; calcium hardness 106 ppm; total hardness 232 ppm. Sample taken: MT64-45, 16 August 1964.

No. 156 Chateau Co., Missouri River, at Fort Benton. Sec. 23, T.25N., R.8E. Approx. el. 2500 ft. Geology: Kc. Soil: B14. Surroundings: grassland. Chemical data: pH 7.9; total alkalinity 154 ppm; calcium hardness 128 ppm; total hardness 186 ppm. Samples taken MT64-46, 47, 16 August 1964.

No. 157 Chateau Co., Howard Lake, about 14 miles southeast of Fort Benton on State secondary raod 230. Lake water yellow. Sec. 13, 14, T.23N., R.10E. Approx. el. 3400 ft. Geology: Kc. Soil: B14. Surroundings: grassland. Dominant aquatics: Typha and Ceratophyllum. Chemical data: pH 7.7; total alkalinity 538 ppm; calcium hardness 310 ppm; total hardness 466 ppm; nitrogen (nitrate and nitrite) not recordable on instrument; phosphate (ortho) .02 ppm; phosphate (meta) .04 ppm. Samples taken: MT64-48 to 50, 16 August 1964.

No. 158 Phillips Co., pond 2 miles north of Junction 376 and 191, along State secondary road 376. Sec. 22, 23, T.24N., R. 24E. Approx. el. 3300 ft. Geology: Kb. Soil L4/B11. Surroundings: grassland.. Dominant aquatic: Typha Chemical data: pH 9; total alkalinity 106 ppm; calcium hardness 468 ppm; total hardness 1370 ppm. Samples taken: MT64-29 to 31, 36, 15 August 1964.

No. 159 Cascade Co., Belt Creek, at Armington. Sec. 36, T.19N., R. 6E. Elevation 3557 ft. Geology: Kk. Soil: C8. Surroundings: grassland and arboreal. Chemical data: ph 7.7; total alkalinity 152 ppm; calcium hardness 152 ppm; total hardness 220 ppm. Samples taken: MT64-87 to 89, 23 August 1964.

No. 160 Judith Basin Co., Dry Wolf Creek, about 10 miles southwest of Windham, along unnumbered road. Sec. 13, 14, 15, 22, T.15N.,m R.10E. Approx. el. 5000 ft. Geology: Mu. Soil: F8. Surroundings: arboreal. Dominant aquatic: mosses. Chemical data: pH 7.9; total alkalinity 74 ppm; calcium hardness 60 ppm; total hardness 64 ppm; nitrogen (nitrate) .006 ppm; nitrogen (nitrite) .004 ppm; phosphate (ortho) .03 ppm; phosphate (meta) 2.57 ppm. Samples taken: MT64-90 to 92, 23 August 1964.

No. 161 Judith Basin Co., Acly Lake (Hobson), 6 miles southwest of Hobson. Sec. 22, 28, 27, T.14N., R.14E. Approx. el. 4400 ft. Geology: KTt. Soil: C8. Surroundings: grassland. Dominant aquatics: algae and Potamogeton. Chemical data: pH8; total alkalinity 170 ppm; calcium hardness 144 ppm; total hardness 198 ppm. Samples taken: MT64-93 to 95, 23 August 1964.

No. 162 Fergus Co., Missouri River, at James Kipp State Park, western end of Fort Peck Reservoir. Sec. 1, T.21N., R.24E. Approx. el. 2200 ft. Geology: Kb. Soil: M2. Surroundings: grassland, shrubland, and arboreal. Chemical data: pH 7.9; total alkalinity not recordable on instrument; calcium hardness 154 ppm; total hardness 250 ppm. Sample taken: MT64-28, 14 August 1964.

No 163 Wheatland Co., pond 9 miles south of Judith Cap along U.S. 191. Pond with pale yellow water. Sec. 7, T.9N., R.16E. Approx. el 4600 ft. Geology: QTt. Soil: B12. Surroundings: grassland. Dominant aquatics: Potamogeton and filamentous algae. Chemical data: pH 9.6; total alkalinity 296 ppm; calcium hardness 102 ppm; total hardness 550 ppm. Samples taken:MT64-96 to 98, 24 August 1964.

No. 164 Wheatland Co., Martinsdale Reservoir, southeast of Martinsdale, northern end of reservoir. Sec. 21, 22, T.8N., R.12E. Elevation 4853 ft. Geology: Kjr. Soil: C5. Surroundings: grassland. Dominant aquatic: Chara. Chemical data: pH 8.2; total alkalinity 265 ppm. Samples taken: MT63-465 to 469, 489 to 493, 14 August 1963.

No. 165 Wheatland Co., pond 4 miles east of Harlowtown, along U.S. 12. Sec. 29, T.8N., R.16E. Approx. el. 4200 ft. Geology: Kcl. Soil: B12/C5. Surroundings: grassland. Samples taken: MT63-458 to 461, 494 to 497, 14 August 1963.

No. 166 Wheatland Co,, Lebo Lake, 8 miles south of Twodot. T.7N., R.14E., T.6N., R.14E. Approx. el. 5000 ft. Geology: Mixture of Ts and Kjr. Soil: C5. Surroundings: grassland. Dominant aquatics: Chara, Polygonum, Nostoc, and Aphanizomenon. Chemical data: pH 8.8; total alkalinity 184 ppm. Samples taken: MT63-452 to 457, 483 to 488, 14 August 1963.

No. 167 Golden Valley Co, pond 1.5 miles east of Ryegate, on U.S. 12. Pond with clear yellow water. Sec. 5, T.6N., R.20E. Approx. el. 3600 ft. Geology: Kjr. Soil: B12. Surroundings: grassland. Dominant aquatics: Equisetum and Typha. Chemical data: pH 7.2; total alkalinity 318 ppm; calcium hardness 346 ppm; total hardness 684 ppm; nitrogen (nitrate) 3.097 ppm; nitrogen (nitrite) .003 ppm; phosphate (ortho) .085 ppm; phosphate (meta) .535. Samples taken: MT64-135, 136, 27 August 1964.

No. 168 Musselshell Co., pond 8.7 miles west of Roundup, on U.S. 12. Sec. 13, T.7N., R.24E. Approx. el. 3400 ft. Geology: Tfu. Soil: L5 . Surroundings: grassland, shrubland, and arboreal. Dominant aquatics: Typha and Scirpus. Chemical dataL pH 7.8; total alkalinity 252 ppm; calcium hardness 270 ppm; total hardness 518 ppm. Samples taken: MT64-137 to 140, 27 August 1964.

No. 169 Musselshell Co., pond 3 miles west of the turn off to Musselshell, along U.S. 12. Sec. 25, T.9N., R.28E. Approx. el. 3100 ft. Geology: Tfu. Soil: L5 . Surroundings: grassland. Dominant aquatics: Typha and Scirpus. Chemical data: Ph 8.9; total alkalinity 1014 ppm; calcium hardness 68 ppm; total hardness 1756 ppm. Samples taken: MT64-141 to 145, 27 August 1964.

No. 170 Sweetgrass Co., pond 2 miles west of Glass Lake (north of Glasston). Pond formed by dammed creek. Yellow water pond. Sec. 11, T.3N., R.14E. Approx. el. 4500 ft. Geology: Tfu. Soil: C5. Surroundings: grassland and sagebrush. Dominant aquatics: Myriophyllum, Potamogeton, and Typha. Chemical data: pH 8.2; total alkalinity 216 ppm; calcium hardness 136 ppm; total hardness 180 ppm; nitrogen (nitrate) 1.2 ppm; nitrogen (nitrite) not recordable on instrument; phosphate (ortho) .06 ppm; phosphate (meta) .02 ppm. Samples taken: MT64-102 to 104, 24 August 1964.

No. 171 Sweetgrass Co., Glass Lake about 5 miles east of road which intersects U.S. 191, 8 miles south of Melville. Lake water milky. Sec. 2, T.3N., R.15E. Approx. el. 4500 ft. Geology: Tfu. Soil: L5 . Surroundings: grassland. Dominant aquatics: Chara, Myriophyllum, and Potamogeton. Chemical data: pH8; total alkalinity 140 ppm; calcium hardness 82 ppm total hardness 112 ppm; nitrogen (nitrate) .6 ppm; nitrogen (nitrite) not recordable on instrument; phosphate (ortho) .08 ppm; phosphate (meta) .17 ppm. Samples taken: MT64-99 to 101, 24 August 1964.

No. 172 Sweetgrass Co., Boulder River, at Big Timber. Sec. 14, 23, T.1N., R.14E. Elevation 4075 ft. Geology: Qal in an area of Tkl. Soil: C5. Surroundings: semi-arboreal. Chemical data: pH 7.8; total alkalinity 96 ppm; calcium hardness 90 ppm; total hardness 114 ppm. Samples taken MT64-105 to 107, 24 August 1964.

No, 173 Stillwater Co., pond 7 miles west of Columbus on U.S. 10. Pond water yellow. Sec. 3, T.2S., R.19E. Approx. el. 3600 ft. Geology: Khc. Soil: C5/L5. Surroundings: grassland. Dominant aquatic: Typha. Chemical data: pH 7.2; total alkalinity 246 ppm; calcium hardness 152 ppm; total hardness 230 ppm; nitrogen (nitrate and nitrite) not recordable on instrument; phosphate (ortho) .12 ppm; phosphate (meta) .08 ppm. Samples taken: MT64-122 to 125, 26 August 1964.

No. 174 Stillwater Co., pond .5 miles west of Columbus on U.S. 10. Pond water yellow. Sec. 21, T.2S., R.25E. Approx. el. 3600 ft. Geology: Qal in an area of Kl and Kb. Soil: C5. Surroundings: grassland. Dominant aquatic: Typha. Chemical data: pH 7.2; total alkalinity 222 ppm; calcium hardness 152 ppm; total hardness 222 ppm. Samples taken: MT64-120, 121, 26 August 1964.

No. 175 Yellowstone Co., pond off Yellowstone River at Laurel, U.S 310. Sec. 16, T.2S., R.24E. Approx. el. 3200 ft. Geology: Qal in an area of Kc. Soil: K2. Surroundings: grassland. Chemical data: pH 7.5; total alkalinity 112 ppm; calcium hardness 82 ppm; total hardness 106 ppm. Samples taken: MT64-118, 119, 25 August 1964.

No. 176 Carbon Co., Cooney Reservoir, approximately 7 miles west of Boyd. Dec. 34, 35, T.4S., R.20E. Approx. el. 4400 ft. Geology: Tfu. Soil: L5. Surroundings: grassland and shrubland. Dominant aquatic: algae. Chemical data: pH 7.6; total alkalinity 160 ppm; calcium hardness 96 ppm; total hardness 146 ppm; nitrogen (nitrate) .004 ppm; nitrogen (nitrite); .006 ppm; phosphate (ortho) .04 ppm; phosphate (meta) .17 ppm. Samples taken: MT64-111 to 114, 25 August 1964.

No. 177 Carbon Co., pond along U.S. 312, 2 miles south of Joliet. Sec. 20, T.4S., R.22E. Approx. el. 3900 ft. Geology: Kcl. Soil: L5. Surroundings: grassland. Samples taken: MT64-115 to 117, 25 August 1964.

No. 178 Carbon Co., Rock Creek, at Red Lodge. Sec. 34, T.7S., R.20E. Approx. el. 5600 ft. Geology: QTt. Soil: F7/F8. Surroundings: arboreal. Dominant aquatics: algae. Chemical data:

pH 7.5; total alkalinity 40 ppm; calcuim hardness 24 ppm; total hardness 26 ppm. Samples taken: MT64-108 to 110, 25 August 1964.

No. 179 Treasure Co., pond 1.5 miles west of BigHorn on U.S. 10. Water yellow. Sec. 33, T.5N., R.34E. Approx. el. 2400 ft. Geology: Qal in an area of Khc. Soil: K2/L5. Surroundings: grassland. Dominant aquatic: Typha. Chemical data: pH 7.3; total alkalinity 278 ppm; calcium hardness 360 ppm; total hardness 452 ppm; nitrogen (nitrate) .57 ppm; nitrogen (nitrate) .03 ppm; phosphate (ortho) .02 ppm; phosphate (meta) .047 ppm. Sample taken: MT64-199 28 August 1964.

No. 180 Big Horn Co., pond 6.1 miles north of Hardin on State 47. Sec. 15, T.1N., R.33E. Approx. el. 2900 ft. Geology: Qal in an area of Kb. Soil: K2/L5. Surroudings: grassland. Dominant aquatics: Typha and Rumex. Chemical data: pH 7.4; total alkalinity 564 ppm; calcium hardness 545 ppm; total hardness 610 ppm; nitrogen (nitrate) 2.796 ppm; nitrogen (nitrite) .004 ppm; phosphate (ortho) .04 ppm; phosphate (meta) .11 ppm. Samples taken: MT64-150 to 152, 28 August 1964.

No. 181 Big Horn Co., pond 6 miles south of Lodge Grass, on U.S. 87. Water yellow. Sec. 11, 12, T.7S., R.35E. Approx. el. 3500 ft. Geology: Qal in an area of Kgr and Kb. Soil: C4. Surroundings: grassland. Dominant aquatic: Typha. Chemical data: pH 7.4; total alkalinity 466 ppm; calcium hardness 502 ppm; total hardness 868 ppm. Samples taken: MT64-153 to 155, 28 August 1964.

No. 182 Phillips Co., Nelson Reservoir, 4 miles north of road which intersects U.S. 2, 17 miles east of Malta. Sec. 23, T.32N., R.32E. Approx. el. 2200 ft. Geology: Kcl. Soil: J2/K2. Samples taken: MT63-25 to 30, 19 June 1963.

No. 183 Valley Co., Fort Peck Reservoir at The Pines. Sec. 20, T.23N., R.38E. Approx. el. 2000 ft. Geology: Kb. Soil: M2. Surroundings: arboreal and grassland. Dominant aquatics: algae. Chemical data: pH 8; total alkalinity 160 ppm; calcium hardness 140 ppm; total hardness 112 ppm. Samples taken: MT64-11-14, 13 August 1964.

No. 184 Valley Co., Fort Peck Reservoir, The Pines II. Sec. 17, T.24N., R.39E. Approx. el. 2000 ft. Geology: Kb. Soil: M2. Surroundings: grassland and arboreal. Samples taken: MT64-15,16, 13 August 1964.

No. 185 Valley Co., Fort Peck Reservoir, at Fort Peck camp site. Sec. 11, T.25N., R.38E. Approx. el. 2000 ft. Geology: Kb. Soil: M2. Surroundings: grassland. Chemical data: pH 8; total alkalinity 136 ppm; calcium hardness 136 ppm; total hardness 208 ppm; nitrogen (nitrate and nitrite) not recordable on instrument; phosphate (ortho) .072 ppm;

phosphate (meta) .348 ppm. Samples taken: MT64-17 to 19, 13 August 1964.

No. 186 Valley Co., Todd Lake, 16 miles north on raod which intersects U.S. 2, three miles east of Frazer. Water yellow. Sec. 3, T.29N., R.44E. Approx. el. 2200 ft. Geology: Khc in an area of Tfu. Soil: B11. Surroundings: grassland. Chemical data: pH 9.1; total alkalinity 3316 ppm; calcium hardness 36 ppm; total hardness 348 ppm; nitrogen (nitrate) .498 ppm; nitrogen (nitrite) .002 ppm; phosphate (ortho) 4.2 ppm; phosphate (meta) 1.8 ppm. Samples taken: MT64-8 to 10, 12 August 1964.

No. 187 Daniels Co., Poplar River, south of Scoby. Cove of river, Sec. 22, T.35N., R.48E. Approx. el 2400 ft. Geology: Qal in an area of Tfu. Soil: B11/C11. Surroundings: grassland. Dominant aquatics: Elodea and Myriophyllum. Chemical data: pH 8. 4; total alkalinity 552 ppm; calcium hardness 76 ppm; total hardness 224 ppm; nitrogen (nitrate and nitrite) not recordable on instrument; phosphate (ortho) .025 ppm; phosphate (meta) 1.225 ppm. Samples taken: MT64-5 to 7, 12 August 1964.

No. 188 Sheridan Co., Medicine Lake, 8 miles north of Froid, east side of State 16. Sec. 31, 32, T.31N., part of T.32N., R.56E., R.57E. Approx. el. 2000 ft. Geology: Tfu. Soil: C8. Surroundings: grassland. Samples taken: MT63-14 to 24, 19 June 1963.

No. 189 Roosevelt Co., Johnson Lake, 3 miles west of Froid. Sec. 21, T.30N., R.55E. Elevation 1930 ft. Geology: Tfu. Soil: C8. Surroundings: grassland. Dominant aquatic: Scirpus. Chemical data: pH 8.8; total alkalinity 1780 ppm; calcium hardness 44 ppm; total hardness 1712 ppm; nitrogen (nitrate) 3.2 ppm; nitrogen (nitrite) not recordable on instrument; phosphate (ortho) 3.45 ppm; phospahte (meta) .15 ppm. Samples taken: MT64-1 to 4, 12 August 1964.

No. 190 Roosevelt Co., Bainville Pond, outside of Bainville. Sec. 33, T.28N., R.58E. Approx. el. 2000 ft. Geology: Qal in an area of Tfu. Soil: C8. Surroundings: grassland. Samples taken: MT63-1 to 13, 19 June 1963.

No. 191 Garfield Co., Hell Creek, at Hell Creek camp site, Fort Peck Reservoir. Sec. 31, T.22N., R.38E. Appros. el 2000 ft. Geology: Kb. Soil: M2. Surroundings: grassland and sagebrush. Chemical data: pH 8.2; total alkalinity 142 ppm; calcium hardness 140 ppm; total hardness 208 ppm; nitrogen (nitrate and nitrite) not recordable on instrument; phosphate (ortho) .05 ppm; phosphate (meta) .20 ppm. Samples taken: MT64-23 to 27, 14 August 1964.

No. 192 McCone Co., Rock Creek, Fort Peck Reservoir, at Rock Creek State Park. Sec. 19, T.23N., R.43E. Approx. el. 2000 ft. Geology: Khc. Soil: M2. Surroundings: grassland. Chemical

data: pH 8.2; total alkalinity 158 ppm; calcium hardness 140 ppm; total hardness 204 ppm. Samples taken: MT64-20, 21, 13 August 1964.

No. 193 McCone Co., Timber Creek, 25 miles south of Rock Creek State Park, (Fort Peck Reservoir), on State 24. Sec. 1, 2, 12, T.19N., R.44E. Approx. el. 2400 ft. Geology: Qal in an area of Tfu. Soil: M2. Surroundings: grassland and sagebrush. Chemical data: pH 8.4; total alkalinity 718 ppm; calcium hardness 92 ppm; total hardness 348 ppm. Sample taken: MT64-22, 14 August 1964.

No. 194 McCone Co., Red Water River, at Circle. River shallow, leaving long ponds. Sec. 10, T.19N., R.48E. Approx. el. 2500 ft. Geology: Qal in an area of Tfu. Soil: B12. Surroundings: grassland. Dominant aquatic: Potamogeton. Chemical data: pH 8.8; total alkalinity 840 ppm; calcium hardness 78 ppm; total hardness 656 ppm. Samples taken: MT64-163 to 165, 30 August 1964.

No. 195 Dawson Co., pond 4 miles west of Richey, along State 20. Sec. 11, T.21N., R.51E. Approx. el. 2500 ft. Geology: Tfu. Soil: C8. Surroundings: grassland. Dominant aquatics: Potamogeton and Scirpus. Chemical data: pH 7.5; total alkalinity 538 ppm; calcium hardness 280 ppm; total hardness 1300 ppm. Samples taken: MT64-166 to 170, 30 August 1964.

No. 196 Richland Co., pond 1.5 miles west of Sidney on State 20. Sec. 30, 31, T.23N., R.59E. Elevation 3116 ft. Geology: Tfu. Soil: C8. Surroundings: grassland. Dominant aquatics: Typha and Potamogeton. Chemical data: pH 7.4; total alkalinity 518 ppm; calcium hardness 218 ppm; total hardness 532 ppm. Samples taken: MT64-171 to 174, 30 August 1964.

No. 197 Wibaux Co., pond 14 miles south of Wibaux on State 7. Sec. 7, T.12N., R.60E. Approx. el. 2900 ft. Geology: Tfu. Soil: C8. Surroundings: grassland. Dominant aquatic: Typha. Chemical data: pH 7.4; total alkalinity 652 ppm. Samples taken: MT64-175 to 179, 30 August 1964.

No. 198 Rosebud Co., pond (formed by old dammed river) at Forsythe Spring, along U.S. 10. Sec. 22, 23, T.6N., R.40E. Approx. el. 2500 ft. Geology: Qal in an area of Khc. Soil: K2. Surroundings: grassland. Dominant aquatic: Typha. Chemical data: pH8; total alkalinity 442 ppm; calcium hardness 48 ppm; total hardness 58 ppm; nitrogen (nitrate) .198 ppm; nitrogen (nitrite) .002 ppm; phosphate (ortho) .02 ppm; phosphate (meta) .10 ppm. Samples taken: MT64-146 to 148, 27 August 1964.

No. 199 Powder River Co., Powder River, at Broadus. Sec. 2, T.4S., R.51E. Approx. el. 3000 ft. Geology: Qal in an area of Tfu. Soil: M2/B12/L5. Surroundings: grassland and semi-arboreal. Chemical data: pH 7.8; total alkalinity 212 ppm; calcium hardness 626 ppm; total hardness 1006 ppm. Samples taken: MT64-156, 157, 29 August 1964.

No. 200 Powder River Co., pond 7 miles north of Little Powder River, on U.S. 212. Sec. 21, T.5S., R.52E. Approx. el. 3000 ft. Geology: Qal in an area of Tfu. Soil: L5. Surroundings: arboreal. Dominant aquatic: Typha. Chemical data: pH 7.9; total alkalinity 380 ppm. Samples taken: MT64-159 to 162, 2 August 1964.

No. 201 Carter Co., Little Missouri River, 1 mile from Alazada. Sec. 24, T.9S., R.59E. Approx. el. 3500 ft. Geology: Qal in an area of Kbf. Soil: L4. Surroundings: grassland and arboreal. Chemical data: pH 8; total alkalinity 112 ppm; calcium hardness 244 ppm; total hardness 390 ppm. Sample taken: MT64-158, 29 August 1964.

V. RESULTS AND DISCUSSION

Systematics

In the systematic section to follow no author citation older than 1848 is given for a taxon which appears in Ralfs' British Desmids.

In the text when the expression typical form is used, it is intended to indicate a form similar to the type.

The occurrence of a taxon indicated as very rare, rare, moderately rare, moderately common (moderately frequent), and common, is of course wholly subjective and refers to the number of localities from which the taxon is known. To the author very rare means known from 2 localities or less, rare from 3-4, moderately rare 5-9, moderately common 10-14, and common 15 or more.

The desmid are treated in the following sequence:

Division Chlorophyta

Class Chlorophyceae

Order Zygnematales

Family Gonatozygaceae
1. Gonatozygon De Bary, 1856

Family Mesotaeniaceae
1. Roya West and West, 1896.
2. Cylindrocystis Meneghini, 1838.
3. Spirotaenia De Brebisson, 1848.
4. Netrium Naegeli, 1849.

Family Desmidiaceae
1. Actinotaenium Naegeli, 1849.
2. Penium De Brebisson, 1844.
3. Closterium Nitzsch, 1817.
4. Spinoclosterium Bernard, 1909.
5. Pleurotaenium Naegeli, 1849.

6. *Triploceras* Bailey, 1851.
7. *Tetmemorus* Ralfs, 1844.
8. *Euastrum* Ehrenberg, 1832.
9. *Micrasterias* Agardh, 1827.
10. *Xanthidium* Ehrenberg, 1837.
11. *Arthrodesmus* Ehrenberg, 1837.
12. *Staurastrum* Meyen, 1829.
13. *Onychonema* Wallich, 1860.
14. *Sphaerozosma* Corda, 1834.
15. *Spondylosium* De Brebisson, 1844.
16. *Hyalotheca* Ehrenberg, 1841.
17. *Bambusina* Kuetzing, 1845.
18. *Desmidium* Agardh, 1825.
19. *Cosmocladium* De Brebisson, 1856.

Geographical distribution maps for each of the above genera are given following the discussion of the last taxon of every second genus. All taxa at or below the species level are listed alphabetically. Information relevant to the taxon is included in the following sequence:

1. Author citation followed by reference, page number, plate and figure number, if given by the authority, and year.

2. Plate and figure numbers for this text.

3. Cell measurements, given in microns, based upon the material studied by the author. The following abbrevations have been used for these entries:

TL. = Total length
TB. = Total breadth
L:BR. = Length to breadth ratio
BI. = Breadth of isthmus
BA. = Breadth of apex
BBA. = Breadth below apex
LSP. = Length without processes
BSP. = Breadth without processes
LP. = Length of processes
LS. = Length of spines
BPL. = Breadth of polar lobe
T. = Thickness
°. = Degrees of arc
NS/10µ. = Number of striae per 10 microns
Z. = Diameter of zygospore

4. Any notes, observations or comments on the taxon.

5. Distribution by county, in alphabetical order, followed by collection locality numbers (map dot number) and in parenthesis, the vial collection number from which illustrations and/or measurements of the desmids were made by the author, or the name of the illustrator of the desmid drawing studied by the writer.

Division Chlorophyta
Class Chlorophyceae
Order Zygnematales

Family Gonatozygaceae

1. Gonatozygon de Bary 1856.

Although widely distributed in the western third of the state, the genus is not common (see map no. 10). The species found do not favor any particular type of lentic habitat and occur in a variety of lakes, ponds, bogs, marshes, and sloughs at varying elevations. There is a greater constancy in size and length to breadth ratios below the species level, than there is in the presence, or development of granules, spines or punctuation.

Gonatozygon brebissonii de Bary, 1858.

Pl. 1 figs. 1-11

This species has a cell wall which is minutely and densely granulated, the granules being sometimes scarcely visible, or sometimes strongly developed and very sharp (West and West, 1904). Numbers of specimens have been found, however, from varying localities, which clearly bear hair like spines. The illustrations of this species by Irénée-Marie, (1939, pl. 66, figs. 11-13 appear to indicate the presence of, or a development toward such hair like spines. Since "spines" appear to be inconstant, I have placed the spine-bearing forms under already existing varieties, on the basis of size. Four varieties are recognized here, one of which is new to science. The species is primarily found in the northwestern part of the state.

Gonatozygon brebissonii de Bary, Conjug. p. 77, t. 4, figs. 26, 27. 1858. var. brebissonii.

Pl. 1 figs. 1,9.

Measurements: TL. 188.0-234.0μ; TB. 5.5-7.0μ; L:BR. 33-34x; BA. 4.8-5.2μ; BBA. 4.0-4.2μ; BWS. 5.0-6.0μ; LS. 10.0μ.

Represented here is the largest form of the species and included are plants bearing sharp granules as well as hair-like spines. The plants, though very rare, are found in both the northern and southern montane region, at elevations ranging from 2000-7000 feet.

Distribution: Beaverhead Co.: 135-(Mt63-338). Lincoln Co.: 5-(Mt63-136).

Gonatozygon brebissonii de Bary var. intermedium Schroeder, Ber. Deut. Bot. Ges. 35(9) p. 690, Taf. 12, fig. 1, 1918.

Pl. 1 figs. 2,3,4,7,8.

Measurements: TL. 117-142μ; TB. 4.0-8.0μ; L:BR. 15-30x; BA. 4.0-5.5μ; BBA. 3.2-5.0μ; BWS. 4.0-6.5μ; LS. 0-1.0μ.

This plant is smaller than G. brebissonii de Bary var. brebissonii and included here also are specimens which possess the hair-like spines previously mentioned (See figs. 7,8). One specimen was found which appeared to be simply punctate. Other workers assign plants of similar size to the type. This is in any case the most encountered form of the species. The author found it only west of the continental divide, at various elevations and in such aquatic habitats as bogs, marshes ponds and lakes. Sieminska's (1965) plant is placed here.

Distribution: Flathead Co.: 22-(6Mon25); 27-(Mon25); 28-(Mt63-501); 29-(H.L.1); 35-(Mt63-39); 42-(Mon16(1)). Granite Co.: 121-(6Mon38). Lake Co.: 81-(Mt63-206); 83-(Mt63-204); 86-(Sieminska,1965); 93-(63-35). Ravalli Co.: 118-(Mt63-300). Sanders Co.: 70-(Mt63-161).

Gonatozygon brebissonii de Bary var. *tenuis* n. var.

Pl. 1 figs. 10-11.

Measurements: TL. 88.0-118.0μ; TB. 3.5-4.0μ; L:BR. 25-30x; BA. 2.0-2.4μ; BBA. 1.5-2.0μ; BWS. 2.5-3.0μ; LS. 0.5μ.

Cells 25-30 times longer than broad, narrowly cylindrical, and attenuated toward the poles, poles subcapitate; all specimens had minute spine-like hairs approximately 0.5μ long. Plant differs from the type and from all described varieties by its smaller size.

Very rare, known only from John's Lake, Glacier National Park.

Distribution: Flathead Co.: 31-(4182).

Gonatozygon brebissonii de Bary var. *vulgare* Racib., Pamietnik Wydz. III Arad. Umiej. w. Krakowie V. 10., p. 67, T. 14, fig. 10. 1885.

Pl. 1 figs. 5,6.

Measurements: TL. 71-78μ; TB. 6.0-6.5μ; L:BR. 11-12x; BA. 4.0-5.0μ; BBA. 3.5-4.0μ; BWS. 5.0-6.5μ; LS. 0-1.0μ.

These plants approach in size *G. brebissonii* de Bary var. *tatricum* Racib. which is slightly larger. They are close in measurements to the plant described as the above mentioned variety (*tatricum*) by Croadsdale (1955) from Alaska. Very rare, known only from two localities in northwest Montana.

Distribution: Glacier Co.: 61-(Mt63-431). Lake Co.: 86-(Mt62-76).

Gonatozygon monotaenium de Bary, 1856.

Pl. 1 figs. 12-19.

The species has a greater geographical distribution than *G. brebissonii*, and occurs in a greater number of habitats. Consequently, it was the species of the genus most encountered by the author. It has been previously reported for Montana by Kidd (1963).

Three varieties are recognized here.

Gonatozygon monotaenium de Bary, Raberhorst, Die Algen Sachsens, No. 539 Hedwigia I no. 16, p. 105-6. 1856. var. *monotaenium*.

Pl. 1 figs. 15,16.

Measurements: TL. 98.7-245.0µ; TB. 9.0-15.0µ; L:BR. 10-22x; BA 10.0-16.0µ.

Granules on the cell walls of this variety are variable, sometimes indistinct. Plants occurred in bogs, marshes, ponds and lakes, distributed in both the northern and southern montane region.

Distribution: Beaverhead Co.: 143-(Mt63-345). Flathead Co.: 28-(Mt63-444); 47-(Mt63-412). Gallatin Co.: 141-(Mt64-126). Glacier Co.: 63-(Kidd). Granite Co.: 125-(6Mon35); 127-(6Mon41). Lincoln Co.: 6-(Mt63-147); 7-(Mt63-128). Sanders Co.: 70-(Mt63-161).

Gonatozygon monotaenium de Bary var. *pilosellum* Nordst., in Wittrock et Nordstedt, Algae aquae dulcis exsic. no. 750 1886 & fasc. 21, p. 48. 1889. (*Gonatozygon pilosum* Wolle).

Pl. 1 figs 12,13,14.

Measurements: TL. 101.0-332.0µ; TB. 7-16µ; L:BR. 10-27x; BA. 8.0-17µ; BWS. 6.2-12.0µ; LS. .75-2µ.

Principally a lake variety more commonly encountered than the typical form of the species but with a smaller distributional range.

found primarily in the northwest.

The plant identified by Kidd (1963) as G. aculeatum Hastings, has been included under this variety.

Until such a time as the genus Gonatozygon is monographed, I have assigned all forms with short thin spines to Nordstedt's variety instead of G. pilosum Wolle. I do not believe that the two plants can be accurately separated, and because of the variation which exists in the development of granules, or spines, I thought it best to enter the plant as above.

Distribution: Flathead Co.: 27(Mon25); 29-(H.L.1); 37-(Mt63-82); 47-(Mt63-412). Glacier Co.: 56-(Kidd*). Lake Co.: 84-(86); 86-(Mt63-188). Lincoln Co.: 1-(4184); 10-(Mt63-157); 12-(Mt63-67,71); 15-(Mt62-28); 17-(Mt63-121). Missoula Co.: 101-(Mt64-70); 102-(Mt62-5). Sanders Co.: 76-(Mt63-190).

Gonatozygon monotaenium de Bary f. punctatum Croasdale, Trans. Amer. Mic. Soc. Vol. 84 (3): p. 304, fig. 3, 1965.

Pl. 1 figs. 17,18,19.

Measurements: TL. 83-95μ; TB. 6.5-9.0μ; L:BR. 11.3-13x; BA. 7.0-9.5μ.

TL. 141-196.0μ; TB. 7.5-12μ; L:BR. 16-26x; BA. 8-13μ.

Croasdale's measurements within the above size range.

TL. 218-386 μ; TB. 12-15μ; L:BR. 16-29x; BA. 13-17μ.

The plants placed here under this forma may be divided on the basis of size into three distinct groups. The distributional range of these are presented below in a similar manner. The plants occur in ponds and lakes in the western part of the state.

Distribution: (small) Beaverhead Co.: 132-(Mt63-185). Flathead Co.: 29-(H.L.1); 86-(Mt63-394). Lake Co.: 84-(Mt62-67). Lincoln Co.: 1-(4184). Silverbow Co.: 136-(Mt63-379).

(Medium) Flathead Co.: 24(Mt63-406). Lincoln Co.: 3-(Mt63-139); 4-(Mt63-130). Powell Co.: 106-(Mt64-74).

(large) Beaverhead Co.: 135-(Mt63-340). Gallatin Co.: 141-(Mt64-128). Lincoln Co.: 10-(Mt63-157). Silverbow Co.: 136-(Mt63-379).

Gonatozygon kinahani (Arch.) Rabenh., Flor. Europ. Alg. III., p. 156. 1868.

Pl. 1 fig. 20.

Measurements: TL. 297.0-305.0μ; TB. 13.5-15μ; L:BR 19.5-20x; B.A. 14-15μ.

This species is very rare, being known from only one locality and that west of the continental divide. It is possible that because of its resemblance to filaments of Mougeotia, it may have been overlooked. Distribution: Ravalli Co.: 111-(Mt63-248).

Family Mesotaeniaceae

1. Roya West and West, 1896.

This rare genus was collected by the author from only three localities and these were in the northwest corner of the state (See map no. 11). At each of the collecting sites the plants occurred in very few numbers. Only two species were found (See Closterium Sp. No. 4).

Roya cambrica West & West, Journ. Bot. 41: p. 41, taf. 446, fig. 11, 1903. var. cambrica fa.

Pl. 2 fig. 3.

Measurements: TL. 108-110μ; TB. 4.75-5.0μ; L:BR. 20-21x.

Plants smaller than the type, closer in measurements to R. cambrica var. limnetica West and West, but lacking the truncate apices of that variety. Very rare, known only from one locality in the northwest. Distribution: Lincoln Co.: 17-(Mt63-120).

Roya pseudoclosterium (Roy) West & West, Journ. Roy. Micr. Soc., p. 153. 1896.

PL. 2 figs. 1.2

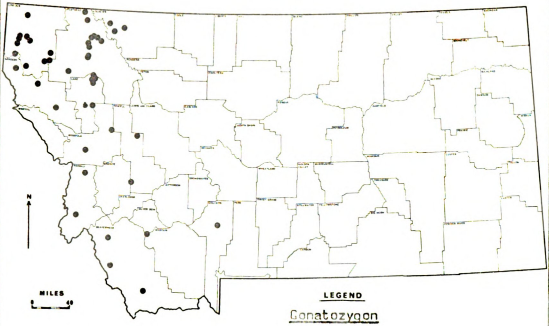
Measurements: TL. 111-125μ; TB. 2.75-3.0μ.

This very rare species was collected from two ponds at low elevations in northwest Montana.

Distribution: Lincoln Co.: 6-(Mt63-147). Sanders Co.: 71-(Mt63-164).

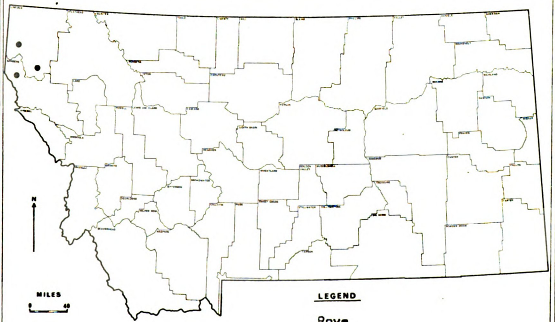
MAP 10

MONTANA



LEGEND

Gonatozygon



LEGEND

Roya

MAP 11

2. Cylindrocystis Meneghini, 1838.

This genus was encountered in the northern and southern montane, and in both lentic an lotic environments, as well as in association with mosses in wet situations. Generally, these aquatic habitats were above 6000 feet. The plants fall into two species each with two varieties. See map no. 13 for geographical distribution of genus.

Cylindrocystis brebissonii Menegh., Nuovi saggi dell'i R. accad. c. sc. Lettere ad arti de Padova V. 4: p. 329 (sep. p.5) et p. 340 (sep. p. 26). 1838. var. brebissonii.

PL. 2 figs. 4-8

Measurements: TL. 43.5-63.0μ; TB. 14-17μ; L:BR. 3-3.7μ.

The most common form of the genus. Sometimes encountered in consirerable numbers. More frequently collected in the southwestern part of the state. Moderately rare.

Previously reported by Sieminska (1965) for collection locality 86. Distribution: Beaverhead Co.: 135-(Mt63-331,332). Flathead Co.: 49-(Mt 63-436). Ravalli Co.: 112-(Mt63-257, 258, 267); 114-(Mt63-256); 116-(Mt63-275).

Cylindrocystis brebissonii Menegh. var. brebissonii morpha.

PL. 2 figs. 9, 10, 11.

Measurements: TL: 25.0-36.0μ; TB. 13.5-17.0μ; L:BR. 1.6-2.6x.

Smaller than type. The plants are probably merely young cells. Collected from elevation at or above 6,600 feet. Very rare.

Distribution: Flathead Co.: 49-(Mt63-436). Ravalli Co.: 112-(Mt63-257).

Cylindrocystis brebissonii Menegh. var. minor West and West, Trans.

Roy. Irish Acad. 32. sec. B, (1): p. 20, t.2, fig. 7 1902.

PL. 2 figs. 12, 13, 14.

Measurements: TL. 25.5-40.0µ; TB. 10.5-13.0µ; L:BR. 2.3-3.2x.

This is a rare variety collected at high elevations (above 6600 feet) from a bog and two lakes, in widely separated areas of western Montana.

Distribution: Flathead Co.: 49-(Mt63-436). Granite Co.: 127-(6Mon41). Ravalli Co.: 112-(Mt63-257, 258, 261).

Cylindrocystis crassa de Bary, Conjug. p. 37, 74 t. 7, figs. c 1-12. 1858. var. crassa.

PL. 2 figs. 17, 18, 20.

Measurements: TL. 31.0-42.0µ; TB. 21.0-28.0µ; L:BR. 1.6-1.7x.

This rare species was gathered from high altitude lakes or in association with mosses in wet situations.

Distribution: Flathead Co.: 32-(Mt63-217): 49-(Mt63-436). Ravalli Co.: 112-(Mt63-261).

Cylindrocystis crassa de Bary var. elliptica West & West?, Trans. Linn. Soc. London. 5(2): p. 48, Taf. 5, fig. 27. 1895.

PL. 2 figs. 15, 16, 19.

Measurements: TL.26-27. 5µ; TB. 21.0-23.0µ; L:BR. 1.1-1.3x.

Very rare, occurring along with the typical in association with mosses in wet habitats. The plants are entered here questionably since they may very well be young cells of the typical form, or merely a smaller form of C. crassa var. crassa.

Distribution : Flathead Co.: 32-(Mt63-217).

3. Spirotaenia De Brébisson, 1848.

An easily recongnizable genus, which is somewhat rare and was collected only west of the continental divide. Only two species were encountered, neither of which occurred in any abundance.

Spirotaenia condensata Bréb. in Ralfs'Brit. Desmid., p. 179, t. 34, f. 1. 1848.

PL. 2 fig. 22.

Measurements: TL. 102.0-218.0µ; TB. 16.5-24.0µ; L:BR. 5.8-10.1x.

This species is the most commonly encountered form of the genus.

Distribution: Lake Co.: 83-(Mt63-204); 86-(Yi); 88-(Mt63-197, 198): 95-(Mt62-59). Missoula Co.: 100-(Mt63-419, 420). Ravalli Co.: 112-(Mt63-257).

Spirotaenia trabeculata A. Braun, in Rabenh. Alg. no. 543. 1856.

PL. 2 fig. 21.

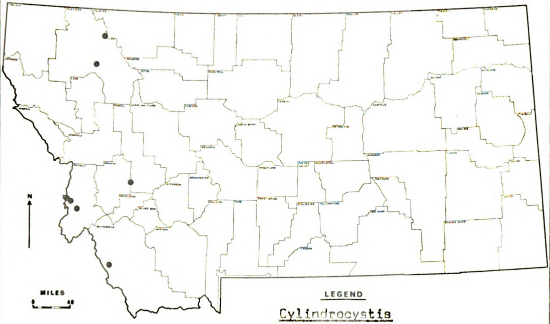
Measurements: T. 199.0-201.0µ.; TB. 21.-22.0µ; L:BR. 9.1-9.5x.

A very rare species known from a single locality in northwestern Montana and occurring in very limited numbers.

Distribution: Lake Co.: 88-(Mt63-197, 198).

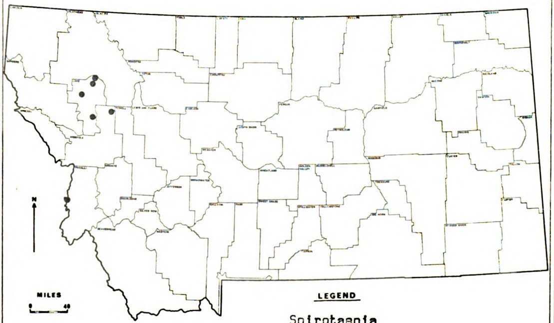
MAP 12

MONTANA



LEGEND

Cylindrocystis



LEGEND

Spirotaenia

MAP 13

4. Netrium Naegeli, 1849.

By far the most prevalent genus of the family Mesotaeniaceae, and at times appearing in significant numbers in a collection. The genus occurs in lakes, ponds, bogs, swamps, marshes, sloughs, and even rivers at varying altitudes. Three species were identified by the author.

Netrium digitus (Ehrenb.) Itzigs & Rothe

Pl. 3 figs. 1,3,4,5,8,9,10,11,12.

This most abundant species of the genus is widely distributed in western Montana. Five varieties are recognized in this study.

Netrium digitus (Ehrenb.) Itzigs. & Rothe, in Rabenh. Alg. no. 508. 1856. var. digitus.

Pl. 3 figs. 8,10.

Measurements: TL. 141.0-360.0μ; TB. 38-87.0μ; L:BR. 3.2-4.6x.

Cells show a great variation in size and shape, and as illustrated here, a number of plants appear to be intermediate, or approaching, N. digitus var. lamellosum (Bréb.) Grönbl. This is the second most common form of the species found in Montana. Moderately rare.

Distribution: Beaverhead Co.: 134-(Mt63-324,327). Flathead Co.: 31-(Kidd); 42(Mon16). Glacier Co.: 154-(Mt62-11). Lake Co.: 82-(Mt63-200); 86-(Mt63-186). Lincoln Co.: 10-(Mt63-155). Missoula Co.: 102-(Mt62-4). Ravalli Co.: 111-(Mt63-249).

Netrium digitus (Ehrenb.) Itzigs. and Rothe var. curtum (Ander.) Krieger, in Rabenhort's Kryptogamen-Flora von Deutschland, Österreich und der Schweiz. 13, Abt. 1, Teil L; p. 216, t. 7 , fig. 3, 1937.

Pl. 3 fig. 1.

Measurements: TL. 98.0-110.0μ; TB. 38.0-40.0μ; L:BR. 2.4-2.9x.

This is a very rare variety known to the writer from only two lakes west of the continental divide.

Distribution: Flathead Co.: 42-(Mon16). Ravalli Co.: 112-(Mt63-261).

Netrium digitus (Ehrenb.) Itzigs. & Rothe var. lamellosum (Bréb.) Grönbl, Acta Soc. Fauna et Flora Fenn., 47: p. 13, 1920.

Pl. 3 figs. 11, 12.

Measurements: TL. 350.0-400.0μ; TB. 63.0-70.0μ; L:BR. 5.7-5.9x.

Included under this variety are plants which would be classified by other authors (e.g. Krieger) as N. digitus var. recta (Turn.) Krieger. See pl. 3 fig. 11. However, I have found complete intergradation between the two forms and do not believe they can be adequately separated. Furthermore, there are also forms which intergrade with var. digitus. Cells with the lateral margins distinctly retuse, as is seen in fig. 12, are rare in the collection. Very rare.

Distribution: Lake Co.: 86-(Mt63-187).

Netrium digitus (Ehrenb.) Itzigs & Rothe. var. naegelii (Bréb.) Krieger, in Rabenhort's Kryptogramen-Flora von Deutschland, Österreich und der Schweiz 13, Abt. 1, Teil 1: p. 218, t. 8, figs. 4,5. 1937.

Pl. 3 figs. 3,4,5.

Measurements: TL. 153.0-284.0μ; TB. 38.0 - 55.0μ; L:BR. 3.5-5.3x.

This variety was collected by the author, more often than any other form of the species. However, all the collection localities were west of the continental divide. Common.

Distribution: Flathead Co.: 23-(Mt63-399); 28-(Mt63-447); 29-(H.L.1); 35-(Mt63-391,392); 36-(Mt63-396); 47-(Mt63-413). Lake Co.: 82-(Mt 63-200); 83-(Mt63-204); 84-(x8); 87-(Mt64-64). Lincoln Co.: 6-(Mt63-146);

18-(Mt63-107); 19-(Mt63-112); 20-(Mt63-91). Missoula Co.: 102-(Mt62-5). Ravalli Co.: 11-(Mt63-251); 115-(Mt63-271); 118-(Mt63-300). Sanders Co.: 70-(Mt63-161); 72-(Mt63-162); 76-(Mt63-159).

Netrium digitus (Ehrenb.) Itzigs. & Rother var. rhomboideum Grönblad, Acta Societatis Pro Gauna et Flora Fenn. 47: no. 4, p. 13, Taf. 4, fig. 38. 1920.

Pl. 3 fig. 9

Measurements: TL. 177.0-210.0µ; TB. 61.0-74.0µ; L:BR. 2.8-2.9x.

Rare,known only from three localities, two of which are bogs, the other a subalpine marsh.

Distribution: Flathead Co.: 28-(Mt63-44). Glacier Co.: 54-(Mt62-15). Granite Co.: 127-(6Mon41).

Netrium interruptum (Bréb.) Lütkem., Cohn's Beiträge zur Biologie der Pflanzen, 8: p. 407, 1902.

Pl. 3 figs. 6,7.

Measurements: TL. 142.0-262.0µ; TB. 37.0-63.0µ; L:BR. 3.3-5.6x.

This species is quite variable in size and length to breadth ratio, and somewhat variable in the shape of the cell as well. It is widely distributed in western Montana. Moderately rare.

Distribution: Beaverhead Co.: 134-(Mt63-323). Flathead Co.: 39-(Mt63-79). Granite Co.: 125-(6Mon51); 127-(6Mon41). Glacier Co.: 54-(Mt62-16). Lake Co.: 84-(Q1). Lincoln Co.: 9-(Mt63-154). Missoula Co.: 100-(Mt63-419, 420). Ravalli Co.: 112-(Mt63-257,261); 119-(Mt63-305).

Netrium oblongum (De Bary) Lütkem., Cohn's Beiträge zur Biologie der Pflanzen, 8: 407, 1902.

Pl. 3 fig. 2.

Measurements: TL. 61.0-67.0µ; TB. 19.0-21.0µ; L:BR. 3.2-3.4x.

The rarest species of this genus collected by the author, and one in which but a few specimens were seen. Known to the writer from only two localities in western Montana, these being widely separated. Very rare.

Distribution: Beaverhead Co.: 134-(Mt63-322). Lake Co.: 88-(Mt63-197).

Family Desmidiaceae

1. Actinotaenium Nageli 1849.

This genus is by no means common, although it is well distributed in northwestern Montana. With few exceptions the species present were not collected in abundance. There are twelve named species and one plant presently entered simply as belonging to the genus.

Actinotaenium capax (Joshua) Teil. var. minus (Schmidle) Teil. Bot. Notiser, Hafte 4: 396, 1954.

Measurements: TL. 67.0µ; TB. 37.0µ.

Very rare. A single specimen seen. Collected from a bog in Glacier Park.

Distribution: Glacier Co.: 54-(Mt62-17).

Actinotaenium clevei (Lund.) Teil. Botaniska Notiser, Hafte 4: p. 393, figs. 10-13. 1954. var. clevei.

Pl. 4 fig. 12.

Measurements: TL. 73.0-97.0µ; TB. 29.0-35.5µ; L:BR. 2.4-2.9x; BI. 27.0-32.0µ.

Although this species is described by West & West (1904) as a rare desmid chiefly of permanent bogs, it was collected by the writer primarily from lakes. The typical form was the most common form of the species gathered by the writer.

Rare.

Distribution: Beaverhead Co: 134-(Mt63-324,327). Flathead Co.: 27- (Mon25). Granite Co.: 125-(6Mon51). Lincoln Co.: 15-(Mt62-27,28).

Actinotaenium clevei (Lund.) Teil. var. gelidum (Wittr.) Teiling, Botaniska Notiser, Hafte 4: p. 393, fig. 14, 1954.

Pl. 4 fig. 11.

Measurements TL. 71.0-75.0μ; TB. 23.0-24.0μ; L:BR. 2.9-3.0x; BI. 22.0-23.0μ.

A very rare plant, known to the writer from only one locality in the northwestern part of the state.

Distribution: Lake Co.: 88-(Mt63-197,198).

Actinotaenium cruciferum (De Bary) Teil. Botaniska Notiser, Hafte 4: p. 396, figs. 16, 17. 1954.

Pl. 4 figs. 5,6.

Measurements: TL. 16.0-18.0μ; TB. 9.0-1.0μ; L:BR. 1.7-1.8x; BI. 8.0-9.0μ.

This small and rather inconspicuous desmid was gathered from a number of scattered localities west of the continental divide. In addition to the typical form two formae and an intermediate "morpha" were collected, but none abundantly. Very rare.

Distribution: Lake Co.: 86-(Mt-62-63).

Actinotaenium cruciferum (De Bary) Teil. morpha.

Pl. 4 fig. 8.

Measurements: TL. 14.5-15.0μ; TB. 7.0-7.5μ; L:BR. 2.0x; BI. 6.0-6.5μ.

Intermediate in size between the typical form (above) and A. cruciferum f. minus Teiling. Very rare, known to the writer from only one pond at low elevation (2000 feet) in the northwest corner of the state.

Distribution: Lincoln Co.: 7-(Mt63-128).

Actinotaenium cruciferum (De Bary) Teil. f. latius Teil. Botaniska Nostiser, Hafte 4: p. 396, 1954.

Pl. 4 fig. 9.

Measurements: TL. 26.0-27.0μ; TB. 17.0-18.0μ; L:BR. 1.5-1.6x; BI. 15.0-15.5μ.

Very rare, obtained from a "squeezing" of Sphagnum along the shore of an oligotrophic high altitude lake (6,000 feet).

Distribution: Ravalli Co.: 112-(Mt63-257).

Actinotaenium cruciferum (De Bary) Teil. fa. minus Teil. Botaniska Notiser, Hafte 4: p. 396, fig. 15, 1954.

Pl. 4 fig. 7.

Measurements: TL. 12.0-12.5μ; TB. 6.5-7.5μ; L:BR. 1.6-1.9x; BI. 6.2-7.0μ.

More frequently seen than the typical form of the species and gathered from a bog and pond. Very rare.

Distribution: Glacier Co.: 54-(Mt62-25). Ravalli Co.: 115-(Mt63-270).

Actinotaenium cucurbita (Bréb.) Teil.

This species was primarily collected from high altitude bogs, and was one of the few Actinotaenia encountered relatively abundant at a locality. Besides the typical form, one additional forma and one variety were also collected.

Actinotaenium cucurbita (Bréb.) Teil., Botaniska Notiser, Hafte 4: p. 406, fig. 66, 1954. var. cucurbita f. cucurbita.

Pl. 5 figs. 2,3.

Measurements: TL. 37.5-41.0μ; TB. 19.5-23.0μ; L:BR. 1.6-1.9x; BI. 16.0-18.5μ.

The type forma of this species was not the form most encountered by the author, although quite a number of specimens were found. It was collected from only one locality, in the southern Montane, both in the plankton and in association with _Sphagnum_ growing along the shore of the lake. Very rare.

Distribution: Ravalli Co.: 112-(Mt63-257,260).

Actinotaenium _cucurbita_ (Bréb.) Teil. f. _latius_ (West) Teil. Botaniska Notiser, Hafte 4: p. 407, 1954.

Pl. 5 fig. 4.

Measurements: TL. 30.0-35.0µ; TB. 18.-21.0µ; L:BR. 1.5-1.7x; BI. 17.0-19.0µ.

This form was encountered more often than the typical form and was gathered in greater numbers. It was collected from bogs and from the plankton ot a lake which possessed a _Sphagnum_ margin in the area of sampling. All of the collection localities were at, or above 6600 feet, and in the western part of the state. The cells are smaller than the measurements given by Teiling in his description, but in outline the cells are similar. Rare.

Distribution: Granite Co.: 127-(6Mon38). Missoula Co.: 100-(Mt63-419). Ravalli Co.: 112-(Mt63-262).

Actinotaenium _cucurbita_ (Bréb.) Teil. var. _attenuatum_ (G.S.West) Teil., Botaniska Notiser, Hafte 4: p. 407, figs. 67-69, 1954.

Pl. 5 fig. 8.

Measurements: TL. 34.0-35.0µ; TB. 17.0-19.0µ; L:BR. 1.8-2.1x; BI. 15.0-15.5µ.

Very rare, collected by the writer only from bogs.

Distribution: Glacier Co.: 54-(Mt62-16). Granite Co.: 126-(6Mon43).

Actinotaenium cucurbitinum (Biss.) Teil.

This species turned up in five collection localities, all in western Montana. In addition to the typical form, one forma and one variety were identified. The typical form of the species was the least encountered.

Actinotaenium cucurbitinum (Biss.) Teil. Botaniska Notiser, Hafte, 4: p. 399, fig. 36, 1954. var. *cucurbitinum* f. *cucurbitinum*.

Pl. 5 fig. 11.

Measurements: 63.0-65.0μ; TB. 25.0-26.0μ; L:BR. 2.5x; BI. 24.0-25.5μ.

Very rare. Collected from a lake in the northwest corner of the state.

Distribution: Lincoln Co.: 15-(Mt62-28).

Actinotaenium cucurbitinum (Biss.) Teil. var. *cucurbitinum* f. *minus* (West & West) Teil. Botaniska Notiser, Hafte 4: p. 399. 1954.

Pl. 5 fig. 10.

Measurements: TL. 40.0-42.5μ; TB. 16.5-18.0μ; L:BR. 2.4-2.5x; BI. 14.5-17.0μ.

More abundant in the writer's collections than the typical form of the species and only found by the author at or above 6800 feet. Very rare.

Distribution: Beaverhead Co.: 134-(Mt63-327). Missoula Co.: 100-

(Mt63-419).

Actinotaenium cucurbitinum (Biss.) Teil. var. minutum (Prescott) Teil. Botaniska Notiser, Hafte 4: p. 400, fig. 39, 1954.

Pl. 5 fig. 9.

Measurements: TL. 30.0-33.0µ; TB. 14.5-15.5µ; L:BR. 2.0-22x; BI. 12.5-14.0µ.

On the basis of the small size of these plants I have entered them as var. minutum. However, Teiling gives no measurements nor cites Prescott's original description of the plant. The plants are identical in shape with the type illustration. Collected only from Glacier National Park.

Very rare.

Distribution: Flathead Co.: 28-(Mt63-500). Glacier Co.: 54-(Mt62-13, 17,20).

Actinotaenium curtum (Bréb.) Teil. Botaniska Notiser, Hafte 4: p. 390, fig. 1, 1954 var. curtum.

Pl. 4 fig. 1.

Measurements: TL. 33.5-35.0µ; TB. 17.0-18.0µ; L:BR. 1.8-2.0x; BI. 16.0-16.5µ.

This is a very rare species known to the writer from a single collection obtained from moss squeezings. Besides the typical A. curtum f. majus (Wille) Teiling, was also found in this association with mosses.

Distribution: Flathead Co.: 47-(Mt63-217).

Actinotaenium curtum (Breb.) Teil. f. *majus* (Willo) Teil., Bot. Notiser, Hafte 4: p. 390, 1954.

Pl. 4 fig. 2.

Measurements: TL. 40.0-42.5µ; TB. 20.0-21.0µ; L:BR. 2.0x; BI. 17.0-17.5µ.

Very rare.

Distribution: Flathead Co.: 32-(Mt63-217).

Actinotaenium diplosporum (Lund.) Teil., Bot. Notiser, Hafte 4: p. 411, fig. 74. 1954. var. *diplosporum*

Pl. 5 figs. 13,14.

Measurements: TL. 60.5-68µ; TB. 28.5-33.0µ; L:BR. 1.8-2.3x; BI. 27.5-29µ.

Two distinct forms of this variety were found; one is guitar-shaped with an indentation above the isthmal region (fig. 13) and this plant is similar to the type illustration by Lundell (1871). The other from lacks the indentation of the lateral walls and at times appears almost cylindrical (fig. 14). Collected only in the northwestern montane region.

Rare.

Distribution: Flathead Co.: 27-(Mon25). Glacier Co.: 54-(Mt62-11,17). Lake Co.: 86-(Mt63-72).

Actinotaenium diplosporum (Lund.) Teil. var. *americanum* (West & West) Teil., Bot. Notiser, Hafte 4: p. 413, fig. 75. 1954. f. *americanum*

Pl. 5 fig. 12.

Measurements: TL. 64.0-66.0µ; TB. 27.5-31.0µ; L:BR. 2-2.1x; BI. 26-28.5µ.

Very rare. Known only from a lake in the northwest.

Distribution: Lincoln Co.: 15-(Mt62-28).

Actinotaenium diplosporum (Lund.) Teil. var. *americanum* (West & West) Teil. f. *minus* (Cush.) Teil., Bot. Notiser, Hafte 4: p. 413, fig. 76, 1954.

Pl. 5 fig. 7.

Measurements: TL. 32.0-37.0µ; TB. 15.0-16.0µ; L:BR. 2.0-2.4x; BI. 15.0-15.5µ.

A number of specimens originally included under this form, after re-examination of the cell wall, were transfered to Penium didymocarpum Lundell. See discussion of this latter-named taxon. It should be noted that in a number of localities both taxa are present. This form of the species is more widely distributed and much more abundant than the typical form. Moderately rare.

Distribution: Beaverhead Co.: 134-(Mt63-319). Flathead Co.: 27-(Mon25); 28-(Mt63-449). Granite Co.: 127-(6Mon38). Lincoln Co.: 15-(Mt62-26). Ravalli Co.: 112-(Mt63-257).

Actinotaenium elongatum (Racib.) Teil., Botaniska Notiser, Hafte 4: 392, fig. 6, 1954.

Pl. 4 fig. 13

Measurements: TL. 108.0-110.0µ; TB. 36.0-36.5µ; L:BR. 2.9-3.0x; BI. 33.0-34.0µ.

The Montana plants were smaller than the measurements given by Teiling (1954) for the type, and are closer in size to A. elongatum var. africanum (Schmidle) Teiling. However, due to the fact that only two specimens were seen, the plants are entered here as simply belonging to the species. Very rare.

Distribution: Flathead Co.: 35-(Mt63-391).

Actinotaenium inconspicuum (West & West) Teil., Botaniska Notiser, Hafte 4: p. 403, figs. 57-58, 1954.

Pl. 5 figs. 1,6

Measurements: TL. 20.0-21.0µ; TB. 7.0-7.5µ; L:BR. 2.8-2.9x; BI. 6.0-6.5µ.

Very rare, known to the author from only two collecting sites, in northwest Montana. Reported by Sieminska (1965) as Penium inconspicuum West, from collection locality number 86.

Distribution: Lake Co.: 86-(Sieminska*); 99-(Mt63-66).

Actinotaenium subglobosum (Nordst.) Teil. Botaniska Notiser, Hafte 4: p. 397, fig. 33, 1954.

Pl. 4 fig. 4.

Measurements: TL. 37.0-41.0µ; TB. 25.0-26.0µ; L:BR. 1.4-1.6x; BI. 24.0-25.5µ.

This species is very rare, known only from Glacier National Park.

Distribution: Flathead Co.: 28-(Mt63-444). Glacier Co.: 54-(Mt62-17).

Actinotaenium subtile (West & West) Teil. Botaniska Notiser, Hafte 4: p. 410, fig. 61, 1954.

Pl. 5 fig. 5.

Measurements: TL. 16.0-17.0µ; TB. 9.5-10.0µ; L:BR. 1.6-1.7x; BI. 8.0-9.0µ.

This is described by West & West (1904) as a rare bog species, and indeed it is a very rare plant in Montana. However, it was collected by the author from a small pond.

Distribution: Lincoln Co.: 14-(Mt63-76).

Actinotaenium taylori (N. Carter) Teil. Botaniska Notiser, Hafte 4: 406, fig. 65, 1954.

Pl. 6 figs. 1,2,3,5,6,7,8.

Measurements: TL. 183.0-250.0µ; TB. 42.0-48.0µ; L:BR. 3.9-5.0µ; BI. 41.5-47.0µ.

In 1935 Carter described Cosmarium taylori from British Columbia, Canada. To my knowledge since that time the plant has not been reported. I believe the desmid presented here is Carter's plant.

The original illustration of this desmid shows a cylindrical-shaped plant with a narrowing of the semicells at the isthmal region. The semicells at their apices bear pores in transverse and longitudinal rows. The remainder of each semicells, approximately two-thirds, is described by Teiling (1954) as being scrobiculate. The chloroplast according to Teiling has developed in a parietal direction, the edges of the lamellae being curled and lacinate. There are several axile pyrenoids. The Montana specimens illustrated in figs. 1,2,3,5 and 6 in outline form, are most like the original illustration by Carter. The so called constricted isthmal region is clearly visible in these drawings. In Fig. 8, a cylindrical desmid, lacking the isthmal indentation and possessing an inner straight and an outer convex margin, is illustrated. All these figures are of the same species as viewed from different sides, and/or of a different developmental stage.

The plant is slightly bent toward the straight margin, frequently resting on this flattened side. Such plants present to the observer a view similar to that seen in figures 1 and 6. The degree of constriction or narrowing of the isthmal region varies, at times being pronounced and at other times indistinct or completely lacking. Such conditions are dependent upon, for example, the extent of elongation of the plant prior to cell division; the degree of development of the new semicell, and/or the angle from which one view the desmid.

The cell wall is basically as described by Teiling with the upper third of the semicells possessing the transverse and longitudinally arranged pores. Supplementary punctae are also present.

The remaining portion of each semicell is covered with what appear to the writer to be perforations and these are in longitudinal rows, and not as irregularly scattered as in the original illustration. See Fig. 7, which shows a portion of the cell wall with these perforations.

The chloroplast ranges from axile to parietal longitudinal bands (See fig. 8). This is apparently dependent upon the age of the plant. Likewise, with the age of the plant the position and umber of pyrenoids varies.

This is a most interesting desmid resembling or sharing characteristics in common with a number of genera (e.g. Penium, Closterium and Pleurotaenium). The presence of the pores indicate the plant should be placed in Actinotaenium. However, the lack of distinct isthmal furrow indicates otherwise.

Although this plant is considered here as being rare, known from only two widely separated areas in western Montana, the plant appears with great frequency in the writer's samples.

Distribution: Glacier Co.: 55-(Mon28). Ravalli Co.: 121-(Mt63-288,289); 123-(Mt63-284,287).

Actinotaenium trachypolum (West & West) Teil. var. messikommeri Teil. Botaniska Notiser, Hafte 4: p. 399, fig. 22, 1954.

Pl. 4 fig. 10.

Measurements: TL. 29.0-34.0μ; TB. 19.0-22.0μ; L:BR. 1.5-1.6x; BI. 16.5-18.0μ.

Very rare.

Distribution: Flathead Co.: 31-(Mon 4181). Lake Co.: 86-(Mt62-75, Mt63-187).

Actinotaenium sp.

Pl. 6 fig. 4.

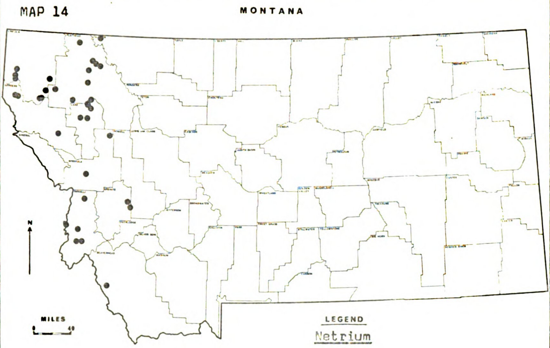
Measurements: TL. 49.0-56.5μ; TB. 14.0-14.5μ; L:BR. 3.5-4.2x; BI. 12.0-13.0μ.

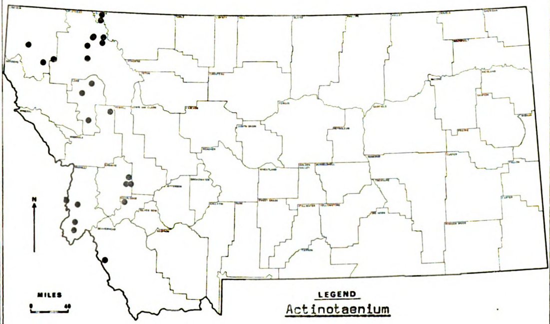
On the basis of possessing pores and an isthmal furrow, the plants have been assigned to the genus Actinotaenium. However, the writer was unable to assign the plants to any known described taxon. Since only a few specimens were seen, it was believed best not to describe it as a new taxon until additional cells are observed.

There are two axile chloroplasts per semicell each with a central pyrenoid. Very rare.

Distribution: Lake Co.: 88-(Mt63-198).

MAP 14


MONTANA
MILES
0
40
N
LEGEND
Netrium


MILES
0
40
N
LEGEND
Actinotaenium

MAP 15

2. Penium Brébisson, 1844.

As is true of most of the genera of desmids previously treated, Penium is not really common, although it is well distributed west of the continental divide. Eight species are reported here, all known only from the western part of the state.

Penium costatum Hodget, Trans, Roy. Soc. Sou. Afri. Vol. 13: p. 71 tax. fig. 6F, 1926.

Pl. 8 figs. 5,6.

Measurements: TL. 129.0-136.0µ; TB. 21.0-22.0µ; BI. 17.5-18.0µ.

This very beautiful desmid was originally described from Africa. The cell wall is some what reminiscent of the central decoration of Cosmarium subnudiceps West & West, and I have illustrated the wall as it appears under an oil immersion objective in fig. 6. It is a very rare species, known only from a single collection locality in western Montana.

Distribution: Ravalli Co.: 115-(Mt63-265).

Penium cylindrus (Ehrenb.) Bréb., in Ralfs' Brit. Desmid., p. 150, tab. 25, fig. 2 var. cylindrus. 1848.

Pl. 7 figs. 2,3.

Measurements: TL. 36.0-56.0µ; TB. 14.0-15.0µ.

Very rare.

Distribution: Granite Co.: 127-(6Mon38,41).

Penium cylindrus (Ehrenb.) Bréb. var. subtruncatum Schmidle, Beitr. alp. Alg. p. 310, t. 14, figs. 27,28, 1895.

Pl. 7 fig. 1.

Measurements: TL. 23.5-25.0µ; TB. 10.5-11.5µ.

Very rare, but collected in greater abundance than the typical form.

Distribution: Granite Co.: 127-(6Mon38). Ravalli Co.: 112-(Mt63-257,261).

Penium didymocarpum Lund., Nova Acta reg. soc. scient. ser. 3, 8: p. 85, t. 5, fig. 9, 1871.

Pl. 7 figs. 5,6,7,8,11,12.

Measurements: TL. 31.0-42.0μ; TB. 14.0-18.0μ; Z. 32.5-35.0ux24.0-25.0μ.

In forming the double zygospores and the lacinate stelloid chloroplast, the plant agrees with Cosmarium illudens Lütk. which Teiling (1954) considers as being synomymous with Actinotaenium diplosporum var. americanum f. minus. Originally, I had identified my plants as this latter taxon. However, I have entered them as P. didymocarpum because under oil immersion, and after staining, it was noted that the cell wall has"granula" or perforations in longitudinal rows. It is difficult to tell which, but I believe they are perforations. Inasmuch as a longitudinal arrangement of these perforations is not characteristic of A. americanum f. minus, I have entered the plants as P. didymocarpum. The plant is one of the more often Penium species encountered in western Montana. Rare.

Distribution: Flathead Co.: 28-(Mt63-444,449,500). Glacier Co.: 54-(Mt62-11,13). Granite Co.: 127-(6Mon41). Lake Co.: 85-(Mt63-47); 86-(Mt63-186).

Penium exiguum West, Journ. Linn. Soc. Bot., 29: p. 126, t. 19, figs. 17,18. 1892. fa.

Pl. 7 fig. 4.

Measurements: TL. 74.5-76.0μ; TB. 9.5-10.0μ; L:BR. 7-8x; BI. 7.5-8.0μ; BA. 7.0-7.5μ.

These plants are not of the typical form nor do they fit any described variety known to the author. In body measurements they are closest to P. exiguum var. glabberimum Grönblad, but the Montana plants are narrower or more slender. I believe it best to simply enter the plant as a form of the species, than to describe it as a new variety or forma, since only two specimens were observed. Very rare.

Distribution: Glacier Co.: 54-(Mt62-11).

Penium margaritaceum (Ehrbg.) Bréb.

One of the most abundantly found Penium species although collected by the writer only west of the continental divide. Two varieties were found with the typical form of the species being the more abundant and having the greater distributional range.

Penium margaritaceum (Ehrbg.) Bréb. in Ralfs' Brit. Desmid., p. 149, t. 25, fig. 1 a-c, 1848. var. margaritaceum.

Pl. 8 fig. 1.

Measurements: TL. 64.0-185.0μ; TB. 13.5-26.0μ; (35.0u); BI. 13.5-26.0μ (28.5μ).

Moderately rare.

Distribution: Flathead Co.: 36-(Mt63-396); 49-(Mt63-436); 52-(Mt63-439). Glacier Co.: 54-(Mt62-11,25). Lake Co.: 88-(Mt63-197,198). Lincoln Co.: 10-(Mt63-156).

Penium margaritaceum (Ehrbg.) Bréb. var. elongatum Klebs. Schrift. phys.-okonom. Gessellsch. Königsberg, 22: p. 21, t. 2, fig. 18, 1879.

Pl. 8 fig. 2.

Measurements: TL. 182-273.0μ; TB. 20.0-22.0μ; BI. 18.0-19.0μ.

Rare.

Distribution: Flathead Co.: 29-(H.L.1); 31-(4182). Sanders Co.: 70-(Mt63-161).

Penium polymorphum Perty, Kenn. Kleinst. Labensforman nach Bau, Funktionen, Systematik, mit Specialver-zeichniss der in der Schweiz beobachtetenen. Bern. p. 207, t. 16, fig. 15, 1852.

Pl. 7 fig. 10a,b.

Measurements: TL. 41.0-56.0µ; TB. 19.0-23.0µ.

I have found that the delicate, longitudinal striolations characteristic of cell walls of this species, may be overlooked, unless the cells are stained and/or viewed under oil immersion. Although very rare, the plants can occur in abundance in a particular habitat.

Distribution: Beaverhead Co.: 134-(Mt63-322). Missoula Co.: 100-(Mt63-419).

Penium silvae-nigrae Raben. var. parallelum Krieger, Desmid in Rabenhort's Kryptogramen Flora von Deutschland, Österreich und der Schwiez. 13 Abt. 1, Teil L: p. 240, t. 11, fig. 5, 1935.

Pl. 7 fig. 9.

Measurements: TL. 66.0-68.0µ; TB. 17.0-18.0µ; BI. 16.5-17.2µ.

Very rare. Collected from one lake in the northwest corner of the state, and in small numbers.

Distribution: Lincoln Co.: 8-(Mt63-152).

Penium spirostriolatum Barker, Quart. Journ. Micr. Sci. 9: p. 194, 1869.

Pl. 8 figs. 3,4.

Measurements: TL. 134.0-212.0µ; TB. 19.5-26.0µ; BI. 19.5-21.5µ.

One of the more often encountered Penium species and the species having the greatest geographical range. It was primarily collected from ponds below 4000 feet. Moderately rare.

Distribution: Beaverhead Co.: 133-(Mt63-318). Flathead Co.: 28-(Mt63-445); 39-(Mt63-77). Lake Co.: 88-(Mt63-197,198); 89-(Mt63-388). Lincoln Co.: 20-(Mt63-91,96). Ravalli Co.: 115-(Mt63-271); 121-(Mt63-289).

3. Closterium, Nitzech, 1817.

Closterium was the third largest genus, measured as number of taxa, collected by the author. Of the genera presented in this text, it was the most frequently encountered and most widely distributed. (see map no. 17). At times it comprised the major portion of the desmid flora (if not all of it) of a locality, qualitatively and/or quantitatively.

I find that such characteristics as curvature, presence or absence of striae, and the number of pyrenoids per semicell can vary considerably within particular species. For example, a taxon with a cell wall described as smooth, might very well be shown to have striae under an oil immersion objective and sometimes only half the cell may possess them. Futhermore, complete intergradation can exist between smooth cell walls and striated ones and at times the presence of one of the other might be important in distinquishing taxa.

There are 94 named taxa, a number of unnamed forms and/or morphae, and 4 plants entered simply as belonging to the genus.

Closterium abruptum West, Journ. Ray. Micr. Soc., p. 719, t.9, fig.1. 1892.

Pl. 21 figs. 1,2.

Measurements: TL. 175.0-218.0µ; TB. 12.5-15.5µ; L:BR. 12-16x; BA 6.0-9.5µ.

The Montana plants have a greater length to breadth ratio than that originally given by West (10x) for the species. They also resemble Closterium juncidum Ralfs var. brevior Roy, except that they completely lack striations. Collected by the author from localities west of the continental divide from lentic environments at medium elevations (3800-4400 feet), and not abundantly.

Distribution: Glacier Co.: 54-(Mt62-13). Lake Co.: 88-(Mt63-197). Ravalli Co.: 115(Mt63-274).

Closterium acerosum (Shrank) Ehrenb.

One of the most common and abundant desmids found and although with one exception, widely distributed in Montana, it was not encountered in the southwest corner of the state. It occurs in a variety of aquatic habitats (lakes, ponds, rivers), generally at, or below, an elevation of 4500 feet.

In the material studied I found overlapping between the characteristics of this species and *Cl. pritchardianum* Arch. Croasdale (1955), indicates a similar overlapping in her Alaskan plants. Interestingly, *Cl. pritchardianum* does commonly occur in the southwestern part of the state.

The species has previously been reported for Montana by Schindler (1954) for a pond in the area of collection locality 93, and by Vinyard (1951) from collection locality 65.

Two forms of the species are recognized here, and intergradations between these exist.

Closterium acerosum (Schrank) Ehrenb., in Ralfs' Brit. Desmid., p. 164, t. 27, fig. 22. 1848. var. *acerosum* f. *acerosum*.

Pl. 18 figs. 1,2,3.

Measurements: TL. 311.0-511.0μ; TB. 36.0-47.0μ; L:BR. 5.8-12.7x.

The most common form of the species encountered.

Distribution: Blaine Co.: 153-(Mt 64-37,38): 154-(Mt64-32). Broadwater Co.: 130-(Mt63-471, Mt64-131). Carter Co.: 201-(Mt64-158). Gallatin Co.: 141-(Mt64-138). Garfield Co.: 191-(Mt64-25). Lake Co.: 83-(Mt63-204); 87-(Mt64-68); 93-(Mt63-35); 98-(Mt 63-62) Liberty Co.: 150-(Mt64-61). Lincoln Co.: 6-(Mt 63-147). Ravalli Co.: 120-(Mt 63-308). Richland Co.: 196-(Mt64-172). Sweetgrass Co.: 170-(Mt64-103); 171-(Mt64-100); 172-(Mt64-105). Valley Co.: 185-(Mt64-17) Yellowstone Co.: 175-(Mt64-118).

Previously reported by Schindler (54) from a pond in the area of collection locality 93 and by Vinyard (51) from 65.

Closterium acerosum (Schrank) Ehrenb. var. acerosum f. elongatum (Bréb.) Kossinsk., Flora Plant. Crypt. U.S.S.R. Vol. V (2), fasc. 1: p. 166, t.7, fig. 7. 1960.

Pl. 18 fig. 4

Measurements: TL. 520.0-805.0μ; TB. 36.0-49.5μ; L:BR. 11-20x.

Because of the intergradation which exists between this plant and the typical form, I have followed Kossinskaja (60) in relegating var. elongatum Breb. to the rank of forma. This forma does not have as wide a geographical distribution as the typical, and in general is confined to western Montana. Moderately rare.

Distribution: Beaverhead Co.: 146-(Mt63-359). Chouteau Co.: 157-(Mt64-49). Flathead Co.: 43-(Mt63-49). Glacier Co.: 63-(Mt63-218). Lake Co.: 93-(Mt 63-35); 98-(Mt63-62). Phillips Co.: 158-(Mt64-29,30,31). Sanders Co.: 76-(Mt63-177).

Closterium aciculare Tuffen West

Two forms of this species were found, the typical form, distinquished by its greater length and greater length to breadth ratio ; and a smaller form, which I have identified as Cl. aciculare var. brevius Elenk. The latter variety was more frequently encountered, and at one locality (5) it occurred along with the typical. The typical form does occur east of the continental divide while var. brevius was only collected by the author west of the divide. The species was primarily collected from lakes, generally, at elevations at or below 3800 feet.

Closterium aciculare T. West, Trans. Roy. Micr. Soc. n.s.8, p. 153, t. 7, fig. 16. 1860 var. aciculare.

Pl. 15 fig. 1.

Measurements: TL. 468-550.0μ; TB. 5.0-7.0μ; L:BR. 66-100x.

Distribution: Lincoln Co.: 5-(Mt63-136). Madison Co.: 137-(Mt63-377). Pondera Co.: 67-(Mt64-55).

Previously reported for Montana by Kidd(63) for collecting site 63, but not found by the writer at that locality.

Closterium aciculare T. West var. brevius Elenk., Tr. Bot. Inst. Acad. Nauk URSS , Ser. 2,4, p. 181. 1938. (not seen)

Pl. 15 fig. 2.

Measurements: TL. 230.0-371.0µ; TB. 4.0-7.0µ: L:BR. 38-74x.

The plants entered here as var. brevius might be designated by others as Cl. pronum Bréb. However, from the Montana material I have studied, the presence of this variety along with the typical form at collection site no. 5, and the intergradation which exists here, I thought it best to enter the plants as above. The variety is more commonly encountered than the typical but was collected by the author only west of the continental divide.

Distribution: Flathead Co.: 29-(H.L.1); 37-(Mt63-82); 42-(Mon16); 47-(Mt63-415). Lake Co.: 87-(Mt64-64,66). Lincon Co.: 5-(Mt63-136); 13-(Mt 63-75). Missoula Co.: 105-(Mt63-247). Sanders Co.: 76-(Mt63-160).

Closterium acutum (Lungb.) Bréb.

This species is chiefly confined to western Montana. It was most often encountered by the author in lakes and ponds at elevations at or below 3800 feet. In addition to the typical form, two varieties were found.

Closterium acutum (Lyngb.) Bréb., in Ralfs' Brit. Desmid., p. 177, t. 30, fig. 5, t. 34. fig. 5a,b,d-f. 1848. var. acutum.

Pl. 15 fig. 17.

Measurements: TL. 106-121.0µ; TB. 3.5-4.5µ; L:BR. 26-20x.

Cells variable in curvature, at times appearing almost straight, thus, in this characteristics intergrading into var. linea (Perty) West & West. Very rare.

Distribution: Chouteau Co.: 157-Mt64-49). Lincoln Co.: 21-(Mt63-101).

Closterium acutum Bréb. var. linea (Perty) West & West, Bot. Trans Yorks. Nat. Union, 5,(23) p.57. 1901. fa.

Pl. 15 fig. 18.

Measurements: TL. 170-175µ; TB. 4.0-7.0µ; L:BR. 25-42x.

The Montana plants are rather large for this variety, but otherwise similar. This variety is very rare, collected from two ponds in the western part of the state.

Distribution: Beaverhead Co.: 132-(Mt 63-185). Lake Co.: 99-(Mt63-66).

Closterium acutum (Lyngb.) Breb. var. variabile (Lemm.) Krieger, in Rabenhorsts' Krypt.-Fl.,13,1, p. 262, t. 13, figs. 18-22. 1935.

Pl. 15 figs. 19,20.

Measurements: TL. 71.0-88.0µ; TB. 4.5-5.0µ; L:BR. 17-19.5x.

Very rare, known to the author from only two localities adjacent to one another, in the northwest corner of the state.

Distribution: Lincoln Co.: 12-(Mt63-71): 13-(Mt63-73).

Previously reported for collection locality 63, by Kidd (63), but not found there by the writer.

Closterium angustatum Kuetz.

This most characteristic species was collected from only the northwestern part of the state where it is of moderate occurrence and occasionally is found in abundance. The plants inhabit bogs, swamp, lakes and ponds at varying elevations.

The Montana plants are generally near the larger size limit, and in all cells studied the apices were characteristically subcapitate and usually slightly recurved.

Closterium angustatum Kuetz., in Ralfs' Brit. Desmid., p. 172. t. 29, fig. 4, 1848. var. angustatum.

Pl. 24 fig. 11.

Measurements: TL. 435.0-494.0μ; TB. 24.0-28.0μ; L:BR. 17-20x; BA. 15.0-17.0μ.

The typical form was the form of the species most often collected. Rare.

Distribution: Flathead Co.: 27-(Mt63-450); 29-(H.L.1). Lake Co.: 83-(Mt 63-204). Lincoln Co.: 9-(Mt63-154).

Closterium angustatum Kuetz. var. borgensii Gutw., Roxpr. Wydz. mat.-przyr. Akadem. Umiejetn. w. Krakowie, 33, p. 36 t. 5, fig. 5, 1896.

Pl. 24 fig. 10

Measurements: TL. 316.0-325.0μ; TB. 22.0-23.0μ; L:BR. 14.3-14.7x; BA. 13.0-15.0μ.

This very rare variety was found at only one locality and only a few specimens were seen. The characteristic nature of the cell wall in this variety may very well be a developmental condition unworthy of taxonomic distinction. The plants were the smallest form of the species found.

Distribution: Flathead Co.: 27-(Mt63-451).

Closterium angustatum Kuetz. var. gracile Kossinsk., Bot. Not. Crypt. Inst. Bot. VI, p. 42, 46, pl. 1, fig. 2. 1949. f. gracile.

Pl. 24 fig. 12.

Measurements: TL. 519.0-608.0μ; TB. 22.0-25.0μ; L:BR. 21.6-24.5x; BA. 15.0-17.5μ.

Two forms of this variety have been collected, Kossinskajas' plant being the one more often encountered. The other, is entered below as a new forma of the variety.

Distribution: Lake Co.: 86-(Mt63-186). Lincoln Co.: 10-(Mt63-156). Sanders Co.: 73(Mt63-166).

Closterium angustatum Kuetz. var. gracile Kossinsk. f. elongatum n.f.

Pl. 24. fig. 13.

Measurements: TL. 585.0-764.0μ; TB. 22.0-24.0μ; L:BR. 26-5-31.0x; BA. 14.5-17.0μ.

Cells large, 26.5-31.0 times longer than their diameter, moderately curved, and gradually attenuated toward the apices, which are slightly swollen to subcapitate, and usually recurved. Cell wall orange in color, generally darker at the ends; with five to six costae visible across the cell. This forma differs from all known members of this species by its larger measurements and greater length to breadth ratio.

Collected from two localities in the northwestern part of the state, a bog and a pond.

Distribution: Glacier Co.: 54-(Mt62-13). Lake Co.: 84-(C3).

Closterium archerianum Cleve, in Lund. Desm. Suec. Nova Acta Reg. Soc. Scient. Uppsala, Ser . 3,8, p. 77, t. 5 fig. 13. 1871.

Pl. 25 fig. 4.

Measurements: TL. 181.0-280.0μ; TB. 17.0-24.0μ; L:BR. 9.5-12x; NS/10μ- 6-9.

This species was collected only in the northwest. Cells of some specimens differ from the type in possessing walls with a greater number of striae per 10 microns.

Distribution: Flathead Co.: 39-(Mt63-78). Glacier Co.: 54-(Mt62-18). Lake Co.: 88-(Mt63-197). Ravalli Co.; 118-(Mt63-300). Sanders Co.: 74-(Mt63-170).

This species was previously reported for Glacier National Park by Vinyard (51).

Closterium baileyanum Bréb., in Ralfs' Brit. Desmid.,p. 169, t. 28, fig. 7, c.d. 1848 var. _baileyanum_.

Pl. 22 figs. 4,5.

Measurements: TL. 347.0-612.0μ; TB. 45.0-53.5μ; L:BR. 7.7-12.5x.

One of the more common _Closteria_ collected, and although it does occur in the southern Montane, it is primarily a species of the northwest. It was gathered from lentic environments and these generally at low elevations. There is considerable intergradation between var. _baileyanum_ and var. _alpinum_ (Viret.) Grönbl. which also occurs in the state.

Distribution: Beaverhead Co.: 135-(Mt63-339). Flathead Co.: 27-(Mt63-451); 28-(Mt63-443). Glacier Co.: 54-(Mt62-11); 63-(Mt63-218). Lake Co.: 82-(Mt63-199,201); 95-(Mt62-58). Lincoln Co.: 6-(Mt63-148); 15-(Mt62- 27). Ravalli Co.: 115-(Mt63-271). Sanders Co.:70-(Mt63-161); 72-(Mt63- 162); 76-(Mt63-191); 79-(Mt63-180).

Closterium _baileyanum_ Bréb. var. _alpinum_ (Viert.) Grönbl, Act Soc. Fauna Flor. Fenn. 46, No. 5, p. 13, t. 1, fig. 12. 1919.

Pl. 22 fig. 6.

Measurements: TL. 547.0-696.0μ; TB. 41.0-46.0μ; L:BR. 13-15x.

Gathered from only the northwest, from ponds and lakes at elevations below 3800 feet. The variety intergraded with the typical form, and was here distinquished from it (var. _baileyanum_), by its greater length to breadth ratio, and generally greater measurements. Rare.

Distribution: Lake Co.: 84-(C3); 88-(Mt63-198). Lincoln Co.: 10-(Mt63-155). Sanders Co.: 74-(Mt63-170).

Closterium _braunii_ Reinsch., Acta Soc. Senekenb. 6, p. 138, t. 20, fig. 101, 1-5. 1867.

Pl. 22 fig. 3.

Measurements: TL. 475-482.0µ; TB. 37.0-45.0µ; L:BR. 10.7-13x.

Very rare. Known from a single locality, a small pond at an elevation of 4200 feet. Only a few specimens were collected.

Distribution: Flathead Co.: 39-(Mt63-77).

Closterium calopsporum Wittr., Nova Acta Soc. Uppsala, 3, ser. 7, p. 23, fig. 11d. 1869. var. calosporum.

Pl. 11 figs. 4,5.

Measurements: TL. 82.7-110.0µ; TB. 7.5-10.0µ; L:BR. 8.4-12x.

This species was collected by the author solely west of the continental divide. Besides the typical form one variety was collected but var. calopsporum was the form most frequently found.

Distribution: Lake Co: 86-(Mt62-63). Lincoln Co.: 15-(Mt62-26,28). Missoula Co.: 101-(Mt64-72). Ravalli Co.: 115-(Mt63-267). Sanders Co.: 76-(Mt63-191); 77-(Mt63-194).

Previously reported by Sieminska (63) from collection locality 86.

Closterium calosporum Wittr. var. brasiliense Borg., Vid, Meddel. naturch. Foren. Kjobenhavn. p. 934. t. 2, fig. 5. 1890.

Pl. 11 fig. 6

Measurements: TL. 119.5-131.0µ; TB. 8.0-9.5µ; L:BR. 11.9-15x.

Rare. Collected from two lakes and a river.

Distribution: Lincoln Co.: 1-(4184);21(Mt63-102). Missoula Co.: 102-(Mt-62-5).

Closterium cornu Ehrenb., in Ralfs' Brit. Desmid., p. 176, t. 30; fig. 6 1848.

Pl. 15 fig. 9.

Measurements: TL. 120.0-145.0µ; TB. 7.5-11.0µ; L:BR. 13.0-16.0x.

Cells appearing stouter than usually illustrated for the species consequently, somewhat similar to Cl. tumidum Johns. However, the Montana plants have a greater length to breadth ratio than the latter named taxon, falling within the dimensions given for Cl. cornu by Krieger (37). Collected primarily from lakes and ponds in the southern Montana and from the Missouri River in central Montana.

Distribution: Beaverhead Co.: 135-(Mt63-338). Fargus Co.: 162-(Mt64-28). Lake Co.: 97-(Mt63-33). Lewis & Clark Co.: 110-(Mt63-463). Ravalli Co.: 115-(Mt63-267).

Closterium costatum Corda

One of the more common Closteria collected. Primarily a western species, but also occurring in central and northeastern Montana. It was often gathered in abundance. In addition to the typical form one variety was also collected.

Closterium costatum Corda, in Ralfs' Brit. Desmid., p. 170, t. 21 fig. 1.1848. var. costatum.

Pl. 24 figs. 4,5,6,8.

Measurements: TL. 219.0-352.0µ; TB. 26.-0-38.0µ; L:BR. 7-10x.

This variety by far the most commonly occurring form of the species. It was chiefly gathered from low elevation ponds (2000-3800 feet) in the northwest, but was also found in central Montana. The variety at times was gathered in abundance. There is some intergradation between the typical and var. westii Cush. which follows.

Distribution: Flathead Co.: 28(Mt 63-442); 39-(Mt63-77). Lake Co.: 84-(B6); 88-(Mt63-197); 95-(Mt62-58). Lincoln Co.: 16-(Mt63-114); 18-(Mt63-107). Sanders Co.: 72-(Mt63-163); 73-(Mt63-166); 74-(Mt 63-171); 78-(Mt 63-183). Sheridan Co.: 188-(Mt63-18). Wheatland Co.: 165-(Mt63-495).

Closterium costatum Corda var. westii Cush., Rhodora, 7, p. 114, 1905.

Pl. 24 fig. 9.

Measurements: TL. 318.0-445.0μ; TB. 35.0-40.0μ; L:BR. 10-11.5x.

This variety was collected from widely separated localities in the northwest, southwest and northeast. The variety, as was true for the typical form was gathered from lentic environments. However, var. westii was found to occur at higher elevations (up to 7000 feet). In my material there was some overlapping of dimensions between the two plants.

Distribution: Beaverhead Co.: 134-(Mt63-324). Lake Co.: 81-(Mt63-207); 89-(Mt63-388). Sheridan Co.: 188-(Mt63-20).

Closterium cynthia de Not., Elem. studio Desmid. Ital. Genoa. p. 65, t. 7, fig. 71. 1867.

Pl. 25 fig. 5.

Measurements: TL. 105.0-151.0μ: TB. 12.0-151.0μ; L:BR. 5.8-9.6x.

This species was primarily collected from ponds west of the continental divide being,however, also known from the southwest and northeast.

Distribution: Beaverhead Co.: 133-(Mt63-318). Flathead Co.: 27-(Mt63-451): 39-(Mt63-77). Lake Co.: 81-(Mt63-206); 83-(Mt63-204). McCone Co.: 194-(Mt64-165). Sanders Co.: 76-(Mt63-159).

Closterium cynthia morpha

Pl. 25 fig. 6

Measurements: TL. 103.0-106.0μ; TB. 8.5-9.0μ; NS/10=14.

This plant was collected from one locality in Glacier National Park. It is similar to the small form illustrated (Pl IV, fig. 3) and described by Groasdale (64) from Labrador. The Montana plants differ from others in being somewhat larger and having fewer striae per 10u. The striations are extremely light, not easily seen and not included in the illustration here. The plant resembed Cl. jenneri Ralfs', which also occurs at this collecting site. Very rare.

Distribution: Flathead Co.: 31-(4181).

Closterium dianae Ehrenb.

This very common species is widely distributed throughout the state. Four varieties and a number of forms were collected.

Closterium dianae Ehrenb., in Ralfs' Brit. Desmid., p. 168, t. 28, fig. 5. 1848. var. dianae f. dianae.

Pl. 12 fig. 10.

Measurements: TL. 225.0-247.0µ; TB. 18.5-25.5µ; L:BR. 9.1-13x; o=102-117°.

The typical and unnamed forms of it are almost exclusively confined to west of the continental divide, where they were encountered with considerable frequency. On the other hand forma intermedium was chiefly collected in southern Montana, occurring in the southwest, southcentral piedmont and south-central midland regions of the state.

Distribution: Lake Co.: 83-(Mt63-202). Missoula Co.: 100-(Mt63-419). Ravalli Co.: 119-(Mt63-305).

Closterium dianae Ehrenb. var. dianae fa.

Pl. 12 fig. 9.

Measurements: TL. 265.0-270.0µ; TB. 31.5-35.0µ; L:BR. 7.3-8.5x; o=135-141°.

A rather stout plant listed here simply as a form of the type, and differing from it (f. dianae) by its smaller length to breadth ratio. Very rare.

Distribution: Flathead Co.: 27-(Mon 25,Mt63-450), Lake Co.: 84-(86).

Closterium dianae Ehrenb. var. dianae fa.

Pl. 11 fig. 7, Pl. 12 fig. 13.

Measurements: TL. 172.0-242.5µ; TB. 14.0-20.0µ: L:BR. 11-13x; O=63-90°.

This form differs from the type by its less curved outer margin. In reference to this degree of arc, it is noted that the plants have a curvature similar to *Cl. pseudodianae* Roy, a species considered by some to be a variety of *Cl. dianae*. However, comparison of the illustrations of these two plants,(on Pl. 11) shows that *Cl. pseudodianae* is considerably more attenuated toward the apices, and is more delicate. Up to nine pyrenoids are present per semicell. Moderately rare.

Distribution: Beaverhead Co.: 133-(Mt63-318). Lake Co.: 87-(Mt64-66). Lincoln Co.: 6-(Mt63-147); 9-(Mt63-154); 13-(Mt64-73); 15-(Mt62-26); 19-(Mt63-111). Sanders Co.: 78-(Mt63-181).

Closterium dianae Ehrenb. var. *dianae* fa.

Pl. 12 figs. 7,8.

Measurements: TL. 310.0-352.0μ; TB. 24.0-28.0μ; L:BR. 11-16x.

A rather larger form of the typical plant.

Distribution: Glacier Co.: 54-(Mt62-11,20). Lake Co.: 84-(86); 95-(Mt62-58).

Closterium dianae, Ehrenb. var. *dianae* f. *intermedium* (Hust.) Kossinsk., Acta Inst. Bot. Acad. Sci. USSR ser.II,7, p. 555. 1951.

Pl. 12 fig. 11.

Measurements: TL. 164.0-218.0μ; TB. 17.5-23.0μ; L:BR. 8.6-11.3x; 0=120-145°.

Normally the plants appear slightly tumid in the mid-region as illustrated in fig. 11, but the inner margin may be simply concave.

There is a striking resemblence between this plant and *Cl. prolongum* Rich.(32), a plant, as far as I can determine, unreported since originally described, and I have wondered whether or not the two plants might not be the same.

This forma, with one exception, was collected across the southern half of the state, its distribution thus being in sharp contrast to that of the typical form previously mentioned.

Distribution: Beaverhead Co.: 135-(Mt63-339). Flathead Co.: 47-(Mt63-412). Gallatin Co.: 140-(Mt64-129). Musselshell Co.: 168-(Mt64-140).

Powder River Co.: 200-(Mt64-159). Rosebud Co.: 198-(Mt64-146). Wheatland Co.: 163-(Mt64-96).

Closterium dianae Ehrenb. var. arcuatum (Bréb.) Rabenh., Fl. Europ. Alg. 3, p. 133. 1868. (See page 140).

Closterium dianae Ehrenb. var. excavatum (Borge) Ružička, Preslia, 29: p. 134, fig. 1:13, 1957.

Pl. 12 figs. 4,6,12.

Measurements: TL. (125.0μ) 148-209.0μ; TB. (15-19.0μ) 25-29.0μ; L:BR. 5.9-11x.

Common. Known from both the northern and southern montane regions. Measurements given above in parenthesis are rather small for the variety.

Distribution: Beaverhead Co.: 131-(Mt63-134). Flathead Co.: 27-(Mt63-451); 42-(Mon16). Lake Co.: 89-(Mt63-388); 92-(Mt63-38); 94-(7Mon15). Lincoln Co.: 2-(Mt63-141,142); 4-(Mt63-133); 6-(Mt63-146). Ravalli Co.: 115-(Mt63-271); 120-(Mt63-311); Roosevelt Co.: 190-(Mt63-5). Sanders Co.: 72-(Mt63-162); 74-(Mt63-170,171). Silverbow Co.: 136-(Mt63-380).

Closterium ehrenbergii Menegh

This was a commonly collected species, especially west of the continental divide. In addition to the typical form, var. malivernianum (De Not.) Rabenh. was also found.

Closterium ehrenbergii Menegh., in Ralfs' Brit. Desmid., p. 166, t. 28 fig. 2, 1848. variety ehrenbergii.

Pl. 14 fig. 5.

Measurements: TL. 292.0-522.0μ; TB. 65.0-101.0μ; L:BR. 4.2-6.7x.

Collected chiefly in western Montana from a variety of habitats (bog, pond, liake, river, etc.) most of which were at medium elevations (4000-5700 feet). In the writer's collections, the typical form occurs almost as frequently as var. malinvernianum.

Distribution: Beaverhead Co.: 142-(Mt63-342); 143-(Mt63-345). Carbon Co.:

176-(Mt64-111); 178-(Mt64-108). Flathead Co.: 22-(6Mon4). Glacier Co.: 58-(Mt63-427). Lake Co.: 84-(B6-X8); 95-(Mt62-60). Lincoln Co., 11-(Mt63-122); 17-(Mt63-120). Ravalli Co.: 120-(Mt63-311, 308). Sanders Co.: 70-(Mt63-161); 72-(Mt63-163).

Previously reported by Schindler (54) from collection locality number 93, but not found there by the writer.

Closterium ehrenbergii Menegh. var. malinvernianum (De Not.) Rabenh., Fl. Europ. Alg. 3, p. 131. 1868.

Pl. 14 fig. 6.

Measurements: TL. 324.0-596.0μ; TB. 69.0-131.0μ; L:BR. 4.5-6.9x.

Cells occasionally with more attenuated apices than is usually illustrated for the variety with the apices being at times slightly recured; the cell walls often appearing only lightly tinted, with the striae extremely difficult to see.

More prevalent in the author's material than var. ehrenbergii, and though essentially a western plant, also collected in south-central and eastern Montana.

Distribution: Beaverhead Co.: 135-(Mt63-330); 145-(Mt63-355). Flathead Col: 23-(Mt63-400); 27-(Mon25); 29-(H.L.1). Glacier Co.: 63-(Mt63-218). Lake co.: 87-(Mt64-69). Lincoln Co.: 2-(Mt63-141); 4-(Mt63-129); 7-(Mt-363-127); 11-(Mt63-123); 19-(Mt63-110); 21-(Mt63-97). Ravalli Co.: 111-(Mt61-248). Sanders Co.: 76-(Mt63-160-175); 77-(Mt63-194). Sweetgrass Co.: 170-(Mt64-102,103,104). Wibaux Co.: 197-(Mt64-177).

Closterium flaccidum Delp., Mem. R. Accad. Scien. Torino, ser. 2, p. 101. t.18, fig. 34-36. 1877.

Pl. 10 fig. 4.

Measurements: TL. 99.0-102.0μ; TB. 18.0-20.0μ; L:BR. 4.9-5.5x.

Closterium flaccidum was considered by Krieger (37) as synonymous with

Cl. parvulum Naeg. However, I believe the plant to be different, the latter named taxon being more slender and not possessing the parabolic curvature of *Cl. flaccidum*. The plant in form, is also somewhat reminiscent of *Cl. incurvum* Breb. but of much larger dimensions, with apices not as acute. Known to the writer from two adjacent localities in the upper northeastern Piedmont region. Very rare.

Distribution: Blaine Co.: 153-(Mt64-38); 154-(Mt64-32).

Closterium gracile Breb.

This species, which is very constant in shape was collected soley from the northwest, where it is of moderate occurrence, at times present in a collection in abundance. Three varieties have been identified including the typical one, all collected from lentic environments.

Closterium gracile Bréb., in Ralfs' Brit. Desmid., p. 221, 1848. var. *gracile*.

Pl. 15 fig. 3.

Measurements: TL. 121-208.0µ; TB. 4.0-7.5µ; L:BR. 24-45x.

Most frequently collected variety.

Distribution: Flathead Co.: 27-(Mon25); 28-(Mt63-500). Lake Co.: 84-(86) Lincoln Co.: 1-(4184); 10-(Mt63-157). Ravalli Co.: 118-(MT63-300). Sanders Co.: 77-(Mt 63-194).

Closterium gracile Bréb. var. *intermedium* Irénée-Marie, Flore Desmidiale de la région de Montreal. Laprairie, Canad., p. 84, pl. 3, figs. 17,18, 1939.

Pl. 15 fig.4.

Measurements: TL. 224.5-272.0µ; TB. 4.8-8.0µ; L:BR. 28-50x.

Some authors (e.g. Croasdale (1953)) assign plants of similar measurements to the typical form. This variety was almost as frequently encountered as the typical.

Distribution: Flathead Co.: 22-(6Mon4); 27-(Mt63-451). Lake Co.: 88-(Mt63-197). Lincoln Co.: 6-(Mt63-149); 10-(Mt63-157). Sanders Co.: 72-(Mt63-162).

Closterium gracile Bréb. var. tenue West & West, Trans.Linn. Soc. Land. Ser. 2,6 Bot. p. 138, t. 18, figs.22,23. 1902.

Pl. 15 fig. 5.

Measurements: TL. 106.0-108.5μ; TB. 4.0-4.2μ; L:BR. 25-27x.

Rarest form of this species present in the author's material. I do not consider this plant identical to Cl. limneticum var. tenuis Lemm. (See discussion under latter named taxon). The plant in morphological characteristics is exactly like the type but of smaller dimensions.

Distribution: Glacier Co. 54-(Mt62-23). Lake Co.: 89-(Mt63-389).

Closterium incurvum Bréb., Liste Desm. p. 150. t.2, fig. 47, 1856. var. incurvum.

Pl. 10 fig. 5.

Measurement: TL. 58.5-71.0μ; TB. 11.5-12.5μ; L:BR. 5-6x; o=183-196°.

Rare; collected from three sites, two ponds and a reservoir, at or below 3100 feet and all west of the continental divide.

Distribution: Lake Co.: 96-(Mt63-46). Sanders Co.: 74-(Mt63-171);75-(Mt63-172).

Closterium intermedium Ralfs' Brit. Desmid.,p. 171, t. 29, fig. 3. 1848. var. intermedium.

Pl. 20 figs. 3,4.

Measurements: TL. 294.0-470.0μ; TB. 24-28.0μ; L:BR. 10.6-16x; NS/10μ= 4.5-6.

Cell walls varying in degrees of striolation, these at times being very coarse. This species is well represented in the writer's collections from western Montana, occurring in a variety of lakes, ponds, and bogs, at varying elevations (3200-7000 feet). The typical form was encountered with equal frequency as var. hibernicum West. which was likewise gathered from the western part of the state.

Distribution: Beaverhead Co.: 134-(Mt63-324). Glacier Co.: 54-(Mt62-13, 18). Lake Co.: 81-(Mt63-206); 83-(Mt63-203); 88-(Mt63-197). Lincoln Co.: 15-(Mt62-26). Ravalli Co.: 117-(Mt63-279); 119-(Mt63-305).

The plant reported by Schindler (54) from ponds south of Ronan (see collection locality number 93) as Closterium ralfsii Bréb. is placed here.

Closterium intermedium Ralfs' var. hibernicum West, Journ. Roy, Micro. Soc., p. 3, t. 1, fig. 2. 1894.

Pl. 20 fig. 5.

Measurements: TL. 316.0-378.0µ; TB. 17.0-21.0µ; L:BR. 15-20x.

Two forms of this variety were found, the basis of separation being size. The smaller was more prevalent in my material. Rare.

Distribution: Flathead Co.: 29-(H.L.1); 31-(4182). Lake Co.: 81-(Mt63-209). Ravalli Co.: 115-(Mt63-265,267).

Closterium intermedium Ralfs' var. hibernicum West. morpha.

Pl. 20 fig. 6.

Measurements: TL. 195.5-282.0µ; TB. 20.0-25.0µ; L:BR. 9.3-14.5x.

Differing from the variety in its shorter length and smaller length to breadth ratio.

Distribution: Flathead.: 27-(Mon25); 29-(H.L.1); 38-(Mt63-87). Lake Co.: 84-(X8); 89-(Mt63-388). Ravalli Co.: 111-(Mt63-249); 115-(Mt63-274).

Closterium jenneri Ralfs' Brit. Desmid. p. 167, t.28, fig. 6. 1848. var. jenneri.

Measurements: TL. 88.0-90.0µ;TB. 8.5-11.0µ; L:BR. 8.8-10.5x.

Measurements given above are taken from Kidd (63) whose illustrations were studied by the author. The plant somewhat resembles the one listed in this text as Cl. cynthia morpha which is also known from this locality. However, Kidd's plant is smaller, less curved, and not striated. Very rare.

Distribution: Flathead Co.: 31-(Kidd*).

Closterium jenneri Ralfs' var. robustum West, Journ. Bot., 37, p. 112, t. 396, fig. 9. 1899.

Pl. 25 fig. 7.

Measurements: TL. 57.0-77.2μ; TB. 9.5-12.0μ: L:BR. 5.7-6.6x.

Only collected in western Montana, never in any abundance, from a variety of habitats at elevations ranging from 2000-7000 feet.

Distribution: Granite Co.: 128-(Mt63-386). Lake Co.: 87-(Mt64-64). Lincoln Co.: 4-(Mt63-129); 8-(Mt63-151), Madison Co.: 138-(Mt63-372). Missoula Co.: 100-(Mt63-419). Sanders Co.: 171-(Mt63-164).

Closterium juncidum Ralfs' Brit. Desmid., p. 172, t. 29, fig. 6. 1848. var. juncidum.

Pl. 21 figs. 4,5.

Measurements: TL. 272.0-406.0μ; TB. 9.5-12.0μ; L:BR. 26-31x.

Closterium juncidum is rare in the author's collections. It is only known from west of the continental divide and only a few specimens were seen. In addition to the typical form var. brevius (Ralfs) Roy was also collected. (See comments on latter-named taxon).

Distribution: Lake Co.: 84-(86). Lincoln Co.: 10-(Mt63-156). Ravalli Co.: 119-(Mt63-304).

Closterium juncidum Ralfs var. brevius (Ralfs) Roy. Journ. Bot., 28, p. 336. 1890.

Pl. 21 figs. 3,14.

Measurements: TL. 159.0-167.0μ; TB. 13.0-15.0μ; L:BR. 11-12.5x.

Rare. Collected from three localities west of the continental divide. I find difficulty in accepting the placement of this variety with Closterium juncidum. The plants are so different in proportions, overall measurements, and the nature of the apices. Cl. juncidum var. brevius appears to me to be more closely related to Cl. ulna or Cl abruptum, the latter in particular. Comparison of the figures of these named species, all given on the same plate, may be made.

Distribution: Flathead Co.: 27-(Mt63-451); 39-(Mt63-77). Lincoln Co.: 10-(Mt63-155).

Closterium kuetzingii Bréb., Mem. Soc. imp. Scient. nat. Cherbourg, 4, p. 156, t. 2, fig. 40. 1856.

Pl. 24 fig. 2.

Measurements: TL. 332.0-620.0μ; TB. 16.0-20.0μ; L:BR. 18-24x.

Another commonly occurring species in western Montana. At collection locality 92, a very large specimen was found (620x19.5μ) having apical processes which were quite long, consequently the cell approached in form Cl. setaceum Enhrenb.

Distribution: Beaverhead Co.: 133-(Mt63-316,318). Flathead Co.: 27-(Mt63-450). Granite Co.: 125-(6Mon35); 127-(6Mon38). Lake Co.: 92-(Mt63-38; 93-(Mt63-35,36); 98-(Mt63-62); 99-(Mt63-66). Lincoln Co.: 11-(Mt63-122, 125). Missoula Co.: 101-(Mt64-70). Ravalli Co.: 118-(Mt63-300). Sanders Co.: 70-(Mt63-161); 72-(Mt63-162); 74-(Mt63-170); 76-(Mt63-177); 78-(Mt63-181).

Closterium lanceolatum Kuetz., in Ralfs' Brit. Desmid., p. 164. t. 28, fig. 1. 1848. var. lanceolatum.

Pl. 16 figs. 3,4.

Measurements: TL. 347.0-505.0μ; TB. 49.0-79.0μ; L:BR. 5.5-8.0x.

Although collected also in northwestern Montana this species was by far more prevalent in the Great Plains region of the state. Known from both lentic and lotic situations and these primarily at low elevations (2000-3400 feet).

Distribution: Blaine Co.: 152-(Mt63-32). Chouteau Co.: ;56-(Mt64-46,47); 157-(Mt64-48). Flathead Co.: 45-(Mt63-42). Glacier Co.: 57-(Mt63-424). Lake Co.: 80-(4Mon52); 93-(Mt63-35). Liberty Co.: 149-(Mt64-59). McCone Co.: 194-(Mt64-164). Powder River Co.; 200-(Mt64-159,160). Richland Co.: 196-(Mt64-171). Roosevelt Co.: 190-(Mt63-7,8). Sanders Co.: 78-(Mt63-181). Wheatland Co.: 163-(Mt64-96). Wibaux Co.: 197-(Mt64-175,179).

<u>Closterium</u> <u>leibleinii</u> Kuetz.

Another very common and widely distributed species in Montana. Chiefly collected from the west, but also present in scattered localities in the central and eastern parts of the state. In addition to the typical form two varieties were encountered, but these were of much rarer occurrence.

<u>Closterium</u> <u>leibleinii</u> Kuetz., in Ralfs' Brit. Desmid., p. 167, t. 28. fig. 4. 1848. var. <u>leibleinii</u>.

Pl. 13 figs. 5,6,7,8.

Measurements: TL. 145.0-215.0μ; TB. 27.0-48.0μ; L:BR. 3.7-7.3x; $0=138-182^{\circ}$.

In the Montana plants I have noted the following characteristics: the general presence of a granular thickening in the cell wall at the apices; the presence of greater number of pyranoids (up to 12) per semicell than is usually attributed to the species; and some very stout forms with small length to breadth ratios.

Distribution: Beaverhead Co.: 133-(Mt63-318); 142-(Mt63-341 ,342); 143-(Mt63-346); 145-(Mt63-352); 146-(Mt63-357). Daniels Co.: 187-(Mt64-5). Deer Lodge Co.: 129-(Mt63-384). Flathead Co.: 32-(Mt63-217); 44-(Mt63-54). Glacier Co.: 57-(Mt63-425); 58-(Mt63-427); 61-(Mt63-432). Lake Co.: 92-

(Mt63-38); 93-(Mt63-37). Lincoln Co.: 4-(Mt63-134); 7-(Mt63-128); 10-(Mt63-157). Madison Co.: 138-(Mt63-372,373); 139-(Mt63-369). Missoula Co.: 104-(Mt63-241). Sanders Co.: 76-(Mt63-159). Wheatland Co.: 164-(Mt63-467); 166-(Mt63-453,455).

Previously reported by Schindler (1954), from collection locality 93.

Closterium leibleinii fa. (=Cl. parvulum Naeg. var. cornutum (Playfair) Krieger, in Rabenhorst's Krypto. Fl., 13, 1, p. 277, t. 16, fig. 19, 1937)?

Pl. 13 fig. 3.

Measurements: TL. 175-203.0μ; TB. 36.0-44.0μ; L:BR. 4.6-5.0x; O=154-161°.

Plants similar to Cl. parvulum var. cornutum but slightly larger in measurements. Since I believe the Montana specimens are more closely allied to Cl. leibleinii, I have entered them here.

Rare. Primarily collected from low-elevation ponds in the northwest. Distribution: Chouteau Co.: 156-(Mt64-46). Flathead Co.: 44-(Mt63-54). Lake Co.: 93-(Mt63-35). Lincoln Co.: 19-(Mt63-111). Sanders Co.: 71-(Mt63-164).

Closterium leibleinii Kuetz. var. recurvatum West & West, Ann. Roy. Bot. Gard. Calcutta VI: p. 192. t. 13, fig. 6. 1907.

Pl. 13 fig. 4.

Measurements: TL. 212.0-214.0μ; TB. 41.0-42.0μ; L:BR. 5-5.1x.

Very rare. Known to the writer from only one locality in the northwest. Measurements slightly larger than those given by Krieger (1937). Distribution: Missoula Co.: 105-(Mt63-245).

Closterium libellula Focke, in Ralfs' Brit. Desmids., p. 152, t. 34, fig. 4. 1848. var. libellula

The typical form is only known from the northwest.

Pl. 9 fig. 3.

Measurements: TL. 229.0-300.0µ; TB. 40.0-42.0µ; L:BR. 5.5-7.1x.

This was the only form of the species collected by the author east of the continental divide.

Distribution: Flathead Co.: 39-(Mt63-79): 40-(Mt63-89). Glacier Co.: 54-(Mt62-11,18). Lincoln Co.: 10-(Mt63-157).

Closterium libellula Focke var. intermedium(Roy. Bisset) West, Mem. Soc. Sc. Nat. Neuchatel 5, p. 1031, t. 23, fig. 60,61. 1914.

Pl. 9 fig. 5.

Measurements: TL. 75.0-101.0µ;TB. 14.5-17.0µ; L:BR. 5-6x.

This was the most frequently encountered form of the species, and was only collected in the northwest.

Distribution: Flathead Co.: 24-(Mt63-411); 27-(Mt63-451). Lake Co.: 84-(B6); 86-(Mt63-187); 88-(Mt63-197). Lincoln Co.: 10-(Mt63-156). Ravalli Co.: 119-(Mt63-304).

Closterium libellula Focke var. interruptum (West & West) Donat, Pflanzenforschung, 5: p. 7. 1926.

Pl. 9 fig. 6.

Measurements: TL. 117.5-224.5µ; TB. 21.5-41.0µ; L:BR. 4.7-6.5x.

This variety was only collected west of the continental divide.

Distribution: Flathead Co.: 27-(Mt63-451). Lake Co.: 84-(X8); 86-(Mt63-187). Lincoln Co.: 19-(Mt63-110). Missoula Co.: 100-(Mt63-419).

Closterium limneticum Lemm. var. fallax Ružička, Preslia,34. p. 188, figs. 14-18. 1962.

Pl. 15, figs. 14,15.

Measurements: TL. 188.0-237.0µ; TB. 8.0-9.0µ; L:BR. 21-25.5x.

Closterium limneticum is considered by some authors (Krieger (37), Kossinskaja (60) West & West (04) as synonymous with Cl. gracile Bréb.

I have chosen to follow Ružička, who considers it a distinct species. The two species may be compared on the same plate. Cl. limneticum has very acute apices, resembling more Cl. idiosporum West & West, or Cl. acutum. Cl. gracile, has more truncate apices and its lateral walls are quite straight.

Distribution: Glacier Co.: 61-(Mt63-432). Lake Co.: 87-(Mt64-65). Wheatland Co.: 164-(Mt63-469).

Closterium lineatum Ehrenb. in Ralfs' Brit. Desmid., p. 173, t. 30 fig. 1 1848. var. lineatum, f. lineatum

Pl. 23 figs. 5.6

Measurements: TL. 586.0-620.0μ; TB. 25.5-28.0μ; L:BR. 22-30x.

Rare. Collected by the author from only three localities in the northwest corner of the state, at or below 3700 feet.

Distribution: Lincoln Co.: 7-(Mt63-127); 10-(Mt63-155); 17-(Mt63-120).

Previously reported by Kidd (63) for collection locality 27, but not found there by the writer.

Closterium lineatum Ehrenb. var. lineatum f. latius (Elenk et Lobik) Kossinsk., Flora Plantarum Cryptogamarum USSR, 5:Conj. 2, Desmid. fas. 1. p. 216. 1960.

Pl. 23 fig. 7

Measurements: TL 45.0-47.0μ; TB. 714.0-768.0μ; L:BR. 15.5-17x.

This is a very rare form, gathered from a low elevation lake (2000 feet) in the northwest. The typical form was also collected at this site, but there is a striking difference in their dimensions.

Distribution: Lincoln Co.: 10-(Mt63-155,156).

Closterium littorale Gay, Monogr. loc. Conjug. Thèse Montpel. Rev. Soc. Nat. 3, sec. 3, p. 75, t.2, fig. 17. 1884.

Pl. 12 figs. 1,2.

Measurements: TL. 175.0-210.0μ; TB. 21.5-26.0μ; L:BR. 7-8.2x.

Collected almost exclusively from lotic environments, and present equally as often in central and south-central Montana as it is in the northwest. In a number of collections, from the central and south-cental areas, the species was abundant.

At collection locality 160, a stouter form was found. Measurements are given below.

Distribution: Broadwater Co.: 130-(Mt63-470,472); (Mt64-133). Carbon Co.: 178-(Mt64-109). Flathead Co.: 39-(Mt63-77); 43-(Mt63-48). Judith Basin Co.: 160-(Mt64-90,91,92). Ravalli Co.:120-(Mt63-311); 123-(Mt63-284). Sweetgrass Co.: 172-(Mt64-105,106,107).

Previously reported by Schindler (54) for collection locality 93, but not found there by the writer.

Closterium littorale Gay morpha

Measurements: TL. 155.0μ; TB. 21.0μ; L:BR. 6.8x.

Differing from the type only in its smaller size.

Distribution: Judith Basin Co. 160-(Mt64-90).

Closterium lunula (Mull.) Nitzsch. Beitr. zur Infus. Neue Schrift. d. naturforsch. Gesellsch. Halle, 3, p. 60,67. 1817. var. lunula.

Pl. 16 fig. 1

Measurements: TL. 523-600.0μ; TB. 82-112.0μ; L:BR. 5-7.4x.

Another species which was collected almost entirely from the northwest. In addition to the typical form var. intermedium Gutw. was also found and there was considerable intergradation between the two in localities where they occur together.

Distribution: Flathead Co.: 35-(Mt63-391): 39-(Mt63-77); 40-(Mt63-89); 41-(Mt63-60). Glacier Co.: 54-(Mt62-13). Lincoln Co. 10-(Mt63-156).

This species was previously reported, as occurring in three ponds south of Ronan, (see collection locality 93) but it was not found in that area by the writer. However, Schindler's illustration is correct for the species.

Closterium lunula (Mull.) Nitzch. var. intermedium Gutw. Rozpr. Wydz. metem.-przyr. Akad. Umiej. Krakow. ser. 2, 13, p. 39, t. 6, fig. 17. 1898.

Pl. 16 fig. 2.

Measurements: TL. 512.0-648.0μ; TB. 92.0-108.0μ; L:BR. 5.4-6.6x.

Distribution: Flathead Co.: 25-(Mt63-409); 39-(Mt63-77); 40-(Mt63-89). Lincoln Co.: 16-(Mt63-114). Sanders Co.: 72-(Mt63-162).

Closterium macilentum Bréb.

One of the principle features uniting the plants listed below is the usual presence of subtruncate to truncate apices, a characteristic which is reminiscent of what is present in C. gracile, and C. juncidum and especially Cl. juncidum var. elongatum f. truncatum Nygaard. However, both these species are much smaller plants (compare figs. 4 & 5, and 6 through 9 on pl. 21.). The plants are separated below into three groups among which there is some overlapping. The cells vary in their degree of attenuation toward the apices, a feature noted in two of the groups. The principle basis of separation here is the nature of the cell wall which ranges from striated to plain.

This species was collected only in the northwest, often in abundance.

Closterium macilentum Bréb., Mem. Soc. imp. Scien. Nat. Cherbourg, 4, p. 153, t.2, fig. 36. 1856. var. macilentum.

Pl. 21 fig. 7.

Measurements: TL. 424.0-624.0μ; TB. 15.0-18.0μ; L:BR. 28-40x.

Cell walls striated, apices obtusely rounded to truncate; varying in their degree of attentuation. The typical was the form most often collected by the author.

Distribution: Flathead Co.: 39-(Mt63-77). Lake Co.: 81- (Mt63-206); 82-(Mt63-201). Lincoln Co.: 9-(Mt63-154); 18-(Mt63-107). Ravalli Co.: 118-(Mt63-300). Sanders Co.: 72-(Mt63-162).

Closterium macilentum Breb. var. macilentum morpha.

Pl. 21 fig. 6.

Measurements: TL. 506.0-630.0µ; TB. 16.0-17.0µ; L:BR. 31-39x.

Plant differing from the type and var. substriatum (Grönbl.) Krieger, by its complete lack of striae. Rare.

Distribution: Flathead Co.: 40-(Mt63-89). Lincoln Co.: 3-(Mt63-138); 9-(Mt63-154); 16-(Mt63-114).

Closterium macilentum Breb. var. substriatum (Grönbl.) Krieger, in Rabenhrst's Krypt. Fl., 13, 1, p. 314, t. 23. fig. 10, 1937.

Pl. 21 figs. 8,9.

Measurements: TL. 484.0-491.0µ; T. 17.0-18.5µ; L:BR. 26.28x.

Cell a deep orange in color, walls punctate to striated-punctate and apices varying in their degree of attenuation. Collected from two localities, both in Glacier National Park.

Distribution: Flathead Co.: 27-(Mt63-450). Glacier Co.: 54-(Mt62-13).

Closterium moniliferum (Bory) Ehrenb.

This was probably the most commonly collected desmid in Montana and the most widely distributed of those studied here, and one often occurring in considerable numbers. In the specimens studied wide variation existed in cell dimensions, and also in the degree of curvature. The cell walls although appearing perfectly smooth (plain) under high power, could be finely striated, striated on only one of the semicells, or completely devoid of striations under oil immersion. In addition to the typical, a forma of the type and one variety were identified. Considerable intergradation among these was also noted.

<u>Clostnrium</u> <u>moniliferum</u> (Bory) Ehrenb., in Ralfs' Brit. Desmid., p. 166. t. 28, fig. 3 1848. var. <u>moniliferum</u>.

Pl. 14 figs. 1,2.

Measurements: TL. 200.0-309.0μ; TB. 31.0-59.5μ; L:BR. 5.3-6.5x; 0=103-110°.

The most often collected form of the species. Found throughout the state.

Distribution: Beaverhead Co.: 134-(Mt63-327); 143-(Mt63-346); 146-(Mt63-358); 147-(Mt63-360). Blaine Co.: 153-(Mt64-37); 154(Mt64-32,33). Big Horn Co.: 180-(Mt64-150,151,152). Broadwater Co.: 130-(Mt63-327). Carbon Co.: 177-(Mt64-115). Chouteau Co.: 157-(Mt64-49). Daniels Co.: 187-(MT64-5). Deer Lodge Co.: 129-(Mt63-384). Flathead Co.: 22-(6Mon5); 26-(Mt63-404); 29-(H.L.1); 37-(Mt63-83); 38-(Mt63-86); 41-(Mt63-60); 43-(Mt 63-50); 44-(Mt63-54): 45-(Mt63-42). Garfield Co.: 191-(Mt64-23,26). Glacier Co.: 54-(Mt62-24); 61-(Mt63-432); 63-(Kidd*). Golden Valley Co.: 167-(Mt64-136). Lake Co.: 84-(86); 93-(Mt63-37); 98-(Mt63-62,63). Liberty Co.: 149-(Mt64-58,59). Lincoln Co.: 2-(Mt63-141); 3-(Mt63-138); 7-(Mt63-127);10-(Mt63-158); 13-(Mt63-73,74,75); 17-(Mt63-120); 20-(Mt63-91). Madison Co.: 137(Mt63-378); 138-(Mt63-372,373). Missoula Co.: 101-(Mt64 -72); 103-(Mt63-230); 104-(Mt63-263). Musselshell Co.: 168-(Mt64-139). Pondera Co. 67-(Mt64-55). Powder River Co.: 200-(Mt64-159). Ravalli Co.: 111-(Mt63-249); 117-(Mt63-280); 118-(Mt63-300); 119-(Mt63-306). Richland Co.: 196-(Mt64-171). Rosebud Co.: 198-(Mt64-146). Sanders Co. 78-(Mt63-181). Sheridan Co.: 188-(Mt63-19). Stillwater Co.: 174-(Mt64-120). Sweetgrass Co.: 170-(Mt64-102). Wheatland Co.: 165-(Mt63-460). Yellowstone Co.: 175-(Mt64-118).

Previously reported by Schindler (54) for collection locality 93, and by Vinyard (51) for 65.

Closterium moniliferum (Bory) Ehrenb. var. moniliferum f. subrectum (Grönbl.) Poljansk., Tr. Bot. inst. Akad. Nauk USSR, ser. 2, 6. p.142. fig. 6 1950. (not seen)

Pl. 14 figs. 8,9.

Measurements: TL. 244.0-360.0μ: TB. 31.5-47.0μ: L:BR. 6.8-8.3x; 0=87-91°.

Collected from western Montana where it is of moderately rare.

Distribution: Beaverhead Co.: 135-(Mt63-331). Lake Co.: 98-(Mt63-62). Lincoln Co.: 4-(Mt63-134); 6-(Mt63-146). Madison Co.: 137-(Mt63-378). Missoula Co.: 102-(Mt62-4). Powell Co. 108-(Mt64-83). Sanders Co.: 71-(Mt63-165).

Closterium moniliferum (Bory) Ehrenb. var. concavum Klebs, Schrift phys.-okonom. Gesselsch. Königsberg. 5 ,22, p.10, t. 1, fig. 5, a.b. 1879.

Pl. 14 fig. 3.

Measurements: TL. 240.0-340.0μ; TB. 41.0-63.0μ; L:BR. 5.3-6.8x; o=116-157°.

Primarily collected in western Montana and in the south-central part of the state. This variety intergrades quite extensively with the typical form.

Distribution: Big Horn Co.: 181-(Mt64-153). Flathead Co.: 26-(Mt63-404); 35-(Mt63-391); 41-(Mt63-58,59). Glacier Co.: 57-(Mt63-426). Lake Co.: 97-(Mt63-34). Lincoln Co.: 6-(Mt63-146); 15-(Mt62-26).Madison Co.: 137-(Mt63-378). Missoula Co.: 101-(Mt64-70); 104-(Mt63-237). Ravalli Co.: 117-(Mt63-280); 120-(Mt63-311). Stillwater Co.: 173-(Mt64-122)

Closterium navicula (Bréb.) Lutkem. in Cohn. Beitr. Biol. Pflanz. 8, p. 395, 405. 1902. var. navicula.

Pl. 9 figs. 1,2.

Measurements: TL. 31.5-62.5μ; TB. 9.0-16.0μ; L:BR. 3.6-4.5x.

This species was collected only in the northwest, and was not abundant. In addition to the typical form one variety was found.

Distribution: Flathead Co.: 39-(Mt63-77). Glacier Co.: 54-(Mt62-12,25). Lake Co.: 81-(Mt63-209); 86-(Mt63-186). Ravalli Co.: 115-(Mt63-267). Sanders Co.: 74-(Mt63-171).

Closterium navicula (Bréb.) Lütkem. var. inflatum West & West. Monagr. Brit. Desmid., Vol. 1, p. 77, t. 7, fig. 18. 1904.

Pl. 9 fig. 4.

Measurements: TL. 90.0µ; TB. 26.0µ; L:BR, 3.5x.

Very rare. Collected from a bog (6800 feet) in the northwest.

Distribution: Missoula Co.: 100-(Mt63-419).

Closterium nematodes Joshua, Journ. Linn. Soc. Lond. Bot., 21, p. 652. t. 22, fig. 7. 1886.

Pl. 25 fig. 9.

Measurements: TL. 190.0-194.0 µ; TB. 17.0-18.0µ; L:BR. 11-11.5x.

This is a very rare species. Collected from a bog in Glacier National Park.

Distribution: Glacier Co.: 54-(Mt62-13).

Closterium parvulum Naeg.

Closterium parvulum is a common abundant species in western Montana. Three varieties have been distinquished here, one of which although previously known, has been designated as a new taxon.

Closterium parvulum Naeg., Gattung. einzel. Algen. 8, p. 106, t.6c fig.2. 1849. var. parvulum

Pl. 10 fig. 8.

Measurements: TL. 69.0-91.0µ; TB. 7.0-12.0µ; L:BR. 7-8.7x; 0=142-170°.

Included here are plants having a greater curvature than is usually assigned to this variety. However, the plants appear identical to Naegeli's figure (d) in the original illustration of the species. The typical form was the form of the species most often collected.

Distribution: Deer Lodge Co.: 129-(Mt63-384). Flathead Co.: 28-(Mt63-447); 36-(Mt63-394); 37-(Mt63-84); 42-(Mon16(1)); 47-(Mt63-414); 48-(Mt63-417). Glacier Co.: 64-(Mt61-1). Lake Co: 81-(Mt63-207); 83-(Mt63-204); 86-(Mt63-188). Lincoln Co.: 4-(Mt63-129); 6-(Mt63-147); 13-(Mt63-73). Missoula Co.: 101-(Mt64-72). Ravalli Co.: 115 (Mt63-267) Teton Co.: 6 -(Mt64-52).

Closterium parvulum Naeg. var. obtusum Croasd., Trans. Amer. Micr. Soc. vol. 83 (2), p. 157, pl. 2, figs. 25,27. 1964.

Pl. 10 fig. 7.

Measurements: TL. 91.0-96.0μ; TB. 11.0-11.5μ; L:BR. 8.2-8.6x; o=138-140°.

Very rare. Collected from a single locality in the northwest.

Distribution: Flathead Co.: 39-(Mt63-77).

Closterium parvulum Naeg. var. taylori nov. var.

Pl. 10 figs. 9,10.

Measurements: TL. 61.0-72.5μ; TB. 8.5-9.0μ; L:BR. 6.5-8.0x o=210-240°.

Cells small, 6.5-8.0 times longer than broad, very strongly curved, 210-240° of arc, not tumid in the isthmal region, gradually narrowed to the apices, which are acute; cell wall smooth; chloroplast with up to six pyrenoids per semicell in an axile series. Differing from the type and all known described varieties and forme by a combination of the following characteristics: greater curvature, smaller length to breadth ratio, and small dimensions.

The plant illustrated by Krieger (37), on plate 16, fig. 21, and identified as var. angustatum, is included here. Taylor's (39) plant, described as a forma of the typical, has a similar curvature, but it is considerably larger. Very rare. Known only from two localities in the northwest.

Distribution: Flathead Co.: 35-(Mt63-391). Lake Co.: 95-(Mt62-60).

Closterium praelongum Bréb., Mem. Soc. imp. Scienc. nat. Cherbourg. 4, p. 152, t. 2, fig. 41. 1856. var. praelongum f. praelongum.

Pl. 21 figs. 16,17.

Measurements: TL. 480.0-776.0μ; TB. 15.5-23.0μ; L:BR. 22-38x.

Closterium praelongum was collected in the northwest as well as the southwest, being by far more frequently encountered in the former. It is of moderate occurrence. Two formae were collected in addition to the typical form one of these being new to science. Though the cell walls are usually smooth, plants have been collected which are very lightly striated.

Distribution: Flathead Co.: 27-(Mt63-451). Lake Co.: 93-(Mt63-35); 95-(Mt62-57). Lincoln Co.: 4-(Mt63-132). Ravalli Co.: 115-(Mt63-270). Sanders Co.: 72-(Mt63-162); 74-(Mt63-170); 76-(Mt63-192); 78-(Mt63-182).

Closterium praelongum Bréb. var. praelongum f. brevior Nordst., K. Sv. Vet.-Akad. Handl. 22, p. 68, t.3, figs. 22-24. 1888.

Pl. 21 fig. 15.

Measurements: TL. 242.0-437.0μ; TB. 15.0-21.0μ; L:BR. 16-25x.

Cell walls of some specimens punctate or lightly striated. This short forma was more frequently collected than f. praelongum.

Distribution: Beaverhead Co.: 133-(Mt63-316). Flathead Co.: 27-(Mt63-450); 38-(Mt63-86); 41-(Mt63-58). Glacier Co.: 61-(Mt63-432). Lake Co.: 97-(Mt63-34). Lewis & Clark Co.: 109-(Mt64-84). Lincoln Co.: 10-(Mt63-155). Powell Co.: 108-(Mt64-83). Ravalli Co.: 118-(Mt63-300).

Closterium praelongum Bréb. var. praelongum f. elongatum nov. fa.

Pl. 21 fig. 18.

Measurements: TL. 948.0-1016.0μ; TB. 28.0-30.0μ; L:BR. 33-36x.

Cells of large size, 33-36 times longer than broad, gradually attenuated toward their extremities which are slightly recurved; cell wall slightly striated.

This forma differs from the typical and all other forms by its greater length and breadth. Very rare. Known from only two localities in the northwest.

Distribution: Lake Co.: 86-(Mt63-188). Liberty Co.: 149-(Mt64-63).

Closterium pritchardianum Archer. Proc. Dubl. Nat. Hist. Soc. 3, pt. 2 p. 250, t. 12, figs. 25-27, 1863. var. pritchardianum.

Pl. 18 fig. 5.

Measurements: TL. 344.0-704.0µ; TB. 27.0-60.0µ; L:BR. 9.3-17.7x; NS/10µ 5.

There was a great range in dimensions for this species, and as indicated previously, a considerable degree of overlapping existed between the characteristics of this plant and Cl. acerosum.

Commonly encountered in western Montana. A single variety has been distinquished from the type.

Distribution: Beaverhead Co.: 133-(Mt63-317); 143-(Mt63-345); 144-(Mt63-350); 145-(Mt63-352,355). Flathead Co.: 38-(Mt63-86,88); 45-(Mt63-42); 47-(Mt63-412); Glacier Co.: 61-(Mt63-431). Lake Co.: 92-(Mt63-38); 97-(Mt63-34). Liberty Co.: 149-(Mt64-59). Lincoln Co.: 11-(Mt63-124). Ravalli Co.: 117-(Mt63-279). Sanders Co.: 72(Mt63-163). Silverbow Co.: 136-(Mt63-381).

Closterium pritchardianum Archer. var. oligo-punctatum Roll. Trav. inst. Bot. Univ. Charkow. 2, p. 226, t.3, fig. 4. 1915.

Pl. 18 fig. 6.

Measurements:TL. 442.0-448.0µ; TB. 31.5-33.5µ; L:BR. 13-13.5x.

Rare. Known from only one locality in the southwest.

Distribution: Silverbow Co.: 136-(Mt63-379).

Closterium pronum Bréb., Mem. Soc. imp. Scienc. nat. Cherbourg. 4, p. 157, t.2, fig. 42. 1856.

Pl. 15 fig. 11.

Measurements: TL. 296.0-355.0μ; TB. 11.5-12.0μ; L:BR. 24.5-30x.

The Montana plants are simply entered as belonging to the species. They are intermediate between the typical and f. brevius West, differing from the former in possessing a smaller length to breadth ratio, but being a little broader than the latter (f. brevius).

Rare. Collected from two localities west of the continental divide. Distribution: Lake Co. 86-(Mt63-186). Ravalli Co.: 112-(Mt63-200).

Closterium pseudodianae Roy, Scott. Naturalist, 10, p. 201. 1890.

Pl. 12 figs. 14,15.

Measurements: TL. 162.0-202.0μ; TB. 12.5-13.0μ; L:BR. 12.9-15x.

Some authors include this species as a variety of Cl. dianae. Rare. Gathered from three collecting sites in the northwest. Distribution: FLathead Co.: 27-(Mon25); 29(H.L.1). Lincoln Co.: 10-(Mt63-157).

Closterium ralfsii Bréb.

The species was collected in western Montana where it is of moderate occurrence. Three varieties were gathered in addition to the typical; and a forma of one of these. Vinyard (51) reports Cl. ralfsii var. gracilius, from collection locality 65, but I did not identify or find this plant. The species was most frequently collected from lakes and ponds at elevation between 3400 and 4600 feet.

Closterium ralfsii Bréb., in Ralfs' Brit. Desmid., p. 174, t.30, fig.2. 1848. var. ralfsii.

Pl. 18 fig. 7.

Measurements: TL. 312.0-514.0μ; TB. 43.0-51.0μ; L:BR. 7-10x.

Rare. Collected from four localities in the northwest.

Distribution: Flathead Co.: 25-(Mon25). Glacier Co.: 63-(Mt63-218). Lincoln Co.: 20-(Mt63-90). Ravalli Co.: 121-(Mt63-288).

Closterium ralfsii Bréb. var. hybridum Rabenh., Krypt.-Fl. sachs. p. 174. 1863. f. hybridum.

Pl. 23. figs. 1,2.

Measurements: TL. 426.0-530.0µ; TB. 33.0-39.0µ; L:BR. 12.8-14.5x; NS/10µ= 9-11.

Cells closely intergrading with the plants entered in the text as Cl. ralfsii var. kreigeri Hughes.

This is the most frequently gathered form of the species and is of moderate occurrence in the west.

Distribution: Beaverhead Co.: 134-(Mt63-324). Flathead Co.: 39-(Mt63-77). Glacier Co.: 54-(Mt62-17) Lake Co.: 83-(Mt63-204). Lincoln Co.: 10-(Mt63-155); 20-(Mt63-90). Missoula Co.: 104-(Mt63-265). Ravalli Co.: 112-(Mt63-260); 119-(Mt63-305). Sanders Co.: 71-(Mt63-164).

Closterium ralfsii Bréb. var. hybridum Rabenh. f. laeve Irénée-Marie, Nat. Canad. 81. p. 40, pl. 11, fig. 7. 1954.

Pl. 23 fig. 3.

Measurements: TL. 359-0-468.0µ; TB. 33.0-38.0µ; L:BR. 9.4-14.2x; NS/10µ= 5.

This is probably the plant described by Gutwinski (1894) as Cl. delpontei(Klebs) De Toni forma glabra, and absorbed into Cl. dianae by Krieger (37). Krieger failed to make allowance for the difference in measurements for the forma, as given by Gutwinski, and those of Cl. dianae.

The plants originally seen by myself were without striae, but upon the study of additional material three specimens were observed which possessed faint striae in the apical region of the semicell. The striae extend a little further down the face of the cell than indicated by Irénée-

Marie, but otherwise the plants are the same. Except for the striae, the plants are identical in form to the variety.

Perhaps Cl. delpontei should be considered a variety of Cl. ralfsii as originally conceived by Klebs.

Rare. Collected from two localities one in the northwest, the other in southwest.

Distribution: Beaverhead Co.: 133-(Mt63-318). Lake Co.: 84-(86).

Closterium ralfsii Bréb. var. kriegeri Hughes, Canad. Journ. Bot. 30: p. 285, fig. 37. 1952. (=Cl. attenuatum Ehrenb.)

Pl. 22. figs. 1,2.

Measurements: TL. 323.0-583.0μ; TB. 33.0-45.0μ; L:BR. 9.3-13.5x.

Upon examination of the illustrations of this plant, one notes the abruptly contracted apices of the cell, a characteristic of Cl. attenuatum Ehrenb. Indeed, I do not believe Hughes' plant can clearly be distinquished from the latter named taxon. However, I did not enter them under Cl. attenuatum for reasons noted below.

At times the cells were not abruptly attenuated at the apices, and most important, at a number of collecting sites, the plants intergraded imperceptibly into Cl. ralfsii var. hybridum. The plants also possessed up to 15 pyranoids per semicell, a number greater than that attributed to Cl. attenuatum. Krieger (37) indicates the number of pyrenoids for that species to be from 6-9. however, it should be noted that Cl. subacutum Samp., considered by Krieger as synonumous with Cl. attenuatum, was originally described as possessing 15 pyrenoids per semicell. Thus, in this respect Sampaios' plant and the Montana plants are alike.

From my obervations on Closterium, as well as other desmids, the number of pyrenoids per semicell may not be a constant taxonomic criterion for some species.

The question then arises whether or not there are two distinct taxa here, (Cl. attentuatum and Cl. ralfsii var. kriegeri) with similar characteristic apices or one taxon? At this time I believe there is one and since the Montana material indicates a relationship to Cl. ralfsii var. hybridum, I have entered them here. Should future studies indicate that the two taxa are distinct, then these would still be assigned to Hughes' variety.

Collected only west of the continental divide and of moderately rare occurrence.

Distribution: Flathead Co.: 23-(Mt63-399); 27-(Mon25); 39-(Mt63-77). Lake Co.: 83-(Mt63-204); 88-(Mt63-197); Lincoln Co.: 16-(Mt63-144); 17-(Mt63-120); 18-(Mt63-107); 20-(Mt63-90).

Closterium ralfsii Bréb. var. novae-angliae (Chushman) Krieger, Desmid. in Rabenhorsts; Krypto.-Fl. 13, 1: p. 348, t. 32, fig. 6, 1937.

Pl. 23 fig. 4.

Measurements: TL. 818.0μ: TB. 24.0μ; L:BR. 34x.

Cell a little narrower than that given for the variety. Very rare. Collected from the northwest and only a single specimen seen.

Distribution: Lake Co.: 81-(Mt63-206).

Closterium rostratum Ehrenb., in Ralfs' Brit. Desmid. p. 175, t. 30 fig. 3, 1848.

Pl. 24 fig. 1.

Measurements: TL. 278.0-373.0μ; TB. 20.0-24.0μ; L:BR. 11.5-17x.

Rare. Known only from west of the continental divide.

Distribution: Granite Co.: 127-(6Mon38). Lincoln Co.: 10-(Mt63-156); 17-(Mt63-120).

Closterium setaceum Ehrenb., in Ralfs' Brit. Desmid., p. 176, t. 30, fig. 4, 1848.

Pl. 24 figs. 3,7.

Measurements: TL. 218.0-518.0µ; TB. 9.0-17.0µ; L:BR. 23.05-30x.

This species was collected in western Montana where it is of moderate occurrence, and from one collecting site in the central part of the state. Distribution: Flathead Co.: 27-(Mon25); 29(H.L.1). Lake Co.: 84-(86). Lincoln Co.: 1-(4184); 10-(Mt63-156). Ravalli Co.: 111-(Mt63-249); 122-(Mt63-260); 199-(Mt63-320,304). Wheatland Co.: 165-(Mt63-495).

Closterium spetsbergense Borge.

This species was of moderate occurrence in western Montana, where it was collected from a variety of ponds and lakes. It was also encountered once from a river plankton collection in the central part of the state.

Besides the typical form, one forma and a variety were collected; the latter two being more prevalent in my material.

Krieger (37) considered this species synonymous with Cl. pseudolunula. However, I have chosen to follow Kossinskaja (60) and consider the two species distinct.

Closterium spetsbergense Borge, Vid. Skrift. 1 Mat.-Naturw. Klass., 11 p. 8, fig. 4. 1911 var. spetsbergense f. spetsbergense.

Pl. 17 fig. 4.

Measurements: TL. 329.0-366.0µ; TB. 47.0-56.0µ; L:BR. 6.25-7.5x.

The typical was the least collected form of the species. Collected from two ponds in the northwest.

Distribution: Flathead Co.: 27-(Mon25). Sanders Co.: 74-(Mt63-71).

Closterium spetsbergense Borge var. spetsbergense f. longius Poljansk., Bot. mater. Sect. Crypt. plant Acad. Sci. USSR, p. 106, fig. 1. 1941. (not seen)

Pl. 17 fig. 1

Measurements: TL. 308-394.0µ; TB. 38.0-41.0µ; L:BR. 8.0-9.3x.

Rare; collected from three localities west of the continental divide and one in central Montana.

Distribution: Cascade Co: 159-(Mt64-89). Lake Co.: 84-(B6); 95-(Mt62-57). Ravalli Co.: 115-(Mt63-273).

Closterium spetsbergense Borge var. subspetsbergense (Woronick.) Kossinsk.. Flora Plantarum Crypto. USSR Vol. V, Conjug. (2), Desmid. Fasc. 1. pl. 154. 1960.

Pl. 17 figs. 2,3.

Measurements: TL. 267.0-390.0μ; RB. 38.0-50.5μ; L:BR. 7-8x.

Cell wall pale yellow to deep orange; smooth, punctate, or striated. Some of the Montana specimens are similar in shape to the plant entered in this text as Cl. turgidum Ehrenb. fa. However, that plant (Cl. turgidum fa.) is considerably larger, and also differs in its thickened apices.

This was the most frequently collected form of the species, but was only found west of the continental divide.

Distribution: Flathead Co.: 26-(Mt63-404); 27-(Mon25); 37-(Mt63-82); 41-(Mt63-60). Lake Co.: 87-(Mt64-69); 97-(Mt63-33). Missoula Co.: 101-(Mt64-70). Ravalli Co.: 119-(Mt63-304); 124-(Mt63-296). Sanders Co.: 74-(Mt63-171).

Closterium strigosum Bréb. Mem. Soc. imp. Scienc. nat. Cherbourg, 4, p. 153, t. 2, fig. 43. 1856. var. strigosum.

Pl. 15 fig. 12.

Measurements: TL. 322.0-378.0μ: TB. 18.0-20.0μ; L:BR. 16-21x.

This species was collected from the northwest and north-central regions of the state.

The species is divided into two groups primarily on the basis of size, the typical form being the larger, while the smaller form appears to be Cl. paracerosum Gay which Krieger (37) considers synonymous with Cl.

strigosum. Both plants were rare and at one locality (157) were encountered together.

Distribution: Chouteau Co.: 157-(Mt64-49). Flathead Co.: 43-(Mt63-49).

Closterium strigosum Bréb. fa. (Cl. paracerosum Gay)

Pl. 12 fig. 5.

Measurements: TL. 148.5-197.5µ; TB. 9.8-12.0µ; L:BR. 14-19x.

Distribution: Chouteau Co.: 155-(Mt64-45); 157-(Mt64-49). Ravalli Co.: 120-(Mt63-310).

Closterium striolatum Ehrenb., in Ralfs' Brit. Desmid., p. 170, t. 29, figs. 2a-g. 1848.

Pl. 20 figs. 1,2.

Measurements: TL. 260.0-474.0µ; TB. 28.0-44 µ; L:BR. 8.5-12.7x; NS/10µ=4.6.

This species was almost exclusively collected west of the continental divide where it is of moderate occurrence. It was found in a variety of aquatic habitats (lake, pond, bog, river, etc.), at varying elevations (2200-7000 feet), and at times present in abundance.

Distribution: BeaverheadCo.: 134-(Mt63-324). Flathead Co.: 28-(Mt63-443-,446); 41-(Mt63-59). Granite Co.: 127-6Mon38). Lake Co.: 83-(Mt63-203). Lincoln Co.: 10-(Mt63-155). Missoula Co.: 102-(Mt62-5). Ravalli Co.: 115-(Mt63-265,266); 117-(Mt63-279); 118-(Mt63-300); 119-(Mt63-302).

Previously reported by Vinyard (51) for collection locality 65.

Closterium subangulatum Gutw., Razpr. Wydz. matem.-pryxyr. Akad. Umiej. w. Krakowie, 33, p. 42, t. 6, fig. 27. 1896.

Pl. 15 fig. 16.

Measurements: TL. 211.0-330.0µ; TB. 19.0-24.0µ; L:BR. 10-12x.

Krieger (37) considered this plant synonymous with Cl. littorale Gay. However, I believe the character of the apex and the straighter nature of the cell readily distinguish the plant from _Cl. littorale_. Compare the figures cited above and those of the latter taxon on plate 12 (Fig. 1, 2).

This species is of moderate occurrence in the northwest and known from one locality in the northeast corner of the state.
Distribution: Broadwater Co.: 130-(Mt64-132). Flathead Co.: 23-(Mt63-399); 29-(H.L.1) Lake Co.: 85-(Mt63-47); 87-(Mt64-69); 95-(Mt62-59). Lincoln Co.: 2-(Mt63-141); 4-(Mt63-132): 6-(Mt63-146); 12-(Mt63-70). Richland Co.: 196-(Mt64-171). Sanders Co.: 76-(Mt63-191).

Closterium subangulatum Gutw. fa.
Measurements: TL. 159.0-197.0μ; TB. 20.0-23 μ; L:BR. 7-9.5x.

This form intergrades into the type but differs from it in its generally smaller dimension and shorter length to breadth ratio. The cells have a stouter appearance and are similar to _Cl. tumidum_, which is still smaller. From my observations _Cl. tumidum_ and _Cl. subangulatum_ might be related.

Rare. Collected from only the northwest.
Distribution: Lake Co.: 86-(Mt63-188). Lincoln Co.: 21-(Mt63-103). Sanders Co.: 72-(Mt63-162); 74-(Mt63-171).

Closterium sublaterale Ružička, Preslia, 29: p. 142. fig. 1:14,15. 1957.

Pl. 14 fig. 7.

Measurements: TL. 293.0-402.0μ; TB. 39-48.0μ; L:BR. 6.8-9.3x.

The plants placed here overlap in characteristics, _Cl. sublaterale_ and _Cl. malinverniamforme_ Grönbl. var. _gracilus_ Hughes. The cells are not as tumid in the isthmal region as _Cl. sublaterale_, thus in this respect more closely resemble var. _gracilus_. However, this is a characteristic which is quite variable in other Closteria and may not be of significance here. In dimensions, the plants are closer to Ruzicka's measurements, especially in length to breadth ratio, but it should be pointed out that the Montana plants can likewise equal or exceed the dimensions of either taxon.

Since Ružička indicated that Cl. malinvernianiforme var. gracilus might possibly be Cl. sublaterale and Kossinskaja (60) transfered Gronblads' plant to Cl. moniliferum, I believe Hughes' plant should be placed with Ružička's, and have entered my plants accordingly. Although primarily a western species it was collected from north-central, south-central and southeastern Montana as well.

Distribution: Beaverhead Co.: 143-(Mt63-345,346); 144-(Mt63-351). Blaine Co.: 154-(Mt64-32). Flathead Co.: 47-(Mt63-414). Galation Co.: 141-(Mt64-127). Lincoln Co.: 11-(Mt63-123). Sanders Co.: 78-(Mt63-181). Sweetgrass Co.: 172-(Mt64-105). Wibaux Co.: 197-(Mt64-178).

Closterium subulatum (Kuetz.) Bréb., in Chevalier Des. microscop. et leur usage. Paris, p. 272. 1839.

Pl. 15 fig. 10.

Measurements: TL. 141.0-145.0μ; TB. 6.0-7.0μ; L:BR. 21-23x.

Rare. Collected from only three localities in the northwest.

Distribution: Lake Co.: 86-(Sieminska*); 95-(Mt62-57). Sanders Co.: 74-(Mt63-171).

Closterium subulatum(Kuetz.) Bréb. morpha.

Pl. 15 fig. 6.

Measurements: TL. 97.0-98.0μ; TB. 7.5-8.0μ; L:BR. 12-12.5x.

Very rare. Collected from one locality in the northwest corner of the state.

Cells differing from the typical form by their shorter length, smaller length to breadth ratio, and their more inflated character. Only two specimens seen.

Distribution: Lincoln Co.: 1-(4184).

Closterium tumidulum Gay., Monogr. Loc. Conjug. Thèse Montpel. Rev. Sec. Nat. 3, ser. 3, p. 72, fig. 13. 1884.

Pl. 11 fig. 2 and Pl. 13 figs. 1,2.

Measurements: TL. 83.0-120.0μ; TB. 14.8-20,0μ; L:BR. 5.2-7.6x.

Although collected from central and northeast Montana,this species was chiefly gathered in the west where it is of moderate occurrence.

Distribution: Beaverhead Co.: 147-(Mt63-362). Daniels Co.: 187-(Mt64-5). Flathead Co.: 38-(Mt63-86). Lake Co.: 98-(Mt63-62). Lincoln Co. : 10-(Mt63-155); 17-(Mt63-120). Ravalli Co.: 119-(Mt63-303). Sanders Co.: 76-(Mt63-159,160,177). Wheatland Co.: 166-(Mt63-455).

Closterium tumidum Johns., Bull. Torr. Bot. Club. 22,(7):p. 291, t. 239. fig. 4, 1895. var. tumidum.

Pl. 15 fig. 13.

Measurements: TL. 101-174.0μ; TB. 10.0-18.5μ; L:BR. 8.8-10.5x

This species was only collected west of the continental divide. Some of the larger forms are reminiscent of the plants listed as Cl. subangulatum fa., but this species is smaller in dimensions.

Rare.

Distribution: Flathead Co.: 27-(Men25); 41-(Mt63-57,58). Lake Co.: 84-(86). Lincoln Co.: 15-(Mt62-28). Ravalli Co.: 113-(Mt63-255); 114-(Mt63-256).

Closterium turgidum Ehrenb., in Ralfs' Brit Desmid., p. 165, t. 27. fig. 3. 1848. var. turgidum.

Pl. 19. figs. 1,3,4.

Measurements: TL. 457.0-668.0μ; TB. 40.0-60.0μ; L:BR. 10.5-13.6x

This species was rather rare in my collections, and was chiefly found west of the continental divide.

Distribution: Beaverhead Co.: 134-(Mt63-320, 326). Flathead Co.: 39-(Mt63-77). Glacier Co.: 54-(Mt62-14). Lake Co.: 82-(Mt63-200); 84-(C3) Sanders Co.: 74-(Mt63-170).

Closterium turgidum Ehrenb. var. turgidum morpha.

Pl. 19 fig. 2.

Measurements: TL. 468.0μ; TB. 66.0μ; L:BR. 7x.

This stout form differs from the type by its shorter length to breadth ratio. Only a single specimen was seen and since the plant may merely be deformed I have entered it simply as a morpha.

Distribution: Flathead Co.: 27-(Mt63-451).

Closterium turgidum Ehrenb. var. giganteum Nordst., in Wittrock et Nordstadt. Alg. aquae dulcis exsicc. No. 382. 1880.

Pl. 19. fig. 5.

Measurements: TL. 576.0-880.0μ; TB. 83.0-86.0μ; L:BR. 6-10.2x.

Very rare. Collected from three localities in the northwest corner of the state.

Distribution: Lincoln Co.: 2-(Mt63-142); 6-(Mt63-145); 20-(Mat63-90).

Closterium ulna Focke, Physiolog. Studien, 1. Breman,p. 59, t.3, fig. 30, 1847. var. ulna.

Pl. 21 figs. 10,12,13.

Measurements: TL. 207.0-334.0μ; TB. 13.5-14.0μ; L:BR. 17-23x.

The striations on the cell walls of some specimens were so delicate they were difficult to discern. Rare.

Distribution: Beaverhead Co.: 134-(Mt63-324). Flathead Co.: 36-(Mt63-

396). Lincoln Co.: 10-(Mt63-155). Sanders Co.: 71-(Mt63-164).

Closterium ulna Focke var. recurvatum (Roll) Krieger, in Rabenhorsts' Krypt. -Fl. 13, 1, p. 343. t. 29. fig. 6. 1937. fa.

Pl. 21 fig. 11.

Measurements: TL. 272.0-311.0µ; TB. 15.0-16.0µ L:BR. 17-19.4x; BA. 11.5-14.0µ.

This plant was previously reported from this locality by Sieminska (65) simply under the species name. The plants clearly have recurved apices, and the cell walls are distinctly striated. This variety,however, was originally described as being smooth.

Very rare. Collected from a single locality in the northwest.

Distribution: Lake Co.: 86-(Mt63-186).

Closterium venus Kuetz.

Certainly this is one of the (if not the) most ubiquitous desmids collected in Montana.

Cells exhibiting considerable variation in dimensions and curvature and intergrading into a number of other taxa.

Traditionally this taxon has been primarily distinquished from Cl. parvulum, by its greater curvature. However, I have found that the curvature of Cl. parvulum can overlap that of Cl. venus by a considerable degree. I have difficulty in distinquishing the two species.

In the illustration of this species (Cl. venus) by Kuetzing, the plant has rather drawn out apices, as one finds in Cl. dianae var. arcuatum or Cl. prolongum Rich., but I know of no other illustration by any author showing this characteristic.

Closterium venus Kuetz., in Ralfs' Brit. Desmid.,p. 220, t. 35, fig. 12, 1848. var. venus f. venus.

Pl. 10 fig. 3.

Measurements: TL. 52.5-74.0μ; TB. 9.0-12.6μ; L:BR. 5.2-7x; o=158-192°.

The plants considered here as the typical were all collected in the northwest where they are of moderate occurrence.

The plant reported by Kidd (63) under the name *Closterium leibleinii* has been placed here.

Distribution: Flathead Co.: 22-(6Mon5); 27-(Mt63-450,451) 31-(Kidd*); 39-(Mt63-78). Lake Co.: 84-(B6); 87-(Mt64-65); 93-(Mt63-35); 95-(Mt62-58,59). Lincoln Co.: 12-(Mt63-70); 15-(Mt62-26). Ravalli Co.: 114-(Mt63-256).

Previously reported by Schindler (54) for collection locality 93.

Closterium venus Kuetz. var. *venus* f. *minus* Roll, Trav. inst. Bot. Univ. Charkow. 2, p. 192, t. 1, fig. 8, 1915.

Pl. 10 figs. 1,2.

Measurements: TL. 37.0-50.0μ; TB. 6.0-8.1μ; L:BR. 5.2-6.2x; o=169-198°.

Similar distributional range as the typical form with which it often occurs.

Distribution: Flathead Co.: 39-(Mt63-77). Lake Co.: 84-(X8); 86-(Mt63-188); 88-(Mt63-198); 95-(Mt62-59). Lincoln Co.: 1-(4184); 10-(Mt63-158); 14-(Mt63-76). Ravalli Co.: 115-(Mt63-270).

Closterium venus Kuetz. var. *appollonionis* Croasd., Trans. Amer. Micros. Soc. 84(3); p. 310, Pl. 1, figs. 18-20. 1965.

Pl. 10 fig. 6, Pl. 11 fig. 1.

Measurements: TL. 100.0-138.0μ; TB. 13.5-29.0μ; L:BR. 6.1-8.2x; o=123-175°.

This is such a commonly occurring species throughout Montana, that I find it difficult to believe it had not been described prior to 1965.

In any case, the plants in their dimensions and curvature appear identical with Croasdale's. A few specimens did have a greater curvature but complete intergradations existed.

This was the most frequently collected form of the species and certainly one of the most abundant desmids in the state.

Distribution: Beaverhead Co.: 132-(Mt63-185); 134-(Mt63-324); 135-(Mt63-335); 143-(Mt63-346); 144-(Mt63-350). Blaine Co.: 153-(Mt64-38); 154-(Mt64-32,33,34,35). Broadwater Co.: 130-(Mt64-134). Chouteau Co.: 157-(Mt64-50). Flathead Co.: 23-(Mt63-399); 35-(Mt63-391); 37-(Mt63-82); 38-(Mt63-86); 39-(Mt63-78); 44-(Mt63-52,54). Garfield Co.: 191-(Mt64-23,24, 25). Glacier Co.: 54-(Mt62-11); 55-(Mon27); 57-(Mt63-423); 61-(Mt63-432). Granite Co.: 127-(6Mon38). Lake Co.: 88-(Mt63-197); 96-(Mt63-44); 97-(mt63-33). Lincoln Co.: 2-(Mt63-141): 5-(Mt63-136); 12-(Mt63-69); 15-(Mt62-26). Madison Co.: 137-(Mt63-378); 138-(Mt63-373). Pondera Co.: 67-(Mt64-55,56,57.) Powder River Co.: 200-(Mt64-161). Powell Co.: 106-(Mt64-75). Sanders Co.: 77-(Mt63-195); 78-(Mt63-181). Sheridan Co.: 188-(Mt63- 16 17). Sweetgrass Co.: 170-(Mt64-102); 171-(Mt64-100); 172-(Mt64-107). Teton Co.:68-(Mt64-52). Valley Co.: 185-(Mt64-18).

Closterium venus Kuetz. var. *crassum* Croasd., Farlowia, 4(4), p. 527. pl. 6, figs. 12-14. 1955.

Pl. 11 fig. 3.

Measurements: TL. 81.0-96.2μ; TB. 11.5-17.5μ; L:BR. 5.4-7.9x; o=154-172°.

This variety was chiefly collected from the northwest where it is of moderate occurrence, and also found in the south-central part of the state where it is rare. It was primarily gathered from ponds and lakes at elevations below 4000 feet.

Distribution: Big Horn Co.: 181-(Mt64-154). Carbon Co.: 177-(Mt64-116). Flathead Co.: 37-(Mt63-85); 40-(Mt63-89); 44-(Mt63-54); 47-(Mt63-413.)

Gallatin Co.: 141-(M64-126). Lake Co.: 84-(X8); 92-(Mt63-38); 95-(Mt62-50). Lincoln Co.: 7-(Mt63-127); 11-(Mt63-125); 18-(Mt63-106); 21-(Mt63-99).

<u>Closterium</u> <u>venus</u> Kuetz. var. <u>crassum</u> Croasd. fa.

Pl. 12 fig. 3.

Measurements: TL. 92.0-95.0μ; TB. 16.5-17.0μ; L:BR 5.5-6.0x; o=190-195°.

Cells closer in their dimensions to var. <u>crassum</u> than to var. <u>apoollonionis</u>, but having a greater curvature than either plant.

Rare. Known only from one locality, a low elevation pond, in the northwest corner of the state.

Distribution: Lincoln Co.: 19-(Mt63-110).

<u>Closterium</u> sp. 1.

Pl. 15 figs. 7,8.

Measurements: TL. 71.0-88.0μ; TB. 4.0-5.0μ; L:BR. 16-17x; BA. 2.0-2.5μ.

These plants could not be satisfactorily assigned to any species known to the writer. They most resemble the plant illustrated by Croasdale (55) as <u>Cl.</u> <u>toxon</u> W. West. However, they are much smaller (less than half the size) in all dimensions. The cell apices are subtruncate-truncate. Since the plant is rare, collected from two localities, a lake and a bog in the northwest, and only a few specimens were seen, it was believed best to simply relegate them to the genus.

Distribution: Glacier Co.: 54-(Mt62-18). Lincoln Co.: 2-(Mt63-144).

<u>Closterium</u> sp. 2.

Pl. 25 fig. 1.

Measurements: TL. 38.5-40.0μ; TB. 6.9-7.0μ; L:BR. 5.5-5.7x.

Cells small, 5.5-5.7 times longer than broad; gradually narrowed to the apices which are dilated, then suddenly acutely attenuated; cell-wall smooth; each chloroplast with a single pyrenoid.

Plants superficially resembling Cl. lagoense Nordst., but that species is considerably larger and in other respects (cell wall, chloroplast, etc.) is quite different.

The plant was originally found by R. Hoham, from collection locality 84, as was the larger, similar plant listed below. His drawings have been used in this text.

At first I was tempted to describe the plant, plus the one that follows, as a new taxon. However, after studying the material and noting the degree of variation, or development of the dilated apices, I decided against it. I believe the dilation may be pathological and the plants are actually Cl. venus var. venus f. minus, which occurs at this locality.

Rare. Known only from one locality in the northwest.

Distribution: Lake Co.: 84-(X8).

Closterium sp. 3.

Pl. 25 fig. 2.

Measurements: TL. 114.8µ; TB. 13.9µ.

Plants resembling the plant entered as Cl. sp. 2 but differing in larger size, and greater number of pyrenoids per semicell. I believe the plant to be either Cl. parvulum or a form of Cl. venus, most likely the former.

Rare. Collected from a single locality in the northwest.

Distribution: Lake Co.: 84-(X8).

Closterium sp. 4.

Pl. 25 figs. 8a,b,c.

Measurements: TL. 39.5-49.0μ; TB. 4.0-5.0μ; L:BR. 8.3-10x.

This was an extremely difficult plant to place, being reminiscent of a number of species in two genera. Consequently, the plants are placed simply under this genus, although, with some reservation. Few specimens were seen (6) and all were preserved, thus the nature of the chloroplast(s) could not be positively discerned. This characteristic would have been helpful in determining whether the plant was a *Roya* or a *Closterium*. The cells have similar dimensions to *Roya obtusa* var. *montana* West & West but the plant differs from that taxon by possessing on apical granule, and not having subtruncate apices. Although resembling *Cl. jenneri*, the Montana plants are smaller and less curved than that species. *Closterium pusillum* Hant. has approximately the same length, but is broader, consequently having a smaller length to breadth ratio. The plants appear very close to *Cl. minutum* Roll. especially in size. However, that species has slightly more attenuated apices and a greater curvature.

Very rare. Collected only twice, from the northwest.

Distribution: Flathead Co.: 43-(Mt63-48). Sanders Co.: 71-(Mt63-164).

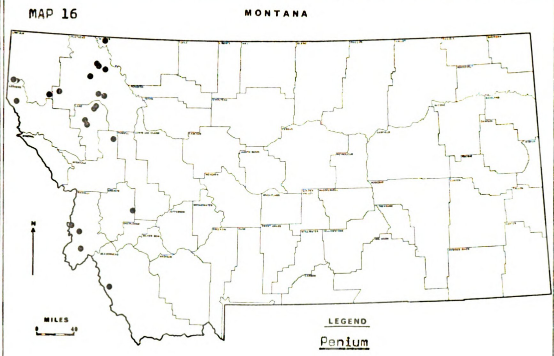
Closterium dianae Ehrenb. var. *arcuatum* (Bréb.) Rabenh., Fl. Europ. Alg. 3, p. 133. 1868.

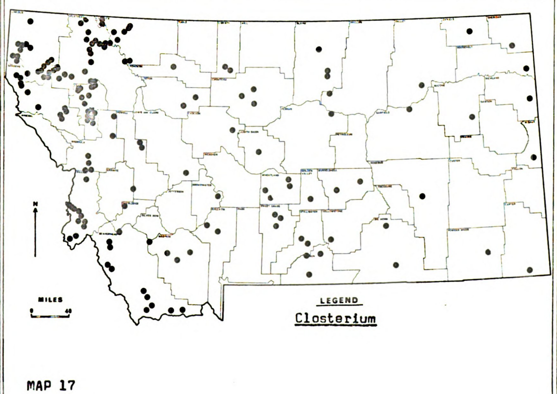
Pl. 12 fig. 16.

Measurements: TL. (121.0) 160.0-212.0μ; TB. (15.5)-18.5-23.0μ; L:BR. 8.2-11x; o=135-155^{o}.

The plant cited from collection locality 177 is rather small, and its measurements are given above in parenthesis. Moderately rare in the west. Rare in south-central Montana.

Distribution: Carbon Co.: 177-(Mt64-115). Flathead Co.: 23-(Mt63-440); 29-(H.L.1). Gallatin Co.: 141-(Mt64-128). Lake Co.: 81-(Mt63-209); 84-(86). Musselshell Co.: 169-(Mt64-141). Sweetgrass Co.: 170-(Mt64-102). Teton Co.: 69-(Mt64-85,86).


MAP 16
MONTANA
MILES
0
40
LEGEND
Penium


MILES
0
40
LEGEND
Closterium
MAP 17

4. Spinoclosterium Bernard, 1909.

This is a very rare genus (species) known to the author from a single locality, a Carex/Equisetum bog, in the northwest. It was present in two samples one collected by G.W. Prescott in '59, the other in a living sample sent by Dr. Prescott in 1967, and collected by his student Miss Fatemah Maghadam. An unsuccessful attempt to culture the plant resulted in the loss of this living material. Consequently, no collection number is cited for the illustrations.

Spinoclosterium cuspidatum (Ball.) Hirano var. spinosum Prescott, Pap. Mich. Acad. Sci. Arts and Letters. 22, p. 203, pl. 19, figs. 1-3. 1937.

Pl. 26 fig. 5.

Measurements: TL. 130.0-142.0μ; TB. 45.0-48.0μ; L:BR. 2.5-3.0x; LS. 15.0-22.0μ.

Cells 2.5-3 times longer than broad, strongly curved, gradually attenuated toward the poles which are broadly rounded and possess a stout spine. Chloroplast variable, axile and distinctly ridged with the ridges flattened against the lateral walls, or (2) 4,5,(6), parietal bands (Plates) per semicell. Pyrenoids in linear series 3 to 4 per band. Terminal vacuoles large with many granules.

The plants have been assigned to var. spinosum on the basis of the dilated apices.

Distribution: Lake Co.: 86A-(Mon206).

5. Pleurotaenium Naegeli, 1849.

This genus was very poorly represented in the Great Plains region of the state, while being most abundantly met with in the western montane region. There are ten species reported, of which only two are considered common constituents of Montana's desmid flora.

Pleurotaenium baculoides (Roy and Biss.) Playfair, Proc. Linn. Soc. New South Wales, 32, p. 162-1907.

Measurements: TL. 400.0-410.0μ; TB. 21.0μ; L:BR. 19.5x; BI. 17.0μ; BA. 15.0μ.

This a very rare species collected from a high altitude (6600 feet) oligotrophic lake.

Distribution: Ravalli Co.: 112-(Mt63-261).

Pleurotaenium coronatum (Bréb.) Rabenh. Fl. Europ. Alg.3, p. 143, 1868. var. coronatum.

Pl. 28 fig. 5.

Measurements: TL. 452.0-584.0μ; TB. 47.0-58.0μ; L:BR. 9.2-12.x; BI 30.0-46.0μ; BA. 25.0-37.0μ.

This species was chiefly collected west of the continental divide and is moderately common. See discussion below for additional note on this species.

Distribution: Flathead Co.: 22-(Mon5); 23-(Mt63-399); 27(Mon25); 47-(Mt63-412). Glacier Co.: 63-(Mt63-218). Lake Co.: 91-(Schindler); 95-(Mt62-60). Lewis & Clark Co.: 109-(Mt64-84). Lincoln Co.: 10-(Mt63-156, 157). Sanders Co.: 74-(Mt63-171).

Previously reported by Schindler (54) from collection locality 91.

Pleurotaenium coronatum (Bréb.) Rabenh. fa.

Measurements: TL. 294.0-346.0μ; TB. 29.0-31.5μ; L:BR. 9.3-11.3x; BI 23.2-26.0μ; BA 21.0-22.0μ; BAI. 31.5-35.0μ.

Cells differing from the typical by their lack of apical tubercles. At collection locality 13, however, specimens were seen in which there was a faint indication of tubercular development. The plants greatly resemble *Pl. nodulosum* Bréb., which West considered as a variety of *Pl. coronatum*. However, they are of much smaller dimensions than *Pl. nodulosum*, and I presently believe their similarities are superficial. I have not assigned the Montana plants to West's *Pl. coronatum* var. *nodulosum* because that variety is based on Brebison's plant which I consider a distinct species.

Very rare. Collected from two localities in the northwest.
Distribution: Lincoln Co.: 12-(Mt63-70); 13-(Mt63-75).

Plerotaenium ehrenbergii (Bréb.) de Bary, Untersuch, Fam. Conjug. p. 75, 1858. var. *ehrenbergii*.

Pl. 28 fig. 6.

Measurements: TL. 274-596.0μ; TB. 22.5-39.0μ; L:BR. 9.8-20x; BI. 18.0-30.0μ; BA. 16.0-26.0μ.

Pl. ehrenbergii was the most frequently collected species of the genus, and it exhibited considerable variability in both form and dimensions. The cells occasionally possessed smaller length to breadth ratios than is ascribed to the type. However, it is impossible to adequately separate the forms on this basis since complete intergradation exists. Very common in western Montana. Much more rarely collected in the central, south-central and northeastern parts of the state.
Distribution: Beaverhead Co.: 132-(Mt63-185); 134-(Mt63-325); 135-(Mt63-333). Flathead Co.: 22-(6Mon4); 27-(Mon25) 29-(H.L.1); 31-(4181); (Kidd*); 36-(Mt63-396); 39-(Mt63-79); 42-(Mon16(1); 47-(Mt63-414). Glacier Co.: 54-(Mt62-19): 61-(Mt63-432). Granite Co.: 126-(6Mon43); 127-(6Mon41). Lake Co.: 82-(Mt63-200); 83-(Mt63-204); 86-(Mt63-187); 88-(Mt63-197); 89-(Mt63-388); 91-(Schindler*); 93-(Mt63-35); 95-(Mt62-58); 98-(Mt63-62); 99-(Mt63-65). Lincoln Co.: 1-(4184); 4-(Mt63-129); 5-(Mt63-137); 6-(Mt63-146); 9-(Mt63-154); 10-(Mt63-155,158); 11-(Mt63-122); 13-(Mt63-73); 19-

-111); 20-(Mt63-92. Madison Co.: 137-(Mt63-377). Missoula Co.: t63-237). Phillips Co.: 182-(Mt63-26). Ravalli Co.: 117-(Mt63- 279); t63-301). Sanders Co.: 71-(Mt63-165); 72-(Mt63-162); 76-(Mt63-160, 77-(Mt63-195); 78-(Mt63-181); 79-(Mt63-178). Sweetgrass Co.: 170- -104). Wheatland Co.: 165-(Mt63-460).

Previously reported by Kidd (63) for collection locality 31, and by dler for 91.

Pleurotaenium ehrenbergii var. ehrenbergii morpha.

Pl. 28 fig. 3.

rements: TL. 434.0µ; TB. 26.0µ; L:BR. 16.7x; BI. 21.0µ; BA. 19.0µ.

Plants differing from the type only in the crown-like placement of ranules.

ibution: Lincoln Co.: 21-(Mt63-102).

Pleurotaenium ehrenbergii (Bréb.) de Bary var. attenuatum Krieger, d. in Rabenhorst's Kryptogamen Flora von Deutschland, Österreich und chwiez. 13, Abt.1, Teil 1: p. 413, fig. 7. 1937.

Pl. 28 fig. 2.

rements: TL. 378.0µ; TB. 31.0µ; L:BR. 12.2x; BI. 21.0µ; BA. 18.0µ.

Very rare. Collected from one locality in the northwest corner of tate. A single specimen was found.

ibution: Sanders Co.: 76-(Mt63-175).

Pleurotaenium ehrenbergii (Bréb.) de Bary var. undulatum Schaarschm., Tudom. Akad. Math. Termesz. Közlemen. 18, p. 278. t.1, fig. 21. 1883.

Pl. 28 fig. 7

rements: TL. 462.0-542.0µ; TB. 33.0=36.0µ; L:BR. 13.5-16.2x; BI. 26.0- ; BA. 20.5-28.0µ.

Rare. Collected from three collecting sites, a bog and two ponds.

evations between 4400-4600 feet, in the northwest.

ibution: Glacier Co.: 54-(Mt62-12,20). Ravalli Co.: 115-(Mt63-265);

Mt63-297).

Pleurotaenium eugeneum (Turn.) West & West, Monogr. Brit. Demid.,1:

02. 1904. var. eugeneum

Pl. 28 fig. 9.

rements: TL. 568.0-786.0µ; TB. 32.0-43.0µ; L:BR. 16.7-18.4x; BI. 25.0-

; BA. 23.0-26.0µ.

Pleurotaenium eugeneum was gathered primarily from west of the con-

tal divide. Although the typical form was not the form of the species

frequently encountered, it was collected from more widely separated

ities. Rare.

ibution: Beaverhead Co.: 133-(Mt63-314). Lake Co.: 81-(Mt63-207).

rs Co.: 74-(Mt63-171). Wheatland Co.: 164-(Mt63-465).

Pleurotaenium euganum (Turn.) West & West var. capense Hodgetts, Trans.

Soc. South Afric. vol. 13; p. 77, fig. 9A. 1926.

Pl. 28 fig.8.

rements: TL. 494.0-614.0µ; TB. 29.0-37.0µ; L:BR. 15.0-18.6x; BI. 25.5-

; BA. 22.0-28.0µ.

Krieger (37) considered this variety typical Pl. ehrenbergii. How-

he states that the total number of apical granules found in Pl. eh-

rgii is from 7-10 with 4-5 being visible across the face. The Mon-

plants have from 14-18 granules at the apex, 6-8 being visible across

face, and are thus similar to Hodgett's plant. Consequently, I have

ated the plant from Pl. ehrenbergii, and entered them as var. capense.

variety was more frequently collected than the typical form but was

gathered from west of the continental divide. Moderately rare.

ribution: Flathead Co.: 28-(Mt63-422); 35-(Mt63-391); 41-(Mt63-61). Co.: 92-(Mt63-38); 93-(Mt63-35). Lincoln Co.: 17-(Mt63-119). oula Co.: 102-(Mt62-5). Ravalli Co.: 118-(Mt63-200).

Pleurotaenium indicum (Grun.) Lund. Nova Acta Reg. Soc. Scient. Up-, ser. 3 vol. 8, p. 90. 1871.

Pl. 27 fig. 10.

urements: TL. 340.0-544.0μ; TB. 29.0-34.0μ; L:BR. 13.2-17.9x; BI. -29.0μ; BA. 16.0-24.0μ.

I find in my material this species has a striking similarity to Pl. acula var. elongatum Cedergren, the cell differing from that plant ntly in its dimensions, and by possessing lateral margin with a greater er of undulations. Both of these characteristics are, however, quite able within each taxon, so perhaps Playfair (10) was correct in assign- Pl. indicum to Pl. trabecula as a variety.

The species was only collected west of the continental divide.

ibution: Beaverhead Co.: 133-(Mt63-314). Flathead Co.: 23-(Mt63- Lincoln Co.; 2-(Mt63-141); 4-(Mt63-129). Ravalli Co.: 111-(Mt63-249)

Pleurotaenium minutum (Ralfs) Delp. Mem. R. Acad. Scien. Torino, ser. 131, t. 20. fig. 17-21. 1878. var. minutum.

Pl. 27 fig. 4.

rements: TL. 82.0-132.0μ; TB. 11.0-13.0μ; L:BR. 7.5-12.9x; BI. 8.5- ; BA. 7.5-8.0μ; BAI 11.0-13.0μ.

This species was rare and few specimens were seen. In addition to ypical, two varieties were encountered, all collected from the north-

ibution: Flathead Co.: 31-(4181). Lake Co.: 86-(Mt62-73, Mt63-186).

leurotaenium minutum (Ralfs) Delp. var. elongatum (West & West)

ren, Ark. f. Bot. 25. p. 31. 1932.

Pl. 27 fig. 3.

ements: TL. 247.0-270.0µ; TB. 11.5-13.0µ; L:BR. 20.5-22.0x; BI.

1.0µ; BA. 6.0-7.0µ.

ery rare.

bution: Lake Co.: 86-(Mt62-63).

Pleurotaenium minutum (Ralfs) Delp. var. gracile (Wille) Krieger,

. Rabenhorst's Krypt.-Fl. 13, 1, p. 394, t. 39, fig. 10. 1937.

Pl. 27 fig. 2.

rements: TL. 180.0-258.0µ; TB. 12.0-12.5µ; L:BR. 15.0-21.2x; BI.

.0µ; BA. 7.5-8.5µ.

Very rare.

ibution: Flathead Co.: 29-(H.L.1). Glacier Co.: 63-(Mt63-218).

Pleurotaenium nodosum (Bail.) Lund., Nova Acta Reg. Soc. Sciet. Up-

, ser. 3,8, p. 90. 1871.

Pl. 28 fig. 1.

rements: TL. 377.0-432.0µ; TB. 45.0-49.0µ; L:BR. 7.6-9.1x; BI. 24.0-

; BA. 33.0-35.0µ; BAI. 47.0-50.0µ.

Very rare. Collected only in the northwest.

ibution: Flathead Co.: 31-(4181,4182), (Kidd*), Lake Co.: 86A(206).

Previously reported by Kidd (63) for collection locality 31.

Pleurotaenium nodulosum (Bréb.) de Bary, Untersuch. Fam. Conjug. p.

.858.

Pl. 27 fig. 12.

rements: TL. 450.0-774.0µ; TB. 52.5-66.5µ; L:BR. 7.5-12.0x; BI 38.0-

; BA. 32.0-46.0µ.

This species is considered by some authors (Krieger, 37; West and , 04) to be a variety of Pl. coronatum. However, I prefer to follow ee-Marie and consider the two plants as distinct species. See notes r Pl coronatum. The plants were primarily collected in the north- where they are moderately common, and generally gathered from ponds lakes at low elevations (2200-3800 feet).

ribution: Beaverhead Co.: 135-(Mt63-339). Flathead Co.: 29-(H.L.1), Mt63-82). Lake Co.: 83-(Mt63-204). Lincoln Co.: 6-(Mt63-146); 10- 3-156). Missoula Co.: 105-(Mt63-245). Ravalli Co.:119-(Mt63-302); (Mt63-299). Sanders Co.: 72-(Mt63-163); 76-(Mt63-159,192).

Pleurotaenium nodulosum morpha.

Pl. 27 fig. 13.

urements: TL. 506.0µ; TB. 72.0µ; L:BR. 7.1x; BI. 48.5µ; BA. 42.0µ.

Cell differing from the type (and all other members of the genus) by presence of a shallow linear sinus. I consider this characteristic bnormality(deformity). A single specimen was recorded. The typical is also present here.

ribution: Sanders Co.: 72-(Mt63-163).

Pleurotaenium trabecula (Ehrenb.) Naeg.

This species was the second most frequently collected member of the s. With one exception, in the south-central part of the state, it was encountered in the west. Four varieties, in addition to the typical were collected.

Pleurotaenium trabecula (Ehrenb.) Naeg., Gattung. einzel. Algen. . 104, t. 6. fig. A. 1849. var. trabecula.

Pl. 27 figs. 6,7.

urements: TL. 328.0-554.0µ; TB. 28.0-39.0µ; L:BR. 9.1-15.7x; BI. 23.0-

; BA. 18.0-33.0μ.

The typical was the form most often collected and the only one with
tributional range extending east of the montane region.

Common in western Montana.

ibution: Beaverhead Co.: 132-(Mt63-185). Flathead Co.: 27-(Mon25); t63-391). Glacier Co.: 58-(Mt63-428); 63-(Kidd*). Lake Co.: 87-(Mt); 93-(Mt63-35); 97-(Mt63-33). Lincoln Co.: 5-(Mt63-137); 21-(Mt63- . Ravalli Co.: 111-(Mt63-248); 122-(Mt63-298). Sanders Co.: 71-(Mt 55); 76-(Mt63-160). Sweetgrass Co.: 170-(Mt64-102, 103, 104).

Pleurotaenium trabecula (Ehrenb.) Näg. var. crassum Wittrock, till K. Sv. Vet.-Akad. Handl. 1, p. 62, t. 4, fig. 17. 1872.

Pl. 27 fig. 1.

urements: TL. 332.0-390.0μ; TB. 37.0-39.0μ; L:BR. 8.9-10.0x; BI. 29.0- u; BA. 22.0-24.0μ.

Very rare. Collected from two widely separated ponds in the north-
.

ribution: Glacier Co.: 61-(Mt63-432). Ravalli Co.: 122-(Mt63-298).

Pleurotaenium trabecula (Ehrenb.) Näg. var. elongatum Cedergren. Ark. ot., 13, p. 12. 1913.

Pl. 27 fig. 8.

urements: TL. 566.0-650μ; TB. 36.0-39.0μ; L:BR. 15.4-20.7x; BI. 21.0- μ; BA. 23.5-30.0μ.

Collected only west of the continental divide where it is of moderately
.

ribution: Flathead Co.: 44-(Mt63-54). Lake Co.: 94-(7Mon15); 95- 2-57); 97-(Mt63-33). Lincoln Co.: 4-(Mt63-34); 20-(Mt63-90,96). ders Co.: 71-(Mt63-164); 72-(Mt63-163).

Pleurotaenium trabecula (Ehrenb.) Näg. var. maxima (Reinsch.) Roll, em. Sci. Lab. Bot. Univ. Kharkoff, 1: p. 10, t. 2, fig. 1. 1927.

Pl. 27 fig. 15.

Measurements: TL. 520.0-801.0µ; TB. 41.0-51.0µ; L:BR. 10.5-17.0x; BI. 30.0-43.0µ; BA. 28.0-34.0µ.

This variety was of moderately rare occurrence in the northwest, and collected only once in the southwestern part of the state.

Distribution: Flathead Co.: 31-(4181, Kidd*). Granite Co.: 126-(6Mon42). Lake Co.: 87-(Mt64-68); 97-(Mt63-33). Lincoln Co.: 16-(Mt63-114); 17-(Mt63-120); 19-(Mt63-111). Sanders Co.: 70-(Mt63-161).

Previously reported by Kidd (63) from collection locality 31.

Pleurotaenium trabecula (Ehrenb.) Nag. var. rectum (Delp) West & West, Monogr. Desmid. 1, p. 212, t. 30 figs.9,10. 1904.

Pl. 27 fig. 9.

Measurements: TL. 176.0-400.0µ; TB. 15.0-23.0µ; L:BR. 12.0-17.7x; BI. 11.0-19.0µ; BA. 11.0-17.5µ.

Collected only from the northwest corner of the state. Moderately rare.

Distribution: Flathead Co.: 28-(Mt63-442): 31-(Kidd*). Glacier Co.: 54-(Mt62-11); 63-(Mt63-218). Lake Co.: 83-(Mt63-204); 84-(Q1, X8); 86- (Mt 63-188).

Previously reported by Kidd (63) from collection locality 31.

Pleurotaenium truncatum (Bréb.) Naeg. Gattung. einzel. Algen, p. 104 1849.

Pl. 28 fig. 4.

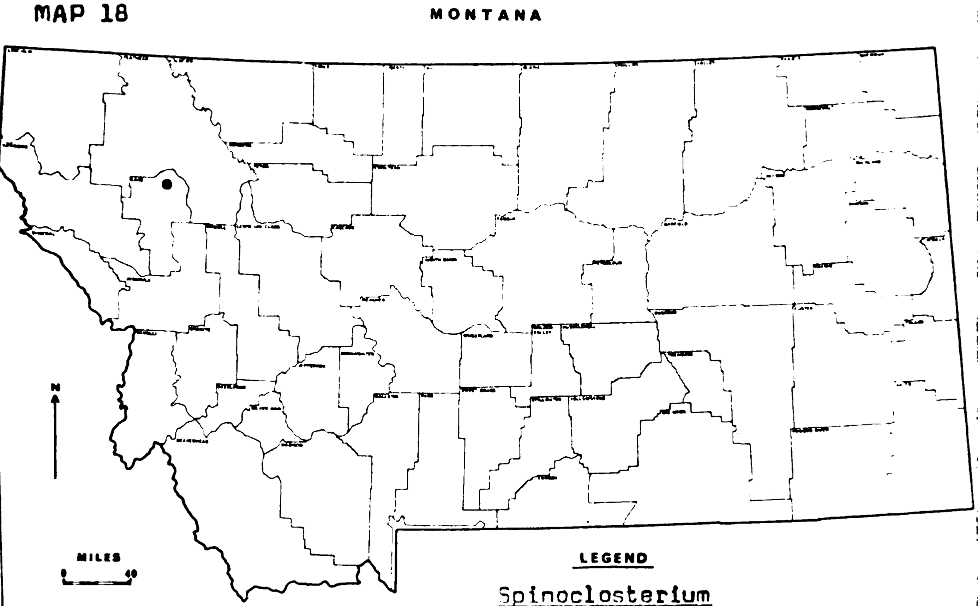
Measurements: TL. 406.0µ; TB. 69.0-70.0µ; L:BR. 5.8-5.9x; BI. 52.0µ; BA. 30.0µ.

This plant greatly resembles var. attenuatum in the narrowing of the
micell toward the apex, and in the reduction of the number of granules
the apices. It differs from that variety in its greater length and in
e slightly greater breadth of the apices. A single specimen was seen.
us, it was believed best to simply enter the plant as belonging to the
ecies.

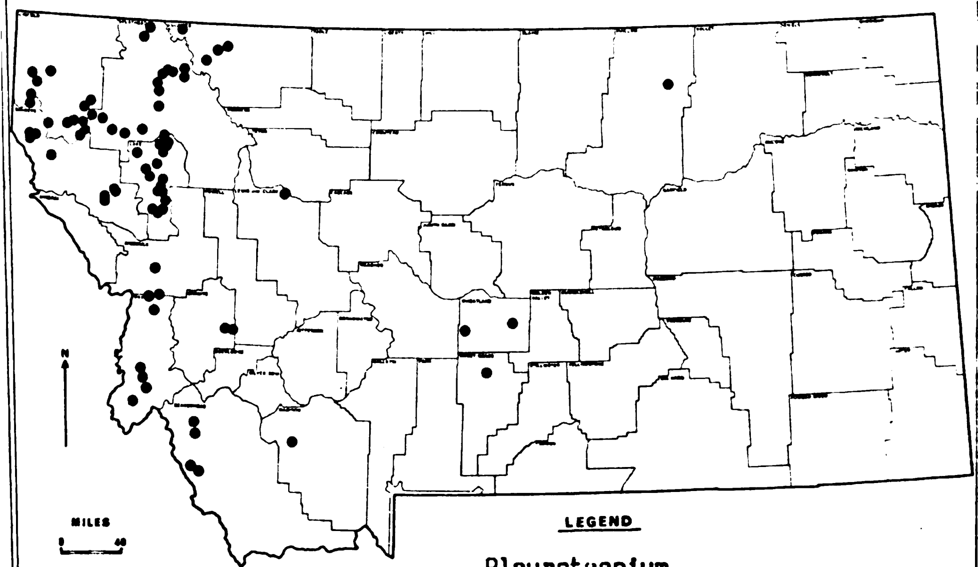
Very rare.

stribution: Lake Co.: 84-(Q1).

MAP 18



Spinoclosterium



Pleurotaenium

MAP 19

6. Triploceras Bailey, 1850.

This genus was very rare being collected but once, west of the continental divide.

Triploceras gracile Bailey, Micr. observ. Smithson. Contr. Knowl. 2 p. 38, t. 1, fig. 10. 1850.

Pl. 28 fig. 10.

Measurements: TL. 482.0μ; TB. 36.0μ; L:BR. 13.4x; BI. 16.0μ; BA. 23.0-32.0μ.

A very rare species. Collected from the plankton of a high altitude lake (6600 feet) in the northwest. A single specimen was seen.

Distribution: Ravalli Co.: 112-(Mt63-260).

7. Tetmemorus Ralfs, 1844.

A rather rare genus being collected from only four collection localities in western Montana and never in any abundance. Four taxa are reported.

Tetmemorus brebissonii var. minor de Bary, Untersuch. Fam. Conjug. p. 73, t.5, fig. 9. 1858.

Pl. 29 fig. 4.

Measurements: TL. 7.0-85.0μ; TB. 24.0-26.0μ; L:BR. 3.1-3.4x; BI. 18.0-19.0μ.

Very rare. Known from a single locality, a high altitude (6600 feet) oligotropic lake, west of the continental divide.

Distribution: Ravalli Co.: 112-(Mt63-257).

Tetmemorus granulatus (Bréb) Ralfs, Brit. Desmid., p. 147, t. 24. fig. 2. 1848. var. granulatus.

Pl. 29 fig. 1.

Measurements: TL. 178.0-190.0μ; TB. 28.0-30.0μ; L:BR. 6.3-6.8x; BI. 25.0-26.0μ; BA. 13.5-15.0μ.

This species is very rare in my collections, being gathered from only one locality, a Sphagnum bog in the northwest. In addition to the typical form the variety attenuatum West, was also collected at this site.

Distribution: Glacier Co.: 54-(Mt62-13).

Tetmemorus granulatus (Bréb) Ralfs. var. attenuatus West, Journ. Linn. Soc. Bot., 29, p. 132, t. 20, fig. 10. 1892.

Pl. 29 fig. 2.

Measurements: TL. 154.0-160.µ; TB. 27.0-28.0µ; L:BR. 5.5-5.7x; BI. 24.0-25.0µ; BA. 16.5-17.5µ.

Cells possessing smaller dimensions than originally indicated by West. Very rare. Collected from a Sphagnum bog in Glacier National Park.

Distribution: Glacier Co.: 54-(Mt62-13).

Tetmemorus laevis (Kütz.) Ralfs, Brit. Desmid., p. 146, t. 24, fig. 3. 1848.

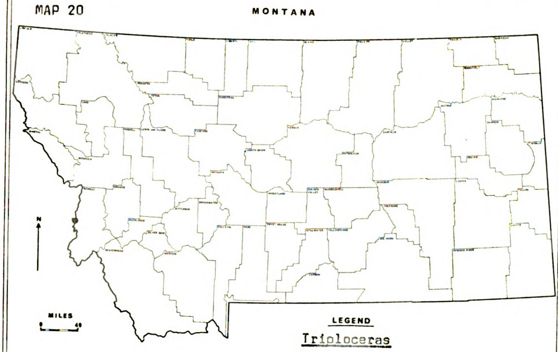
Pl. 29 fig. 3.

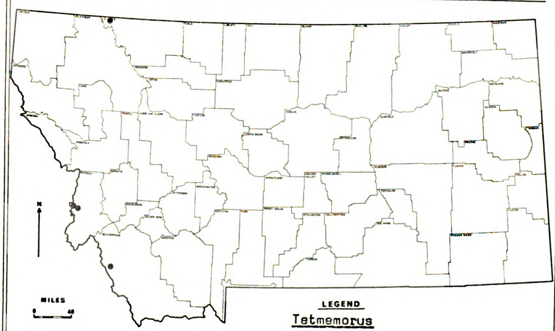
Measurements: TL. 73.5-79.0µ; TB. 21.0-23.0µ; L:BR. 3.4-3.8x; BI. 18.0-20.0µ.

This species was collected from western Montana and although rare, it was the most frequently encountered and most abundant member of this genus. Gathered from Sphagnum squeezings and/or the plankton of two lakes (6600-7000 feet) and intermingled with other algae in a creek.

Distribution: Beaverhead Co.: 134-(Mt63-324). Ravalli Co.: 112-(Mt63-257,261); 114-(Mt63-256).

MAP 20


MONTANA
N
MILES
0
40
LEGEND
Trioloceras


N
MILES
0
40
LEGEND
Tetmemorus

MAP 21

8. Euastrum Ehrenb. 1832.

The genus Euastrum was well represented in the desmid flora of western Montana, but was only encountered twice outside this region. (See map no. 22). Sixty five taxa were identified by the author, three of which appear to be new to science. Additional unnamed forms were also found. The most commonly collected species were: E. bidentatum Maeg., E. denticulatum (Kirchn.) Gay, E. insulare(Wittr.) Roy, E. oblongum (Grav.) Ralfs, and E. verrucosum Ehrenb.

Euastrum abruptum Nordst. var. lagoense (Nordst.) Krieger, Desmid. in Rabenhorst's Krypt.-Fl., 13(1); p. 605, t. 83, fig. 4-6. 1937.

Pl. 35 fig. 17.

Measurements: TL. 25.0-26.0μ; TB. 19.0-20.0μ; BI. 5.0-6.0μ.

Very rare. Collected only from the northwest.

Distribution: Flathead Co.: 27-(Mon25). Sanders Co.: 74-(Mt63-171).

Euastrum affine Ralfs, Brit, Desmid., p. 82, t. 13, fig. 3. 1848.

Pl. 33 fig. 1.

Measurements: TL. 127.0-150 μ; TB. 66.0-70.0μ; BI. 18.0-22.0μ.

This species was found in a variety of lentic habitats (bog, swamp, lake, etc.) at varying elevations (2200-6800 feet) but never in any abundance. Collected only in the northwest. Moderately rare.

Distribution: Flathead Co.: 28-(Mt63-445); 31-(4181). Lake Co.: 85-(Mt63-47). Lincoln Co.: 9-(Mt63-154). Missoula Co.: 100-(Mt63-419).

Euastrum ansatum Ralfs, Brit. Desmid., p. 85, t. 14, fig. 2, 1848. var. ansatum.

Pl. 30 fig. 4.

Measurements: TL. 78.0-82.0μ; TB. 38.0-40.0μ; BI. 11.0-12.0μ.

This species is represented in Montana by two varieties in addition to the typical form and two unnamed formae, none of which occur in any abundance. Only gathered in the western part of the state.

Distribution: Flathead Co.: 46-(Mt62-1). Lake Co.: 86-(Mt63-187). Sieminska*).

Previously reported by Sieminska (65) from collection locality 86.

Euastrum ansatum Ralfs var. concavum Krieger, Desmid. in Rabenhorst's Krypt.-Fl. 13(1): p. 487, t. 58, fig. 12. 1937.

Pl. 30 fig. 5.

Measurements: TL. 80.0-82.0μ; TB. 37.0-39.0μ; BI. 12.0-13.0μ.

Very rare.

Distribution: Flathead Co.: 28-(Mt63-449). Glacier Co.: 54-(Mt62-16).

Euastrum ansatum var. triporum Krieger, Desmid. in Rabenhorst's Krypto.-Fl. 13(1); p. 492, t. 59, fig. 8. 1937.

Pl. 30 fig. 3.

Measurements: TL. 75.0-82.0μ; TB. 33.0-37 μ; BI. 9.0-12.5μ.

Plants possessing a linear series of two to three pores in the apical region of the cell in addition to those present on the face of the semicell. Basal swellings above the linear sinus are at times reduced, rarely wanting.

Very rare. Collected from two bogs, one in the northwest, the other in the southwest.

Distribution: Glacier Co.: 54-(2Mon8). Granite Co.: 127-(6Mon41).

Euastrum ansatum fa. 1.

Pl. 30 fig. 1.

Measurements: TL. 62.0-65.0μ; TB. 32.0-33.0μ; BI. 12.5-13.0μ.

Semicells pyramidate with distinct undulation of lateral margins and with a slight protuberance immediately above the isthmus. Small circular thickening on facial region. Cells differing from the type in their smaller size.

Very rare. Collected from a bog in Glacier National Park.

Distribution: Flathead Co.: 28-(Mt63-443).

Euastrum ansatum fa. 2.

Pl. 30 fig. 2.

Measurements: TL. 65.0μ; TB. 32.3μ; BI. 105μ.

Plant similar in dimensions to forma 1. listed above, but differing from that plant in possessing two small pores above the isthmal protuberance, and lacking the facial thickening present in forma 1. Close to E. ansatum f. biscrobiculata, but that taxon lacks the lateral undulations shown in this plant.

Very rare. Collected from a bog in the southern Montane.

Distribution: Granite Co.: 127-(6Mon41).

Euastrum attenuatum Wolle, Bull. Torr. Bot. Club. 8(1), p. 3, t. 6, fig. 20.1881. var. attenuatum.

Pl. 35 fig. 1.

Measurements: TL. 54.0-56.0μ; TB. 30.0-32.0μ; BI. 10.0μ.

This plant, which I have assigned to the species, resembles E. attenuatum var. japonicum Hinode, especially in the open sinus and general shape of the semicells. This was the least encountered form of the species.

The species is rare in Montana. Collected from a bog in the northwest. Very rare.

Distribution: Glacier Co.: 54-(Mt62-24).

Euastrum attenuatum Wolle var. splendens (Fritsch. & Rich.) Grönbl. & Scott, Acta Bot. Fenn. 58, p. 12. 1958.

Pl. 35 fig. 2.

Measurements: TL. 66.0-70.0µ; TB. 36.0-39.0µ; BI. 10.0-11.0µ.

Although rare, this form of the species occurred in the greatest numbers.

Distribution: Glacier Co.: 54-(Mt62-24).

Euastrum bidentatum Naeg.

Although this species was one of the most frequently collected and abundant members of the genus, it was only gathered in the west where it is widely distributed.

The species shows a considerable degree of variation in facial ornamentation and examples of these have been figured on plate 38.

In addition to the typical form one variety and two unnamed forms were gathered.

Euastrum bidentatum Naeg., Gattung. einzel. Alg. 8, p. 122, t. 7D. fig. 1, 1849. var. *bidentatum*.

Pl. 38 figs. 1,4,6,9.

Measurements: TL. 41.0-56.0µ; TB. 27.5-37.0µ; BI.6.5-11.0µ.

The typical was encountered most frequently, and was often abundant. Cells varying in dimensions and facial decoration, but quite constant in form.

Distribution: Beaverhead Co.: 134-(Mt63-325). Flathead Co.: 22-(6Mon31) 23-(Mt63-400); 24-(Mt63-411); 25-(Mt63-407,408); 27-(Mt63-451, Mon 25); 28-(Mt63-500); 29-(H.L.1); 31-(4181, 4182); 39-(Mt63-77,78); 42-(Mon16(1)). Glacier Co.: 54-(2Mon8). Granite Co.: 125-(6Mon51); 127-(6Mon38); 128-(Mt63-386). Lake Co.: 81-(Mt63-206,212); 83-(Mt63-204); 84-(X8); 85-(Mt 63-47); 86-(Mt63-188, Sieminska*). Lincoln Co.: 10-(Mt63-156,157). Missoula Co.: 100-(Mt63-419). Ravalli Co.: 11-(Mt63-246,251);112-(Mt63-

257); 114-(Mt63-256); 119-(Mt63-301,302); 123-(Mt63-286). Sanders Co.: 72-(Mt63-163); 74-(Mt63-171). Common.

Previously reported by Sieminska (65) for collection locality 86.

Euastrum bidentatum Naeg. var. bidentatum fa.

Pl. 38 fig. 7.

Measurements: TL. 68.0-70.0μ; TB. 44.7-47.0μ; TL. 12.0-12.5μ.

Cells differing from the type in having larger dimensions. Collected from one locality, a high altitude lake (7000 feet) in the southwest. Very rare.

Distribution: 134-(Mt63-320,325).

Euastrum bidentatum Naeg. var. speciosum (Boldt) Schmidle, Bih. Kgl. Sv. Vet.-Akad. Handl., 24,3(8): p. 47. 1898.

Pl. 38 fig. 8.

Measurements: TL. 56.5-66.0μ; TB. 36.5-42.0μ; BI. 10.0-12.0μ.

With the considerable degree of variation which exists in the typical form, this is probably a questionable variety. More commonly collected in the southern montane region than in the north. Moderately rare.

Distribution: Beaverhead Co.: 135-(Mt63-331). Flathead Co.: 28-(Mt63-449). Granite Co.: 126-(6Mon42); 128-(Mt63-386). Lake Co.: 86-(Mt62-79).

Euastrum bidentatum Naeg. morpha.

Pl. 38 fig. 2.

Measurements: TL. 62.0μ; TB. 36.0μ; BI. 8.5μ.

Plant differing in its less extended or developed apical and lateral lobes, and slightly longer cell. Only a single specimen was seen. The typical was also present at this locality.

Distribution: Flathead Co.: 29-(H.L.1).

Euastrum binale. (Turp.) Ehrenb.

This species was only collected west of the continental divide. Two forms and one variety were identified.

Euastrum binale (Turp.) Ehrenb. f. gutwinskii Schmidle, Bericht. Deutsch. Bot. Gesellsch. 11, (10), p. 552. 1894.

Pl. 36 fig. 9.

Measurements: TL. 17.0-20.0μ; TB. 14.0-16.0μ; BI. 3.5-5.0μ.

This was the most commonly encountered form of the species, occuring in a number of different aquatic habitats (e.g. bog, pond, lake, river, etc.) at varying elevations (2200-6800 feet). Gathered only west of the continental divide.

Distribution: Flathead Co.: 38-(Mt63-86). Lake Co.: 85-(Mt63-47); 86-(Sieminska*). Lincoln Co.: 10-(Mt63-157). Missoula Co.: 100-(Mt63-420); 103-(Mt63-236). Ravalli Co.: 112-(Mt63-257); 114-(Mt63-256).

Previously reported by Sieminska (65) for collection locality 86, but not found there by the author.

Euastrum binale (Turp.) Ehrenb. f. hians West, Journ. Linn. Soc. Bot. 29, p. 140, t. 20, fig. 14. 1892.

Pl. 36 fig. 8.

Measurements: TL. 12.0-14.0μ; TB. 12.0-12.5μ; BI. 3.0-3.5μ.

Cells a little stouter in appearance than usually illustrated for this form, but still within the dimensions given by West. Very rare. Known from a single locality in the northwest.

Distribution: Flathead Co.: 31-(4182).

Euastrum binale (Turp.) Ehrenb. f. minor West, Journ. Bot. 26, p. 340. 1888.

Pl. 36 fig. 5.

Measurements: TL. 11.0-12.0μ; TB. 9.5-10.0μ; BI. 2.5-3.0μ.

Very rare. Collected from a single locality west of the continental divide.

Distribution: Flathead Co.: 23-(Mt63-399). Lake Co.: 86-(Sieminska*).

Previously reported by Sieminska (65) as var. minus for collection locality 86.

Euastrum coralloides Josh. var. subintergrum West & West.

This plant listed by Sieminska (65) for collection locality 86, has been included under E. denticulatum (Kirchn.) Gay. Her illustration is very similar to that given by Krieger (37) for E. denticulatum var. quadrifarium Krieger, and her measurements also fit well.

Euastrum crassicolle Lund, Nova Acta Reg. Soc. Scient. Upsala, ser., 3, 8, p. 23, t. 2, fig. 8. 1871.

Pl. 31 figs. 2,3.

Measurements: TL. 25.0-27.0μ; TB. 15.0-16.5μ; BI. 6.0-7.5μ.

A rare species collected from two widely separated localities in the west.

Distribution: Beaverhead Co.: 134-(Mt63-322). Flathead Co.: 28-(Mt63-449).

Euastrum crassum (Bréb.) Kuetz.

This species was collected from two localities, one in the northwest (bog), the other in the southwest (oligotrophic lake), being gathered in abundance in the former. In addition to the typical form, two varieties were present, and one form which may be new to science.

Euastrum crassum (Bréb.) Kuetz. Phycol. germ. p. 135. 1845. var. crassum.

Pl. 32 fig. 1.

Measurements: TL. 163-174.0μ; TB.81.0-87.0μ; BI. 24.5-38.0μ.

The species was present in abundance in a number of collections. However, it is only known to the author from a single locality; a bog in the northwest. There is considerable variation in the development of the three prominent protuberances across the base of the semicell. Consequently, it is difficult at times to distinquish cells which belong to var. crassum and those which are var. michiganense. Very rare.

Distribution: Glacier Co.: 54-(Mt62-11,12,15,20,24).

Euastrum crassum (Bréb.) Kuetz. var. michiganense Presc., Pap. Mich Acad. Sci. Arts and Letters. 20, p. 165, pl. 126, figs. 1,2,. 1935.

Pl. 33 fig. 6.

Measurements: TL. 162-190.0μ; TB. 81.0-89.0μ; BI. 24.5-26.0μ.

This variety was collected with the typical form with which there is complete intergradation. Very rare.

Distribution: Glacier Co.: 54-(Mt62-20).

Euastrum crassum var. tumidum Okada, Mem. Fac. Fish, Kagoshima Univ. vol. 3, 1: p. 201, pl. 2, figs. 1,2. 1953.

Pl. 32 fig. 2.

Measurements: TL. 154.0-162.0μ; TB. 96.0-102.0μ; BI. 26.0-27.0μ.

Very rare. Known from the plankton of a high altitude (6600feet) oligotrophic lake in the southwest. Very rare.

Distribution: Ravalli Co.: 112-(Mt63-260).

Euastrum crassum (Bréb.) Kuetzing var. tumidum fa. suboblongum fa. nov.

Pl. 32 fig. 3.

Measurements: TL. 170-177.0μ; TB. 100-104.0μ; BI. 24.0-26.0μ; BPL. 52.0-54.0μ; T. 56.5-58.0μ.

Cells large, oblong, deeply constricted, sinus linear; semicells in face view five-lobed, incisions between basal and lateral lobes shallow and open, between lateral and apical lobes fairly deep and narrow; semi-cells with a single basal protuberance above the isthmus. Side view of semicell subpyramidate; apex truncate with rounded angles, basal angles subrectangular. Vertical view oblong with a protuberance in the center of the convex margins, and a slight undulation between the protuberance and the pole.

The plant was collected along with E. crassum var. tumidum. It differs from it in its larger dimensions and the greater development of the lateral lobes. There was an indication that the three basal protuberances, characteristic of the species, could be present for there was a slight swelling in the areas where these would normally develop.

The lobing present in this plant is very reminiscent of that in E. oblongum.

Very rare.

Distribution: Ravalli Co.: 112-(Mt63-260).

Euastrum denticulatum (Kirchn.) Gay, Bull. Soc. Bot. France, 31. p. 335. 1884 var. denticulatum.

Pl. 37 figs. 1,2,3.

Measurements: TL. 18.5-25.0μ; TB. 14.0-20.5μ; BI. 3.0-6.0μ.

This is a very common desmid in Montana, although only collected in the west. Because of the great variability, and intergradation which exists in the plants studied, no attempt was made to segregate them into the numerous forms which have been described. The plant listed by Sieminska (65) as E. coralloids Josh. var. subintegrum West & West fa. is included here.

Distribution: Beaverhead Co.: 133-(Mt63-316); 134-(Mt63-324); 135-(Mt63-

339). Flathead Co.: 27-(Mt63-450, Mon25); 29-(H.L.1); 31-(4182); 35-(Mt63-391); 39-(Mt63-78). Glacier Co.: 54-(Mt62-13). Granite Co.: 125-(6Mon44,51); 126-(6Mon43); 128-(Mt63-386). Lake Co.: 81-(Mt63-206); 82-(Mt63-200); 83-(Mt63-204); 85-(Mt63-47); 86-(Mt63-188); 88-(Mt63-197); 89-(Mt63-388). Lincoln Co.: 8-(Mt63-151); 15-(Mt62-28). Missoula Co.: 100-(Mt63-419); 101-(Mt64-72); 102-(Mt62-5). Ravalli Co.: 111-(Mt63-248,250); 112-(Mt63-261); 115-(Mt63-269). Sanders Co.: 72-(Mt63-162); 74-(Mt63-170); 76-(Mt63-176); 77-(Mt63-194).

Euastrum denticulatum (Kirchn.) Gay var. *dangeardii* La Porte, Recherches. sur la Biologie et Systematique des Desmidiées. Dissert. Paris. p. 83, fig. 188-193. 1931.

Pl. 37 fig. 4.

Measurements: TL. 30.5-33.0μ; TB. 23.5-25.5μ; BI. 6.0-7.5μ.

Krieger (37) considered this plant, as well as Dick's (23) forma *boldtii* (the illustration of which is identical to the Montana plant), to be the typical form. However, I do not agree with this. In fact, the plant is so distinct and different from all forms of *E. denticulatum* I believe it should be elevated to the rank of species.

Rare. Collected only west of the continental divide at high elevations (6600-6800 feet).

Distribution: Missoula Co.: 100-(Mt63-419). Ravalli Co.: 112-(Mt63-257).

Euastrum didelta Ralfs, Brit. Desmid., p. 84. t. 14, fig.1, 1848. var. *didelta*.

Pl. 34 fig. 6.

Measurements: TL. 118.0-132.0μ; TB. 60.5-73.0μ; BI. 18.0-20.5μ.

This species was only collected in the northwest and sometimes gathered in abundance. Two varieties in addition to the typical form were collected but they were of rare occurrence. Moderately rare.

Distribution: Flathead Co.: 28-(Mt63-445): 31-(4181). Glacier Co.: 54-(Mt62-20); 63-(Mt63-218). Ravalli Co.: 112-(Mt63-260).

Euastrum didelta Ralfs var. everettonsiforme Ducellier, Bulletin de La Societe Bot. de Genève. 2 me serie, vol. 7: p. 87, text figs. 16,17. 1915.

Pl. 33 fig. 5.

Measurements: TL. 129-132μ; TB. 71-74.0μ; BI. 21.0-22.5μ; T. 51.0μ.

Krieger (37) considered this plant synonymous with E.humerosum Ralfs. However, I believe Ducellier was correct in placing the plant as a variety of E. didelta. I do not consider the plant identical to Wolles' E. everttense, which also occurs in Montana.

Distribution: Lake Co.: 88-(Mt63-198).

Euastrum didelta Ralfs var. truncatum Krieger, Desmid. in Rabenhorst's Krypt.-Fl. 13(1): p. 250, t. 68, fig. 1. 1937.

Pl. 34 fig. 7.

Measurements: TL. 134.0-140.0μ; TB. 70.0-75.0μ; BI. 16.0-19.0μ.

In the Montana material studied there was considerable intergradation between this variety and the typical.

Rare. Collected from single locality in the northwest.

Distribution: Flathead Co.: 31-(Mon4181).

Euastrum dubium Naeg., Gattung. einzel. Algen. 8, p. 122, t.7, fig. 2. 1849. var. dubium f. dubium.

Pl. 36 fig. 20.

Measurements: TL. 31.0-34.0μ; TB. 21.0-23.0μ; BI. 5.5-7.0μ.

Euastrum dubium was rather rare in my material, being collected only from the northwest. The typical was one of the least encountered forms of the species. In a number of specimens, scrobiculations and pores were seen in a semicicular pattern above and/or to the sides of the central protuberance, consequently overlapping, in characteristics, forma scrobiculatum Lütkem.

Distribution: Lincoln Co.: 10-(Mt63-156).

Euastrum dubium Naeg. var. dubium f. scrobiculatum Lütkem., Verh. k.k. zool-bot. Gessellsch. Wien 60: p. 482, t.2., fig. 1. 1910.

Pl. 36 fig. 19.

Measurements: TL. 26.5-30.0μ; TB. 18.0-20.5μ; BI. 5.0-6.2μ.

Very rare.

Distribution: Flathead Co.: 28-(Mt63-442,447).

Euastrum dubium Naeg. var. ornatum Wolosz., Rozpr. sprawozd. possied. Wydz. mat.-przyr. Akad. Umiej. Krakow. serv. B, 57, p. 49, t. 3, fig. 32 1919.

Pl. 36 fig. 18.

Measurements: TL. 23.0-26.0μ; TB. 17.5-19.0μ; BI. 5.0-6.0μ.

This variety was the most frequently collected form of the species.

Distribution: Flathead Co.: 25-(Mt63-407,409). Lake Co.: 81-(Mt63-206). Lincoln Co.: 1-(4184).

Euastrum elegans (Bréb.) Kuetz., in Ralfs' Brit. Desmid., p. 89. t.14. fig. 7. 1848. elegans.

Pl. 36 fig. 21, 22.

Measurements: TL. 28.0-32.0μ; TB. 19.0-23.0μ; BI. 4.25.8μ.

Euastrum elegans was collected in both the northern and southern Montane, but more frequently gathered in the north. It was encountered in a variety of habitats (lentic and lotic) at varying elevations (2200-7000 feet), but not in abundance. Moderately common.

Distribution: Beaverhead Co.: 134-(Mt63-327). Flathead Co.: 29-(H.L.1);

31-(4182, Kidd*). Glacier Co.: 54-(Mt62-11). Granite Co.: 126-(6Mon43) Lincoln Co.: 1-(41884); 10-(Mt63-157). Ravalli Co.: 112-(Mt63-257); 113-(Mt63-255); 114-(Mt256).

Previously reported by Kidd (63) for collection locality 31.

Euastrum elegans (Bréb.) Kuetz. var. elegans morpha.

Pl. 36, fig. 23.

Measurements: TL. 31.0-31.5μ; TB. 20.0-21.0μ; BI. 4.0-5.0μ.

Cells with less apiculate superior angles, and possessing a quadrigranulate protuberance above the isthmus as opposed to the triverrucose (trigranualte), one generally present. Accessory facial granules may also occur. Very rare.

Distribution: Flathead Co.: 31-(4183, Kidd*).

Euastrum elegans (Bréb.) Kuetz. var. compactum (Wolle) Krieger, Desmid. in Rabenhorst's Krypt.-Fl. 13, 1, p. 593, t. 82, fig. 1,2. 1937.

Pl. 36 fig. 24.

Measurements: TL. 30.0-31.0μ; TB. 21.022.0μ; BI. 5.0-6.0μ.

Very rare. Collected from a single locality in the northwest.

Distribution: Lake Co.: 95-(Mt62-56).

Euastrum everettense Wolle

This species was considered by Krieger (37) as synonymous with E. ampullaceum Ralfs. However, as pointed out by Grönblad (56), the protuberances of these two species are quite different. Furthermore, they differ in side and top views, and the cell wall of E. everettense is very coarsely scrobiculate. Probably a much closer relationship exists between E. everettense and E. didelta, than with E. ampullaceum.

The species was only collected west of the continental divide.

In addition to the typical form, which is really rather rare in my collections, two varieties and a forma of one these was also gathered.

Euastrum everettense Wolle, Desmids of the United States and List of American Pediastrum, Bethlehem, Pa. p. 102, pl. 28, fig. 5-7. 1892. var. everettense.

Pl. 34 fig. 4.

Measurements: TL.120-126.0μ; TB. 63.0-64.0μ; BI. 15.5-16.0μ; T. 40.0-45.0μ.

Very rare. Known to the author from a single locality in Glacier National Park.

Distribution: Glacier Co.: 63-(Mt63-218).

Euastrum everettense Wolle var. crassum (Pres. & Scott) Jackson, nov. comb. (Euastrum obesum Josh. var. crassum Presc. & Scott, Trans. Amer. Micr. Soc. Vol. 61, (1): p. 9, pl. 1, fig. 23. 1942).

Pl. 34 fig. 5.

Measurements: TL. 106-118.0μ; TB. 55.0-58.0μ; BI. 16.0-17.5μ.

In a note (part of the G.W. Prescott iconograph) dated March 8, 1953, and attached to the original sketch from which E. obesum var. crassum was described, Scott indicated his dissatisfaction with the inclusion of var. crassum with E. obesum. He had thought the plant possibly E. everettense, but in all the thousands of specimens he had seen of var. crassum he never once observed the pronounced constriction just below the apex, chatacteristic of E. everettense. Consequently, he questioned the identification of the plant as identical to Wolle's. He noted the differences between them, but still indicated that he had little doubt that the plant was the same as Irénée-Marie's (39) illustration (fig. 11, pl. 8) of E. everettense.

The similarity between these two taxa, in face, vertical and side views, in addition to the coarsely scrobiculate walls, I believe, confirm his belief in their relationship to one another (compare figs. on pl. 34). Consequently, the transfer here of var. crassum to E. everettense.

There is also a strong resemblence between var. crassum and E. ansatum var. robustum Ducel., and possible the two plants are the same. Interestingly enough a forma (no. 1) of var. crassum was collected which resembles one of Ducellier's figures (fig. 23). However, E. ansatum is a smaller, more delicate desmid, and the plants listed above are clearly related to E. everettense. Future study may determine that Ducellier's plant is more properly placed with E. everettense.

This was the most frequently encountered form of the species and it occurred along with the typical form at locality 63. Two additional formae of var. crassum were also encountered. The plant entered by Sieminska (65) as E. ansatum var. dideltiforme Ducell. is placed here.

Distribution: Flathead Co.: 28-(Mt63-445). Glacier Co.: 63-(Mt63-218). Lake Co.: 84-(X8); 86-(Mt63-186).

Euastrum everettense Wolle crassum (Presc. & Scott) Jack. fa. 1.

Pl. 34 fig. 1.

Measurements: TL. 91-102.0μ; TB. 47.5-51.0μ; BI. 17.0-17.5μ; T. 31-33.0μ.

Cells of medium size, approximately twice as long as broad; sinus linear; semicells campanulate; three lobed; lateral lobes broadly rounded; polar lobe slightly dilated, apex convexo-truncate with a short median incision; lateral margins convex; semicells with two protuberances across middle of semicell, and between the lateral lobes (obscure in face view); a faint protuberance also present above the isthmus, but below and between the other two protuberances previously mentioned.

Side view basically as in the typical form. Vertical view differing in that the supra-isthmal swelling can be seen from the top. This is because the cells are not as thick in the area above the protuberance as they usually are in the typical form.

Cell wall coarsely scrobiculate.

This is the form resembling Ducellier's (18) illustration (fig. 23) of E. ansatum var. robustum.

Very rare. Known from a single collection in the northwest.

Distribution: Lake Co.: 84-(Q1).

Euastrum everettense Wolle var. crassum (Presc. & Scott) Jack. fa. 2

Pl. 34 fig. 2.

Measurements: TL. 106.0μ; TB. 49.0μ; BI. 18.0μ.

This plant was found growing with plants considered as typical var. crassum. It differs from var. crassum in its reduced form in lacking the undulation of the lateral margins, which is usually seen in face view and also in possessing generally broader apex. Although prominences are not visible in face view, they are seen when the cell is viewed from the top, or the side, thus in this respect the cell is similar to the type.

In checking the original drawings by Scott, the author found an illustration (No. 1051) of a plant which is similar to the one illustrated here. Scott notes indicate E. obesum var. crassum. "Proportionally not as wide as usual. Facial swelling very low. Wall scrobiculate all over." His measurements of the cell are slightly larger than mine. (L. 112μ, W. 57μ, I.18μ.)

The plant somewhat resembles E. ansatum group, but as indicated previously, that species is a smaller and delicate desmid.

Very rare.

Distribution: Lake Co.: 84-(Q1).

Euastrum evolutum West & West.

With one exception (collection locality 195) this species was only collected west of the continental divide. It is a fairly common desmid in this region, being represented by three varieties and, presently, an unnamed forma of one of these. My concept of the species would include E. quebecense Irénée-Marie as a variety, or possible just as a forma.

Euastrum evolutum West & West var. guianense (Racib.) West & West, Jour. Linn. Soc. Bot., 33: p. 292. 1898.

Pl. 37 fig. 10.

Measurements: TL. 43.0-46.0μ; TB. 28.0-30.0μ; BI. 7.0-8.5μ.

Rare.

Distribution: Flathead Co.: 27-(Mt63-458). Lake Co.: 86-188). Lincoln Co.: 1-(4184).

Euastrum evolutm West & West var. integrius West & West, Trans. Linn. Soc. Ser. II. Bot. 5, p. 224, pl. 14, fig. 23-25. 1896.

Pl. 37 fig. 13.

Measurements: TL. 52.0-59.0μ; TB. 33.5-34.5μ; BI. 7.5-9.0μ.

Very rare. Collected from a single locality in Glacier National Park.

Distribution: Flathead Co.: 29-(H.L.1).

Euastrum evolutum var. integrius West & West fa. turgidum Scott & Presc., Hydrobiologia Vol. 4: p. 581. pl. 3 figs 4,5. 1952.

Pl. 37 fig. 9

Measurements: TL. 48.0-54.0μ; TB. 34.0-35.5μ; BI. 8.0-9.0μ.

Plants most like Scott and Prescott's figure 5. I also believe that E. quebecense Irénée-Marie, is best considered as synonymous with this form or at least should be placed with this species.

Distribution: Lake Co.: 87-(Mt64-64). Lincoln Co.: 21-(Mt63-101).

Euastrum evolutum West & West var. *poriferum* (Pres. & Scott) Jackson nov. comb.

(*E. turneri* West & West var. *poriferum* Pres. & Scott, Hydrobiol.4(4) p. 392, pl. 3, fig. 6. 1952).

Pl. 37 fig. 11.

Measurements: TL. 40.0-47.0μ; TB. 26.0-30.0μ; BI. 6.0-9.0μ.

The nature of the apical lobe, with its deep linear to slightly open incision, the general slope of its margin, and the presence of two mucilage pores above the facial protuberances of the semicell, indicates that this variety is more closely related to *E. evolutum* than to *E. turneri* West and West.

This was the most often encountered variety of this species and occurred in two forms distinguished primarily on the basis of size.

Moderately rare.

Distribution: Dawson Co.: 195-(Mt64-166). Flathead Co.: 27-(Mt63-450, 451). Lake Co.:1-(4184); 87-(Mt64-64); 95-(Mt62-60). Ravalli Co.: 115-(Mt63-270).

Euastrum evolutum West & West var. *poriferum* (Pres.&Scott) Jack. fa.

Pl. 37 figs. 7,8.

Measurements: TL. 35.0-39.0μ; TB. 21.5-26.0μ; BI. 4.0-5.5μ.

Plants differing from the typical form of the variety in their smaller dimensions and reduced ornamentation. This was the most frequently collected form of the variety. Moderately rare.

Distribution: Flathead Co.: 47-(Mt63-412,414). Lake Co.: 94-(7Mon15); 95-(Mt62-60); 97-(Mt63-33). Lincoln Co.: 4-(Mt63-129); 5-(Mt63-137); 11-(Mt63-123); 20-(Mt63-91).

Euastrum gayanum de Toni, Syll. Alg. 1, p. 1075. 1889.

Pl. 36 fig. 14.

Measurements: TL. 11.5-12.0µ; TB. 11.0µ; BI. 2.7-3.0µ.

Very rare. Collected from a bog in the northwest.

Distribution; Glacier Co.: 54-(Mt62-13).

Euastrum gemmatum Bréb., in Ralfs' Brit. Desmid., p. 87, t.14, fig. 4, 1848. var. *gemmatum*.

Pl. 38 fig. 5

Measurements: TL. 50.5-58.0µ; TB. 35.7-41.5µ; BI. 8.4-12.0µ.

This species was only collected west of the continental divide. Rare.

Distribution: Flathead Co.: 27-(Mt63-450, Kidd*); 29-(H.L.1); 31- (4181, 4182, Kidd*).

Previously reported by Kidd (63) from collection localities 27 and 31.

Euastrum gemmatum Bréb. var. *alatum* Kossinskaja, Not. Syst. Sec. Cryptog. Inst. Bot. Acad. Sci. USSR, 6, 1-6, p. 43, t.1, fig. 4 1949.

Pl. 38 fig. 3.

Measurments: TL. 43.0-52.0µ; TB. 32.2-39.0µ; BI. 8.0-11.0µ.

Encountered more frequently than var. *gemmatum*, but only collected west of the continental divide.

Distribution: Flathead Co.: 27-(Mon25); 31-(4183; (Kidd*). Granite Co.: 126-(6Mon42); 127-(6Mon41). Lincoln Co.; 15-(Mt62-28).

Euastrum humerosum Ralfs, Brit. Desmid., p. 82, t. 13, fig. 2. 1848.

Pl. 33 fig. 3.

Measurements: TL. 120-144.0µ; TB. 70.5-76.0µ; BI. 17.5-23.0µ.

This is a rather rare species, only collected in the northwest. Only a few specimens were seen.

Distribution: Flathead Co.: 31-(4181). Lake Co.: 85-(Mt63-47); 86-(Mt63-187, Sieminska*).

Previously reported by Sieminska (65) for collection locality 86.

Euastrum insulare (Wittr.) Roy

This was a very commonly collected species in western Montana, sometimes gathered in abundance. However, the vast majority of the collecting sites are in the northwest. In addition to the typical form three varieties were encountered.

Euastrum insulare (Wittr.) Roy, Scott. Naturalist. 1877. var. insulare.

Pl. 36 fig. 6.

Measurements: TL. 20.0-21.0μ; TB. 13.0-13.5μ; BI. 4.0-4.5μ.

The typical form was very rare in the author's collections, being known from a single locality (A bog 6800 feet) in the northwest.

Distribution: Missoula Co.: 100-(Mt63-419).

Euastrum insulare (Wittr.) Roy var. basichondrum Messikomer, Hedwigia, 78: p. 162, t. 2. figs. 14,15. 1938.

Pl. 36 fig. 11.

Measurements: TL. 30.0-34.5μ; TB. 21.0-24.5μ; BI. 5.0-6.5μ.

Cell walls sometimes distinctly punctate, other times not so. Moderately rare. Known only from the northwest.

Distribution: Granite Co.: 128-(Mt63-385). Flathead Co.: 23-(Mt63-399); 47-(Mt63-412). Lincoln Co.: 4-(Mt63-130). Sanders Co.: 76-(Mt63-159).

Euastrum insulare (Wttr.) Roy var. lacustre (Messik.) Krieger, Desmid. in Rabenhorst. Krypto-Fl. 13(1), Leif. 4, p. 556, t. 76, figs. 15-18. 1937.

Pl. 36 fig. 12.

Measurements: TL. 29.0-33.5μ; TB. 20.0-23.5μ; BI. 4.57.0μ.

Cells with wall sometimes coarsely punctate, other times appearing smooth.

This variety is moderately rare and is present in both the northern and southern montane.

Distribution: Deer Lodge Co.: 129-(Mt63-384). Flathead Co: 23-(Mt63-399) 47-(Mt63-412). Gallatin Co.: 140-(Mt64-130). Glacier Co.: 54-(Mt62-15) Granite Co.: 128-(Mt63-385). Lake Co.: 87-(Mt64-66). Lincoln Co.: 20-(Mt63-90); 21-(Mt63-103).

Euastrum insulare (Wittr.) Roy var. silesiacum Grönbl., Soc. Scient. Fenn. Comm. Biol. 2,5, p. 13, t. 1. fig. 26, 27. 1927.

Pl. 6 fig. 7.

Measurements: TL. 19.0-24.0μ; TB. 14.0-16.5μ; BI. 3.3-5.0μ.

This was the most frequently collected form of the species, sometimes gathered in large numbers. However, it was only found west of the continental divide. Common.

Distribution: Flathead Co.: 27-(Mt63-451, Mon 25); 29-(H.L.1). Lake Co.: 81-(Mt63-206); 82-(Mt63-209); 84-(X8); 87-(Mt64-64); 88.-(Mt63-197); 89-(Mt63-388); 95-(Mt62-58). Lincoln Co.: 1-(4184); 9-(Mt63-154); 10-(Mt63-156); 15-(Mt62-27). Ravalli Co.: 111-(Mt63-248); 112-(Mt 63-261); 115-(Mt 63-274). Sanders Co.: 72-(Mt63-163); 74-(Mt63-171).

Euastrum prescottii sp. nov.

Pl. 36 fig. 4.

Measurements: TL. 17.0-19.0μ; TB. 13.5-16.0μ; BI. 6.2-7.0μ; T. 10.5-11.5μ.

Cells minute, 1-1.2 times longer than broad, sinus widely open but narrowed toward the isthmus; semicells three-lobed, basal angles sub-acutely rounded, upper part of the lateral margins concave; apex broad and retuse-emarginate in the middle. Side view of semicell quadrate-pyramidate, basal angles broadly rounded, apex trilobulate. Vertical view rhomboid-rectangular, angles rounded, poles bilobulate, prominent protuberance at the middle on each side, a small swelling between protuberance and polar angles, or side margins concave, polar lobe trilobulate at both ends.

Cell wall appearing smooth, but after staining a linear series (4) of pores visible on face.

Very rare. Known from a single locality in Glacier National Park.
Distribution: Flathead Co.: 28-(Mt63-500).

Euastrum luetkemulleri Ducell, Bull. Soc. Bot. Genève, 2 ser. 10, p. 134, fig. 123, 1918. var. *luetkemulleri*.

Pl. 36 fig. 15.

Measurements: TL. 19.5-21.5μ; TB. 13.5-14.0μ; BI. 4.5-5.0μ.

Very rare. Known from a bog in Glacier National Park.
Distribution: Glacier Co.: 54-(Mt62-11).

Euastrum luetkemulleri Ducell., var. *carniolicum* (Lütk.) Krieger, Desmid.in Rabenhorst Krypto.-Fl. 13(1) Leif 4, p. 561, t. 80, fig. 5-7. 1937.

Pl. 36 fig. 10.

Measurements: TL. 24.5-26.0μ; TB. 16.0-18.0μ; BI. 5.0-6.9μ.

Very rare. This variety was encountered in a collection from a bog in Glacier National Park, occuring along with the typical form.
Distribution; Glacier Co.: 54-(Mt62-11).

Euastrum montanum West & West. Proc. Trans. Bot. Soc. Edinb. 23, p. 14, t. 1, fig. 11. 1905.

Pl. 36 fig. 2,3.

Measurements: TL. 23.0-24.0μ; TB. 17.5-18.0μ; BI. 5.0-6.0μ.

Very rare. Known from *Sphagnum* "squeezings" and plankton of a high altitude (6600 feet) oligotrophic lake west of the continental divide.
Distribution: Ravalli Co.: 112-(Mt63-257, 261.)

Euastrum obesum Josh., Journ. Linn. Soc. London Bot. 21, p. 638. t. 23, fig. 19, 20. 1886. var. *obesum*.

Pl. 34 fig. 3.

Measurements: TL. 96.0μ; TB. 49.0μ; 17.8μ.

Very rare. Known to the author from a single collection taken from a lake in Glacier National Park.
Distribution: Glacier Co.: 63-(Mt63-218).

Previously reported by Sieminska (65) for collection locality 86. however not found there by the author.

Euastrum oblongum (Grev.) Ralfs, Brit. Desmid., p. 80, t. 12, fig. 2-g. 1848. var. *oblongum*.

Pl. 33 figs. 2,4.

Measurements: TL. 138.0-174.0μ; TB. 69.0-86.0μ; BI. 23.0-29.0μ.

This species was only collected in western Montana, primarily west of the continental divide, where it is of common occurrence.
Distribution: Beaverhead Co.: 134-(Mt63-319,324); 135-(Mt63-331). Flathead Co.: 22-(6Mon31). 24-(Mt63-406); 27-(Mon 25 , Mt63-450); 31-(4182).

39-(Mt63-77,80). Granite Co.: 127-(6Mon41); 128-(Mt63-386). Lake Co.: 81-(Mt63-207); 84-(C3); 85-(Mt63-47); 86-(Mt63-187); 88-(Mt63-197); 95-(Mt62-58). Lincoln Co.: 10-(Mt63-157); 14-(Mt63-76). Ravalli Co.: 115-(Mt63-270); 119-(Mt63-305). Sanders Co.: 76-(Mt63-193).

Euastrum pectinatum Bréb. var. brachylobum Wittr. Bih. till K. Sv. Vet.-Akad. Handl. 1, p. 48, t. 4. fig. 5. 1872.

Pl. 35 fig. 5.

Measurements: TL. 68.0-70.0μ; TB. 44.0-45.0μ; BI. 11.0-14.0μ;

Cells intergrading into E. pectinatum var. rostratum Taylor.

Very rare. Encountered by the writer only in the northwest.

Distribution: Flathead Co.: 23-(Mt63-399). Granite Co.: 126-(6Mon43).

Euastrum pectinatum Bréb. var. rostratum Taylor, Mich. Acad. of Sci. Arts and Letters, vol. 20, p. 206, pl. 41, fig. 4, 1934.

Pl. 35 fig. 4.

Measurements: TL. 54.0-65.0μ; TB. 41.0-43.5μ; BI. 11.0-12.5μ.

Rare;collected only west of the continental divide.

Distribution: Flathead Co.: 28-(Mt63-500); 29-(H.L.1); 35-(Mt63-93). Lincoln Co.: 19-(Mt63-111).

Euastrum pectinatum Bréb. var. rostratum Taylor fa.

Pl. 35 fig. 3.

Measurements: TL. 620u; TB. 42.0μ; BI. 9.75μ.

Cells differing from the typical form of the variety by possessing a ring of granules (probably hardened mucilage) at the apex and by having the semicell walls coarsely punctate.

Very rare.

Distribution: Lincoln Co.: 19-(Mt63-111).

Euastrum sibiricum Boldt, Öfver. K. Sv. Vet.-Akad. Förhandl. 42(2): p. 99, t. 5. fig. 2.1885.

Pl. 36 fig. 16.

Measurements: TL. 19.0-20 μ; TB. 15.5-16.0μ; BI. 2.5-2.0μ.

Very rare. Known to the author from localities in the northwest.

Distribution: Lake Co.: 86-(Mt63-188). Lincoln Co.: 1-(4184).

Euastrum sinuosum Lenorm.

Although this species is represented by four varieties in Montana, none occur in any abundance. Known only from the northwest.

Euastrum sinuosum Lenorm. in Ralfs' Brit. Desmid., p. 85. 1848. var. *sinuosum* f. *sinuosum*.

Pl. 31 fig. 6.

Measurements: TL. 70.0-71.0μ; TB. 40.5-41.0μ; BI. 12.0-12.5μ.

Distribution: Flathead Co.: 28-(Mt63-445).

Euastrum sinuosum Lenorm. var. *sinuosum* f. *scrobiculatum* Nordst. Acta. Univ. Lund. vol. 9, p. 9. 1873.

Pl. 31 fig. 7.

Measurements: TL. 70.5-72.0μ; TB. 40.5-42.0μ; BI. 12.5-13.0μ.

Although this forma was only collected from one site, it was gathered in greater abundance than any other form of this species. It occurs along with the typical form and intergrades with it.

Distribution: Flathead Co.: 28-(Mt63-444,445, 500).

Euastrum sinuosum Lenorm. var. *aboense* (Elfr.) Cedergr. Ark. f. Bot., 25, A. p. 35. 1932.

Pl. 31 fig. 5.

Measurements: TL. 56.0-62-5μ; TB. 35.5-38.5μ; BI. 11.0-13.0μ.

Very rare.

Distribution: Missoula Co.: 100-(Mt63-419).

Euastrum sinuosum Lenorm. var. reductum West and West, Journ. Bot., 35, p. 83. 1897.

Pl. 31 fig. 4

Measurements: TL. 64.0-66.5μ; TB. 40.0-43.0μ; BI. 14.0μ.

Very rare.

Distribution: Lake Co.: 86-(Mt63-187, Y1, Sieminska*).

Previously reported by Sieminska (65) for this same locality.

Euastrum turneri West, Jour. Linn. Soc. Bot., 29, p. 141, t. 20, fig. 18. 1892. var. turneri.

Pl. 37 fig. 5.

Measurements: TL. 38.0-40.0μ; TB. 27.0-28.0μ; BI. 8.0-9.0μ.

Rare. Known to the author solely from collection taken west of the continental divide.

Distribution: Lake Co.: 82-(Mt63-201); 84-(X8); 86-(Mt63-188).

Euastrum turneri West, fa.

Pl. 37 fig. 6.

Measurements: TL. 27.0-30.0μ; TB. 19.-23.0μ; BI. 5.5-6.0μ.

Plants differing from the type by their smaller dimensions.

Distribution: Granite Co.: 127-(6Mon41). Ravalli Co.: 112-(Mt63-257).

Euastrum validum West & West, Trans. Linn. Soc. Bot. ser. 2,5, p. 245, t. 14, fig. 32,33. 1896.

Pl. 36 fig. 1

Measurements: TL. 25.0-26.0μ; TB. 16.0-18.0μ; BI. 4.5-5.0μ.

Very rare. Collected from the northwest and only few specimens observed.

Distribution: Lake Co.: 84-(Q1, X8); 86-(Mt63-188).

Euastrum verrucosum Ehrenb.

This species was one of the most common Euastra collected, and although almost exclusively restricted to the western Montane, it was also found in the northeast. It exhibits considerable morphological variation, being represented in the desmid flora by five varieties in addition to the typical form, and by a number of forma, one of which is new to science. One plant has simply been entered as belonging to the species.

Euastrum verrucosum Ehrenb.,in Ralfs' Brit. Desmid.,p. 79, t. 11, fig. 2, 1848. var. verrucosum.

Pl. 39 fig. 1.

Measurements: TL. 101.0-11.0μ; TB. 92.0-104.0μ; BI. 22.0-25.0μ.

The typical form was collected in the northwest as well as the northeast. It is represented in the collection by two forms which differ in dimensions and most important, in the nature of the sinus. The plants listed here have a linear sinus. Rare.

Distribution: Flathead Co.: 31-(4181); Ravalli Co.: 112-(Mt63-260). Sheridan Co.: 188-(Mt63-20).

Euastrum verrucosum Ehrenb. var. verrucosum morpha.

Pl. 39 fig. 2.

Measurements: TL. 112.0-126.0μ; TB. 93.5-112.0μ; BI.22.5-24.0μ. I. 44.0-72.0μ.

Differing from the typical (above) by its generally larger dimensions and by its sinus which is open, or half linear and half open.

Distribution: Flathead Co.: 37-(Mt63-84). Lincoln Co.: 19-(Mt63-111).

Euastrum verrucosum Ehrenb. var. *alatum* Wolle, Desmids of the United States and list. of American *Pediastrum*, Bethlehem, Pa., p. 101, t. 20, fig. 4. 1184 f. *alatum*.

Pl. 40 figs. 5,7.

Measurements: TL. 80.0-96.0μ; TB. 72.0-82.0μ; BI. 18.0-21.0μ.

This variety is well represented in the author's collections. It was encountered in both the northern and southern montane regions and in three formae in addition to the typical form, one of which is believed new.

Distribution: Beaverhead Co.: 133-(Mt63-316). Flathead Co.: 22-(6Mon4) Lake Co.: 86-(Sieminska*); 91-(Schindler*). Lincoln Co.: 21-(Mt63-97). Ravalli Co.: 115-(Mt63-265). Sanders Co.: 71-(Mt63-164).

Previously reported by Schindler (54) from collection locality 91 and by Sieminska (65) for 86.

Euastrum verrucosum Ehrenb. var. *alatum* Wolle forma *alpinum* Huber-Pest., Arch. f. Hydrobiol., 12, H. 3, p. 429, text. fig. 14. 1931.

Pl. 40 fig. 3.

Measurements: TL. 96.0-103.0μ; TB. 75.0-81.0μ; BI. 20.5-22.0μ.

The convex nature of the upper portion of the basal lobes indicates, I believe, that the plant would be more properly placed as a forma of var. *subalatum* Huber-Pest., than listed here, but, until the genus undergoes a revision, I shall follow the original author's interpretation.

Distribution: Lake Co.: 86-(Mt63-187).

Euastrum verrucosum Ehrenb. var. alatum Wolle fa. cyclops fa. nov.

Pl. 40 fig. 4.

Measurements: TL. 79.0-86.0μ; TB. 66.0-71.0μ; BI. 18.0-22.0μ; T. 37.5-45.0μ.

Plants differing from the typical form of the varieties in its smaller diemnsions and larger facial protuberance in proportion to size of the semicell.

Very rare. Collected only in Glacier National Park.

Distribution: Flathead Co.: 24-(Mt63-411); 25-(Mt63-407).

Euastrum verrucosum Ehrenb. var. alatum Wolle fa. extensum Presc. & Scott, Hydrobiol. vol. 4(4): p. 394, pl. II, fig. 6. 1952.

Pl. 39 fig. 3; Pl. 40 fig. 6.

Measurements: TL. 103-106.0μ; TB. 97.0-102.0μ; BI. 21.0-23.5μ.

Cells larger than the original described plant.

Rare.

Distribution: Beaverhead Co.: 133-(Mt63-314). Flathead Co.: 27-(Mon 25). Lincoln Co.: 12-(Mt63-68).

Euastrum verrucosum Ehrenb. var. reductum Nordst., Acta Univ. Lund. 16, p. 9, t. 1, fig. 14. 1880.

Pl. 41 figs. 2,3.

Measurements: TL. 94.0-100.0μ; TB. 76.0-84.0μ; BI. 22.05-23.5μ.

This very rare plant was collected from two widely separated sites, one small roadside pond, in south-central Montana, the other a lake in the northeast corner of the state.

Very rare.

Distribution: Gallatin Co.: 141-(Mt64-126). Sheridan Co.: 188-(Mt63-16,17,18,19).

Euastrum verrucosum Ehrenb. var. rhomboideum Lund. fa. pterygoideum Huber-Pest., Arch. f. hydrobiol. 22, p. 444, text fig. 37. 1931.

Pl. 39 fig. 4.

Measurements: TL. 114.0-128.0µ; TB. 116.0-124.0µ; BI. 23.0-25.5µ.

Very rare.

Distribution: Flathead Co.: 31-(4181).

Euastrum verrucosum Ehrenb. var. schoenavii Kaiser, Krypt. Forsch. Bayer. Bot. Ges. 1(4), , p. 221, text fig. 9. 1919.

pl. 41 fig. 4.

Measurements: TL. 95.0-100.0µ; TB. 67.0-71.0µ; BI. 22.0-23.5µ.

The Montana plants, in side view, agree well with Kaiser's illustration and fairly well in the apical view. However, in face view my plants possess a linear sinus while Krieger's (37) figure (t. 96, fig. 3) of the variety indicates a sinus which is at least halfway open.

Very rare. Known from a lake in the northeast corner of the state.

Distribution: Sheridan Co.: 188-(Mt63-17).

Euastrum verrucosum Ehrenb. var. subalatum Huber-Pest., Arch f. Hydrobiol. 22, p. 431, text fig. 17. 1931.

Pl. 40 figs. 1,2.

Measurements: TL. 82.0-102.0µ; TB. 65.0-86.0µ; BI. 19.0-24.0µ.

Primarily collected west of the continental divide where it is of moderate occurrence.

Distribution: Beaverhead Co.: 135-(Mt63-339). Flathead Co.: 31-(4181).

Lake Co.: 86-(Mt62-80, Sieminska*); 88-(Mt63-197); 95-(Mt62-59). Lincoln Co.: 9-(Mt63-154). Sanders Co.: 74-(Mt63-171); 76-(Mt63-176).

Previously reported by Sieminska (65) for collection locality 86.

Euastrum varrucosum Ehrenb. fa.

Pl. 41 fig. 1.

Measurements: TL. 64.0µ; TB. 54.0µ; BI. 20.0µ.

This plant has the general shape of *E. verrucosum*. However, it is completely devoid of granules or decorated protuberances. Only a single specimen was seen, so it was believed best simply to enter the plant as belonging to the species.

Distribution: Sheridan Co.: 188-(Mt63-19).

Euastrum sp. 1.

Pl. 36 fig. 13.

Measurements: TL. 17.5-18.0µ; TB. 11.0-12.0µ; BI. 3.0-4.0µ.

Cells minute, approximately 1.5 times as long as broad, deeply constricted; sinus linear; semicells truncate pyramidate, three-lobed; polar lobe broad, retuse-emarginate in the middle, angles acutely rounded; lateral lobes, low; basal lobe angles somewhat angular to rounded. Side view of semicell ovate. Vertical view elliptical.

Plants closest to *E. insulare* but like the distinctly exerted apical lobe present in that species.

Very rare.

Distribution: Lake Co.: 86-(Mt62-72).

Euastrum sp. 2.

Pl. 31 fig. 1

Measurements: TL. 43.0μ; TB. 23.5μ; BI. 9.0μ.

This very rare plant was collected only once, and is considered a monstrosity presently defying a sensible written description.

Collected from a high altitude (6800) bog.

Distribution: Missoula Co.: 100-(Mt63-419).

9. *Micrasterias* Agarh, 1827.

The genus *Micrasterias* was only encountered in collections from western Montana, these almost entirely from the northwest. Thirty- five taxa were identified, representing twenty species. Eight additional unnamed forms were also found. Thus, it is the fifth largest genus qualitatively. Although possessing a greater number of taxa, and known from a greater number of collection localities, the genus has a smaller distributional range than such genera as *Gonatozygon* and *Pleurotaenium*, which are of lesser importance in these respects (see map no. 23). It should be mentioned here, however, that *Pleurotaenium* was more abundant in numbers of individuals encountered. *Micrasterias* was more frequently observed by the author (qualitatively and quantitatively) in collections from ponds at lower elevations (at or below 3800 feet) than in any other aquatic habitat.

Micrasterias americana (Ehrenb.) Ralfs

Micrasterias americana appeared in collections from both the northern and southern montane. It was, however, encountered but once in the south, while being of moderate occurrence in the north.

The specimens studied are placed below in three groups which one may consider as: the typical form (var. *americana*); a form of the typical; and a form of var. *boldtii* Gutw. Or, one may look upon these groups as representing: the typical form; a variety of the species, and finally a reduced form of that variety. This latter form possesses the basic morphological characteristics of an existing variety of the species, namely var. boldtii. The interpretation, of course, is dependent upon which characteristics one considers significant and uses in segregating the taxa.

I believe there is a distinct variety in addition to the typical form, and a reduced form of that variety.

Micrasterias americana (Ehrenb.) Ralfs, Brit. Desmid., p. XIX, 1848. var. *americana*.

Pl. 46 fig. 3, pl. 47 fig. 1.

Measurements: TL. 162-180.0μ; TB. 132.0-135.0μ; BI. 31.0-32.0μ; BPL. 71.0-80.0μ.

This plant was the largest form encountered by the author.

Rare. Known only from collections obtained from west of the continental divide.

Distribution: Flathead Co.: 30-(Kidd*). Ravalli Co.: 118-(Mt63-300); 119-(Mt63-302).

Previously reported by Kidd (63) for collection locality 30.

Micrasterias americana (= new variety?).

Pl. 47 figs. 2-7.

Measurements: TL. 128.0-156.0μ; TB. 105.0-137.0μ; BI. 22.5-27.0μ; BPL. 55.0-69.0μ.

Cells of moderate size, a little longer than broad, deeply constricted, sinus open or rarely partially closed; semicells five-lobed; polar lobe cunnate (fig. 6), or subquadrate at base and then dilated toward the upper half (Figs. 3-7) with angles produced into diverging processes which may be denticulate along their upper margin (fig. 6), a pair of smaller, asymmetrically disposed, accessory processes present; incisions between polar and superior lobes open; lateral lobes equal-subequal, incisions between superior and inferior lateral lobes, shallow and usually widely open; superior lateral lobes divided into two lobules (figs. 3,4) with inner margins denticulate, or four lobules (figs. 2, 7), the two proximal lobules smaller than the distal ones. Cell wall with scattered acute granules; usually one, rarely two, rows of larger acute granules along each side of sinus; papilla generally present on central protuberance above isthmus, additional papillate protuberances may be developed on either side of central protuberance (fig. 7); pair of papillae at base of incisions between superior and polar lobes.

The above description is based solely on material seen by the author.

This plant is not new to science, being previously reported by Irénée-Marie (39), Prescott and Scott (42), and Taft (31) but entered as var. americana or form thereof. Brook's (57) and Prescott and Scott's (42) plants listed under M. mahabuleshwarensis Hobs. var. dichotoma Smith, are probably also the same. The Montana plants are most like Irenee-Marie's, from Canada.

The plants are separated from the typical form by their more slender polar processes, and the more elaborate ornamentation of the semicells, the paired papillae at the base of the polar incisions being a most characteristic and constant feature. The plants are generally, also smaller.

Smith (24) indicates that two prominent spines, placed as above, are quite characteristic of all specimens of the species (typical form) he had observed. However, these are papillae, or, at least very large acute granules. Furthermore, the plants considered the typical are generally larger, more robust (Compare fig. 3, pl. 46, and fig. 1, pl. 47), and not as ornate.

Because this is a previously known entity, and one of considerable variability, the author believed it best to merely enter the plants as belonging to the species, until such a time as the author can consult other phycologist.

This was the most commonly encountered form of the species. Collected in both the northern and southern montane region.

Distribution: Beaverhead Co.: 135-(Mt63-330, 339, 340). Flathead Co.: 27-(Mt63-451). Lake Co.: 81-(Mt63-206). Lincoln Co.: 12-(Mt63-67). Missoula Co.: 102-(Mt62-5). Sanders Co.: 74-(Mt63-171); 76-(Mt63-176).

Micrasterias americana (=Micrasterias americana var. boldtii Gutw.?)

Pl. 46 figs. 4,5.

Measurements: TL. 118.0-130.0µ; TB. 100.0-102.0µ; BI. 21.0-24.5µ; BPL. 55.0-61.0µ.

As previously indicated under the general discussion of this species, these plants have the basic morphological characteristics of var. boldtii (reduced form). They differ from it in possessing the paired papillae at the base of the polar incisions. Consequently, I believe they are reduced forms of the plants listed above, and not a reduced form of the typical

Very rare. Whereas, other forms M. americana, were generally collected at elevation at or below 3800 feet, this form was gathered from two localities, one at 5280 feet, the other 7000 feet.

Distribution: Granite Co.: 127-(6Mon38). Lake Co.: 86-(Mt62-77).

Micrasterias brachyptera Lund., Nova, Acta Reg. Soc. Scient. Upsala, ser. 3,8, p. 12, t. 1, fig. 4 1871. var. brachyptera.

Pl. 49 fig. 4.

Measurements: TL. 206.0-210.0μ; TB. 145.0-150.0μ; BI. 30.0-32.0μ; BPL. 55.0-60.0μ.

This was a very rare species in the collections, being known from only two localities in the northwest. Two forms were encountered. The one listed first is considered identical to the type. The other, is simply entered as an unnamed forma. The forma differs in possessing a less inflated polar lobe; a lesser number of lobulations; an open sinus and coarser spines.

Distribution: Lake Co.: 84-(Q1).

Micrasterias brachyptera Lund. fa.

Pl. 49 fig. 2.

Measurements: TL. 184.0-190.0μ; TL. 155.0-160.0μ; BI. 31.0μ; BPL. 45.0-57.0μ.

Distribution: Flathead Co.: 28-(Mt63-446).

Micrasterias conferta Lund., Nova Acta Reg. Soc. Sceint. Upsala, ser. 3,8, p. 14, t. 1, fig.5. 1871.

Pl. 48 fig. 1,2.

Measurements: TL. 95.0-98.0μ; TB. 82.0-90.0μ; BI. 24.5-26.0μ; BPL. 43.0-46.0μ.

Very rare. Collected from a high altitude lake (6600 feet) west of the continental divide.

Distribution: Ravalli Co.: 112-(Mt63-258,260).

Micrasterias crux-melitensi (Ehrenb.) Hass., in Ralfs' Brit. Desmid., p. 73, t. 9, fig. 3, 1848. var. crux-melitensi.

Pl. 44 figs. 1,3.

Measurements: TL. 110.4-138.0μ; TB. 108.0-125.0μ; BI. 14.0-20.0μ; BPL. 42.0-52.0μ.

One of the more frequently collected species of Micrasterias but only known to the author from the northwest. It was gathered from a variety of lentic habitats (bog, lake, pond, etc.) which were at or below 4000 feet. Moderately rare.

Distribution: Flathead Co.: 22-(6Mon32); 23-(Mt63-400). Lake Co.: 87-(Mt64-64); 94-(7Mon15); 97-(Mt63-33). Lincoln Co.: 2-(Mt63-142); 6-(Mt63-146); 12-(Mt63-67); 19-(Mt63-111).

Micrasterias crux-melitensi (Ehrenb.) Hass., var. crux-melitensi fa.

Pl. 44 fig. 2.

Measurements: TL. 128.0μ; TB. 119.0μ; BI. 19.0μ; BPL. 45.0μ.

Differing from the type in the appearance of the apical lobe and the greater number of lobulations of the superior lateral lobes. Collected along with the typical form. Very rare.

Distribution: Lincoln Co.: 2-(Mt63-142).

Micrasterias decemdentata (Naeg.) Arch. in Pritchard Hist. of Inf. ed. 4, p. 726. 1861. fa.

Pl. 44 fig. 4.

Measurements: TL. 67.5-71.5μ; TB. 69.0-70.0μ; BI. 19.5-20.0μ. BPL. 48.0-50.0μ.

Very rare. Only two specimens seen.

Distribution: Flathead Co.: 31-(4183).

Micrasterias denticulata Breb. var. angulosa (Hantzsch.) West & West, Trans. Roy. Irish Acad. 32, sect. B(1): p.30. 1902.

Pl. 55 fig. 1.

Measurements: TL. 170.0-174.0μ; TB. 212.0-215.0μ; BI. 34.0-36.0μ; BPL. 57.0-60.0μ.

Very rare. See comments under M. verrucosa Roy.

Distribution: Glacier Co.: 54-(2Mon8), 64-(Mt61-2).

Micrasterias depauperata Nordst. var. kitchelii (Wolle) West & West, Trans. Linn. Soc. of Lond. sec.ser. Bot.5(5): p.239. 1896.

Pl. 44 fig. 6.

Measurements: TL. 136.0-140.0μ; TB. 140.0-150.0μ; BI. 19.0-20.0μ; BPL. 90.0-105.0μ.

Very rare. Known to the writer only from the plankton of a high altitude (6600 feet) oligotrophic lake in the northwest.

Distribution: Ravalli Co.: 112-(Mt63-260).

Micrasterias fimbriata Ralfs, Brit. Desmid., p.71, t.8, fig.2. 1848. var. fimbriata fa. fimbriata.

Pl. 49 fig. 1.

Measurements: TL. 228.0-234.0μ; TB. 205.0-209.0μ; BI. 20.0-30.0μ; BPL. 48.0-50.0μ.

This species was collected in two forms of which the typical form was by far the rarer.

Distribution: Flathead Co.: 29-(H.L.1). Lake Co.: 84 (Q1).

Micrasterias fimbriata Ralfs var. *fimbriata* fa. *spinosa* (Bissett) Croasd, Trans. Amer. Micro. Soc. 75(1); p. 8, pl. 2, fig. 5. 1956.

Pl. 49 fig. 3,6.

Measurements: TL. 227.0-265.0μ; TB. 192.0-222.0μ; BI. 26.0-31.0μ; BPL. 47.0-61.5μ.

Moderately rare.

Distribution: Galcier Co.: 54 -(Mt62-18). Lake Co.: 82-(Mt63-199); 83-(Mt63-102). Lincoln Co.: 15-(Mt62-26); 19-(Mt63-109). Ravalli Co.: 11-(Mt63-249); 112-(Mt63-260).

Micrasterias fimbriata Ralfs var. *fimbriata* fa. *spinosa* (Bissett) Croasd., morpha.

Pl. 49 fig. 5.

Measurements: TL. 210.0-220.0μ; TB. 191.0μ; BI. 26.0μ; BPL. 47.0-48.0μ.

Differing in the reduced number of body spines.

Distribution: Lincoln Co.: 19-(Mt63-109).

Micrasterias jenneri Ralfs, Brit. Desmid., p. 76, t. 11, fig. 1. 1848.

Pl. 46 fig. 1,2.

Measurements: TL. 117.0-138.0μ; TB. 94.5-107.0μ; BI. 24.0-27.0μ; BPL. 62.0-66.0μ.

Very rare. Known only from a single locality (bog) in the northwest.

Distribution: Granite Co.: 127-(6Mon38).

Micrasterias laticeps Nordst., Vidensk. Medd. f.d. naturk. Foren i Kjobenhavn. No. 14-15 p. 220, t.2, fig. 14, 1870. var. *laticeps*.

Pl. 42 figs. 10,11.

Measurements: TL. 132.0-144.0μ; TB. 149.0-185.0μ; BI. 20.0-24.0μ; BPL. 131.0-176.0μ.

Moderately rare. Known only from west of the continental divide. Distribution: Flathead Co.: 29-(H.L.1); 31-(4181, Kidd*). Lake Co.: 82-(Mt63-199): 83-(Mt63-202). Lincoln Co.: 10-(Mt63-155).

Previously reported by Kidd (63) from collection locality 31.

Micrasterias laticeps Nordst. var. crassa Presc., Pap. Mich. Acad. of Sci. Arts and Letters, 20, p. 166, pl. 25, fig. 7. 1935.

Pl. 42 fig. 9.

Measurements: TL. 110-114.0μ; TB. 133.0μ; BI. 20.0μ.

Very rare. Collected once, from the northwest. Distribution: Flathead Co.: 31-(4181).

Micrasterias muricata (Bailey) Ralfs, Brit. Desmid., p. 210. 1848.

Pl. 44 fig. 5.

Measurements: TL. 175.0-202.0μ; TB. 122.0-133μ; BI. 24.0-24.5μ; BPL. 87.0-102.0μ.

Very rare. Known to author from a single plankton collection from a high altitude (6600 feet) oligotrophic lake in the northwest. Distribution: Ravalli Co.: 112-(Mt63-260).

Micrasterias papillifera Bréb., in Ralfs' Brit. Desmid., p. 72, t. 9 fig. 1, 1848. var. papillifera.

Pl. 48 figs. 4,6.

Measurements: TL. 130.0-146.0μ; TB. 119.0-123.0μ; BI. 19.0-21.5μ; BPL. 32.0-39.0μ.

This species was one of the few collected in both the northern and southern Montane. In addition to var. papillifera, var. spinosa (Wolle)

Krieger, was also gathered, the latter being encountered more frequently. Very rare.

Distribution: Flathead Co.: 31-(4181). Lincoln Co.: 9-(Mt63-154).

Micrasterias papillifera Bréb. var. speciosa (Wolle) Krieger, Desmid. in Rabenhorst's, Krypto.-Flo. 13(2); p. 90. t. 130, fig. 3. 1939.

Pl. 48 figs. 3,5.

Measurements: TL. 142.0-158.0μ; TB. 125.0-136.0μ; BI. 17.0-20.0μ; BPL. 37.0-46.5μ.

Krieger and Bourrelly (56) transferred this variety to M. novae-terrae (Cushm) Krieger. However, I believe the plant is properly placed with M, papillifera and have retained it here.

Rare.

Distribution: Beaverhead Co.: 135-(Mt63-339). Flathead Co.: 27-(Mt63-451.) Glacier Co.: 63-(Mt63-218). Ravalli Co.: 119-(Mt63-304).

Micrasterias pinnatifida (Kuetz.) Ralfs, Brit. Desmid., p. 77, t. 10, fig. 3, 1848, var. pinnatifida.

Pl. 42 figs. 1-5.

Measurements: TL. 60.5-75.0μ; TB. 61.0-83.5μ; BI. 10.5-19.0μ; BPL. 36.0-61.0μ.

Although this plant is only known from the northwest it was one of the more frequently encountered species of the genus. In addition to the typical form, one variety was collected, but it was of much rarer occurrence.

Distribution: Flathead Co.: 29-(H.L.1); 31-(Kidd*). Glacier Co. 54-(Mt62-23). Lake Co.: 84(Q1); 86-(Mt62-80); 87-(Mt64-64). Lincoln Co.: 2-(Mt63-141); 19-(Mt63-110-111). Sanders Co.: 76-(Mt63-191).

Previously reported by Kidd (63) for collection locality 31.

Micrasterias pinnatifida (Kuetz.) Ralfs var. *pseudoscitans* Grönbl. Act. Soc. Fauna, Fl. Fenn. 47(4):p.36, t. 6, fig. 7,8. 1920.

Pl. 42 figs. 6,7.

Measurements: TL. 63.0-70.0μ; TB. 71.0-73.0μ; BI. 12.0-15.0μ; BPL. 46.0-52.0μ.

Very rare. Known to the author from two localities in the northwest.

Distribution: Flathead Co.: 23-(Mt63-399); 31-(4181). Lake Co.: 86-(Sieminska*).

Previously reported by Sieminska (65) from collection locality 86 but not found there by the author.

Micrasterias pinnatifida (Kuetz.) Ralfs var. *pseudoscitans* Grönb. fa.

Pl. 42 fig. 8.

Measurements: TL. 80.0μ; TB. 88.0μ; BI. 13.0μ; BPL. 57.0-60.0μ.

Plant differing by its more inflated basal lobes and more convex polar lobe. Collected along with the usual form of the variety.

Distribution: Flathead Co.: 31-(4181).

Micrasterias radians Turn., K. Sv. Vet.-Akad. Handl. 25(5)p. 92, t. 5, fig. 62. 1892. var. *radians*

Pl. 45 fig. 1.

Measurements: TL. 126.0μ; TB. 119.0μ; BI. 16.0μ; BPL. 52.0μ.

This plant appears to be similar to that illustrated by Krieger (39) as similar to the type on plate 115, fig. 8. However, it also resembles *M.crux-melitensis*, but differs from that species in having the base of the polar lobe narrower and with longer diverging processes and by possessing much longer and more slender lobules.

Very rare.

Distribution: Lincoln Co.: 15-(Mt62-28).

Micrasterias radiata Hass., Hist. Brit. Freshw. Alg. London, p. 386. t. 90, fig. 2, 1845. var. radiata

Pl. 45 fig. 2.

Measurements: TL. 144-182.0μ; TB. 131.0-164.0μ; BI. 19.5-24.0μ; BPL. 65.0-82.0μ.

This species was collected only west of the continental divide where it is moderately rare. In addition to the typical form one variety was found.

Distribution: Flathead Co.: 27-(Mon 25); 31-(Kidd*). Glacier Co.: 54-(Mt62-11). Lake Co.: 84-(X8); 95-(Mt62-59). Lincoln Co.: 10-(Mt63-157); 15-(Mt62-28). Sanders Co.: 76-(Mt63-176).

Previously reported by Kidd (63) for collecting locality 31.

Micrasterias radiata Hass. var. pseudorux Grönbl., Acta Soc. Fauna. Fl. Fenn. 47, p. 37, t. 6. fig. 12-14. 1920.

Pl. 45 fig. 3.

Measurements: TL. 154.0μ; TB. 137.0μ; BI. 21.0μ; BPL. 70.0μ.

Very rare. Known to the writer from a single locality (pond 2181 feet) in the northwest.

Distribution: Sanders Co.: 72-(Mt63-163).

Micrasterias radiosa Ralfs

Although this species was only collected in the northwest, it was one of the most commonly encountered Micrasterias spp. In addition to the typical form, one variety and a forma were found.

Micrasterias radiosa Ralfs, Brit. Desmid., p. 72, t. 8, fig. 3, 1848. var. *radiosa*.

Pl. 50 figs. 1,5.

Measurements: TL. 118.0-163.0μ; TB. 109.0-147.0μ; BI. 15.0-20.0μ; BPL. 20.0-29.0μ.

A few specimens included here under the typical (collection vials marked below with an asterisk) possessed semicells which appeared to be covered with mucilaginous concretions (see figure 5). Surface details of the cell wall of such plants are difficult to make out. They generally appear granular

Plants of moderate occurrence in the northwest.

Distribution: Flathead Co.: 23-(Mt63-399,400*). Lake Co.: 87-(Mt64-65*). Lincoln Co.: 2-(Mt63-141*).; 4-(Mt63-133); 9-(Mt63-154); 19-(Mt63-110, 111).

Micrasterias radiosa Ralfs var. *ornata* Norstd., Vid. Medd. nat. Foerm. Kjobenhavn 14-15, p. 223, t. 2, fig. 11. 1870. fa. *ornata*

Pl. 50 figs. 2,3.

Measurements: TL. 132.0-198.0μ; TB. 125.0-194.0μ; BI. 15.0-21.5μ; BPL. 22.0-30.0μ.

This was the most often encountered form of the species. Moderately common.

Distribution: Flathead Co.: 23-(Mt63-400); 29-(Mt66-H.L.1); 46-(Mt62-1). Lake Co.: 84-(X8); 86-(Mt63-188); 95-(Mt62-59). Lincoln Co.: 2-(Mt63-141); 6-(Mt63-145, 146); 19-(Mt63-110). Sanders Co.: 72-(Mt63-163) 73-(Mt63-166).

Micrasterias radiosa Ralfs var. *ornata* Nordst. fa. *elegantior* (G.S. West) Smith, Wiscon. Geol. and Nat. Hist. Survey Bull. 57; p. 47, t. 60, fig. 4. 1924.

Pl. 50 figs. 4,6.

Measurements: TL. 181.0-228.0μ; TB. 178.5-203.0μ; BI. 12.3-21.0μ; BPL. 23.5-32.0μ.

Krieger (39) considered this plant a distinct variety but a number of intermediate forms between it and fa. ornata, were observed. Consequently, the original interpretation of the plant seems correct to me. Moderately rare.

Distribution: Flathead Co.: 27-(Mon25); 31-(4182). Glacier Co.: 54-(Mt62-17); 63-(Mt63-218). Lincoln Co.: 10-(Mt63-156).

Micrasterias rotata(Grev.) Ralfs, Brit. Desmid., p. 259, t. 6, fig. 1c. 1848. var. rotata f. rotata

Pl. 51 figs. 1,2.

Measurements: TL. 246.0-334.0μ; TB. 204.0-286.0μ; BI. 29.0-41.0μ; BPL. 48.0-67.0μ.

The most common species of the genus collected, occurring in both the northern and southern Montane. In addition to the typical form one named forma and a number of morphae were encountered.

Distribution: Beaverhead Co.: 134-(Mt63-324, 327); 135-(Mt63-339). Flathead Co.: 27-(Mt63-451); Glacier Co.: 54-(Mt62-18). Lake Co.: 81-(Mt63-207); 82-(Mt63-200); 83-(Mt63-204); 91-(Schindler*): 95-(Mt62-56, 58). Lincoln Co.: 9-(Mt63-154); 10-(Mt63-158); 13-(Mt63-74).

Previously reported by Schindler (54) for collection locality 91.

Micrasterias rotata(Grev.) Ralfs var. rotata fa. evoluta Turn., K. Sv. Vet.-Akad. Handl. 25(5): p. 167, t. 23, fig. 1. 1892.

Pl. 52 figs. 1,2,3.

Measurements: TL. 260.0-312.0μ; TB. 236.0-300.0μ; BI. 30.0-39.0μ; BPL. 48.0-70.0μ.

Of moderate occurrence. Known only from collection obtained from west of the continental divide.

Distribution: Flathead Co.: 27-(Mon25); 39-(Mt63-77); 40-(Mt63-89). Lake Co.: 84-(X8). Lincoln Co.: 15-(Mt62-28); 16-(Mt63-113); 19-(Mt63-108). Ravalli Co.: 111-(Mt63-248).

Micrasterias rotata (Grev.) Ralfs var. *rotata* morpha.

Pl. 53 fig. 1.

Measurements: TL. 270.0μ; TB. 241.0μ; BI. 40.0μ; BPL. 58.0μ.

Cells differing from the normal form by having the incision between the superior lateral lobes and polar lobe partially open; and a distinct constriction midway between the apex and base of polar lobe.

Distribution: Flathead Co.: 31-(4181).

Micrasterias rotata(Grev.) Ralfs var. *rotata* morpha.

Pl. 53 fig. 2.

Measurements: TL. 260.0μ; TB. 211.0μ; BI. 38.0μ; BPL. 52.0μ.

Plant differing from the type by possessing partially open lateral incisions between the polar lobe and superior lateral lobes, and opened incisions between superior and inferior lateral lobes; and a distinct constriction below the apical region of the polar lobe.

Distribution: Lincoln Co.: 9-(Mt63-154).

Micrasterias rotata (Grev.) Ralfs, morpha.

Pl. 53. fig. 3.

Measurements: TL. 280.0μ; TB. 230.0μ; BI. 31.0μ; BPL. 62.0μ.

Cells large, a little longer than broad, very deeply constricted, sinus linerar; semicells five-lobed, interlobular incisions widely open; polar lobe projected somewhat opening inflated at base, apex retuse emarginate, angles bidentate; lateral lobes almost equal and divided into four lobules, each lobule furcate to tridentate. The most striking difference between this plant and the type is the presence of widely open interlobular incisions.

Distribution: Lincoln Co.: 19-(Mt63-111).

Micrasterias rotata (Grev.) Ralfs, morpha.

Pl. 53 fig. 4.

Measurements: TL. 265.0μ; TB. 244.0μ; BI. 30μ ; BPL. 96.0μ.

Monstrosity.

Distribution: Flathead Co.: 39-(Mt63-77).

Micrasterias thomasiana Arch. var. *notata* (Nordst.) Grönbl., Acta. Soc. Fauna, Fl. Fenn. 47, p. 38. 1920.

Pl. 54 figs. 1-5.

Measurements: TL. 256.0-310.0μ; TB. 230.0-276.0μ; BI. 31.0-37.0μ; BPL. 55.0-65.0μ.

The plants placed here as var. *notata* were collected in two forms. The typical form of the variety has linear interlobular incisions, and was the least abundant form collected. The other possesses undulate interlobular incisions. Intergradations, however, between the two do exist. Variation in the general shape, extension of angles, and placement of teeth, of the polar lobe, were also present. Examples of these have been illustrated on plate 54. Isthmal protuberances were present in some specimens, greatly reduced in some and wanting in others.

It should be noted that there is a resemblance between the undulate forms (figure 1& 4) and *M. thomasiana* var. *simplex* Skuja, and these plants may be intermediate between the two varieties.

The most often encountered form of the species, primarily collected from bogs. Known only from the northwest. Rare.

Distribution: Glacier Co.: 54-(Mt62-14); 64-(Mt61-2). Granite Co.: 126-(6Mon43). Missoula Co.: 100-(Mt63-420).

Micrasterias thomasiana Arch. var. *pulcherrima* G.S. West, Journ. Linn. Soc. Lond. Bot. 39: p. 58, t. 4, fig. 1. 1909.

Pl. 55 fig. 3.

Measurement: TL. 201.0-228.0µ; TB. 177.0-187.0µ; BI. 28.0-33.0µ; BPL. 46.0-48.0µ.

Very rare. Known only from a single collection, a high altutude (7000 feet) lake in the southern montane region.

Distribution: Beaverhead Co.: 134-(Mt63-324).

Micrasterias truncata (Corda) Bréb.

This is another of the more abundantly collected species of the genus, although it was only found in the northwest. Four varieties in addition to the typical form have been identfied.

Micrasterias truncata (Corda) Bréb., in Ralfs' Brit. Desmid., p. 75. t. 8, fig. 4, 1848. var. *truncata*.

Pl. 43 figs. 7,8.

Measurements: TL. 82-102.0µ; TB. 67.0-95.0µ; BI. 17.0-26.0µ; BPL. 51.0-72.0µ.

A considerable degree of intergradation exists between var. *truncata* and var. *semiradiata* (Naeg.) Cleve. This desmid is of moderately rare occurrence in collection from the northwest.

Distribution: Flathead Co.: 31-(4182, 4183). Glacier Co.: 54-(Mt62-25). Lake Co.: 84-(Q1); 86-(Mt63-187, Sieminska*). Lincoln Co.: 9-(Mt63-154)

Previously reported by Sieminska (65) for collection locality 86.

Micrasterias truncata (Corda) Bréb. var. *mauricianum* Irénée-Marie, Natural. Canad., 76, 1-2: p. 29, pl. 3, fig. 5,6. 1949.

Pl. 43 fig. 9.

Measurements: TL. 120.0μ; TB. 89.0μ; BI. 24.0μ; BPL. 76.0μ.

Very rare. Known from a single collection obtained from a high altitude (7000 feet) bog.

Distribution: Granite Co.: 127-(6Mon38).

Micrasterias truncata var. neodamensi (A. Braun) Dick, Krypt. Forsch. 1,7, p. 448, t. 20, fig. 8. 1926.

Pl. 43 fig. 5.

Measurements: Tl. 72.0-95.0μ; TB. 70.0-90.0μ; BI. 17.0-20.5μ; BPL. 60.0-71.0μ.

Very rare. Known from two widely separated localities in the north-west.

Distribution: Glacier Co.: 54-(Mt62-16). Ravalli Co.: 112-(Mt63-260).

Micrasterias truncata (Corda) Breb. var. semiradiata (Naeg.) Cleve, Öfvr. K. Vet.-Akad. Förhandl. 10, p. 487, 1864.

Pl. 43 figs. 3,4.

Measurements: TL. 76.5-87.0μ; TB. 90.5-102.0μ; BI. 14.5-17.0μ; BPL. 56.0-70.0μ.

This variety was the most frequently encountered form of the species. The plants intergrade considerably with the typical form.

Distribution: Flathead Co.: 36-(Mt63-393); 47-(Mt63-414). Lake Co.: 87-(Mt64-65). Lincoln Co.: 5-(Mt63-137); 19-(Mt63-110,111). Sanders Co.: 76-(Mt63-159).

Micrasterias truncata var. uralensis Krieger, Desmid. in Rabenhorst's Krypto.-Fl. 13(2): p. 34, t. 104, fig. 5. 1939.

Pl. 43 figs. 1,2,6.

Measurements: TL. 69.05-82.2µ; TB. 60.5-67.0µ; BI. 18.0-25.0µ; BPL. 43.0-52.0µ.

Very rare. Collected from two bogs west of the continental divide. Very few specimens seen.

Distribution: Glacier Co.: 54-(Mt62-25). Missoula Co.: 100-(Mt63-419).

Micrasterias verrucosa Bissett. (Roy?), in Wolle in Bull. Torr. Bot. Club.12(12):p.127,t. 51, fig. 10. 1885.

Pl. 55 figs. 2a,b,c,d.

Measurements: TL. 263-276.0µ; TB. 216-232.0µ; BI. 31.0-33.0µ; BPL. 65.5-76.0µ.

Bissett's illustration of M. verrucosa does not show the polar lobe as illustrated in Figure 2a. However, in the Montana plants, the polar lobe is quite variable and intergradations exist between the two conditions. Some examples of the polar lobes have been illustrated on plate 55.

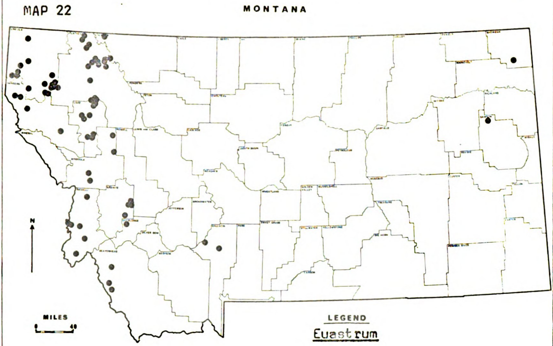
From my observations, this morphological variation, as well as others mentioned below, appears to be related to the age of the plant. Consequently, in a population, a gradual intergradation from reduced forms. similar to M. denticulatum var. angulosa, to the more elaborate forms of M. varrucosa illustrated in Figure 2a, were noted. These last mentioned plants also possessed cell walls which were deeply colored and coarsely punctate-granulate (mucilage?). The protuberances characteristic of this species were likewise variable in their degree of development, and sometimes impossible to discern.

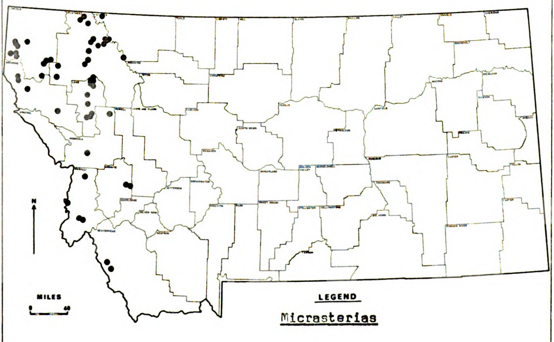
In reference to the above mentioned M. denticulatum Bréb., it is interesting to note that Ralfs' illustration of this species (t. 12, fig. 1) indicates a polar lobe much more emarginate than we presently ascribe to that species. Thus, his plants are reminiscent of the figure 2a (this text) of *M. verrucosa*.

Rare. Known only from the northwest.

Distribution: Flathead Co.: 39-(Mt63-77,78). Glacier Co.: 54-(Mt62-16). Lake Co.: 86-(Mt62-80).

MAP 22


MONTANA
N
MILES
0
40
LEGEND
Euastrum


N
MILES
0
40
LEGEND
Micrasterias

MAP 23

10. Xanthidium Ehrenberg, 1837.

The genus Xanthidium was almost exclusively collected west of the continental divide. (See map no. 24). It is represented in our material by 20 taxa (in 5 species), one of which is new to science, and 5 unnamed formae.

It occurred in both lentic and lotic habitats but primarily the former. Very few taxa were gathered in any abundance.

Xanthidium antilopaeum (Bréb.) Kuetz.

This was the most abundantly collected Xanthidium occurring in both the northern and southern Montana. It is a very large (with reference to the number of described intraspecific taxa) and complex species, and from my observations of the morphological variation found, some of these taxa might best be grouped and treated as distinct species.

In addition to the typical form, seven varieties and two formae have been identified. One additional plant is entered as merely belonging to the species.

Xanthidium antilopaeum (Bréb.) Kuetz., Spec. alg. p. 177. 1849. var. antilopaeum.

Pl. 58 figs. 1,2.

Measurements: TL. 68.0-80.0μ; TB. 65.0-74.0μ; BI. 14.0-19.0μ; LSS. 44.0-51.0μ; BSS. 43.0-51.0μ.

The typical form was one of the forms of the species least encountered and generally occurred in small numbers.

Rare. Known only from three localities in the northwest corner of the state.

Distribution: Lake Co.: 81-(Mt63-210); 95-(Mt62-58). Lincoln Co.: 9-(Mt63-154).

Xanthidium antilopaeum (Bréb.) Kuetz. var. americanum Scott and Grönbl., Soc. Scien. Fenn. Comment. Biol. 15(12): p. 29, fig. 105. 1956.

Pl. 58 fig. 5; Pl. 59 figs. 10,11.

Measurements: TL. 66.0-80.0μ; TB. 81.0-89.0μ; BI. 16.0-19.0μ; LSS. 52.0-60.0μ; BSS. 52.0-60.0μ.

In this variety the scrobiculae in the central area of the semicell are variable in number and arrangement, appearing in a single or double arc, or in an ellipsoidal pattern.

Rare. Known only from collection localities in the northwest.

Distribution: Flathead Co.: 29-(H.L.1). Glacier Co.: 54-(Mt62-20,24). Lincoln Co.: 19-(Mt63-111). Ravalli Co.: 111-(Mt63-250).

Xanthidium antilopaeum (Bréb.) Kuetz. var. callosum (Cushm.) Irénée-Marie, Hydrobiologia, 12(4): p. 336, pl. 3, fig. 3. 1959.

Pl. 58 fig. 6.

Measurements: TL. 97.0μ; TB. 83.0μ; LSP. 14.0μ; LSS. 62.0μ; BSS. 49.0μ.

The general shape of the semicell, and the open sinus present in this variety are unlike that characteristic of X. antilopaeum and perhaps it would be better to remove this variety from this species complex, and place it as a distinct species. This new species would also include other select taxa presently included under X. antilopaeum e.g. var. limneticum Smith, var. eurycerum Scott & Grönbl., var. subeurycerum Scott & Grönbl. and the plant identified by Irénée-Marie (39) as X. pseudobengalicum Grönblad.

Very rare. Known only from a collection taken from a high altitude (6600 feet) oligotrophic lake in the northwest.

Distribution: Ravalli Co.: 112-(Mt63-260).

Xanthidium antilopaeum (Bréb.) Kuetz. var. *crameri* Grönbl., Acta Soc. Pro. Fauna, Fl. Fenn., 49, no. 7, p. 47, pl. 4, figs. 28-29. 1921.

Pl. 58 figs. 3,4.

Measurements: TL. 59.0-86.0μ; TB. 65.0-88.0μ; BI. 16.0-19.0μ; LSS. 51.0-68.0μ; BSS. 51.0-60.0μ.

This variety was one of the more frequently found *Xanthidia*, being moderately common in ponds and lakes at the lower elevations (generally below 3700 feet) west of the continental divide.

The thickened central area of the semicells, of the Montana specimens, varied in its scrobiculation pattern being a simple series of pits arranged in an arc, or having the whole region scrobiculate.

Distribution: Flathead Co.: 22-(6Mon5, 6Mon32); 23-(Mt63-398,399); 35-(Mt63-391); 36-(Mt63-393). Lake Co.: 87-(Mt64-64). Lincoln Co.: 5-(Mt63-137); 18-(Mt63-107); 19-(Mt63-111); 20-(Mt63-94); 21-(Mt63-99). Sanders Co.: 72-(Mt63-163).

Xanthidium antilopaeum (Bréb.) Kuetz. var. *lemneticum* Smith, Trans. Wis. Acad. vol. 20, p. 347, pl. 10, figs., 14-16. 1922.

Pl. 58 figs. 7,8.

Measurements: TL. 94.0-105.0μ; TB. 100.0-119.0μ; BI. 15.0-20.0μ; LSS. 61.0-73.0μ; BSS. 50.0-63.0μ.

Apparently this variety has not been reported since originally described by Smith in 1922, at least not under this name. Some specimens greatly resemble var. *subeurycerum* Scott and Grönbl., this is especially true of my fig. 8, and possibly these two taxa are the same. I believe this variety and var. *callosum* are also very closely related and interestingly both occur together in my Montana material.

Very rare. Known only from a high altitude lake (6600 feet) in the northwest.

Distribution: Ravalli Co.: 112-(Mt63-260).

<u>Xanthidium antilopaeum</u> (Bréb.) Kuetz. var. <u>minneapoliense</u> Wolle, Bull. Torr. Bot. Cl. 11. p. 16. 1884. fa. <u>minneapoliense</u>.

Pl. 57 figs. 6,9.

Measurements: TL. 68.0-74.0μ; TB. 68.0-74.0μ; BI. 14.0-16.0μ; LSS. 49.0-53.0μ; BSS. 49.0-53.0μ.

This variety was another of the more often encountered <u>Xanthidia</u>. Occurring in both the northern and southern Montane in ponds and lakes at elevations ranging from 2200 to 7000 feet.

The plants have been separated, on the basis of size, into two groups the smaller of which is considered the typical form of the variety.

Distribution: Beaverhead Co.: 134-(Mt63-324). Flathead Co.: 39-(Mt63-79). Glacier Co.: 64-(Mt61-2). Lake Co.: 81-(Mt63-208); 84-(X8); 95-(Mt62-59).

<u>Xanthidium antilopaeum</u> (Bréb.) Kuetz. var. <u>minneapoliense</u> Wolle morpha.

Pl. 57 figs. 10,11,12.

Measurements: TL. 85.0-92.0μ; TB. 82.0-89.0μ; BI. 16.0-20.0μ; LSS. 64.0-68.0μ; BSS. 59.0-63.0μ.

Plants differ from the typical form of the variety in their greater overall dimensions. I do not regard this difference in size significant enough to warrant the creation of a new taxon. Rare.

Distribution: Lake Co.: 82-(Mt63-199,200). Lincoln Co.: 10-(Mt63-156). Sanders Co.: 76-(Mt63-176).

Xanthidium _antilopaeum_ (Bréb.) Kuetz. var. _planum_ Roll., Journ. Inst. Bot. Acad. Sci. de USSR No. 10 (18): p. 28, pl. 2, figs. 7-10. 1936.

Pl. 57 fig. 1.

Measurements: TL. 69.0-76.0µ; TB. 81.0-84.0µ; BI. 18.0-20.0µ; LSS. 54.0-60.0µ; BSS. 57.0-58.5µ.

I believe the plant described as _X._ _antilopaeum_ var. _quebecense_ by Irénée-Marie (39)from Montreal, Canada, is the same as that listed here.

Very rare. Only a few specimens seen. Known only from two collection localities in the northwest corner of the state.

Distribution: Lincoln Co.: 8-(Mt63-151); 9-(Mt63-154).

Xanthidium _antilopaeum_ (Bréb.) Kuetz. var. _polymazon_ Nordst., Acta. Univ. Lund. vol. 9:38, 1, fig. 20. 1873. fa. _polymazon_

Pl. 57 figs. 2,3,4.

Measurements: TL. 56.0-75.0µ; TB. 61.0-81.0µ; BI. 13.0-17.0µ; LSS. 48.0-56.0µ; BSS. 45.0-53.0µ.

The plants assigned to this variety are of common occurrence in western Montana, and are placed into two groups on the basis of size. Those presented here are considered the typical form of the variety.

This forma is known from both the northern and southern Montana, and was encountered primarily in collections from ponds and lakes at elevations ranging from 3200-7000 feet.

Distribution: Beaverhead Co.: 134-(Mt63-324). Flathead Co.: 27-(Mon25); 29-(H.L.1); 31-(4183). Glacier Co.: 54-(Mt62-13); 64-(Mt61-2). Lake Co.: 84-(X8); 86-(Mt63-187).

Xanthidium _antilopaeum_ (Bréb.) Kuetz. var. _polymazon_ Nordst. fa. _maius_ Turn. K. Sv. Vet. -Akad. Handl. 25, (5): p. 100, pl. 3, fig. 1. 1892.

Pl. 57 figs. 7,8,13.

Measurements: TL. 74.0-88.0µ; TB. 79.0-92.0µ; BI. 16.5-20.0µ; LSS. 48.0-66.0µ; BSS. 58.0-64.0µ.

The separation of this plant as a distinct taxon on the basis of size seems somewhat dubious.

The semicells exhibited some variation in their facial ornamentation, examples of which have been illustrated on pl. 57. These minor variations are not regarded as taxonomixally significant. Figure 8 illustrates a plant possessing two linear rows of scrobiculae (pores?) variable number, and in addition, the lower semicell exhibits two thickenings below the characteristics arcuate row of verrucae. Figure 13 illustrates a cell in which the upper semicell possess three thickenings below the verrucae.

Although this form of the variety is only known to the author from the northwest it was encountered more often than the typical form of the variety.

Distribution: Glacier Co.: 64-(Mt61-2). Lake Co.: 81-(Mt63-206); 82-(Mt63-200); 83-(Mt63-205). Lincoln Co.: 10-(Mt63-156). Ravalli Co.: 111-(Mt63-248). Sanders Co.: 72-(Mt63-163); 76-(Mt63-176); 77-(Mt63-195).

Xanthidium antilopaeum (Bréb.) Kuetz. fa.

Pl. 57 fig. 5.

Measurements: TL. 71.0u; TB. 77.0µ; BI. 20.0u; LSS. 65.5µ; BSS. 69.0µ.

Semicells more elliptical than var. antilopaeum, thus more closely resembling var. oligacantum Schmidle. However, this latter named taxon has but a single spine at each of the upper angles, whereas there are two present in the Montana plant. Furthermore, var. oligacanthum is devoid of any differentiated central area, and in the Montana plant, there was observed a number of scrobiculae, in two arcs.

The plant does not appear to fit any known described taxon. It is not described as new because only a single specimen was found.

Very rare.

Distribution: Lincoln Co.: 2-(Mt63-142).

Xanthidium armatum (Bréb.) Rabenh. var. fissum Nordst., Alg. aq. dulc. et. Char. Sandvic. p. 17, t. 2. fig. 6. 1878.

Pl. 59 fig. 1.

Measurements: TL. 135.0-140.0µ; TB. 97.0-100.0µ; BI. 27.0µ; LSS. 104.0-112.0µ; BSS. 68.0-73.0µ.

Very rare. Known from a single collection taken from a high altitude oligotrophic lake (6600 feet).

Distribution: Ravalli Co.: 112-(Mt63-260).

Xanthidium cristatum Bréb.

This species is only known to the author from collection localities west of the continental divide, but it is of fairly common occurrence here and sometimes gathered in abundance.

It was chiefly collected from ponds and lakes at altitudes ranging from 2200-4000 feet, but also encountered in a bog and lotic habitat.

The species is a rather large one with reference to described taxa, and is represented in our collections by four varieties, one forma which is new to science, and four unnamed formae.

Xanthidium cristatum Bréb., in Ralfs' Brit. Desmid., p. 115, t. 19. fig. 3. 1848. var. cristatum.

Pl. 56 figs. 2,3,11.

Measurements: TL. 66.0-80.0µ; TB. 52.0-58.0µ; BI. 11.0-14.7µ; LSS. 51.0-

58.0μ; BSS. 37.0-41.0μ.

The plants regarded here as the typical form are in actuality _X. cristatum_ Breb. var. _scrobiculatum_ Scott & Grönblad. I did not enter them under that name because I am not convinced that that variety is distinct from the typical, and suspect that the scrobiculae were misinterpreted as granules, in the original description of the species. Other authors (e.g. Irénée-Marie (39), Smith (24)) have identified similar plants as var. _uncinatum_ Bréb. It is however, not that variety.

In the Montana material it was noted that a central protuberance within the surrounding pits was generally present, although it was not always clearly evident or obvious in face view. Consequently, the designation of forma _papillatum_ Scott & Grönbl. of var. _scrobiculatum_ may not be warrented.

Only encountered in collections from the northwest where it is of moderate occurrence.

Distribution: Flathead Co.: 24-(Kidd*); 27-(Mon25); 31-(4181, 4182, Kidd*). Glacier Co.: 54-(2Mon9, Mt62-14). Lake Co.: 83-(Mt63-202); 84-(Q1). Lincoln Co.: 10-(Mt63-157).

Previously reported by Kidd (63) for collection localities 24 and 31.

Xanthidium _cristatum_ Bréb. var. _cristatum_ fa.

Pl. 56 fig. 4.

Measurements: TL. 69.0μ; TB. 56.0μ; BI. 14.0μ; LSS. 54.0μ; BSS. 40.0μ.

Plant differing from those designated as the typical by the lack of facial ornamentation (scrobiculae). Cell wall punctate; semicells with a single, centrally located pore.

Very rare. Only a single specimen observed.

Distribution: Lake Co.: 84-(X8).

Xanthidium cristatum Bréb. var. papilliferum Irénée-Marie, Flora Desmidiale de la Région de Montreal, Laprairie, Canada, p. 243, 244, pl. 43, fig. 13. 1939.

Pl. 56 fig. 12.

Measurements: TL. 77.0-80.0μ; TB. 66.0-69.0μ; BI. 15.0μ; LSS. 58.0-62.0μ; BSS. 44.0-50.0μ.

This variety might best be considered simply as a forma of var. uncinatum Bréb., since the semicells basically have the same shape as that variety, and furthermore, facial ornamentation appears to be quite variable in this group of Xanthidia (see var. uncinatum Bréb. fa. ornatum).

Very rare. Known only from the northwest.

Distribution: Lake Co.: 95-(Mt62-59).

Xanthidium cristatum Bréb. var. uncinatum Bréb. fa. ornatum fa. nova.

Pl. 56 figs. 13,14.

Measurements: TL. 78.0-83.0μ; TB. 68.0-77.0μ; BI. 16.0-17.5μ; LSS. 60.0-63.0μ; BSS. 49.0-52.0μ.

Shape of the semicells as in var. uncinatum Bréb. and var. papilliferum Irénée-Marie. Plants also similar to the latter named taxon in possessing three elongated granules on the basal angles of the semicells, facing the linear sinus (only one visible in face view) and in having a supra-isthmal papilla. This plant is distinguished from both of the above named varieties by the scrobiculated central thickened area of the semicell.

In addition to the scrobiculae, which are usually arranged as a ring surrounding an inner central thickening (protuberance), smaller circular pits may be present on each side of the protuberance. Additional granules may also occur on each side of the supra-isthmal papilla and/or at the base of the single basal lateral spines.

Very rare. Known only from one locality in the northwestern part of the state.

Distribution: Lake Co.: 95-(Mt62-58).

Xanthidium cristatum Bréb. var. hipparquii Irénée-Marie, Flore Desmidiale de la Région de Montreal, Laprairie, Canada. p. 244, pl. 43. fig. 6, 1939.

Pl. 56 fig. 5.

Measurements: TL. 76.0-78.0μ; TB. 52.0-59.0μ; BI. 13.0-14.0μ; LSS. 46.0-53.5μ; BSS. 36.0-38.0μ.

The plant identified by Sieminska (65) as X. cristatum Bréb. var. leiodermum(Roy & Biss.) Turner is placed here.

Very rare. Known to the author from a single collection locality in the northwest.

Distribution: Lake Co.: 86-(Mt63-187).

Xanthidium cristatum Bréb., morpha.

Pl. 56 fig. 10

Measurements: TL. 49.0μ; TB. 39.5μ; BI. 12.0μ.

This plant is considered abnormal and was simply entered as belonging to X. cristatum on the basis of the general shape of the semicells and the number and arrangement of the projections (aborted spines?). The plant could have been placed with X. obsoletum Taylor, which has similar projections. However, that species has a linear sinus and the semicells are not as triangular in shape as that in the Montana plant.

The typical is also present at this locality.

Distribution: Flathead Co.: 31-(4181)

Xanthidium cristatum Bréb. var. *leiodermum* (Roy & Bliss.) Turn.
K. Sv. Vet.-Akad. Handl., 25(5): p. 99, t. 12, f. 33. 1892.

Pl. 56 figs. 6,7.

Measurements: TL. 59.0-64.0μ; TB. 46.0-53.0μ; BI. 13.0-15.0μ; LSS. 47.0-50.0μ; BSS. 37.0-40.0μ.

This variety is reminiscent of var. *hipparquii* since they both have the single spines at the basal angles of the semicells, directed toward the sinus (convergent). They differ from that variety in the shape of the semicell, *hipparquii* having a more elevated apex, and *leiodermum* usually being transverobovate (compare figures 5,6 & 7 on pl. 56).

In the Montana material studied, the cells generally possessed an open sinus, but the sinus may also be closed, at least toward the inner portion. The two mid-lateral spines were usually directed more vertically than indicated in the original description. Scrobiculae may also occur on the face of the semicell, but toward the apex (not shown in figures given here).

Rare. Known only from collections gathered from west of the continental divide.

Distribution: Lake Co.: 95-(Mt62-58). Lincoln Co.: 1-(4184). Ravalli Co.: 114-(Mt63-256); 115-(Mt63-267).

This species was previously reported by Sieminska (65) for collection locality 86. However, because her plant appears to be closer to var. *hipparquii*, which is known to the author only from collection locality 86, I have placed her plant under that variety.

Xanthidium cristatum Bréb. var. *leiodermum* (Roy & Biss.) Turn. fa.

Pl. 56 fig. 8.

Measurements: TL. 59.0-64.0μ; TB. 46.0-56.0μ; BI. 12.5-13.0μ; LSS. 42.0-50.0μ; BSS. 37.0-40.0μ.

Cells differing from the usual form of the variety by the presence of a smooth thickened central area. Plants similar to X. cristatum var. floridense Scott & Grönbl., but of a stouter, squatter appearance and with shorter spines. A reduced form possessing only 8 spines was also encountered and listed separately below.

Similar plants have been reported in the literature as X. cristatum (Irénée-Marie, 1939), X. cristatum fa. (Borge, 1894), or as var. leiodermum (Croasdale, 1957, 1964).

Distribution: Flathead Co.: 22-(6Mon5).

Xanthidium cristatum Bréb. var. leiodermum (Roy & Biss.) Turn. fa.

Pl. 56 fig. 9.

Measurements: TL. 54.0-61.0μ; TB. 50.0-59.0μ; BI. 14.0-17.0μ; LSS. 47.0-51.0μ; BSS. 41.0-44.0μ; T. 26.0μ.

Cells possessing only eight spines. Otherwise, similar to form of the var. leiodermum listed above.

Very rare.

Distribution: Flathead Co.: 42-(Mon16).

Xanthidium fasciculatum Ehrenb. var. oronense West & West, Trans. Linn. Soc. of Lond. sec. ser. Bot. vol.5(5): p. 253, pl.15, fig. 25, 1896.

Pl. 56 fig. 1

Measurements: TL. 66.0-74.0μ; TB. 61.0-63.0μ; BI. 17.0-17.5μ; LSS. 50.0-52.0μ; BSS. 46.0-47.0μ.

Very rare. Known to the author from only one locality in the northwest.

Distribution: Lake Co.: 81-(Mt63-206, 207).

Xanthidium hastiferum Turn.

As I have interpreted this species, it is represented in Montana by four varieties and one form entered only as belonging to the species. It was only encountered in collections from the northwest, and although known from a number of localities in that region, the species, with the exception of one form, was not really common, or gathered in any abundance. It was primarily collected from ponds and lakes at low altitudes (at or below 3800 feet).

Xanthidium hastiferum Turn., Journ. Royal Micro. Soc., p. 938, fig. 20. 1885. var. hastiferum fa.

Pl. 59 figs. 6,7,9.

Measurements: TL. 45.0-55.0μ; TB. 70.0-91.0μ; BI. 11.0-14.0μ; LSS. 42.0μ; BSS. 46.0-50.0μ.

The plants included here as a fa. of the typical can be identified as X. subhastiferum W. West var. subhastiferum (sensu Smith, 1924). They are not entered under that name because I do not believe that that taxon, as presently conceived, can be accurately separated from X. hastiferum.

In the original description of X. subhastiferum, West states that his plant is distinquished from X. hastiferum by its non-angular semicells, larger size and in being destitute of apical spines. According to Smith's (24) account of the variation present in the typical form of this species, however, one would conclude that the characteristics used by West to distinquish his plant from X. hastiferum are not reliable.

Comparing the original illustrations of both these taxa, it appears to me that they are two distinct species, both exhibiting similar forms. The plants listed here I have assigned to X. hastiferum on the basis of the more angular shape of the semicell, and, perhaps more significant, the positioning of the upper lateral spine. In *X. subhastiferum* the two lateral spines are placed more directly above one another and, although diverging, point outward from the sides of the semicell. The upper lateral spines in *X. hastiferum* lie closer to the central axis of the cell and generally point more vertically.

This was the form of the species most often encountered and present in the greatest numbers at a locality. Moderately rare.

Distribution: Flathead Co.: 27-(Mon25). Glacier Co.: 65-(Vinyard*). Granite Co.: 127-(6Mon41). Lake Co.: 95-(Mt62-60). Lincoln Co.: 15-(Mt62-26). Sanders Co.: 72-(Mt63-163).

Previously reported by Vinyard (54) as *X. subhastiferum* from collection locality 65.

Xanthidium hastiferum Turn. var. *javanicum* (Nordst.) Turn. f. *planum* Turn., k. Sv. Ver. Akad. Handl., 25(5): p. 100. 1892.

Pl. 59 fig. 2.

Measurements: TL. 76.0µ; TB.70.0µ; BI. 14.0µ; LSS. 46.0µ; BSS. 50.0µ.

Very rare. Known from a single collection locality in the northwest. A single specimen seen.

Distribution: Sanders Co.: 74-(Mt63-170).

Xanthidium hastiferum Turn. var. *johnsonii* West & West, Journ. Linn. Soc. Bot. 33, p. 299, pl. 17, fig. 1. 1898. fa. *johnsonii*.

Pl. 59 fig. 3,5.

Measurements: TL. 47.0-49.0µ; TB. 75.5-85.0µ; BI. 12.0-14.0µ; LSS. 47.0-48.5µ; BSS. 49.5-52.5µ.

Rare. Known from three localities in the northwest.

Distribution: Flathead Co.: 29-(H.L.1) Lincoln Co.: 6-(Mt63-148); 17-(Mt63-117).

Xanthidium hastiferum Turn. var. *johnsonii* West & West fa. *longispinum* Cushman, Torrey Bot. Cl. 31, p. 163, pl. 7, fig. 8. 1904.

Pl. 59 fig. 4.

Measurements: TL. 62.0-78.0µ; TB. 98.0-102.0µ; BI. 13.5-14.5µ; LSS. 50.0-51.0µ; BSS. 56.5-61.0µ.

Rare. Known from three localities west of the continental divide.

Distribution: Lake Co.: 82-(Mt63-200); 83-(Mt63-202). Sanders Co.: 76-(Mt63-192).

Xanthidium hastiferum fa.

Pl. 59 fig. 8.

Measurements: TL. 49.0-52.0µ; TB. 85.0-88.0µ; BI. 13.0-14.0µ; LSS. 48.0-49.0µ; BSS. 50.0-51.5µ.

This plant could be a form of the typical, or possibly var. *javanicum*. Thus it was believed best merely to indicate it as belonging to the species.

Very rare.

Distribution: Ravalli Co.: 115-(Mt63-265, 268).

11. *Arthrodesmus* Ehrenberg, 1832.

The genus *Arthrodesmus* was primarily encountered in collections from the northwest. (See map no. 25) Ten species (one of them new to science) encompassing twenty three taxa were identified. Excluding the new species 19 varieties and 3 formae are given below. Two unnamed formae, one forma assigned questionably to a variety, one morpha, and a plant entered solely as belonging to the genus, were also identified.

With the exception of *A. convergens* Ehrenb. var. *convergens*, none of the above are common and very few occurred in any abundance at a collection locality.

The genus occurred in a variety of aquatic habitats at varying altitudes.

Arthrodesmus bifidus Bréb.

This was a rare species in the Montana material, and few specimens were seen by the author. It is known from three localities in the north west. These being habitats with rather rich desmid floras, at medium altitudes (4100-5275).

Besides the typical, a form of the typical and two varieties are listed. In addition, a desmid previously known to science, but identi - fied as a different species, is placed here as an unnamed forma of one of the varieties.

Arthrodesmus bifidus Bréb., Mem. Soc. Imp. Sci. Natur. Cherbourg. 4, p. 135, t. 1. fig. 19. 1856. var. bifidus

Pl. 62 figs. 6.

Measurements: TL. 15.0-16.0μ; TB. 15.0-18.0μ; BI. 5.0-8.5μ; LSS. 12.5-13.0μ; BSS. 12.5-13.5μ; LS. 1.5-3.0μ.

Very rare. Known only from Glacier National Park region where it was collected from a bog and a lake.

Distribution: Flathead Co.: 29-(H.L.1). Glacier Co.: 54-(Mt62-11,25).

Arthrodesmus bifidus Bréb. fa.

Pl. 62 fig. 5.

Measurements: TL. 16.0μ; TB. 18.0μ; BI. 8.5μ; LSS. 13.0μ; BSS. 12.5μ; LS. 2.0-3.0μ.

Cells differing from the typical form by the variable number of spines at the angles of the semicells, these being 1,2, or 4 per angle.

Plants very similar in overall shape to A. bifidus var. massionwellsensis Sieminska, but much larger than that variety and not possessing as many spines.

Only one specimen observed. Collected from a bog in Glacier National

Park. The typical form also occurs at this locality.

Distribution: Glacier Co.: 54-(Mt62-11).

Arthrodesmus bifidus Bréb. var. cruciatus Skuja, Nova Acta Reg. Soc. Scient. Upsal. ser. 4. vol.14. no. 5, p. 147. 1949.

Pl. 62 fig. 7

Measurements: TL. 17.0-18.0μ; TB. 16.0μ; BI. 4.0-4.9μ; LSS. 11.0-12.0μ; BSS. 9.0-10.0μ; LS. 3.0-4.0μ.

The measurements given above for this variety, as well as that given by Sieminska (65) are a little smaller than those given by Skuja. Very rare.

Distribution: Lake Co.: 86-(Mt62-75, Sieminska*).

Previously reported by Sieminska (65) from collection locality 86.

Arthrodesmus bifidus Bréb. var. cruciatus Skuja fa.

Pl. 62 figs. 8,9.

Measurements: TL. 19.0-20.0μ; TB. 15.5-19.0μ; BI. 5.0-5.5μ; LSS. 11.5-14.0μ; BSS. 9.0-12.0μ; LS. 3.4-4.5μ.

This plant was previously reported from Montana by Sieminska (65) as A. trispinatus West & West. A similar plant was also reported by Wade (57) from Michigan, under the same taxon. However, it was my understanding that West's & West's plant was not a desmid. In any case, the plant is not identical to West's and West's in shape, and placement of the spines. Their plant has its spines one above the other and possesses a stouter appearance.

The Montana plants have a similar shape to Skuja's var. cruciatus, and the measurements of the present specimens fit perfectly for that variety. Sieminska's measurements are smaller, especially the isthmus which she states is 3.5μ.

The plants differ from the typical form of the variety in having three spines per pole of the semicell. Two spines are located at the upper angle of the pole, the other at the lower angle.

Very rare.

Distribution: Lake Co.: 86-(Mt62-75, Sieminska*).

Arthrodesmus bifidus Bréb. var. messionwallsensis Sieminsk., Trans. Amer. Micr. Soc. 84(1); p. 113. pl. 5, fig. 2,3,4. 1965.

Measurements: TL. 12.0µ; TB. 12.0µ; BI. 1µ; LSS. 10.0µ; BSS. 9.0µ; LS. 3.0µ; T. 4.0µ.

This variety was not found by the author. However, a plant with a similar shape was collected from locality 54. The author's plant differs from Sieminska's in possessing a lesser number of spines per semicell, and greater dimensions. It is listed in this text as a form of the typical, since only a single speciment was seen.

Distribution: Lake Co.: 86-(Sieminksa*).

Arthrodesmus bulnheimii Racib. var. subincus West & West, Monogr. Brit. Desmid. vol. 4, p. 105, pl. 116, fig. 3, 1912.

Pl. 60 fig. 8.

Measurements: TL. 40.0-44.0µ; TB. 29.0-36.0µ: BI. 6.0-6.5µ; LSS. 19.0-19.5µ; BSS. 16.5-19.0µ; LS. 13.0-18.0µ.

Rare. Known to the author from three localities west of the continental divide.

Distribution: Flathead Co.: 36-(Mt63-393). Lake Co.: 83-(Mt63-205); 86-(Mt62-80, Sieminska*).

Previously reported by Sieminska (65) for collection locality 86.

Arthrodesmus convergens Ehrenb., in Ralfs' Brit. Desmid., p. 118, t. 20, fig. 3. 1848. var. convergens

Pl. 60 fig. 5.

Measurements: TL. 34.5-40.0μ; TB. 52.0-69.0μ; BI. 9.0-12.5μ; BSS. 38.0-46.5μ; LS. 5.0-14.0μ.

This species, the typical form, was the most frequently encountered and abundant Arthrodesmus. It also has the greatest distributional range, being found in our collections from both the northern and southern Montane, in a variety of lentic habitats (pond, lake, bog, pool) at varying altitudes (2200-7000 feet).

Distribution: Beaverhead Co.: 135-(Mt63-330). Flathead Co.: 27-(Mt63-450); 31-(4183). Granite Co.: 127-(6Mon38). Lake Co.: 81-(Mt63-207); 82-(Mt63-200); 83-(Mt63-204); 86-(Mt63-188); 89-(Mt63-389). Lincoln Co.: 10-(Mt63-158). Ravalli Co.: 115-(Mt63-266). Sanders Co.: 74-(Mt63-171).

Arthrodesmus convergens Ehrenb. var. convergens fa.

Pl. 60 fig. 7.

Measurements: TL. 40.0-42.0μ; TB. 76.0-85.0μ; BI. 10.-12.0μ; BSS. 43.0-47.0μ; LS. 9.0-20.0μ.

This plant differs from the type in its greater overall size and usually longer spines. It resembles A. convergens var. deplanata Laporte, in its length to breadth ratio but var. deplanata is smaller than the type.

Very rare.

Distribution: Lake Co.: 88-(Mt63-197); 95-(Mt62-59).

Arthrodesmus convergens Ehrenb. var. wollei Irénée-Marie, Hydrobiologia vol. 4, (3): p. 34, pl. 4, fig. 7. 1952.

Pl. 60 fig. 4.

Measurements: TL. 33.0-34.0μ; TB. 38.0-44.0μ; BI. 7.0-8.0μ; BSS. 30.0-33.0μ; LS. 2.0-6.5μ.

Rare. Known only from collections west of the continental divide.
Distribution: Flathead Co.: 27-(Mon25); 29-(H.L.1). Lincoln Co.: 1-(4184).

Arthrodesmus convergens Ehrenb. var. wollei Irénée-Marie fa.

Pl. 60 fig. 6.

Measurements: TL. 32.0-37.0μ; TB. 47.0-58.0μ; BI. 9.0-10.0μ; BSS. 32.0-37.0μ; LS. 7.0-10.5μ.

Plants small; cells equal or slightly longer than broad without spines, deeply constricted and with the sinus open; semicells elliptical with spines convergent, divergent, or horizontal, disposed medianly or nearly so; cell wall punctate.

Plants differing from the typical form of the variety by the greater length of the spines and larger overall measurements.
Distribution: Glacier Co.: 54-(Mt62-21). Lake Co.: 84-(86). Ravalli Co.: 112-(Mt63-261).

Arthrodesmus incus (Bréb.) Hass.

Arthrodesmus incus was one of the two species of this genus collected outside the northwest. It was represented by four varieties, but the typical form was not found by the author.

Arthrodesmus incus (Bréb.) Hass. var. extensus Anderson, Bih. K. Sv. Vet.-Akad. Handl. 16, Afd. 3, 5:p. 13, pl. 1, fig. 7. 1890.

Pl. 61 fig. 2.

Measurements: TL. 22.0-23.0μ; TB. 38.0-43.0μ; BI. 4.0-4.5μ; LSS. 17.0-22.0μ; BSS. 14.0-15.5μ; LS. 11.0-13.0μ.

Although this variety is very rare, being known to the author from only two localities, many specimens have been seen.
Distribution: Lake Co.: 82-(Mt63-199); 86-(Mt62-66).

Arthrodesmus incus (Bréb.) Hass. var. *indentatus* West & West, Monogr. Brit. Desmid. vol. 4: p. 94, pl. 113, figs. 20-24. 1912.

Pl. 61 fig. 5

Measurements: TL. 28.0-30.5μ; TB. 40.0-42.0μ; BI. 5.5-6.0μ; LSS. 19.5-20.0μ; BSS. 17.5-18.0μ; LS. 12.5-14.0μ.

This variety is known from both the northern and southern Montane. The plant is listed below as a morpha differs in the shortness of the spines, and in the spines being directed horizontally.

Distribution: Lincoln Co.: 10-(Mt63-157). Ravalli Co.: 112-(Mt63-260).

Arthrodesmus incus (Bréb.) Hass. var. *indentatus* West & West morpha.

Pl. 61 fig. 1.

Measurements: TL. 21.0μ; TB. 22.5-25.2μ; BI. 6.0μ; BSS. 15.5-18.0μ; LS. 3.0-5.0μ.

Distribution: Beaverhead Co.: 135-(Mt63-338).

Arthrodesmus incus (Bréb.) Hass. var. *malaccensis* Bernard, Sur quelques algues unicellulaires deau douce, p. 55-56, figs. 95 a,b,c, & 96. 1909.

Pl. 61 fig. 3.

Measurements: TL. 14.0μ; TB. 21.0μ; BI. 4.2-4.5μ; BSS. 13.0μ; LS. 3.04-4.0μ.

Very rare. Only a single specimen observed.

Distribution: Lake Co.: 86-(Mt62-72).

Arthrodesmus incus (Bréb.) Hass. var. *vulgaris* Eichler & Racib., Nowe Gatunki zielenic. Rozpr. i Sprawozd. Wydx. mat.-przyr. Akad. Umiej. Krakow, 26 p. 119 . 1893.

Pl. 61 fig. 4.

Measurements: TL. 19.0µ; TB. 28.0-31.8µ; BI. 5.5µ; BSS. 18.0-20.0µ; LS. 4.5-6.0µ.

Very rare.

Distribution: Flathead Co.: 22-(6Mon5).

Arthrodesmus _mooarii_ sp. nova.

Pl. 60 figs. 1,2.

Measurements: TL. 42.0-45.0µ; TB. 58.0-63.0µ; BI. 10.0-11.0µ; BSS. 32.0-35.0µ; LS. 11.0-15.0µ; T. 20.0µ.

Cells of medium size longer than broad without the spines. deeply constricted; sinus widely open with acute apex; semicells transverse rhomboid, lateral margins straight to slightly convex and bearing a single long, gradually attenuated spine which may be hollow at base; spines parallel to convergent, disposed medianly, one face of each semicell possessing a subapical, conical (hollow) protubernace (spine-like); asymmetically disposed so that only one protuberance is visible in face view at a time. One pyrenoid per semicell is present. Cell wall with mucilage pores which are at times difficult to see.

Very rare. Known from a single locality in Glacier National Park.

Distribution: Flathead Co.: 29-(H.L.1).

Arthrodesmus _octocornis_ Ehrenb., Die Infusionsthierchen. p. 152. 1838. var. _octocornis_

Pl. 62 figs. 1,3,4.

Measurements: TL. 32.6-43.0µ; TB. 27.0-36.0µ; BI. 4.0-6.0µ; LSS. 20.50-26.0µ; BSS. 15.0-21.0µ; LS. 3.0-10.0µ.

In our material the length of the spines is quite variable.

This species was only encountered in collections from the northwest and is of moderately rare occurrence.

In addition to the typical form one variety was collected, but with much less frequency.

Distribution: Flathead Co.: 22-(6Mon5); 28-(Mt63-442); 29-(H.L.1); 42-(Mon16(1)). Glacier Co.: 63-(Kidd*). Lake Co.: 81-(Mt63-213); 86-(Mt62-66). Lincoln Co.: 1-(4184); 15-(Mt62-28).

Previously reported by Kidd(63) for collection locality 63.

Arthrodesmus octocornis Ehrenb. var. tenuis Irénée-Marie, Revue Algologique vol. 1, fasl. 2, p. 93, fig. 3. 1954.

Pl. 62 fig. 2.

Measurements: TL. 25.0-27.5μ; TB. 20.0-28.0μ; BI. 3.5-4.3μ; LSS. 16.0-17.0μ; BSS. 11.0-14.0μ; LS. 5.0-8.5μ.

Rare. Known from three collection localities west of the continental divide.

Distribution: Flathead Co.: 28-(Mt63-442,443). Lake Co.: 82-(Mt63-199), 86-(Mt62-64).

Arthrodesmus phimus Turn., K. Sv. Vet.-Akad. Handl., 25(5): p. 136, t. 12, fig. 9. 1892 var. phimus.

This is a very rare species in Montana and the typical form reported here is known to me only from an illustration by Schindler (54).

Distribution: Lake Co.: 93-(Schindler*).

Arthrodesmus phimus Turn. var. occidentalis West & West, Trans. Roy. Irish Acad. 32: p. 59, t. 2. fig. 17. 1902. fa.

Pl. 61 figs. 7,8.

Measurements: TL. 17.0-21.0μ; TB. 26.0-35.0μ; BI. 4.5-5.0μ; LSS. 14.0μ; BSS. 13.5-15.0μ; LS. 7.0-10.0μ.

Cell differing from the typical form of this variety by its longer spines, but other authors have previously included specimens with even longer spines under this variety. Plant similar to that illustrated by Thomasson (59) as Staurodesmus phimus (Turn.) Thomasson.

Figure 8 illustrates a plant with a slightly convex apex and retuse lateral margin, characteristics of var. hebridarum West. This plant intergrades with that in figure 7, both occurring together, thus kept together here.

Very rare.

Distribution: 86-(Mt62-76).

Arthrodesmus ralfsii fa. latiuscula West & West, Monogr. Brit. Desmid. vol. 4; p. 96, pl. 114, fig. 5. 1912.

Pl. 61 fig. 6.

Measurement: TL. 22.0-23.5μ; TB. 35.2-40.0μ; BI. 6.2-6.5μ; BSS. 22.0-24.0μ; LS. 7.0-9.0μ.

Very rare.

Distribution: Flathead Co.: 29-(H.L.1). Granite co.: 127-(6Mon38).

Arthrodesmus tortus Grönb., Mem. Soc. Fauna, Fl. Fenn., 28, p. 21. figs. 5-11. 1952.

Pl. 62. figs. 10,11,12,13.

Measurements: TL. 20.0-26.0μ; TB. 25.0-26.0μ; BI. 8.5-10.0μ; BSS. 20.0-22.0μ; LS. 1.0-3.0μ.

Very rare.

Distribution: Lincoln Co.: 13-(Mt63-73). Ravalli Co.: 115-(Mt63-265, 266).

Arthrodesmus tortus Grönbl. fa.?

Pl. 62 figs. 14,15.

Measurements: TL. 18.0-20.0μ; TB. 18.0-20.5μ; BI. 7.0-7.5μ; LSS. 15.0-16.0μ; BSS. 15.0-17.5μ; LS. 1.5-3.0μ; T. 7.0-7.5μ.

Cells in their outline similar to A. tortus as illustrated in Fig. 10, and as is characteristic of that species the semicells are twisted at the isthmus. They differ from Grönblad's plant in their smaller measurements.

The plant is entered here with reservation because I am uncertain whether it is really a small form of A. tortus or a biradiate facies of Staurastrum. This is because a triradiate plant illustrated on pl. 62 figure 18, and entered here questionably as St. pterosporus Lundell, was also present at this locality. This Staurastrum is similar in size to the Arthrodesmus and also in the general nature of the semicells. Whereas the biradiate plant does not have retuse lateral margins the triradiate plants do. No dichotypical specimen between these plants was found.

In face view this Arthrodesmus is also similar to A. phimus but the twisted semicells clearly distinquish this plant from that species.

The author has a strong inclination to view the twisted Arthrodesmus type cells as biradiate facies of Staurastrum. The biradiate plants were by far the more abundant form and they do resemble A. tortus. Thus they were entered with that species.

Distribution: Flathead Co.: 29-(H.L.1).

Arthrodesmus trianqularis Lagerh., Öfvers. K. Sv. Vet.-Ak. Förhand. 42, No. 7: p. 244, pl. 27. fig. 22. 1886 var. trianqularis.

Pl. 61 fig. 9

Measurements: TL. 26.2-28.0μ; TB. 43.5-52.0μ; BI. 6.2-7.0μ; BSS. 24.0-26.0μ; LS. 8.5-13.0μ.

This species was only encountered in collections from the northwest where it is of moderately rare occurrence. Three varieties were identified with the typical from being the most rare.

Distribution: Flathead Co.: 39 (Mt63-78).

Arthrodesmus triangularis Lagerb. var. inflatus West & West, Journ. Linn. Soc. Bot., 33, p. 320. 1898.

Pl. 61 fig. 10.

Measurements: TL. 29.0-37.2µ; TB. 55.0-61.0µ; BI. 5.5-7.0µ; BSS. 26.5-31.0µ; LS. 9.0-16.0µ;

Very rare.

Distribution: Lake Co.: 88-(Mt63-197,198); 89-(Mt63-388).

Arthrodesmus triangularis Lagerh. var. subtriangularis (Borge) West & West, Proc. Trans. Bot. Soc. Edinb., 23, p. 24, t. 2, fig. 36, 1905.

Pl. 61 figs. 11,12.

Measurements: TL. 31.0-34.5µ; TB. 56.5-70.0µ; BI. 6.0-8.0µ; BSS. 21.0-25.0µ; LS. 24.0-22.0µ.

This was the most frequently encountered form of the species. Rare.

Distribution: Flathead Co.: 29-(H.L.1). Glacier Co.: 54-(Mt62-12). Lincoln Co.: 1-(4184): 10-(Mt63-157).

Arthrodesmus sp.

Pl. 60 fig. 3.

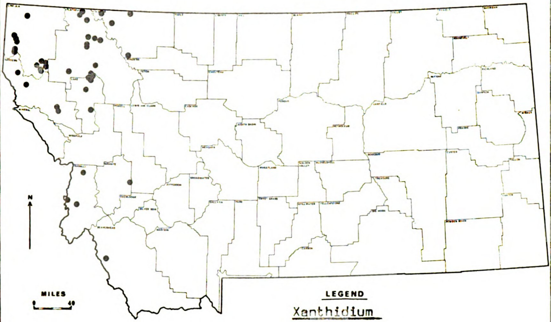
Measurements: TL. 19.0-19.5µ; TB. 19.0-21.0µ; BI. 4.0µ; BSS. 18.0-18.5µ; LS. .5-1.0µ; T. 10.0µ.

This plant could not be placed with any described taxon known to the author. Since a single specimen was seen it was believed best to simply enter the plant as belonging to the genus.

Distribution: Flathead Co.: 22-(6Mon5).

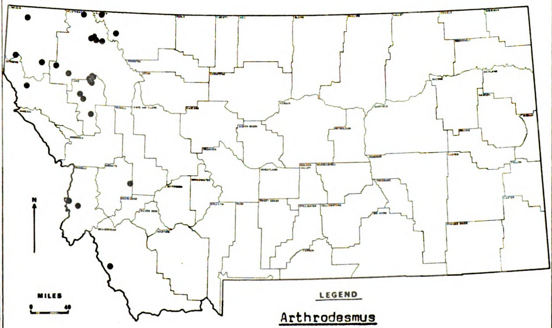
MAP 24

MONTANA



LEGEND

Xanthidium



LEGEND

Arthrodesmus

MAP 25

12. Staurastrum Meyen, 1829

Staurastrum was the second largest genus, by number of taxa collected, ranking third following Cosmarium and Closterium in extent of distributional range. See map no. 26. As here presented it is represented in the desmid flora of Montana by 190 taxa (within 130 species) of which 2 are new varieties and 2 are new formae. Numerous unnamed formae and morphae were also encountered and one plant is entered solely as belonging to the genus.

Staurastrum aculeatum (Ehrenb.) Menegh., in Ralfs' Brit. Desmid., p. 142, t. 23, fig. 2. 1848.

Pl. 99 figs. 6,7.

Measurements: TL. 42.-57.0μ; TB. 53.0-62.0μ; BI. 15.5-20.5μ.

This plant was rare, being known only from collections taken west of the continental divide. In addition to the typical form, var. ornatum Nordst. was also collected. A discussion of var. ornatum and an indication of its distributional range is given under the species St. proboscidium (Bréb.) Archer.

Distribution: Flathead Co.: 28-(Mt63-442, 443, 447). Lake Co.: 81-(Mt 63-209); 86-(Mt62-63,73, Sieminska*).

Previously reported by Sieminska (65) for collection locality 86.

Staurastrum affine West & West, Trans. Bot. Soc. Edinb., 23: p. 26, t. 2, fig. 27. 1905.

Pl. 101. fig. 9.

Measurements: TL. 32.0μ; TB. 36.0-40.0μ; BI. 8.5μ.

Very rare. Known from a single locality in north-central Montana.

Distribution: Blaine Co.: 152-(MT 63-32).

Staurastrum alternans Bréb. in Ralfs' Brit. Desmid., p. 132, t. 21, fig. 7, 1848. var. alternans

Pl. 89 figs. 6,7,8.

Measurements: TL. 19.0-24.5μ; TB. 19.0-25.0μ; BI. 6.0-8.5μ.

This is a common species in the collections, occurring in both the northern and southern montane regions. The cells are usually equally as long as broad or, a little longer than broad. A number of specimens were also found in which the angles (rays) of the semicells are more produced and the plants distinctly broader than long. These latter mentioned plants are entered below as an unnamed forma of the species.

Distribution: Broadwater Co.: 130-(Mt64-131). Daniels Co.: 187-(Mt64-5). Flathead Co.: 35-(Mt63-391); 37-(Mt63-82); 47-(Mt63-412,415). Gallatin Co.: 140-(Mt64-129); 141-(Mt64-126). Lake Co.: 83-(Mt63-204); 86-(Siminska*); 92-(Mt63-38); 93-(Mt63-36). Lincoln Co.: 4-(Mt63-131); 12-(Mt63-68); 13-(Mt63-73,74); 15-(Mt62-26); 21-(Mt63-101). Missoula Co.: 101-(Mt64-72). Ravalli Co.: 115-(Mt63-266). Sanders Co.: 71-(Mt63-165); 72-(Mt63-162); 75-(Mt63-173); 76-(Mt63-191).

Previously reported by Sieminska (65) for collection locality 86.

Staurastrum alternans Bréb. var. alternans fa.

Pl. 89 figs. 9,10.

Measurements: TL. 19.0-23.5μ; TB. 24.0-29.5μ; BI. 8.0-8.5μ.

Rare. Differing from the type in its more produced angles.

Distribution: Flathead Co.: 35-(Mt63-391). Lincoln Co.: 4-(Mt63-131); 21-(Mt63-101). Sanders Co.: 72-(Mt63-162).

Staurastrum anatinum Cooke & Wills. var. longibrachiatum West & West, Tran. Roy. Soc. Edinb., 41: p. 504, t. 7, figs. 8,9. 1905.

Pl. 100 figs. 3,4.

Measurements: TL. 31.0-35.0µ; TB. 66.0-85.0µ; BI. 11.0-11.5µ; LP. 21.0-28.0µ.

I have assigned these plants to var. longibrachiatum but could just as well have entered them as var. curtum G.M. Smith. In body dimensions they are like var. longibrachiatum while the length of the processes is somewhat short, and thus similar to var. curtum. The length of processes, however, can be quite variable so the plants are entered as above. Rare.

Distribution: Beaverhead Co.: 135-(Mt63-333,339, 340); 142-(Mt63-334); 143-(Mt63-345). Lincoln Co,: 6-(Mt63-145).

Staurastrum arachnae Ralfs, Brit. Desmid., p. 136, t. 23, fig. 6. 1848.

Pl. 77 fig. 1.

Measurements: TL. 22.0-25.0µ; TB. 32.0-37.0µ; BI. 8.5-9.0µ; BSP. 14.0-16.0µ; LP. 9.0-10.0µ.

Measurements smaller than those given for the species by West & West (22). Very rare. Known from a single locality in Glacier National Park.

Distribution: Flathead Co.: 31-(4181).

Staurastrum arctiscon (Ehrenb.) Lund. Nova Acta Reg. Soc. Scient. Upsal. ser. 3, vol. 8: p. 70, t. 4, fig. 8. 1871.

Pl. 79 figs. 1,2.

Measurements: TL. 93.0-118.0µ; TB. 82.0-105µ; BI. 21.0-33.0µ; LSP. 54.0-67.0µ; BSP. 40.0-53.5µ.

A very common desmid in the northwest where it was primarily encountered in lentic environments at or below 3800 feet. Also known from a high altitude lake (7000 feet) in the southwestern part of the state.

Distribution: Beaverhead Co.: 135-(Mt63-330;340). Flathead Co.: 23-(Mt 63-398,400); 27-(Mon25); 29-(H.L.1); 35-(Mt63-390); 36-(Mt63-393). Glacier Co.: 63-(Mt63-218,Kidd*); 64-(Mt61-2). Lake Co.: 80-(4Mon52); 82-(Mt63-200); 83-(Mt63-203); 84-(B_6); 86-(Mt63-188); 89-(Mt63-369); 95-(Mt62-59); 97-(Mt63-33). Lincoln Co.: 3-(Mt63-138); 5-(Mt63-136); 15-(Mt62-28); 19-(Mt63-111). Missoula Co.: 101-(Mt64-73). Sanders Co.: 72-(Mt63-162); 76-(Mt63-176); 77-(Mt63-194).

Previously reported by Kidd(63) for collection locality 63, and by Thomasson (62) for Two Medicine Lake, located in the southeastern part of Glacier National Park (not illustrated).

Staurastrum arcuatum Nordst. f. aciculifera West & West, Journ. Linn. Soc. sec. ser. Bot., vol. 5: p. 262, pl. 16, fig. 34. 1896.

Pl. 80 figs. 6,7.

Measurements: TL. 31.0-32.0μ; TB. 33.0-37.0μ; BI. 8.0-8.5μ; LSP. 22.0-24.0μ; BSP. 22.0-33.0μ.

This plant is identical to that illustrated by Irénée-Marie (39) as St. furcatum var. pisciforme Turn. (Pl. 55, figs. 9, 10).

Cells a little smaller than measurements originally given by West and West. Otherwise identical. Rare.

Distribution: Granite Co.: 127-(6Mon41). Lake Co.: 84-(Mt62-81); 86-(Mt62-63,72); 94-(7Mon15). Ravalli Co.: 115-(Mt63-271).

Staurastrum arcuatum Nordst. var. guitanense West, Journ. Linn. Soc. Bot., vol. 29: p. 181, t. 23, fig. 10. 1892. fa.

Pl. 91 figs. 5,6,7,8.

Measurements: TL. 20.0-24.0μ; TB. 22.0-26.0μ; BI. 6.0-7.0μ.

In face view the plants most resemble var. guitanense and like it, have the dorsal processes characteristic of the type greatly reduced.

The development of dorsal processes however, it quite variable in these plants, being in most cases completely absent. The plants are small for var. quitanense, and more closely match the length measurements of the type. Consequently, the plants are entered here as an unnamed forma.
Distribution: Flathead Co.: 29-(H.L.1). Lincoln Co.: 5-(Mt63-137); 15-(Mt62-26).

Staurastrum aristiferum Ralfs var. prescottii Irénée-Marie, Hydrobiologia, vol. 4: p. 57, pl. 6 figs. 4,5. 1952. fa.

Pl. 67 figs. 1,2.

Measurements: TL. 24.0-25.0μ; TB. 38.5-44.0μ; BI. 5.0-6.0μ; BSS. 22.5-27.0μ; LS. 8.0-12.0μ.

Plants differing from Irénée-Marie's in being triradiate. Consequently, they are entered as a forma. In face view the plant also resembles St. cuspidatum var. delpontei Irénée-Marie, but differ from that taxon in apical view, in which it is similar to St. aristiferum var. protuberans West & West. Very rare.
Distribution: Lake Co.: 86-(Mt63-186,187).

Staurastrum avicula Bréb. in Ralfs' Brit. Desmid., p. 140, t. 23, fig. 11. 1848. var. avicula

Pl. 91 figs. 1,2.

Measurements: TL. 27.5-31.5μ; TB. 30.5-40.0μ; BI. 7.0-10.0μ; BSS. 30.5-36.0μ.

A number of specimens were found in which one semicell possessed but a single spine at the corners thus resembling St. lunatum Ralfs. The other semicell, however, had two spines or bifurcate processes typical of the species. Semicell completely devoid of spines were also noted.

The plant described by Wade (57) as St. avicula var. cororulatum is placed in this text with St. rugosum Irénée-Marie. This species was only encountered in collections from the northwest where it is of moderately rare occurrence.

Distribution: Flathead Co.: 29-(H.L.1); 35-(Mt63-391); 42-(Mon16). Lake Co.: 87-(Mt64-64); 95-(Mt62-60). Lincoln Co.: 13-(Mt63-74); 15-(Mt62-26); 17-(Mt63-118,121).

Previously reported by Thomasson (62) for Two Medicine Lake located in the southeastern part of Glacier National Park (not illustrated).

Staurastrum bicorne Haupt., Mitth. a. d. Naturwiss. Ver. f. Neuvor-pommern u. Rügen Jahrg. 20: p. 95, t. 3, figs. 21, 24, 27. 1888.

Pl. 96 figs. 8,9,10,11,12.

Measurements: TL. 53.0-65.0μ; TB. 71.0-112.0μ; BI. 12.0-14.0μ.

This species was only encountered in northwestern Montana where it is of common occurrence. Some of the smaller specimens are somewhat reminiscent of St. johnsonii West & West.

Distribution: Flathead Co.: 23-(Mt63-399); 29-(H.L.1); 35-(Mt63-391); 36-(Mt63-393); 47-(Mt63-415). Glacier Co.: 64-(Mt61-2). Lake Co.: 87-(Mt64-65). Lincoln Co.: 2-(Mt63-142); 4-(Mt63-130); 19-(Mt63-110); 21-(Mt63-100,103). Sanders Co.: 72-(Mt63-163); 76-(Mt63-160).

Staurastrum bienneanum Rabenh., Alg. no.1410. 1862 var. bienneanum

Pl. 71 figs. 15,16.

Measurements: TL. 36.0-44.0μ; TB. 37.2-44.0μ; BI. 11.5-12.0μ.

The larger forms of this plant illustrated in fig. 16, have more rounded lateral angles than are generally attributed to the type.

Rare. Known from two localities in the northwest.

Distribution: Lincoln Co.: 9-(Mt63-154). Missoula Co.: 101-(Mt64-70).

Staurastrum *bienneanum* Rabenh., var. *ellipticum* Wille, Öfvers. K. Vet.-Akad. Förh., 5: p. 50, t. 13, fig. 49. 1879.

Pl. 71 fig. 13.

Measurements: TL. 30.0-32.0μ; TB. 30.5-32.5μ; BI. 8.5-9.0μ.

Cells a little smaller than measurements given for the variety by West and West (12).

Rare. Known only from two collection localities west of the continental divide.

Distribution: Flathead Co.: 41-(Mt63-60,61). Missoula Co.: 100-(Mt63-419).

Staurastrum *bienneanum* Rabenh. fa.

Pl. 71 figs. 12,14.

Measurements: TL. 25.0-36.0μ; TB. 25.5-33.5μ; BI. 6.5-12.0μ.

Plants differing from the type in being a little longer than broad. The plants are small and resemble the one identified as *Staurodesmus* *bienneanum* var. *ellipticus* (Wille) Croasdale (1962), and illustrated on pl. 6, fig. 107.

Moderately rare.

Distribution: Beaverhead Co.: 133-(Mt63-314). Flathead Co.: 23-(Mt63-399); 27-(Mon25); 31-(4183); 47-(Mt63-415). Lincoln Co.: 19-(Mt63-110). Ravalli Co.: 117-(Mt63-280). Sanders Co.: 76-(Mt63-159).

Staurastaum *boldtianum* Grönb., Acta Soc. Sci. Fenn., n. ser. B2(5) p. 40, pl. 4, fig. 4. 1942.

Pl. 63 fig. 5.

Measurements: TL. 23.0μ; TB. 21.0μ; BI. 8.0μ.

Plant most resembles this species as illustrated by Croasdale (62) under the name *Staurodesmus* *boldtianus* (=*Std.* *sibericus* (Borg.) Teil.

var. crassangulatus (Borg.) Teil.),also somewhat resembling St. zachariasii Schrod. as illustrated by Grönblad (63). This latter named species, however, is smaller.

Very rare. A single specimen observed.

Distribution: Flathead Co.: 28-(Mt63-444).

Staurastrum boreale West & West, Proc. Trans. Bot. Soc. Edinb., 23: p. 27, t. 2. fig. 25, 1905.

Pl. 103 figs. 1,2,3.

Measurements: TL. 22.0-26.0μ; TB. 31.0-46.0μ; BI. 7.0-9.0μ.

It appears that this species differs from St. gracile Ralfs only in its smaller size and probably should be considered a variety of that species.

Known only from collection localities west of the continental divide where it occurs with moderately rare frequency.

Distribution: Flathead Co.: 27-(Mon25); 42-(Mon16). Lake Co.: 82-(Mt63-201); 84-(X8); 86-(Mt63-188); 95-(Mt62-59). Lincoln Co.: 6-(Mt63-148). Missoula Co.: 102-(Mt62-4).

Staurastrum botrophilum Wolle, Bull. Torr. Bot. Club 8(1) p. 2, t.6, fig. 13, 1881.

Pl. 86 fig. 9.

Measurements: TL. 45.0-46.0μ; TB. 40.0-42.0μ; 10.0-11.0μ.

Very rare. Only a few specimens seen.

Distribution: Flathead Co.: 39-(Mt63-78). Granite Co.: 127-(6Mon38).

Staurastrum brachiatum Ralfs, Brit. Desmid., p. 131, t. 23, fig. 9. 1848.

Pl. 77 fig. 2.

Measurements: TL. 24.0-34.0μ; TB. 21.0-40.0μ; BI. 7.0-8.5μ.

Rare. Never collected in any abundance.

Distribution: Flathead Co.: 29-(H.L.1). Lake Co.: 86-(62-63, Sieminska*); 94-(7Mon15). Ravalli Co.: 115-(Mt63-265).

Previously reported by Sieminska (65) for collection locality 86.

Staurastrum brasiliense Nordst. var. lundellii West & West, Trans. Linn. Soc. Lond. sec. ser. Bot. vol. 5(5): p. 259. 1896.

Pl. 77, figs. 3,4.

Measurements: TL. 110-180.6μ; TB. 113.0-140.7μ; BI. 31.0-36.0μ.

This species is rather rare in the collection and is known only from the northwest.

Distribution: Flathead Co.: 31(Kidd*); 46-(Mt62-1). Glacier Co.: 54-(Mt62-13). Lake Co.: 86-(Mt63-187, Sieminska*).

Previously reported by Sieminska (65) for collection locality 86.

Staurastrum brebissonii Arch. in Pritch. Infus., p. 739. 1861 var. brebissonii

Pl. 73 figs. 4,5

Measurements: TL. 40.0-48.0μ; TB. 47.0-53.0μ; BI. 12.0-15.0μ; LSS. 40.0-45.0μ; BSS. 43.5 -50.0μ.

This was one of the more common Staurastra encountered. Collected in both the northern and southern montane regions. In addition to the typical form, the species is represented in the collections by a small form of the type, and one variety.

Distribution: Beaverhead Co.: 133-(Mt63-315); 135-(Mt63-337). Flathead Co.: 23-(Mt63-399). Granite Co.: 128-(Mt63-386). Lake Co.: 85-(Mt63-47); 95-(Mt62-58).

Staurastrum brebissonii Arch.var. brebissonii fa.

Pl. 73 figs. 2,3.

Measurements: TL. 39.0-43.0μ; TB. 39.0-45.0μ; BI. 9.5-13.5μ; LSS. 36.5-40.5μ; BSS. 36.0-39.0μ.

Plant differing from the type in its smaller dimensions. The most often encountered form of the species. Only known from west of the continental divide.

Distribution: Flathead Co.: 23-(Mt63-399); 25-(Mt63-407); 28-(Mt63-445); 39-(Mt63-77). Lake Co.: 81-(Mt63-206,212); 86-(Mt62-66). Lincoln Co.: 9-(Mt63-154); 14-(Mt63-76). Missoula Co.: 100-(Mt63-419).

Staurastrum brebissonii Arch. var. truncatum Grönbl., Soc. Sci. Fenn. Comm. Biol., 2: p. 27 pl. 2, figs. 85-86, 1927.

Pl. 73 fig. 6,7.

Measurements: TL. 46.0-49.0μ; TB. 43.5-48.0μ; BI. 15.0-16.5μ; LSS. 46.0-49.0μ; BSS. 43.0-46.5μ.

Very rare.

Distribution: Lincoln Co. : 8-(Mt63-152). Sanders Co.: 76-(Mt63-175).

Staurastrum breviaculeatum Smith, Bull. Wis. Geol. Nat. Hist. Surv., 57: p. 78, pl. 70, figs. 10-18. 1924.

Pl. 75 fig. 1

Measurements: TL. 35.5-37.0μ; TB. 40.0-44.0μ; BI. 11.0-12.0μ; LSS. 34.0-35.0μ; BSS. 34.0-38.0μ; LS. 3.0-4.0μ.

The plant illustrated in fig. 1 and entered here as the typical form of the species differs from the type in its depressed semicells and more closed sinus. It is somewhat reminiscent of St. gladiosum Turn., but possesses shorter, stouter spines. Very rare.

Distribution: Sanders Co.: 74-(Mt63-171).

Staurastrum breviaculatum Smith morpha

Pl. 75 fig. 2

Measurements: TL. 41.0μ; TB. 45.0μ; BI. 15.5μ; LSS. 39.0μ; BSS. 39.0μ; LS. 1.5-4.0μ.

Differing from the type in the depressed nature of the semicells and reduced number of spines.

Very rare.

Distribution: Flathead Co.: 29-(H.L.1).

Staurastrum brevispinum Bréb., in Ralfs' Brit. Desmid., p. 124, t. 34, figs. 7a,b. 1848.

Pl. 67 figs. 6,7,10

Measurements: TL. 31.5-45.0μ; TB. 28.0-40.0μ; BI. 9.0-13.5μ; LS. .5-1.0μ.

In the material studied there was considerable intergradation between var. _brevispinum_ and var. _boldtii_ Lagerheim. Consequently, plants which could be assigned to var. _boldtii_ have been included under the typical form.

This species was encountered in the northern and southern montane regions, occurring in lentic environments at altitudes ranging from 2000 to 7000 feet. The typical form was collected most frequently. Moderately common.

Distribution: Beaverhead Co.: 135-(Mt63-330,333). Flathead Co.: 31-(Kidd*): 35-(Mt63-391); 36-(Mt63-395). Glacier Co.: 54-(Mt62-24). Lake Co.: 83-(Mt63-203,204); 87-(Mt64-64). Lincoln Co.: 4-(Mt63-134); 15-(Mt62-26). Missoula Co.: 101-(Mt64-72). Sanders Co.: 72-(Mt63-163); 74-(Mt63-171).

<u>Staurastrum</u> <u>brevispinum</u> Bréb. var. <u>alatum</u> West & West, Trans. Roy. Soc. Edinb., 41: p. 502, t.7, fig. 16. 1905.

Pl. 67 fig. 8.

Measurements: TL. 40.0-44.0μ; TB. 31.5-34.0μ; BI. 10.5-11.0μ; LS. .5-1.0μ.

Plants smaller than measurements given by West and West, but similar in form. Very rare. Known only from west of the continental divide. Distribution: Flathead Co.: 29-(H.L.1). Sanders Co.: 76-(Mt63-190).

<u>Staurastrum</u> <u>bullardii</u> Smith, Bull. Wis. Geol. Nat. Hist. Sur., 57: p. 91. pl. 74, figs. 19-23, pl. 75, figs. 1-3. 1924.

Pl. 107 figs. 5-7

Measurements: TL. 45.0-80.0μ; TB. 69.0-83.5μ;BI.6.5-9.5μ;LSP. 20-24.0μ; LP. 30.0-45.0μ.

The apical emarginate verrucae characteristic of this species were not always present. Various stages of verrucae development, however, were observed in specimens from collection locality 101.

Moderately rare.

Distribution: Carbon Co.: 178-(Mt64-109). Lewis & Clark Co.: 109-(Mt64-84). Lincoln Co.: 17-(Mt63-118). Missoula Co.: 101-(Mt64-70). Powell Co.: 106-(Mt64-74).

<u>Staurastrum</u> <u>chaetoceras</u> (Schröder) G.M. Smith, Bull. Wis. Geol. Nat. Hist. Surv.,57: p. 99, pl. 76, figs. 21-24; pl. 77, fig. 1. 1924.

Pl. 109 figs. 2,4

Measurements: TL. 60.0-91.0μ; TB. 70.0-94.0μ; BI. 5.5-7.5μ; LSP. 18.0-26.5μ; BSP. 12.0-19.0μ; LP. 34.0-49.0μ.

Very rare. Known from two collection localities, a small pond at

3600 feet altitude in north-central Montana, and a creek in the northeast at an elevation of 2000 feet.

Distribution: McCone Co.: 192-(Mt64-21). Teton Co.: 68-(Mt 64-51).

Staurastrum chaetoceras (Schröd.) G.M. Smith fac. triradiata.

Pl. 109 figs. 1,3

Measurements: TL. 82.0-88.0µ; TB. 95.0-97.0µ; BI. 8.0-8.5µ; LSP. 32.0-36.0µ; BSP. 24.0-25.0µ; LP. 44.0-48.0µ.

Rare. Known only from the piedmont region (northcentral and south-central Montana) of the state. Collected from two rivers and reservoir, and not in abundance.

Distribution: Carbon Co.: 176-(Mt64-111). Chateau Co.: 156-(Mt64-46). Liberty Co.: 150-(Mt64-61).

Staurastrum chaetoceras (Schröder) G.M. Smith fa.

Pl. 109 fig. 5.

Measurements: TL. 78.0-79.0µ; TB. 108.0-115.0µ; BI. 6.0-6.5µ; LSP. 22.0-23.5µ; BSP. 11.0-13.0µ; LP. 52.0-57.0µ.

This plant differs from St. chaetoceras in the shape of the corpus and the greater length of the processes. The semicells bear a row of three acute granules below the apex. A minute spine was present at the basal corners of one semicell. The plant, in body form, most resembles the species as illustrated by Skuja (Pl. 39, fig. 1. 1956). Very rare. Only known from a lake at an elevation of 4000 feet in the northwest.

Distribution: Missoula Co.: 101-(Mt64-70).

Staurastrum cingulum (West & West) G.M. Smith Trans. Wis. Acad. Sci. Arts and Letters. 20: p. 353. 1922.

Pl. 105 figs. 1,2,3

Measurements: TL. 48.0-84.0μ; TB. 64.0-95.0μ; BI. 6.0-11.5μ; LSP. 27.0-40.0μ; BSP. 15.0-21.0μ; LP. 25.0-47.0μ.

It was found that the shape of the semicell in this species was quite variable, ranging from subcylindrical to cup-shaped. There was also considerable variation in the length of the processes, with the longer processes usually appearing more gracefully curved. The body of the semicells commonly possessed the typical isthmal ring of granules, however, specimens were found which completely lacked these granules as well as the intramarginal granules normally present at the apex. Plants lacking said body ornamentation might be placed by some authors with St. paradoxum Meyen. Brook (59) mentions and illustrates forms with similar reduction of ornamentation. Moderately rare.

Distribution: Beaverhead Co.: 135-(Mt63-340). Deer Lodge Co.: 129-(Mt63-383). Lake Co.: 88-(Mt63-197). Lincoln Co.: 7-(Mt63-127); 17-(Mt63-116,117). McCone Co.: 192-(Mt64-21). Valley Co.: 183-(Mt64-11).

Staurastrum clevei (Wittr.) Roy & Biss., Ann. Scott. Nat. Hist., 6: p. 18, 1893.

Pl. 80 fig. 15.

Measurements: TL. 40.0μ; TB. 40.0μ; BI. 8.0μ; LSP. 28.0μ; BSP. 21.0-22.0μ; LP . 10.0-12.0μ.

Very rare. Collected from a high altitude (7000 feet) bog pool. A single specimen observed.

Distribution: Granite Co.: 127-(6Mon41).

Staurastrum connatum (Lund.) Roy & Biss., Journ. Bot., 24: p. 237. 1886.

Pl. 63 fig. 4

Measurements: TL. 36.0-40.0μ; TB. 25.0-30.0μ; BI. 6.0-7.5μ; LSS. 22.0-25.0μ; BSS. 23.0-25.0μ; LS. 7.0-10.0μ.

Rare. This species is only known to the author from collections taken west of the continental divide.

Distribution: Lake Co.: 81-(Mt63-206); 95-(Mt62-58). Ravalli Co.: 115-(Mt63-265,271).

Staurastrum connatum (Lund.) Roy & Biss. fa.?

Pl. 63 fig. 3

Measurements: TL. 22.0-26.0μ; TB. 20.0-21.0μ; BI. 5.5-6.0μ; LSS. 19.0-20.0μ; BSS. 18.5-19.0μ; LS. 2.0-3.0μ.

This plant is very similar to that illustrated by Irénée-Marie (39) on pl. 45, fig. 13, under the name St. apiculatum Bréb. It also fits well for the measurements he gives. It differs from his plant in that the spines on the Montana specimens are divergent while in Irénée-Marie's plant the spines are directed vertically. I do not believe the plant is identical to either of the two forms of St. dejectum var. apiculatum (Bréb.) Lund. (=St. apiculatum) which are recognized in this study. Consequently, the plant is not placed with var. apiculatum. Since the plant is reminiscent of St. connatum in the shape of the semicells, but differs from it in its much reduced spines and smaller dimensions, the plant is entered with this species with reservation. Very rare. Only a few specimens seen.

Distribution: Flathead Co.: 31-(4182).

Staurastrum controversum Bréb., in Ralfs' Brit. Desmid., p. 141, t. 23, fig. 3. 1848.

Pl. 99 fig. 3

Measurements: TL. 23.0-25.0μ; TB. 36.0-37.0μ; BI. 7.5μ.

Very rare. Known from a single collection taken from a small pond in the northwest.

Distribution: Ravalli Co.: 115-(Mt63-274).

Staurastrum corniculatum Lund. var. spinigerum W. West f. latum Grönbl., Acta Bot. Fenn., 66, p. 30, figs. 116, 167, 1964.

Pl. 66 figs. 5,6

Measurements: TL. 36.0-38.5μ; TB. 35.0-40.5μ; BI. 18.0-19.0μ; LSS. 36.0-38.0μ; BSS. 35.0-37.0μ.

The shape of the semicells in this plant is so characteristic and constant, and differs so from the type, that one could consider this plant a distinct variety. All of the Montana specimens possessed pores, and these did not extend into the angles (radial corners) of the semicells. The presence or absence of spines was variable, but most specimens lacked them. Very rare. Known from a single collection locality in the northwest.

Distribution: Lincoln Co.: 5-(Mt63-137).

Staurastrum corniculatum Lund. var. biunguiculatum var. nov.

Pl. 66 fig. 7

Measurements: TL. 38.0-42.0μ; TB. 37.0-42.0μ; BI. 14.5-17.0μ; LSS. 36.0-40.5μ; BSS. 36.0-38.0μ.

Cell as broad as long or a little longer than broad, sinus open; semicells in face view triangular with ventral lateral margins indented, apical angles (radial corners) with paired, curved spines disposed vertically one above the other. Cells porous on the corpus, but not on the radial corners.

Plant distinguished from the type and all described varieties and formae by the paired robust and sharply curved spines present at the radial corners of the semicells.

The Montana specimens are reminiscent of the Michigan plant reported by Wade(52) as a forma of St. aviculoides Grönbl. (38). In vertical view they are identical to Gronblad's plant, but differ from it in front view in having indented lateral margins in contrast to the straight margins shown by Grönblad. They differ from Wade's plant in having the pores restricted to the corpus of the semicell, and, in apical view, in having the sides convex in the middle as opposed to concave. Very rare.
Distribution: Missoula Co.: 101-(Mt64-70,72).

Staurastrum cornutum Arch., Ann. Mag. Nat. Hist., p. 232, 1881.

Pl. 84 figs. 1,2,3.

Measurements: TL. 37.0-42.0μ; TB. 41.0-52.0μ; BI. 11.0-13.0μ; BSS. 29.0-37.0μ.

This species showed morphological variation similar to that reported by Croasdale (57) for her Alaskan material. Cells ranging from practically spineless forms to forms with large bi and trifurcate spines. Some plants in form approached St. forficulatum var. cornutiforme Wade.

Rare.

Distribution: Flathead Co.: 29-(H.L.1). Glacier Co.: 54-(Mt62-13).
Lake Co.: 86-(Mt62-63).

Staurastrum crenulatum (Näg.) Delp., Spec. Desm. subalp., p. 164, t. 12, fig. 1-11. 1877.

Pl. 104 fig. 4

Measurements: TL. 22.5-24.0μ; TB. 37.0-38.0μ; BI. 7.5-8.5μ.

Very rare. Known from a single collection taken from a lake in the northwest.

Distribution: Lincoln Co.: 15-(Mt62-26).

Staurastrum cristatum (Naeg.) Arch. var. japonicum Hirano, Acta Phytotax. Geobot., 14(3): p. 71, fig. 3. 1951.

Pl. 90 figs. 10,11.

Measurements: TL. 37.0-39.0μ; TB. 35.0-40.0μ; BI. 13.5-16.0μ.

Very rare. Known only from two localities in the northwest.

Distribution: Lincoln Co.: 15-(Mt62-26); 17-(Mt63-121).

Staurastrum curvatum West, Journ. Linn. Soc. Bot., 29: p. 172, t. 22, f. 13. 1892.var. curvatum morpha

Pl. 63 fig. 2

Measurements: TL. 21.0-25.5μ; TB. 21.5-24.0μ; BI. 3.5-4.0μ; LSS. 18.0-19.0μ; BSS. 15.5-17.0μ; LS. 4.0-6.0μ.

Differing from the typical form of the species by its somewhat smaller body measurements and much shorter spines.

Very rare. Known only from a bog in Glacier National Park.

Distribution: Glacier Co.: 54-(Mt62-11,17).

Staurastrum curvatum West f. brevispina Nygaard, Kgl. danske Vidensk. Selskab, Biol. Sk.,7(1):p. 89, fig. 43. 1949.

Pl. 63 fig. 1

Measurements: TL. 34.0-36.5μ; TB. 32.0-34.0μ; BI. 7.0-7.5μ; LSS. 24.5-26.5μ; BSS. 28.0-30.0μ; LS. 5.0-8.0μ.

Very rare.

Distribution: Lake Co.: 82-(Mt63-199). Sanders Co.: 76-(Mt63-192).

Staurastrum sp. 1 (=St. curvatum West var. inflatum Lind. & Pearsall?)

Pl. 66 figs. 1,2,3,4.

Measurements: TL. 30.0-34.0µ; TB. 54.0-61.0µ; BI. 6.0-7.5µ; LSS. 30.0-31.5µ; BSS. 26.0-30.0µ; LS. 11.0-17.0µ; Z. 45.0:46.0µ-56.5:59.0µ.

This plant is very similar in form and measurements to St. curvatum var. inflatum, especially as illustrated by Brook (figs. 19-24, 1958). under the name Staurodesmus curvatum var. inflatus. Teiling (67) considers this species as a variety of Std. dejectus but I do not believe this plant belongs to that species. Furthermore, the zygospore for the Montana plants does not fit. The zygospore is more reminiscent of that described by West, West and Carter (23) for St. cuspidatum.

Since I can not find a satisfactory position for this plant I have entered it only as belonging to the genus, and indicated in parentheses a possible identification. Although a very rare plant, being known from a single locality in the northwest, it was collected in abundance.

Distribution: Lake Co.: 83-(Mt63-202,204,205).

Staurastrum curvirostrum Turn., K. Sv. Vet.-Akad. Handl., 25(5): p. 107, pl. 17, figs. 12 a & b. 1892. ?

Pl. 69 fig. 7

Measurements: TL. 43.0µ; TB. 77.0µ; BI. 12.0µ; BSP. 46.0µ; LS. 13.0-17.0µ.

There are similarities between this plant and those entered as St. dickiei var. maximum West. This is seen in the placement of the spines and the nature of the sinus, and may possibly be yet another form of that variable species. It is entered here with reservation since only a single specimen was seen. Turner's original illustration is confined to a single semicell and it is somewhat difficult to visualize the exact form of the plant. Very rare.

Distribution: Sanders Co.: 76-(Mt63-176).

Staurastrum cuspidatum Bréb. in Ralfs' Brit. Desmid., p. 122, t. 22, fig. 1. 1848. var. cuspidatum

Pl. 64 figs. 6,7,8,9

Measurements: TL. 18.0-22.0μ; TB. 24.0-31.5μ; BI. 3.5-4.5μ; BSS. 19.0-23.0μ; LS. 1.5-5.0μ.

The plants illustrated in figs. 6,7, and 8 are what I regard as the typical form of the species. The plant illustrated in fig. 9, occurred along with the typical form at one locality. The upper semicell of the plant in fig. 9 (dichotypical), is reminiscent of St. eximium Turner. This was a moderately rare species. Known to the author only from west of the continental divide. Plants identified as St. cuspidatum Bréb. var. maximum W. West have been entered under S. mamillatum Nordstedt.

Distribution: Flathead Co.: 47-(Mt63-415). Lake Co.: 83-(Mt63-205); 95-(Mt62-60). Lincoln Co.: 5-(Mt63-137); 15-(Mt62-26); 21-(Mt63-97).

Staurastrum cyclacanthum West & West var. americanum Scott. Grönbl., Acta Soc. Sci. Fenn. nov. ser. B., 2, No. 8: p. 35, pl. 18, fig. 14. 1957.

Pl. 97 fig. 17

Measurements: TL. 24.0-27.0μ; TB. 28.0-36.0μ; BI. 5.0-7.0μ.

These plants had a greater development of ornamentation on the basal inflation of the semicells than indicated by Scott and Gronblad in the original discription. Rare.

Distribution: Flathead Co.: 36-(Mt63-395); 47-(Mt63-412). Glacier Co.: 57-(Mt63-424). Sanders Co.: 75-(Mt63-173).

Staurastrum cyrtocerum Bréb., in Ralfs' Brit. Desmid.,p. 139, t. 22, fig. 10 . 1848.

Pl. 104 fig. 5.

Measurements: TL. 24.0-3[illegible].0μ; TB. 26.0-35.0μ; BI. 7.0-8.5μ.

Plants similar to those illustrated by Croasdale (65), Dick (23) and Skuja (28) as being this species. The plant illustrated by Sieminska (65) from collection locality 86, under the name St. hexacerum (Ehrenb.) Wittr., is probably this species. Rare.

Distribution: Beaverhead Co.: 134-(Mt63-324). Lake Co.: 81-(Mt63-211); 86-(Mt62-63,73,Sieminska*?). Ravalli Co.: 114-(Mt63-256).

Previously reported by Schindler (54) for collection locality 93 but he gives no illustration.

Staurastrum dakotii Taft, Ohio. Journ. Sci. 48, p.87, pl. 1, fig. 5 1948.

Pl. 91 figs. 11,12.

Measurements: TL. 29.5-34.0μ; TB. 36.0-42.0μ; BI. 10.0-11.5μ.

The contour of the plant in face view is identical to that in the original illustration of the species, except that the granules on the Montana specimens are not so strongly developed. In vertical view there are some differences. In this view the angles of the semicell are more acute in the Montana specimens, and the sides are straighter. In addition, there were no scattered granules in the center of the semicell, pores being present instead. Pores in series are also present along the radial angles of the semicell.

This plant is very reminiscent of St. oxyrhynchum Roy & Biss. Very rare. Known from only two localities in the northwest.

Distribution: Flathead Co.: 28-(Mt63-442,443). Lake Co.: 81-(Mt63-213).

Staurastrum dejectum Bréb.

Staurastrum dejectum was one of the more frequently collected and abundant species of the genus. It was primarily encountered in the northwest and was of common occurrence.

Besides the typical form three additional varieties are reported.

Staurastrum dejectum Bréb., in Ralfs' Brit. Desmid., p. 121, t. 20, fig. 5. 1848. var. dejectum

Pl. 64 figs. 1,2.

Measurements: TL. 26.0-27.0μ; TB. 26.0-29.0μ; BI. 5.5-6.5μ.

Very rare. Known only from two bogs in the northwest.

Distribution: Flathead Co.: 22-(6Mon5). Granite Co.: 127-(6Mon41).

Staurastrum dejectum Breb. var. apiculatum (Bréb.) Lund., Desm. Suec. p. 59. 1871.

Pl. 64 figs. 3,4.

Measurements: TL. 20.0-27.0μ; TB. 20.0-27.5μ; BI. 4.0-6.0μ.

I have separated the plants which I consider St. dejectum var. apiculatum into two groups. The first consists of those plants with an elongated isthmus (figs. 3,4). These intergrade somewhat with the typical form of the species. In the second group, listed below as an unnamed forma, the length of the isthmus is reduced and with this shortening of the isthmus the sinus becomes more acute. These latter plants are generally smaller in body measurements. Moderately rare.

Distribution: Flathead Co.: 36-(Mt63-393). Lake Co.: 83-(Mt63-205); 87-(Mt64-66). Lincoln Co.: 2-(Mt63-141); 13-(Mt63-73). Sanders Co.: 76-(Mt63-159).

Staurastrum dejectum Bréb. var. apiculatum (Bréb.) Lund. fa.

Pl. 64 fig. 5.

Measurements: TL. 16.0-21.0μ; TB. 17.0-21.5μ; BI. 4.5-6.0μ.

Plants distinguished from the typical form of the variety by its shortened isthmus. Moderately common and the most frequently collected form of the species.

Distribution: Beaverhead Co.: 135-(Mt63-334). Flathead Co.: 29-(H.L.1). Lake Co.: 83-(Mt63-204); 84-(Q_1,B_6); 86-(Mt63-188); 98-(Mt63-62). Lincoln Co.: 6-(Mt63-149). Madison Co.: 137-(Mt63-378). Sanders Co.: 70-(Mt63-161); 76-(Mt63-159).

Staurastrum dejectum Bréb. var. paten Nordst., K. Sv. Vet.-Akad. Handl., 22(8): p. 39, t. 4, Fig. 16. 1888.

Pl. 63 fig. 8.

Measurements: TL. 23.0-27.0μ; TB. 21.5-25.5μ; BI. 6.0-9.0μ.

The typical form of this variety is rare, being known from only three localities west of the continental divide. The plant listed below as a forma differs from the type in being larger and exhibiting greater morphological variation.

Distribution: Flathead Co.: 22-(6Mon5); 31-(Kidd*). Lincoln Co.: 12-(Mt63-70).

Staurastrum dejectum Bréb. var. patens Nordst. fa.

Pl. 63 figs. 9-13.

Measurements: TL. 28.0-31.0μ; TB. 31.0-38.0μ; BI. 7.0-9.5μ; Z. 32.0-37.0μ.

Plants differing from the type in their larger measurements and in the greater degree of morphological variation exhibited by the cell.

Triradiate forms more frequently encountered than quadriradiate facies. Those plants with dorsal margins of the semicells less convex than ventral margins, and with the spines marginal or nearly so, and divergent (fig. 9), are similar to the typical form of the variety except in size. Those plants with dorsal margins equally as convex as the ventral margins and with spines generally parallel and medially inserted (figs. 11,12) are reminiscent of St. mucronatum Ralfs. Complete intergradation exists between these forms.

The developing zygospore, encountered at collection locality 5, is at this stage, larger than that attributed to the species. Very rare. Collected in abundance at site no. 5.

Distribution: Lincoln Co.: 3-(Mt63-138); 5-(Mt63-136,137).

Staurastrum dejectum Bréb. var. robustum (Messik.) Jackson comb. nov. (St. cuspidatum var. robustum Messik., Viertel-jahrschr. Naturf. Ges. Zurich, 73: p.208, t. 8, fig. 11. 1928).

Pl. 64 figs. 13,14.

Measurements: TL. 43.0-47.0μ; TB. 46.0-49.0μ; BI. 7.0-9.0μ; BSS. 38.0-41.0μ.

On the basis of the shape of the semicell and elongated nature of the isthmus I believe it best to consider this plant as a variety of St. dejectum than as a variety of St. cuspidatum. The plant described by Croasdale (65) as Staurodesmus dejectus var. borealis is probably a quadrate facies of this variety.

The plant differs from the type in its larger measurements.

Very rare.

Distribution: Lincoln Co.: 19-(Mt63-110). Sanders Co.: 76-(Mt63-160).

Staurastrum dentatum Kreiger, Archiv. f. Hydrobiologie, Suppl. - Bd. 11: p. 197, pl.16, fig. 20. 1932.

Pl. 97 fig. 16.

Measurements: TL. 27.0-28.0μ; TB. 28.0-29.5μ; BI. 5.5-6.0μ.

Very rare. Known from a single collection locality west of the continental divide.

Distribution: Lake Co.: 86-(Mt63-186).

Staurastrum denticulatum (Näg.) Arch. in Pritch. Infus. p. 738, 1861.

Pl. 90 fig. 9.

Measurements: TL. 31.5-33.5μ; TB. 32.5-33.0μ; BI. 10.5-13.0μ.

There are more than two or three rows of granules at the angles but, as is characteristic of this species, the granular rows are restricted to the angles. Rare.

Distribution: Lincoln Co.: 2-(Mt63-141); 8-(Mt63-152); 14-(Mt63-76).

Staurastrum dickiei Ralfs

This species was one of the most common Staurastra collected, and although primarily encountered in the northwest, it was also found in the southwestern montane region. It exhibits considerable morphological variation, being represented in Montana's desmid flora by four varieties in addition to the typical form, and a number of unnamed forma.

Staurastrum dickiei Ralfs, Brit. Desmid.,p. 123, t. 21, fig. 3. 1848. var. dickiei

Pl. 68 fig. 1

Measurements: TL. 29.0-32.0μ; TB. 35.5-40.5μ; BI. 8.5-9.5μ.

The typical form of the species has the smallest measurements and the unnamed formae listed separately below differ from it in their greater dimensions. Rare. Known only from the northwest.

Distribution: Flathead Co.: 36-(Mt63-395). Lincoln Co.: 12-(Mt63-71); 13-(Mt63-73); 19-(Mt63-110).

Staurastrum dickiei Ralfs var. dickiei fa.

Pl. 68 fig. 3.

Measurements: TL. 36.0-41.0μ; TB. 51.0-55.0μ; BI. 10.0-11.0μ; BSS. 39.0-45.0μ.

Differing from the type in its greater dimensions. However, this forma should not be confused with St. dickiei var. maximum West & West which is a taxon distinct from this.

Moderately rare. Known from ponds and lakes at low elevations (at or below 3800 feet) in the northwest.

Distribution: Flathead Co.: 35-(Mt63-391). Lake Co.: 87-(Mt64-64). Lincoln Co.: 4-(Mt63-133); 5-(Mt63-137); 21-(Mt63-104). Sanders Co. 76-(Mt63-160).

Staurastrum dickiei Ralfs var. dickiei fa.

Pl. 68 fig. 5.

Measurements: TL. 41.0-45.0μ; TB. 58.0-63.0μ; BI. 11.0-14.0μ; BSS. 44.0-47.0μ.

Another unnamed forma assigned to the type. It differs from the type and the previously listed form in its larger measurements and generally more open sinus. Plants approached var. maximum. Moderately rare. Known only from the northwest.

Distribution: Flathead Co.: 23-(Mt63-400); 27-(Mon25); 29-(H.L.1). Lincoln Co.: 6-(Mt63-146); 19-(Mt63-110).

Staurastrum dickiei Ralfs var. circulare Turn., K. Sv. Vet.-Akad. Handl., 25(5) p. 105, t. 16, fig. 5. 1892.

Pl. 68 fig. 7.

Measurements: TL. 40.0-49.0μ; TB. 40.5-47.0μ; BI. 10.0-14.5μ; BSS. 36.0-42.0μ.

Moderately common. Known to the author only from west of the continental divide.

The plant previously reported by Kidd(63) as St. dickiei, for collection locality 31, is placed here.

Distribution: Flathead Co.: 29-(H.L.1); 31-(4181, Kidd*); 47-(Mt63-413). Lake Co.: 83-(Mt63-205); 84-(Q_1X_8); 86-(Mt63-188); 88-(Mt63-197); 89-(Mt63-389); 95-(Mt62-58). Lincoln Co.: 5-(Mt63-137); 10-(Mt63-156).

Staurastrum dickiei Ralfs var. latum Hirano, Contr. Biol. Lab. Kyoto Univ., 9: p. 304, pl. 39, fig. 13. 1959.

Pl. 68 fig. 2.

Measurements: TL. 28.0-30.0μ; TB. 40.0-42.0μ; BI. 8.0-9.5μ; BSS. 34.0-36.0μ.

Very rare. Only two specimens seen.

Distribution: Flathead Co.: 37-(Mt63-82).

Staurastrum dickiei Ralfs var. maximum West, Trans. Linn. Soc. Lond. sec. ser. Bot., 5(2): p. 72, t. 8, fig. 19. 1895.

Pl. 68 figs. 4,6.

Measurements: TL. 38.5-46.0μ; TB. 55.0-65.0μ; BI. 11.0-14.0μ; BSS. 37.0-42.0μ.

Two forms of this variety are included here. The first exhibits the distinctly open sinus, stout spines in a lateral position, and the ventral margin of the semicell equal to or slightly more convex than the dorsal margin (fig. 4), as is characteristic of the variety. In the second form the spines are more apically inserted and the dorsal margin is flatter. The two forms intergrade. The dimensions of the alga are close to those given in the original description. Moderately rare. Encountered in both the northern and southern montane regions.

Distribution: Beaverhead Co.: 135-(Mt63-340); 147-(Mt63-360). Flathead Co.: 27-(Mon25,Mt63-451). Lake Co.: 94-(7Mon15); 95-(Mt62-60). Lincoln Co.: 15-(Mt62-28). Ravalli Co.: 115-(Mt63-265). Sanders Co.: 74-(Mt63-171).

Staurastrum dickiei Ralfs var. rhomboideum West & West, Journ. Linn. Soc. Bot., 35:p. 545, t. 16, fig. 9. 1903.

Measurements: TL. 34.0-37.0µ; TB. 50.0-55.0µ; BI. 9.0-10.5µ; BSS. 37.0-40.0µ.

Rare. Encountered only in collections from the northwest.

Distribution: Flathead Co.: 39-(Mt63-78). Glacier Co.: 54-(Mt62-13). Lake Co.: 84-(C_3). Missoula Co.: 101-(Mt64-70).

Staurastrum dickiei Ralfs fa.

Pl. 69 fig. 6

Measurements: TL. 40.0-42.5µ; TB. 63.0-65.0µ; BI. 10.0µ; BSS. 45.0-46.0µ.

Plants differing from the type in its greater size, and nature and placement of spines. In size the plant is closest to var. maximum. The spines are marginal, long, stout and convergent.

Very rare. Only two specimens seen. Consequently, only entered as belonging to the species.

Distribution: Lake Co.: 81-(Mt63-210); 95-(Mt62-59).

Staurastrum dilatatum Ehrenb. in Ralfs' Brit. Desmid., p. 133, t. 21, fig. 8, 1848. var. dilatatum f. dilatatum

Pl. 89 figs. 11,12,13

Measurements: TL. 26.0-35.0µ; TB. 27.0-33.0µ; BI. 9.0-12.0µ.

Staurastrum dilatatum was of moderately frequent occurrence in the collections, but only known from the northwestern part of the state. The typical form was the one most often collected.

Distribution: Flathead Co.: 28-(Mt63-442,446,449,500); 29-(H.L.1); 52-(Mt63-439). Glacier Co.: 54-(2Mon9). Lake Co.: 81-(Mt63-206,212). Lincoln Co.: 9-(Mt63-154); 10-(Mt63-157). Ravalli Co.: 114-(Mt63-256).

Previously reported by Schindler (54) for collection locality 93 but he gives no illustration.

Staurastrum dilatatum Ehrenb. var. dilatatum fa. fusiforme fa.nov.

Pl. 89 figs. 14,15,16

Measurements: TL. 28.0-32.0μ; TB. 33.0-38.0μ; BI. 6.0-7.5μ.

Cells broader than long, deeply constricted, sinus widely open; semicells in their upper portion fusiform, the dorsal margin being convex, the ventral margin inflated at the isthmus; lateral angles produced into truncate, tapering rays. Vertical view triradiate, lateral margins concave. Cell wall finely granulate, the granules arranged in concentric rings. Granules at the extremities of the rays are sometimes more acute. Differing from the type by its longer tapering rays. Rare.

Distribution: Flathead Co.: 47-(Mt63-413). Lake Co.: 87-(Mt64-65). Lincoln Co.: 4-(Mt63-129); 19-(Mt63-112).

Staurastrum distentum Wolle, Desmid. of the United States and list of Amer. Pediastrum. Bethlehem, Pa. p. 149, pl. 41, figs. 15,16. 1882.

Pl. 80 fig. 14

Measurements: TL. 23.0-26.5μ; TB. 35.0-37.5μ; BI. 10.5-11.0μ.

The plant is usually devoid of any granules on the body. However, one or two scattered granules were found on a couple of specimens.

Very rare. Known from a single locality in the northwest.

Distribution: Lake Co.: 81-(Mt63-206,211).

Staurastrum dybowskii Woloszynska, Inst. Biol. Bot. Univ. Lvov. p. ? pl. 3, figs. 53, 54. 1919 (not seen).

Pl. 101 figs. 5,6.

Measurements: TL. 18.0-23.0μ; TB. 38.0-46.0μ; BI. 6.0-8.0μ.

This plant is entered here tentatively since only the type illustration was available to the author for study. The citation given above is all that is presently known to the writer regarding where the original description occurs. Rare. Collected only in the northwest.

Distribution: Flathead Co.: 29-(H.L.1). Lake Co.: 83-(Mt63-204). Lincoln Co.: 1-(4184).

Staurastrum erasum Bréb., Mem. Soc. Imp. Sci. Nat. de Cherboug 4:p. 143, t. 1, fig. 28. 1856.

Pl. 73 fig. 1.

Measurements: TL. 33.0-34.0μ; TB. 35.0-36.0μ; BI. 11.0μ; BSS. 33.0-34.0μ.

Very rare. Known from a single collection locality west of the continental divide.

Distribution: Ravalli Co.: 115-(Mt63-265).

Staurastrum floriferum West & West, Trans. Linn. Soc. sec. ser. Bot., 5: p. 265, pl. 18, fig. 1. 1896. var. floriferum.

Pl. 107 figs. 1,2,3,4.

Measurements: TL. 24.0-34.0μ; TB. 52.0-74.0μ; BI. 6.0-9.0μ.

Encountered primarily in the northern montane region, but also known from the northern piėdmont area. Generally collected from lentic environments at low elevations (at or below 3400 feet). Moderately rare.

Distribution: Flathead Co.: 35-(Mt63-391); 36-(Mt63-393). Glacier Co.: 54-(Mt62-25). Lake Co.: 83-(Mt63-205); 94-(7Mon15); 95-(Mt62-58). Lincoln Co.: 3-(Mt63-140); 5-(Mt63-137); 12-(Mt63-67); 15-(Mt62-28). Teton Co.: 68-(Mt64-51).

Staurastrum forficulatum Lund.

This species is only known from two localities, a bog in Glacier National Park and a pond in the northwestern part of the state. Although very rare, the species shows a considerable degree of variation and in addition to the typical form of the plant, two varieties and a dichotypical specimen were identified.

Staurastrum forficulatum Lund., Desm. Suec. p. 66 t. 4, fig. 5, 1871. var. forficulatum

Pl. 84 fig. 7.

Measurements: TL. 34.0-38.0µ; TB. 47.0-50.0µ; BI. 12.0-13.0µ; BSP. 33.0-36.0µ.

Cells with bi or trifurcate processes. Development of apical verrucae variable, and intergradation exists between that characteristic of the typical form (fig. 7), and that present in var. subheteroplophorum f. simplex Grönblad.

Previously reported by Sieminska (65) for this locality.

Distribution: Lake Co.: 86-(Mt62-80).

Staurastrum forficulatum Lund. var. cornutiforme Wade, Revue Algologique, No. 4: p. 267, pl. 2, fig. 9. 1957.

Pl. 84 figs. 4,5.

Measurements: TL. 35.0-40.0µ; TB. 46.0-55.0µ; BI. 11.5-14.5µ; BSP. 31.0-33.0µ.

Most abundant form of the species collected. This variety shows great variation in the shape of the semicell as well as the degree of ornamentation, and at times is strikingly reminiscent of St. cornutum (compare figs. 1,2 and 4).

The plant reported by Sieminska (65) as *St. forficulatum* var. *heteracanthum*, for collection locality 86 is placed here.
Distribution: Glacier Co.: 54-(Mt62-13,19). Lake Co.: 86-(Mt62-80, Mt63-187, Sieminska*).

Staurastrum forficulatum Lund. var. *subheteroplophorum* Grönbl. f. *simplex* Grönbl. Acta Soc. Pro. Fauna. Fl. Fenn., 49(7): p. 57, figs. 5-6. 1921.

Measurements: TL. 38.0-40.0µ; TB. 53.0-55.0µ; BI. 12.0-13.0µ.

Collected along with the typical form and intergrading with it.
Distribution: Lake Co.: 86-(Mt62-80).

Staurastrum forficulatum Lund. var. *subheteroplophorum* Grönbl. f. *simplex* Grönbl. & *St. magnifurcatum* Scott & Grönblad.

Pl. 84 fig. 6

Measurements: TL. 35.0-40.0µ; TB. 50.0-55.0µ; BI. 11.5-13.0µ; LSP. 36.5-38.0µ; BSP. 34.0-37.0µ.

The bottom semicell of this plant is similar to that illustrated by Scott and Gronblad. (pl. 30, fig. 2) for their *St. magnifurcatum*. The vertical view is also similar. The upper semicell is similar to Grönblad's original illustration of *St. forficulatum* var. *subheteroplophorum* f. *simplex* (pl.5, fig. 6. 1920).

From the degree of morphological variation present in the Montana material one could conclude that *St. magnifurcatum* is yet another form of *St. forficulatum* and should not be regarded as a distinct species.
Distribution: Lake Co.: 86-(Mt62-80).

Staurastrum furcatum (Ehrenb.) Bréb., Mem. Soc. Imp. Sci. Nat. de Cherbourg. 4: p. 136. 1856.

Pl. 80 figs. 9,10.

Measurements: TL. 30.0-36.0μ; TB. 26.0-37.0μ; BI. 7.0-9.5μ; LSP. 22.0-26.0μ; BSP. 18.0-22.0μ.

Rare. Known only from west of the continental divide.

Distribution: Flathead Co.: 31-(4181). Lake Co.: 86-(Mt63-187). Ravalli Co.: 115-(Mt63-271).

<u>Staurastrum</u> <u>furcigerum</u> Bréb.

A common desmid but only known from western Montana. In addition to the typical form, two formae and one unnamed forma and morpha were also collected.

<u>Staurastrum</u> <u>furcigerum</u> Bréb., in Menegh. Linnaea 14: p. 226. 1840. var. <u>furcigerum</u> f. <u>furcigerum</u>

Pl. 82 figs. 1,2,3.

Measurements: TL. 46.5-68.0μ; TB. 41.5-67.0μ; BI. 12.0-18.0μ; LSP. 35.5-44.0μ.

This was the most frequently encountered and abundant form of the species. It was collected primarily in the northwest but is also known from the southern montane region. It is chiefly a lake species.

The length of the processes varies and those possessing the longest processes are listed below separately as an unnamed forma.

Distribution: Deer Lodge Co.: 129-(Mt63-384). Flathead Co.: 22-(6Mon5); 23-(Mt63-398); 39-(Mt63-78,79,81); 47-(Mt63-413). Glacier Co.: 56-(Kidd*); 63-(Kidd*). Lake Co.: 87-(Mt64-66); 94-(7Mon15). Lincoln Co.: 2-(Mt63-142); 3-(Mt63-138); 4-(Mt63-133,134); 6-(Mt63-146,149); 19-(Mt63-111); 20-(Mt63-91); 21-(Mt63-97).

Previously reported by Kidd(63) for collection localities 56, and 63. The plant entered questionably as this species by Sieminska (65) for collection locality 86, is not this species.

Staurastrum furcigerum var. furcigerum f. furcigerum morpha.

Pl. 83 fig. 2.

Measurements: TL. 54.0-68.0μ; TB. 52.0-71.0μ; BI. 10-16.5μ; LSP. 34.0-40.0μ.

Differing from the type in slightly longer processes.

Distribution: Beaverhead Co.: 135-(Mt63-330,340). Deer Lodge Co.: 129-(Mt63-383). Flathead Co.: 29-(H.L.1). Lake Co.: 86A-(Mt62-69). Lincoln Co.: 15-(Mt62-28). Missoula Co.: 101-(Mt64-70). Powell Co.: 106-(Mt64-74). Sanders Co.: 72-(Mt63-163); 74-(Mt63-171); 76-(Mt63-190); 77-(Mt63-194).

Staurastrum furcigerum Bréb. var. furcigerum f. armigerum (Bréb.) Nordst. Videnskab. Meddel. f.d. naturh. Foren. Kjobenhavn. p. 207. 1888.

Pl. 83 fig. 1.

Measurements: TL. 54.0-56.0μ; TB. 56.0-61.5μ; BI. 12.0-15.0μ; LSP. 35.0-42.0μ.

Rare. Only known from collections west of the continental divide.

Distribution: Flathead Co.: 31-(4181). Lake Co.: 95-(Mt62-59). Missoula Co.: 102-(Mt62-4). Ravalli Co.: 115-(Mt63-271).

Previously reported by Thomasson(62) for Two Medicine Lake, located in the southeastern part of Glacier National Park. Thomasson entered the plant under the name St. armigerum var. furcigerum, but not figured.

Staurastrum furcigerum Bréb. var. furcigerum f. eustephana (Ehrenb.) Nordst. Videnskab. Middel. f. d. natur. Foren. Kjobenhavn. p. 207. 1888.

Pl. 82 figs. 4,5.

Measurements: TL. 50.0-63.0μ; TB. 51.0-69.0μ; BI. 12.0-16.5μ; LSP. 36.0-45.0μ.

Moderately rare.

Distribution: Deer Lodge Co.: 129-(Mt63-383). Flathead Co.: 23-(Mt63-399); 36-(Mt63-393). Lake Co.: 84-(B_6). Lincoln Co.: 2-(Mt63-141).

Staurastrum furcigerum Bréb. var. furcigerum forma.

Pl. 83 fig. 3.

Measurements: TL. 70.0-84.0μ; TB. 83.0-85.0μ; BI. 13.0-18.0μ; LSP. 44.0-50.0μ.

Differing from the type in its greater size. Very rare. Known from a single collection locality in the northwest.

Distribution: Glacier Co.: 63-(Mt63-218).

Staurastrum galeatum Turn., K. Sv. Vet. Akad. Handl., 25(5): p. 122, t. 14, figs. 3,9,10. 1892.fa.

Pl. 97 fig. 14.

Measurements: TL. 22.0-23.0μ; TB. 29.0-31.0μ; BI. 4.5-5.0μ.

This is very distinctive form of St. galeatum and rather small in size. It is reminiscent of Krieger's (32) var. reductum except that this plant has apical verrucae. Very rare.

Distribution: Sanders Co.: 71-(Mt63-165).

Staurastrum gemelliparum Nordst., Vidensk. Medd. f.d. naturh. Foren. Kiobenhavn, no. 14: p. 230, t. 4, fig. 54. 1870.

Pl. 80 fig. 5.

Measurements: TL. 26.0-34.0μ; TB. 22.0-27.0μ; BI. 9-12.5μ; LSP. 20.0-27.0μ.

Very rare. Previously reported by Sieminska (65) for the same locality, a pond in the northern montane region.

Distribution: Lake Co.: 86-(Mt62-73, Sieminska*).

Staurastrum glabrum (Ehrenb.) Ralfs, Brit. Desmid., p. 217. 1848.

Pl. 69 fig. 1.

Measurements: TL. 22.0-27.0μ; TB. 29.5-37.0μ; BI. 5.5-7.5μ; BSS. 25.0-27.0μ.

Rare. Known only from the northwestern part of the state. Previously reported by Sieminska (65) for collection locality 86. However, her plant is not identical to the one listed here.

Distribution: Flathead Co.: 37-(Mt63-82); 42-(Mon16). Lincoln Co.: 6-(Mt63-149).

Staurastrum gladiosum Turn., Journ. R. Micr. Soc. ser. 2, vol. 5, part. 6 p. 938, t. 16, fig. 21. 1885. var. *gladiosum* f. *gladiosum*

Pl. 75 figs. 5,6,7.

Measurements: TL. 42.0-45.0μ; TB. 43.0-50.0μ; BI. 12.5-14.0μ; LSS. 35.0-38.0μ; BSS. 37.0-43.0μ.

The typical form of the species was very rare. Known from a single collection locality in the northern montane region.

Distribution: Lake Co.: 84-(X_8).

Staurastrum gladiosum Turn. var. *gladiosum* f. *ornata* Laporte, Recherches sur la, Biologie et la Systematique des Desmid. Encyclop. Biologique, 9:p. 118 figs. 177,178, 179. 1931.

Pl. 75 fig. 4.

Measurements: TL. 35.0-44.0μ; TB. 37.0-46.0μ; BI. 10.0-14.0μ; LSS. 33.0-39.0μ; BSS. 31.0-34.0μ.

This was the most common form of the species. The plants, exclusive of the spines, are longer than broad. This form might well be considered as a distinct variety. There was some variation in the length and nature of the spines, and while at times they appear short, straight and quite stiff, at other times they appear rather long and flexuous. A quadrate facies, listed below, was also encountered. The plant reported by Kidd (63) as St. teliferum Ralfs for collection locality 31 is placed here. Moderately common.

Distribution: Flathead Co.: 27-(Mon25, Mt63-451); 31-(4181, Kidd*). Glacier Co.: 54-(Mt62-11). Granite Co.: 127-(6Mon41). Lake Co.: 81-(Mt63-212); 86-(Mt62-80); 88-(Mt63-198); 89-(Mt63-389). Lincoln Co.: 10-(Mt63-156). Missoula Co.: 100-(Mt63-419). Ravalli Co.: 114-(Mt63-256); 115-(Mt63-265).

Staurastrum gladiosum Turn. var. gladiosum f. ornata Laporte, quadrate facies

Pl. 75 fig. 3.

Measurements: TL. 42.0-44.0μ; TB. 38.0-42.0μ; BI. 14.5-15.0μ; LSS. 35.5-37.5μ; BSS. 31.0-32.0μ.

Very rare.

Distribution: Missoula Co.: 100-(Mt63-419).

Staurastrum gracile Ralfs, Brit. Desmid., p. 136, t. 22, fig. 12. 1848.

Pl. 103 figs 4-11.

Measurements: TL. 29.0-41.0μ; TB. 44.0-68.0-(73.0)μ; BI. 7.5-10.0μ; LSP. 27.0-33.0μ.

The size range of this species is as given by Brook (59). The Montana plants do show, however,some differences from his in other respects. The processes in the Montana specimens are subparallel to slightly divergent (exclusive of the dichotypical(?) plant illustrated in fig. 8). Thus the plants more closely resemble Ralfs' original description. No convergent processes were observed. In vertical view, as pointed out by Brook

(59), the intramarginal rows of granules usually lie in pairs (3-5 pairs per margin). However, specimens have been seen in which this arrangement is not apparent. In addition, the linear series of granules which run from the granular pairs down along the face of the semicell may at times be as described for St. boreale (a single linear series). Also observed was a double series (two rows) of granules extending from the apex of the plant down across the face of the semicell.

Brook (59) indicates the close affinity between St. gracile and St. cingulum and a specimen (fig. 8) was encountered in which half the cell is St. gracile and the other half is apparently St. cingulum. Moderately common.

The plant reported by Kidd (63) for collection locality 56, as St. paradoxum, I believe is St. gracile.

Distribution: Deer Lodge Co.: 129-(Mt63-384). Flathead Co.: 29-(H.L.1); 34-(Mt62-3); 35-(Mt63-391); 36-(Mt63-396). Glacier Co.: 56-(Kidd*): 63-(Mt63-218). Lake Co.: 83-(Mt63-205). Lincoln Co.: 4-(Mt63-133). Sanders Co.: 73-(Mt63-167); 76-(Mt63-499).

Previously reported by Kidd(63) for collection locality 56, and by Schindler (54) for collection locality 91. Schindler gives no illustration.

Staurastrum grande Bulnh., Hedwigia, 2(9):p.51, t. 91, fig. 41. 1861. var. grande

Pl. 72 figs. 1,4.

Measurements: TL. 84.0-94.0μ; TB. 82.0-93.5μ; BI. 17.0-23.0μ.

Very rare. Known only from a small pond in the northwest.

Distribution: Lake Co.: 83-(Mt63-202,204,205).

Staurastrum grande Bulnh. var. parvum West, Journ. Roy. Micr. Soc., p. 11, t. 2, fig. 51. 1894.

Pl. 72 figs. 2,3.

Measurements: TL. 70.0-75.0μ; TB. 65.0-67.0μ; BI. 15.0-19.0μ.

Very rare. Knwon from a high altitude (7000 feet)lake west of the continental divide.

Distribution: Granite Co.: 125-(6Mon49).

Staurastrum granulosum (Ehrenb.) Ralfs, Brit. Desmid., p. 217. 1848.

This species is known to the author only from an illustration by Schindler (54) who reported its presence at collection locality 91. It has been included with St. lunatum Ralfs.

Staurastrum groenbladii Skuja, Arbeiten d. Naturforsch.- Ver. Riga., 19: p. 17, t. 1, figs. 16,17. 1931.

Pl. 71 figs. 4,7.

Measurements: TL. 25.5-27.0μ; TB. 21.0-23.0μ; BI. 11.0-12.0μ.

Very rare. Known only from Glacier National Park region.

Distribution: Flathead Co.: 24-(Mt63-411); 25-(Mt63-407).

Staurastrum gurgeliense Schm., Öesterr. Bot. Zeitschr., 45: p. 64, (sep. p. 35), pl. 16 figs. 23a&b. 24a&b. 1896.

Pl. 101 fig. 1.

Measurements: TL. 20.0-22.0μ; TB. 25.0-27.0μ; BI. 7.0-8.0μ.

Very rare.

Distribution: Flathead Co.: 28-(Mt63-443).

Staurastrum hantzschii Reinsch.

Staurastrum hantzschii was a moderately common desmid, although only encountered in the northwest. The Montana specimens showed considerable morphological variation, indicating affinities to a number of other taxa, (e.g. St. nonanum Turn., St. renardii Reinsch, and St. tohopekaligense Wolle). The variation in this species is in the number of processes in the lower whorl as well as in the length of these processes. A number of dichotypical specimens were also encountered.

Staurastrum hantzschii Reinsch, Acta Societ. Senckenb. vol. 6: p. 129, t. 22, D II. 1867. var. hantzschii

Pl. 78 fig. 1.

Measurements: TL. 37.0-41.0μ; TB. 31.0-34.0μ; BI. 13.0-13.5μ; LSP. 27.0-32.0μ; BSP. 22.0-25.0μ.

The length of the processes is so variable in this species that one can not adequately separate St. hantzschii Reinsch var. congruum (Racib.) West & West, from the type. Consequently, plants which would otherwise be assigned to West & West's variety are included with the typical form.

In fig. 6 we have a dichotypical specimen. The upper semicell is the typical form of the species. The lower semicell is what I regard as St. tohopekaligense Wolle var. brevispinum G.M. Smith. Other dichotypical specimens with shorter processes and in which there are 3 processes in the lower whorl were also found. Such plants are reminiscent of St. renardii.

Distribution: Flathead Co.: 28-(Mt63-443); 31-(4182); 48-(Mt63-416). Granite Co.: 127-(6Mon41). Sanders Co.: 74-(Mt63-171).

Staurastrum hantzschii Reinsch var. hantzschii fa.

Pl. 78 figs. 2,3,4,5.

Measurements: TL. 42.0-44.0μ; TB. 38.0-42.0μ; BI. 13.5-15.5μ; LSP. 31.0-32.5μ; BSP. 23.0-25.0μ.

This form differs from the type in having longer processes. The plant is identical to that illustrated by Hinode (pl. 13, fig. 30, 1959) as St. hantzschii var. japonicum Roy & Biss., by Irénée-Marie (Pl. 55, fig. 13, 1939) as St. tohopekaligense var. nonanum (Turn.) Schmid., by Scott and Prescott (pl. 48, fig. 6, 1961) as St. tohopekaligense fa. minus (Turn.) Scott & Presc., and by West & West (t. 21, fig. 27, 1902) as a form of St. tohopekaligense var. trifurcatum (=St. tohopekaligense var. brevispinum).

In fig. 3, the upper semicell has 9 processes in the lower whorl, and in vertical view the semicell is as in fig. 4. The bottom semicell has only 6 processes in the lower whorl and in apical view these are arranged as in fig. 5. Plants possessing only 3 processes (dichotypical) in the lower whorls were also encountered in the same population, these semicells being similar to St. tohopekaligense var. brevispinum.

I regard these plants as intermediate forms diverging from the type and eventually leading to the St. tohopekaligense var. nananum type.

Distribution: Flathead Co.: 31-(4183). Sanders Co.: 74-(Mt63-171).

St. hantzschii Reinsch fa.(=St. tohopekaligense var. brevispinum G.M. Smith, Bull. Wis. Geol. & Nat. Hist. Surv., 57(2): p. 121, pl. 82, figs. 8-11. 1924)

Pl. 78 fig. 6,7,8.

Measurements: TL. 44.0- 55.0μ; TB. 41.0-54.0μ; 12.0-14.5μ; LSP. 28.0-30.0μ; BSP. 20.0-23.0μ.

Of thd desmids included under St. hantzschii, this one was the most frequently collected. It differs from the type (St. hantzschii) in that the semicells possess only 3 precesses in the lower whorl. Dichotypical specimens with one semicell possessing more than this number are known from collection localities 48 and 127. The processes are also longer than in the type and in the Montana material this length is quite variable. This was especially true of specimens collected at locality 83. At that locality there was a progression in the length of the processes culminating in specimens which can be identified as St. tohopekaligense var. nananum (fig. 9). Moderately rare. Can occur in abundance at a locality.

Distribution: Flathead Co.: 31-(Kidd*); 41-(Mt63-58); 48-(Mt63-416). Granite Co.: 127-(6Mon41). Lake Co.: 81-(Mt63-210); 83-(Mt63-204); 86-(Mt62-63).

Previously reported by Kidd (63) for collection locality 31, under the name St. tohopekaligense. The plant he reports as St. leptocanthum from the same locality is also placed here.

St. hantzschii fa. (=St. tohopekaligense var. nananum (Turn.) Schmid., Engler's Bot. Jahrbuch., 26: p. 52, fig 113. 1898).

Pl. 78 fig. 9.

Measurements: TL. 60-64.0μ; TB. 56.0-62.0μ; BI. 15.0-17.0μ; LSP. 31.5-32.0μ; BSP. 26.0-27.0μ.

Very rare.

Distribution: Lake Co.: 83-(Mt63-203).

Staurastrum heimerlianum Lutkem., Verhandl. d.k.k. zool.-botan. Gesellsch. 42: p. 568, 1892.

Pl. 97 fig. 15.

Measurements: TL. 14.0-17.0μ; TB. 30.0-37.0μ; BI. 6.5-7.0μ.

Very rare. Known only from two localities in the northwest.

Distribution: Lake Co.: 86-(Mt63-186, Sieminska*). Sanders Co.: 75-(Mt63-173).

Previously reported by Sieminska for collection locality 86.

<u>Staurastrum</u> <u>hexacerum</u> (Ehrenb.) Wettr., Bih. K. Sv. Vet. Akad. Handl., 1: p. 51. 1872.

Pl. 101 figs. 2,3,4.

Measurements: TL. 15.0-19.0μ; TB. 16.0-23.0μ; BI. 4.0-5.5μ.

Moderately rare. Known only from collections taken from the northwest.

Distribution: Flathead Co.: 28-(Mt63-449); 37-(Mt63-82). Lincoln Co.: 12-(Mt63-70); 13-(Mt63-74); 14-(Mt63-76). Sanders Co.: 77-(Mt63-195).

Previously reported by Sieminska (65) for collection locality 86, but I do not believe her plant is this species.

<u>Staurastrum</u> <u>inconspicuum</u> Nordst. Acta Univ. Lund., 9: p. 26, t. 1, fig. 11. 1873. var. <u>inconspicuum</u>.

Pl. 97 fig. 1

Measurements: TL. 14.0-16.0μ; TB. 14.0-18.0μ; BI. 5.0-7.0μ.

In addition to the typical form of the species which is only known from one locality, var. <u>crassum</u> Gay was also found. Very rare.

Distribution: Lake Co.: 86-(Mt63-186, Sieminska*).

Previously reported by Sieminska (65) for this collection locality.

<u>Staurastrum</u> <u>inconspicuum</u> Nordst. var. <u>crassum</u> Gay, Mono. loc. Conj. p. 68,t. 2, fig. 10. 1884.

Pl. 97 fig. 2.

Measurements: TL. 10.0-13.5μ; TB. 10.0-14.0μ; BI. 5.0-6.0μ.

More frequently encountered than the typical form. Known only from west of the continental divide. Rare.

Distribution: Flathead Co.: 31-(4182). Glacier Co.: 54-(Mt62-16). Lake Co.: 95-(Mt62-58).

Staurastrum inflexum Bréb., Mem. d.1. Societe Imp. des Sciences Naturelles der Cherbourg. vol. 4: p. 140, t. 1, fig. 25. 1856.

Pl. 104 figs. 1,2,3.

Measurements: TL. 16.0-24.0μ; TB. 21.0-36.0μ; BI. 4.5-7.0μ; LP. 7.0-15.0μ.

The length of the processes in this species is quite variable. Common. Only known from collections west of the continental divide.

Distributions: Flathead Co.: 23-(Mt63-400); 28-(Mt63-442); 29-(H.L.1); 31-(4182); 35-(Mt63-391); 44-(Mt63-51). Granite Co.: 128-(Mt63-386). Lake Co.: 81-(Mt63-213); 85-(Mt63-47); 87-(Mt64-66) 94-(7Mon15). Lincoln Co.: 1-(4184); 4-(Mt63-129); 5-(Mt63-137); 6-(Mt63-147); 13-(Mt63-73); 15-(Mt62-26); 19-(Mt63-109). Ravalli Co.: 115-(Mt63-266). Sanders Co.: 70-(Mt63-161); 74-(Mt63-171); 78-(Mt63-181).

Staurastrum insigne Lund., Nova Acta Soc. Sci. Upsal., ser. 3,8: p. 58, pl. 3, fig. 2. 1871.

Pl. 71 figs. 1,2.

Measurements: TL. 24.0-27.0μ; TB. 20.0-23.0μ; BI. 10.0-13.0μ.

Very rare. Known from a single locality in Glacier National Park. Only a few specimens seen. Note change in magnification for the illustration of this species.

Distribution: Flathead Co.: 28-(Mt63-449,500).

Staurastrum iotanum Wolle, Desmids of the United States and list of American Pediastrums. Bethelehem, Pa., p.137, t. 51, figs. 5-7. 1884.

Pl. 97 fig. 3.

Measurements: TL. 12.0-19.5µ; TB. 15.0-21.0µ; BI. 4.0-5.0µ.

This was a moderately common desmid, although only known from the northwest. In addition to the typical form, the var. tortum Teil. was also encountered.

Distribution: Flathead Co.: 28-(Mt63-443); 35-(Mt63-391). Glacier Co.: 54-(Mt62-12). Granite Co.: 126-(6Mon42). Lake Co.: 83-(Mt63-204); 84-(Q_1); 89-(Mt63-388); 95-(Mt62-58).

Staurastrum iotanum Wolle var. tortum Teil., Sv. Bot. Tidskr. 10, Hafte 1, p. 65, fig. 15, 1916.

Pl. 97 fig. 4,5.

Measurements: TL. 15.0-19.0µ; TB. 14.5-17.0µ; BI. 4.0-5.0µ.

Very rare.

Distribution: Flathead Co.: 31-(4181). Granite Co.: 127-(6Mon41).

Staurastrum irregulare West, Journ. Roy. Micros. Soc., p. 12, t. 2, figs. 49, 50. 1894.

This species was reported by Sieminska (65) for collection locality 86, and is known only to the author from her illustration.

Distribution: Lake Co.: 86-(Sieminska*).

Staurastrum jaculiferum West, Journ. Linn. Soc. Bot.,29: p. 172, t. 22, fig. 14. 1892. var. jaculiferum

Pl. 62 figs. 21,22.

Measurements: TL. 33.0-39.0µ; TB. 25.0-30.0µ; BI. 3.0-4.0µ; LSS. 13.0-15.5µ; BSS. 12.0-13.0µ; LS. 10.0-15.5µ.

This species is very rare. The measurements are smaller than those given by West (92).

Distribution: Lake Co.: 86-(Mt62-63).

Staurastrum jaculiferum West var. excavatum West & West, Journ. Linn. Soc. Bot., 35: p. 544, t. 17, fig. 5. 1903.

Pl. 62 figs. 19,20.

Measurements: TL. 32.0-37.0μ; TB. 26.0-30.0μ; BI 4.0-4.5μ; LSS. 16.0-17.0μ; BSS. 12.5-14.0μ.

Plants similar to that reported by Gronblad (pl. 2, figs. 21,22. 1936) as this variety, and that reported by Irénée-Marie (pl. 49, fig. 14. 1939) as St. cuspidatum var. divergens. Sieminska (65) records a quadrate form, in addition to the typical triradiate plant, from collection locality 86. The plant she identifies as St. cuspidatum var. divergens is included here. Very rare.

Distribution: Flathead Co.: 31-(4181). Lake Co.: 86-(Mt63-186, Sieminska*).

Staurastrum johnsonii West & West, Trans. Linn. Soc. sec. ser. Bot., 5: p. 266, pl. 17, fig. 16. 1896.

Pl. 96 figs. 4,5.

Measurements: TL. 41.0-59.0μ; TB. 56.0-98.0μ; BI. 8.5-12.0μ.

This species may be a biradiate facies of St. submanfeldtii West, or St. pseudosebaldi Wille. Moderately rare. Known only from the northwest.

Distribution: Flathead Co.: 27-(Mon25); 29-(H.L.1); 35-(Mt63-391); 36-(Mt63-393); 41-(Mt63-58). Glacier Co.: 54-(Mt62-13,20). Lake Co.: 83-(Mt63-204). Missoula Co.: 101-(Mt64-70).

Staurastrum laeve Ralfs, Brit. Desmid., p. 131, t. 23, fig. 10. 1848. var. laeve

Pl. 80 figs. 1,2.

Measurement: TL. 20.0-24.0μ; TB. 25.0-26.0μ; BI. 6.5-7.0μ.

Very rare. Known from a single pond in the northwest corner of the state.

Distribution: Lincoln Co.: 19-(Mt63-110).

Staurastrum laeve Ralfs. var. latidivergens Scott & Grönblad., Acta Soc. Sci. Fenn. 2(8): pl. 31, fig. 4. 1957.

Pl. 80 figs. 3,4.

Measurements: TL. 24.0-28.0μ; TB. 27.0-28.5μ; BI. 7.0-7.5μ.

This plant is similar in form to that illustrated under the above name by Scott and Gronblad (57), but unfortunately the description of the plant apparently was omitted from their publication. Very rare. Known from two localities west of the continental divide.

Distribution: Flathead Co.: 47-(Mt63-413). Lincoln Co.: 5-(Mt63-137).

Staurastrum lapponicum (Schmid.) Grönbl., Soc. Sci. Fenn. Comm. Biol., 2. p.29 pl. 2, figs.106,107, 1927. var. lapponicum f. lapponicum

Pl. 88 figs. 2,3.

Measurements: TL. 29.5-41.5μ; TB. 29.0-42.0μ; BI. 8.0-12.0μ.

This was a common species, being known from both the northern and southern montane regions, as well as south-central Montana. In addition to the typical form, which intergrades with St. punctulatum Breb., a form which appears to be new to science was also found.

Distribution: Flathead Co.: 23-(Mt63-399); 27-(Mon25,Mt63-450); 28-(Mt63-444); 29-(H.L.1); 31-(4181). Glacier Co.: 54-(2Mon9). Lake Co.: 81-(Mt63-209); 83-(Mt63-204); 86-(Mt62-63). Lincoln CO.: 10-(Mt63-157); 15-(Mt62 26). Sanders Co.: 72-(Mt63-162); 77-(Mt63-194).

Staurastrum lapponicum (Schmid.) Grönbl. fa. *depressum* fa. nov.

Pl. 88 figs. 4,5.

Measurements: TL. 33.5-39.0µ; TB. 36.0-42.0µ; BI. 10.0-12.0µ.

Plants differing from the type in being broader than long and in the more depressed nature of the semicells. Known from the south-central piedmont and western montane regions.

Distribution: Beaverhead Co.: 133-(Mt63-316); 134-(Mt63-327). Flathead Co.: 29-(H.L.1); 36-(Mt63-394). Granite Co.:128-(Mt63-386). Lake Co.: 87-(Mt64-65). Lincoln Co.: 6-(Mt63-146). Sweetgrass Co.: 171-(Mt64-100).

Staurastrum leptocanthum Nordst., Vidensk. Medd. f.d. naturh. Foren. Kjobenhavn, 15: p. 229, t. 4., fig. 46. 1870.

This was a very rare species, known from a single collection locality in the northwest. Only a single specimen was observed and it was in poor condition. The plant reported by Kidd (63) for collection locality 31, under this name is entered in this text as *St. hantzschii* fa. (=*St. tohopekaligense* var. *brevispinum*).

Distribution: Flathead Co.: 41-(Mt63-58).

Staurastrum longipes (Nordst.) Teil., Bot. Notiser, Hafte 1:p. 80, fig. 23. 1946.

Pl. 110 fig. 2.

Included under this species are desmids which range in semicell shape from subcylindrical to cyathiform. The subcylindrical plants are reminiscent fo *St. pinque* var. *tridentata* Nygaard. Others appear to be similar to Skuja's (pl. 54, fig. 2. 1964) *St. longipes* var. *longibrachiatum* (Teil) Skuja. The cyathiform-shaped plants are similar to the species as illustrated by Smith (pl. 73, figs. 3-6, 1924) and West & West and

Carter (pl. 146, figs. 2,3, 1923).

Distribution: Beaverhead Co.: 147-(Mt63-362). Glacier Co.: 57-(Mt63-421). Powell Co.: 106-(Mt64-74); 107-(Mt64-79).

Staurastrum longipes (Nordst.) Teil. morpha

Pl. 110 fig. 4.

Measurements: TL. 120-144.0μ; TB. 105.0-112.0μ; BI. 8.0-8.5μ; LSP. 26.0-28.0μ; BSP. 18.0-21.0μ; LP. 62.0-73.0μ.

Plant differing from the type in its longer processes. Very rare.

Distribution: Powell Co.: 106-(Mt64-74); 107-(Mt64-79).

Staurastrum longipes (Nordst.) Teil. morpha.

Pl. 110 fig. 1,3.

Measurements: TL. 60.0-81.0μ; TB. 74.0-94.0μ; BI. 7.0-8.5μ; LSP. 29.0-38.0μ.

Cells differing from the type in the greater length of the corpus. Plants reminiscent of var. longibrachiatum (Teil.) Skuja, and St. pinque var. tridentata Nygaard.

Distribution: Beaverhead Co.: 147-(Mt63-362). Carbon Co.: 177-(Mt64-115). Deer Lodge Co.: 129-(Mt63-383).

Staurastrum longiradiatum West & West, Trans. Linn. Soc. sec. ser. Bot., 5: p. 267, pl. 17, fig. 23. 1896. var. longiradiatum

Pl. 97 fig. 19.

Measurements: TL. 26.0-29.0-(40.0μ;) TB. 55.0-72.0μ; BI. 6.0-7.0μ; LSP. 26.0-29.0μ; BSP. 12.0-15.0μ.

Very rarely, the processes are divergent which accounts for the greater total length measurement given above in parenthesis. This was a common species encountered not only in western Montana but in the northeastern midland region as well. The typical form of the species is moderately rare and only found in the west. The plant identified as St. longiradiatum by Smith (pl. 74 figs. 5-11, 1924) is not this species, and plants similar to Smith's are entered under St. planktonicum Teiling. Distribution: Beaverhead Co.: 135-(Mt63-340). Flathead Co.: 23-(Mt63-399); 44-(Mt63-52). Glacier Co.: 63-(Mt63-218). Missoula Co.: 101-(Mt 64-70).

Previously reported by Schindler (54) for collection locality 93, but his plant is entered under St. planctonicum, and by Vineyard (51) for Glacier National Park but he gives no illustration.

Staurastrum longiradiatum var. mistassiniense Irénée-Marie, Le Naturalist Canadien, 76: p. 306, pl. 4, fig. 38.1949.

Pl. 97 figs. 18,20,21.

Measurements: TL. 22.0-28.0μ; TB. 30.0-47.0μ; BI. 5.0-7.0μ.

The length of the processes is variable as is true for the var. longiradiatum and intermediary forms exist. Irénée-Marie does not indicate any form of supra-isthmal ornamentation in his origianl illustration but granules may be present as they likewise may be in the typical form.

This was by far the more frequently encountered form of the species, generally occurring in lentic environments at low elevations (at or below 3700 feet).

Distribution: Deer Lodge Co.: 129-(Mt63-384). Flathead Co.: 23-(Mt63-400); 35-(Mt63-391); 36-(Mt63-393); 47-(Mt63-412). Garfield Co.: 191-(Mt62-26). Lake Co.: 87-(Mt64-65). Lincoln Co.: 6-(Mt63-146); 12-(Mt63-67); 13-(Mt63-73,75); 16-(Mt63-113); 18-(Mt63-105); 19-(Mt63-112); 20-(Mt63-90,96); 21-(Mt63-97). Missoual Co.: 101-(Mt64-70). Sanders Co.: 71-(Mt63-165).

Staurastrum louisianicum Scott & Grönbl., Acta Soc. Scient. Fenn., nov. ser. B. 2 , No. 8: p. 41, pl. 21, figs. 14-18. 1957. fa.

Pl. 67 fig. 9

Measurements: TL. 38.5μ; TB. 43.0μ; BI. 13.0μ; BSS. 37.5μ.

The Montana plant differs from the type in having a more elevated apex, spines of equal length, and in apical view having concave margins. In the type the dorsal margin is broadly convex, the spines are of unequal length, the upper one being longer, and in apical view the margins are straight or very slightly retuse. In spite of these differences I believe the plant belongs to this species and is entered as an unnamed forma since only a single specimen was seen.

Distribution: Lincoln Co.: 17-(Mt63-118).

Staurastrum lunatum Ralfs, Brit. Desmid., p. 124, t. 34, fig. 12. 1848. var. lunatum

Pl. 90 figs. 1,2,3,4.

Measurements: TL. 24.0-30.0μ; TB. 22.0-31.0μ; BI. 8.0-10.0μ; LSS. 22.0-29.0μ; BSS. 21.5-27.0μ.

Staurastrum lunatum was a common desmid occurring primarily in western Montana, but also encountered in the northeast. The typical form was the form most frequently collected. The plant identified as St. granulosum by Schindler (54) has been included here.

Distribution: Flathead Co.: 22-(6Mon5); 27-(Mt63-450); 28-(Mt63-443,500). Lake Co.: 81-(Mt63-206,210); 91-(Schindler*). Lincoln Co.: 6-(Mt63-149); 13-(Mt63-74). Missoula Co.: 101-(Mt64-70). Ravalli Co.: 115-(Mt63-265).

Staurastrum lunatum Ralfs fa.

Pl. 90 figs. 5,6,7,8.

Measurements: TL. 32.0-36.0μ; TB. 36.0-43.0μ; BI. 11.0-15.0μ.

Plants differing from the typical form in their greater dimensions. They are reminscent of St. lunatum var. planctonicum West & West, but that variety is larger. It was believed best to enter the plants solely as belonging to the species. Specimens were found which completely lacked spines, while some possessed two at each corner (fig. 5). More widely distributed than the typical form.

Distribution: Beaverhead Co.: 132-(Mt63-185). Flathead Co.: 23-(Mt63-399); 37-(Mt63-85). Lake Co.: 87-(Mt64-64). Lincoln Co.: 4-(Mt63-129, 134); 6-(Mt63-146). Sheridan Co.: 188-(Mt63-17).

Staurastrum maamense Arch. Quart. Journ. Micr. Sci., 9: p. 200, 1869. var. maamense

Pl. 85 fig. 3.

Measurements: TL. 38.0-39.0µ; TB. 33.5-36.0µ; BI. 9.0µ.

This was a very rare species. Known only from Glacier National Park.

Distribution: Flathead Co.: 29-(H.L.1); 31-(4181).

Staurastrum maamense Arch. f. atypicum Magnotta, Mich. Acad. Sci. Arts and Letters, vol. 20:p. 164, pl. 26, figs. 7-8, 1935.

Pl. 85 figs. 4,5.

Measurements: TL. 34.0-39.5µ; TB. 32.0-43.0µ; BI. 19.0-12.0µ.

The plant identified as St. cornutum by Kidd (63) from collection locality 31 has been included here. Very rare.

Distribution: Flathead Co.: 29-(H.L.1); 31-(4181, 4182, Kidd*).

Staurastrum mamillatum Nordst.

This species, although a common desmid, was only encountered in the northwest, occurring primarily in lakes and ponds at elevations between 3000-4400 feet. As here presented, it includes one variety, a forma, and morpha in addition to the typical form.

Staurastrum mamillatum Nordst., Vidensk. Medd. f.d. naturh. Foren. Kjobenhavn, No. 15, p. 225, t.4, fig. 55, 1870. var. mamillatum

Pl. 64 fig. 12 & Pl. 65, figs. 2,3,5,8.

Measurements: TL. 23.0-26.0μ; TB. 30.0-46.0μ; BI. 4.0-5.0μ; BSS. 21.0-23.0μ; LS. 4.0-16.0μ.

Cells intergrading in size with plants identified as St. cuspidatum var. maximum. Length of the spines quite variable, usually convergent, more rarely divergent. The typical form was of moderately common occurrence. Known only from the northwest. A rather small form of the typical is listed below separately.

Distribution: Flathead Co.: 27-(Mon 25); 29-(H.L.1); 37-(Mt63-82); 47-(Mt63-414). Glacier Co.: 54-(Mt62-11). Lincoln Co.: 5-(Mt63-137); 12-Mt63-67). Sanders Co.: 76-(Mt63-191).

Staurastrum mamillatum Nordst. morpha.

Measurements: TL. 17.0-20.0μ; TB. 22.0-30.0μ; BI. 4.0-5.0μ; BSS. 16.0-19.0μ; LS. 2.5-7.0μ.

Small form.

Distribution: Flathead Co.: 31-(4182). Granite Co.: 126-(6Mon42). Lincoln Co.: 12-(Mt63-67).

Staurastrum mamillatum Nordst. (=St. cuspidatum Breb. maximum West, Naturalist, Lond., p. 247, 1891.)

Pl. 65 figs. 1,2,3,4,6,9.

Measurements: TL. 28.5-37.0μ; TB. 45.0-63.0μ; BI. 5.0-8.5μ; LSS. 29.0-35.0μ; BSS. 26.0-35.0μ; LS. 7.5-16.0μ.

I believe Teiling (67) is correct in placing this plant as a variety of Staurodesmus mamillatus. However, since I have not used the genus Staurodesmus in this presentation, the plant is entered as belonging to St. mamillatum and its precise identification is indicated in parenthesis. Known only from the northwest.

The plant reported by Kidd(63) as St. cuspidatum for collection localities 31 and 63 belongs here.

Distribution: Flathead Co.: 29-(H.L.1); 31-(Kidd*); 35-(Mt63-391); 36-(Mt63-394). Glacier Co.: 63-(Mt63-218, Kidd*). Lake Co.: 83-(Mt63-202, 204). Sanders Co.: 76-(Mt63-192).

Staurastrum mamillatum (=St. cuspidatum Breb. var. maximum, West, fa)

Pl. 65 fig. 10.

Measurements: TL. 46.0-51.0µ; TB. 66.0-70.0µ; BI. 5.5-6.0µ; LSS. 32.0-34.0µ; BSS. 27.0-29.0µ; LS. 23.0-26.0µ.

This plant intergrades into var. maximum. Consequently it is assigned to that variety as an unnamed forma. It differs from it in possessing slightly upcurved angles, and in the greater length of the spines. The plants are reminiscent of St. curvatum var. elongatum G.M. Smith, and could very well be that plant, but they seem more properly placed with St. mamillatum. Very rare. Known from a single locality in the northwest.

Distribution: Missoula Co.: 101-(Mt64-70).

Staurastrum manfeldtii Delp.

This species is one of the most polymorphic desmids encountered. As presented below I have grouped plants which can be identified with other taxa (names given in parentheses) but for which transitional forms exist which indicate their closer affinities to St. manfeldtii.

Teiling (47) in his excellent paper on planktonic Staurastra, pointed out that in Delponte's original illustration of this species there were two figures in which the sinus of the plants was like those of St. sebaldi Reinsch. He furthermore states that there is nc guarantee that Delponte's material was homogeneous. The Montana specimens studied indicated that Delponte's illustrations do represent a single species. My figs. 1,2 and 3 (pl. 94) are similar to Delponte's figs. 10, 11, 12 and 13. These specimens have shortened, subparallel to somewhat convergent processes, and were the least encountered form of the species. Figures 4,5 and 7 of this text, are similar to his figs. 14 and 16, and with longer, more convergent processes. The latter forms might well be assigned to St. sebaldi var. ornatum Nordst. by some authors, but in my opinion, it is not that taxon. I believe West, West and Carter's (pl. 148, fig. 7, 1922) illustration of St. sebaldi var. ornatum is an example of such a determination. Figures 1,2 and 5 are from the same population.

Plants with longer processes, disposed parallel or slightly divergent appear as in figs. 2 and 3 of pl. 95. Lengthening and changes of direction of the processes may be accompanied by a change in semicell shape from cyathiform to subcylindrical. These last mentioned forms are reminiscent of St. gracile var. cyathiforme West & West. The plants which are illustrated on pl. 95, figs. 7 and 8, can be identified as St. sebaldi var. ornatum f. planctonica Teiling. Since I believe, however, that they are more closely allied to St. manfeldtii they are entered here under the name St. manfeldtii var. planctonicum Lutkemuller. (See discussion under St. planctonicum Teil. var. ornatum (Grönbl.) Teil.)

Staurasticum manfeldtii (including all above forms) was a common and widely distributed desmid.

Staurastrum _manfeldtii_ Delp. Spec. Desm. subalp., p. 160, t. 13, figs. 16-19. 1877. var. _manfeldtii_.

Pl. 94 figs. 1,2,3.

Measurements: TL. 52.0-60.0μ; TB. 66.0-86.0μ; BI. 12.5-16.0μ.
Distribution: Flathead Co.: 22-(6Mon5); 44-(Mt63-54). Lincoln Co.: 2-(Mt63-141); 17-(Mt63-116); 21-(Mt63-97).

Staurastrum _manfeldtii_ Delp. var. _manfeldtii_ (=_St_. _sebaldi_ var. _ornatum_?)

Pl. 94 figs. 4,5,7.

Measurements: TL. 37.5-57.0μ; TB. 64.0-97.0μ; BI. 11.5-13.5μ.

This form of the species has convergent processes, and the cells exhibited a considerable degree of variation in the ornamentation of the apices and processes. It intergrades completely with the plant given above. The most frequently collected and abundant form of the species.
Distribution: Beaverhead Co.: 135-(Mt63-340); 143-(Mt63-345). Flathead Co.: 35-(Mt63-390); 36-(Mt63-393); 42-(Mon16). Glacier Co.: 59-(Mt63-429). Lake Co.: 81-(Mt63-206); 87-(Mt64-64); 95-(Mt62-60). Lincoln Co.: 2-(Mt63-141); 4-(Mt63-133); 5-(Mt63-137); 6-(Mt63-145); 12-(Mt63-67,68); 15-(Mt62-26). Ravalli Co.: 115-(Mt63-265); 117-(Mt63-279). Wheatland Co.: 164-(Mt63-465).

Staurastrum _manfeldtii_ Delp. var. _manfeldtii_

Pl. 95 figs. 1,2,5.

Measurements: TL. 50.0-62.0μ; TB. 86.0-110.0μ; BI. 11.0-13.5μ.

Included in this group are those forms intergrading with the plants identified as _St_. _gracile_ var. _cyathiforme_.
Distribution: Beaverhead Co.: 135-(Mt63-340). Deer Lodge Co.: 129-(mt63-383). Glacier Co.: 64-(Mt61-2). Lake Co.: 80-(4Mon52). Lincoln Co.: 12-

(Mt63-67); 20-(Mt63-90); 21-(Mt63-97). Missoula Co.: 101-(Mt64-70). Roosevelt Co.: 189-(Mt64-4). Sheridan Co.: 188-(Mt63-16).

Staurastrum manfeldtii Delp. (=St. gracile var. cyathiforme West & West, Trans. Linn. Soc. Lond. sec. ser. Bot., 5(2): p. 77, t. 9. fig. 2. 1895) Pl. 95 figs. 3,6.

Measurements: TL. 50.0-56.0μ; TB. 93.0-98.0μ; BI. 11.0-12.0μ.

In apical view (figs. 4,6) there is some variation in the development and pattern of ornamentation. Transitional forms between these plants and the typical form exist. This was a very rare form. Known from a single locality in the northwest. (See Teiling (47) for a discussion of this plant and its relationship to St. planktonicum Teiling.)

Distribution: Missoula Co.: 101-(Mt64-70).

Staurastrum manfeldtii Delp. var. planctonicum Lutk. (=St. sebaldi var. ornatum f. planctonica Teil., Svensk Bot. Tidskrift, 41(2): p. 232. 1947) Pl. 95 figs. 7,8.

Measurements: TL. 62.0-101.0μ; TB. 91.0-115.0μ; BI. 11.5-15.0μ; LSP. 53.0-62.0μ.

Rare. Known only from four widely separated localities. Thomasson (62) has reported St. sebaldi var. ornatum f. planctonica from Two Medicine Lake located in the southeastern part of Glacier National Park. His plant (photograph) most resembles the plants I have illustrated in figs. 2 and 3 of pl. 95.

Distribution: Beaverhead Co.: 135-(Mt63-334,340). Garfield Co.: 191-(Mt64-27). Teton Co.: 68-(Mt64-51). Wheatland Co.: 164-(Mt63-465).

Staurastrum margaritaceum (Ehrenb.) Menegh., in Ralfs' Brit. Desmid., p. 134, t. 21, fig. 9. 1848.

Pl. 104 figs. 12,13,14.

Measurements: TL. 22.0-29.0μ; TB. 23.0-29.0μ; BI. 7.0-8.0μ.

Moderately rare. Known from both the northern and southern montane regions. This species was previously reported for the state by Sieminska (65). She indicates the presence of St. margaritaceum var. gracilius Scott and Grönbl., for collection locality 86, but this variety was not identified by the author.

Distribution: Beaverhead Co.: 135-(Mt63-340). Flathead Co.: 24-(Mt63-411); 25-(Mt63-407); Granite Co.: 127-(6Mon38). Lake Co.: 84-(Q_1); 86-(Sieminska, as var. gracilius*).

Staurastrum meriani Reinsch. Act. Societ. Senckenb. vol. 6:p. 125, t. 23, Dl, figs. 1-11, 1867.

Pl. 86 fig. 1.

Measurements: TL. 43.0-44.0μ; TB. 23.0-25.5μ; BI. 18.0-18.5μ.

Very rare. Known from a high altitude lake (7000 feet) in the northwest.

Distribution: Flathead Co.: 49-(Mt63-436).

Staurastrum messikommerii Lundberg, Bot. Notiser, 4: p. 290. 1931. var. messikommerii

Pl. 100 figs. 1,2.

Measurements: TL. 34.0-44.0μ; TB. 50.0-67.0μ; BI. 8.5-12.0μ.

This species was only collected west of the continental divide. The typical form was most frequently collected. Moderately common.

Distribution: Flathead Co.: 29-(H.L.1); 35-(Mt63-391); 36-(Mt63-396); 43-(Mt63-50); 47-(Mt63-412). Lake Co.: 93-(Mt63-). Lincoln Co.: 4-(Mt63-134); 13-(Mt63-73); 19-(Mt63-110); 21-(Mt63-101). Sanders Co.: 75-(Mt63-172, 173); 79-(Mt63-179).

<u>Staurastrum messikommerii</u> Lundberg var. <u>urnaeforme</u> Lundberg, Bot. Notiser, 4: p. 290, fig. 13a,b,c,d,e. 1931

Pl. 100 figs. 5,6,7.

Measurements: TL. 37.0-44.0μ; TB. 71.0-80.0μ; BI. 9.0-12.0μ.

Rare.

Distribution: Lincoln Co.: 12-(Mt63-71). Sanders Co.: 71-(Mt63-164); 75-(Mt63-172).

<u>Staurastrum micron</u> West & West f. <u>biradiata</u> Irénée-Marie, Flore desmidiale de la Region de Montreal, Lapraire. Canada, p. 304, pl. 55, fig. 8. 1939.

This plant was reported by Sieminska (65) for collection locality 86 and is only known to the author from her illustration. It is possible that specimens of this forma have been included under <u>St. iotanum</u> var. <u>tortum</u>.

Distribution: Lake Co.: 86-(Sieminska*).

<u>Staurastrum minnesotense</u> Wolle, Bull. Torr. Bot. Club, 12: p. 6, t. 47, figs. 7-8. 1885.

Pl. 85 fig. 6.

Measurements: TL. 96.0-128.0μ; TB. 106.0-137.0μ; BI. 24.0-30.0μ; LSS. 71.0-98.0μ; BSS. 70.0-84.0μ.

Rare. Known only from the northwest.

Distribution: Glacier Co.: 54-(2Mon8); 63-(Mt63-218,219); 64-(Mt61-2). Lake Co.: 86-(Sieminska*). Missoula Co.: 102-(Mt62-4).

Previously reported by Sieminska (65) for collection locality 86.

<u>Staurastrum monticulosum</u> Bréb., in Ralfs' Brit. Desmid., p. 130, t. 34, fig. 9. 1848.

Pl. 93 figs. 1,2.

Measurements: TL. 35.0-42.0μ; TB. 28.0-36.0μ; BI. 12.5-14.0μ.

Very rare. Known only from Glacier National Park. See discussion of St. monticulosum var. groenlandicum f. hastatum, given under St. spongiosum Bréb. forma.

Distribution: Flathead Co.: 28-(Mt63-447).

Staurastrum mucronatum Ralfs, Ann. Mag. Nat. Hist., 15: p. 152, t. 10, figs. 5,6. 1845.

Pl. 63 figs. 6,7.

Measurements: TL. 16.0-20.0μ; TB. 18.0-20.0μ; BI. 4.0-5.0μ; BSS. 17.0-19.0μ.

Moderately rare. Encountered only in collections taken west of the continental divide. The plant identified as St. mucronatum and reported for collection locality 91, by Schindler (54) is not identical to the plants placed here.

Distribution: Flathead Co.: 35-(Mt63-391); 37-(Mt63-82); 47-(Mt63-413). Lincoln Co.: 4-(Mt63-131); 13-(Mt63-73). Sanders Co.: 70-(Mt63-161).

Staurastrum mucronatum Ralfs var. subtriangulare West & West, Journ. Linn. Soc. Bot., 35: p. 545, t. 17, fig. 11. 1903.

Pl. 63 fig. 14.

Measurements: TL. 36.0μ; TB. 52.0μ; BI. 10.0μ.

I believe this variety is more closely related to St. dejectum var. patens, than it is to St. mucronatum. Very rare. Known from a single collection locality in the northwest.

Distribution: Flathead Co.: 36-(Mt63-393).

Staurastrum muricatum Bréb., in Ralfs' Brit. Desmid., p. 126, t. 22, fig. 2. 1848.

Very rare. Only a single specimen found and it was in poor condition. Collected from a creek in the northwest.

Distribution: Ravalli Co.: 114-(Mt63-256).

Staurastrum muticum Bréb., in Ralfs' Brit. Desmid., p. 125, t.21, fig 4. 1848.

Pl. 71 fig. 9, 10,11.

Measurements: TL. 14.5-23.0μ; TB. 15.0-20.5μ; BI.5.0-8.0μ.

There are two forms assigned to this species. In the first the sinus is sub-linear while in the second the sinus is decidedly open. Most of the Montana specimens are rather small in size. Moderately rare.

Distribution: Flathead Co.: 24-(Mt63-11); 25-(Mt63-407); 27-(Mt63-450); 28 -(Mt63-443). Granite Co.: 127-(6Mon38). Ravalli Co.: 112-(Mt63-261).

Previously reported by Thomasson (62) for Two Medicien Lake located in the southeastern part of Glacier National Park (not illustrated).

Staurastrum natator West

Staurastrum natator was a moderately common *Staurastrum* and only encountered in collections from the northwest. It is represented in the desmid flora of Montana by two varieties and one forma in addition to the typical form.

Staurastrum natator West, Journ. Linn. Soc. Bot., 29: p. 183, t. 23, fig. 14. 1892. var. *natator*

Pl. 106 figs. 2,3,4.

Measurements: TL. 38.0-68.0μ; TB. 51.5-80.0μ; BI. 8.5-9.0μ; LSP. 32.0-35.0μ.

Rare.

Distribution: Flathead Co.: 29-(H.L.1); 31-(4182, Kidd*). Glacier Co.:

54-(Mt62-24); 63-(Mt63-218).

Previously reported by Kidd (63) for collection locality 31.

Staurastrum natator West var. crassum West & West, Trans. Linn. Soc. sec. ser. Bot., 5: p. 265, pl. 17, fig. 14. 1896.

Pl. 106 fig. 1.

Measurements: TL. 31.0-45.0µ; TB. 48.0-57.0µ; BI. 7.5-9.0µ; LSS. 30.0-33.5µ.

Rare.

Distribution: Granite Co.: 126-(6Mon42). Lake Co.: 83-(Mt63-240); 86-(Mt62-72).

Staurastrum natator West. var. rhomboideum Carter, Journ. Linn. Soc. Bot., 50. p. 171, figs. 31,32. 1935.

Pl. 106 fig. 6.

Measurements: TL. 39.0-41.0µ; TB. 52.0-55.5µ; BI. 9.0-12.0µ; T. 27.0-30.5µ.

Very rare. Known only from two bogs in the northwest.

Distribution: Glacier Co.: 54-(2Mon8). Granite Co.: 127-(6Mon38).

Staurastrum natator West. var. rhomboideum Carter fa. triquetra Carter, Journ. Linn. Soc. Bot., 50: p. 171, figs. 33, 34. 1935.

Pl. 106 fig. 5.

Measurements: TL. 36.0-40.0µ; TB. 45.0-47.0µ; BI. 10.5-14.0µ.

Very rare.

Distribution: Flathead Co.: 41-(Mt63-58). Missoula Co.: 100-(Mt63-420).

Staurastrum neglectum West, Journ. Linn. Soc. Bot., 39: p. 70, t. 3, fig. 12. 1909.

Pl. 101, figs. 7,8.

Measurements: TL. 22.0-23.0µ; TB. 28.0-30.0µ; BI. 5.0-5.5µ.

Very rare. Known from a single lake in Glacier National Park.

Distribution: Flathead Co.: 29-(H.L.1).

Staurastrum omearii Arch., Nat. Hist. Rev. (Proc.) v. 5: p. 254, t. 21, figs. 8-13. 1858.

Pl. 62 figs. 16,17.

Measurements: TL. 21.0-23.0μ; TB. 22.0-24.0μ; BI. 7.0-8.5μ; LSS. 14.0-17.0μ; BSS. 14.0-19.0μ.

This was a rare species, collected west of the continental divide.

Distribution: Flathead Co.: 28-(Mt63-500). Granite Co.: 127-(6Mon38). Lincoln Co.: 15-(Mt62-26).

Staurastrum ophiura Lund., Nova Acta Reg. Soc. Sci. Upsal, ser. 3,8: p. 69, t. 4, fig. 7. 1871.

Pl. 81 fig. 1.

Measurements: TL. 73.5-87.0μ; TB. 134.0-140.0μ; BI. 21.0-22.0μ.

This was a rare species in the collections. Known only from the northwest.

Distribution: Flathead Co.: 31-(4182, Kidd*); 36-(Mt63-393). Lincoln Co.: 10-(Mt63-153,155); 18-(Mt63-106).

Previously reported by Kidd (63) for collection locality 31.

Staurastrum orbiculare Ralfs

This species was one of the most frequently collected Staurastra. It was encountered in a variety of habitats ranging in elevation from 2000 to 7000 feet. It is represented in the collections by four varieties, one forma and two unnamed forms in addition to the typical.

Staurastrum orbiculare Ralfs, Birt. Desmid., p. 125, t. 21, fig. 5h. 1848. var. orbiculare,

Pl. 70 fig. 8.

Measurements: TL. 38.0-56.0μ; TB. 33.0-47.0μ; BI. 10.0-15.0μ.

Encountered only in the northwest.

Distribution: Flathead Co.: 26-(Mt63-405); 40(Mt63-89). Lake Co.: 88-(Mt63-197); 89-(Mt63-388). Lincoln Co.: 6-(Mt63-149); 10-(Mt63-158). Missoula Co.: 100-(Mt63-420). Ravalli Co.: 115-(Mt63-265).

Staurastrum orbiculare Ralfs. var. orbiculare fa.

Pl. 70 fig. 3.

Measurements: TL. 32.0-45.0μ; TB. 34.0-46.0μ; BI. 9.0-13.0μ.

Cells differing from the type in being equally as broad as long, or broader than long. Semicells depressed. Collected primarily in the northwest but also encountered in the southern montane region.

Distribution: Beaverhead Co.:135-(Mt63-330). Lake Co.: 87-(Mt64-66); 92-(Mt63-38). Lincoln Co.: 2-(Mt63-141); 12-(Mt63-68). Sanders Co.: 70-(Mt63-161); 76-(Mt63-159).

Staurastrum orbiculare Ralfs var. depressum Roy & Biss. Journ. Bot., 24: p. 237, t. 268 fig. 14. 1886.

Pl. 70 fig. 4.

Measurements: TL. 19.0-26.0μ; TB. 19.0-26.5μ; BI. 6.0-8.0μ.

One of the more common forms of the species present.

Distribution: Flathead Co.: 22-(6Mon5); 36-(Mt63-395); 42-(Mon16). Lake Co.: 81-(Mt63-210); 83-(Mt63-205); 87-(Mt64-64); 94-7Mon15). Lincoln Co.: 10-(Mt63-158). Ravalli Co.: 115-(Mt63-274).

Staurastrum orbiculare Ralfs. var. hibernicum (West) West & West, Mongr. Brit. Desmid. vol. 4, p. 156, pl. 124, figs. 5-9. 1912.

Pl. 70 fig. 10.

Measurements: TL. 52.5µ; TB. 43.0µ; BI. 14.0µ.

Very rare. Only a single specimen seen.

Distribution: Lake Co.: 89-(Mt63-389).

Staurastrum orbiculare Ralfs var. protractum Play., Proc. Linn. Soc. New South Wales, 37: p. 532, pl. 54, fig. 25. 1913.

Pl. 70 fig. 1.

Measurements: TL. 49.5-56.5µ; TB. 46.0-51.5µ; BI. 11.0-14.5u.

Very rare. Known from two localities in the northwest.

Distribution: Lake Co.: 83-(Mt63-204). Lincoln Co.: 14-(Mt63-76).

Staurastrum orbiculare Ralfs var. ralfsii West & West, Mongr. Brit. Desmid. vol. 4, p. 156, pl. 124, figs. 12,13,15,16. 1912.

Pl. 70 fig. 5.

Measurements: TL. 29.5-35.0µ; TB. 28.0-31.0µ; BI. 8.0-9.0µ.

Very rare.

Distribution: Flathead Co.: 22-(6Mon32). Glacier Co.: 54-(Mt62-12,19).

Staurastrum orbiculare Ralfs var. ralfsii West & West, f. major West, Journ. Roy. Micr. Soc. p. 731. 1892.

Pl. 70 figs. 6,7.

Measurements: TL. 49.0-53.5µ; TB. 43.5-47.0µ; BI. 12.0-13.5µ.

Plants intergrade considerably into var. orbiculare. Rare.

Distribution: Beaverhead Co.: 135-(Mt63-333). Flathead Co.: 39-(Mt63-77). Lake Co.: 95-(Mt62-59). Sanders Co.: 74-(Mt63-171).

Staurastrum orbiculare Ralfs var. ralfsii fa

Pl. 70 figs. 2,9.

Measurements: TL. 20 - 27.0µ; TB. 18.0-25.0µ; BI. 4.5-7.0µ.

of this size are generally assigned to var. depressum. How-
of the subtriangular semicells they have been entered as
orma of var. ralfsii. In face view the sides of the semi-
come subretuse (fig. 9), with somewhat truncate apices.
ring from var. ralfsii in their smaller dimensions. Plant
Kidd (63) for collection locality 31, as var. depressum is
. Moderately common.
: Flathead Co.: 27-(Mon25); 29-(H.L.1); 31-(Kidd*); 39-(Mt63-
.: 83-(Mt63-204); 86-(Mt63-188); 97-(Mt63-33). Lincoln Co.:
(Mt63-137); 12-(Mt63-67); 13-(Mt63-73); 14-(Mt63-76); 15-(Mt

trum oxyacanthum Arch. var. polyaccanthum Nordst. Öfv. K.
örh., 42(3): p. 11, t. 7,fig. 9. 1885.

Pl. 99 fig. 2.

: TL. 28.0-30.0μ; TB. 34.0-40.0μ; BI. 9.0μ.
milar to that illustrated by Croasdale (pl. 8, figs. 8-10,
evon Island. The plant is small for the variety and the pro-
horter.
: Flathead Co.: 28-(Mt63-449).

trum pachyrhynchum Nordst., Övers. K. Sv. Vet. Akad. Förh.,
t. 8, fig. 34. 1875.var. pachyrhynchum

Pl. 69 figs. 2,5.

: TL. 32.0-34.5μ; TB. 31.0-32.0μ; BI. 8.0-9.5μ.
ecies was a moderately common desmid though never collected
ance. The typical form is only known from Glacier National
collected in tri- and quadrate facies (listed below separately).
Glacier Co.: 54-(Mt62-19,23).

Staurastrum pachyrhynchum Nordst. var. pachyrhynchum (quadrate facies)

Pl. 69 fig. 8.

Measurements: TL. 40.0-46.0 ; TB. 33.0-46.0 ; BI. 21.0-22.0 .

Distribution: Flathead Co.: 28-(Mt63-443,445).

Staurastrum pachyrhynchum Nordst. var. convergens Racib., Pamietnik Wydz. 3 Akad. Umiej. w. Krakowie. Tom., 17: p.98, t.7, fig. 14. 1889.

Pl. 69 fig. 4.

Measurements: TL. 33.0-34.0 ; TB. 32.0-33.0 ; BI. 9.0-9.5 .

In the Montana material there is considerable intergradation between this variety and the typical form of the species. Very rare.

Distribution: Lake Co.: 84-(B_6); 86-(Mt63-188).

Staurastrum pachyrhynchum Nordst. fa. (=St. clepsydra Nordst.?)

Pl. 69 fig. 3.

Measurements: TL. 32.0-36.0 ; TB. 34.5-40.0 ; BI. 8.0-11.0 .

Plants similar to the one described by Thomasson (52) as a forma of St. pachyrhynchum, and also to that described by Borge (03) under the same name. Borge (18) later transferred his plant to St. clepsydra. The triangular shape of the semicells, as seen in face view, flattened apex, deep sinus, and narrow isthmus indicate that the plant should be placed with St. clepsydra. However, the Montana plants clearly have thickened angles which is characteristic of St. pachyrhynchum so that they have been entered under that species name.

Distribution: Flathead Co.: 27-(Mon25). Lake Co.: 83-(Mt63-204); 95-(Mt62-58). Sanders Co.: 76-(Mt63-191,192).

Staurastrum paradoxum Meyen. in Ralfs' Brit. Desmid., p. 138, t. 10 fig. 8. 1848. var. paradoxum

Pl. 108 figs. 3,4.

Measurements: TL. 37.0-43.0μ; TB. 39.0-62.0μ; BI. 5.5-7.5μ; LSP. 21.0-26.0μ.

Triradiate and quadriradiate specimens were present in the collections but the triradiate are the most common. The plants are quite small, thus more closely fitting the dimensions given by Ralfs (48).

The plant reported as this species by Kidd(63) for collection locality 56, was included with St. gracile.

Distribution: Beaverhead Co.: 135-(Mt63-330). Ravalli Co.: 122-(Mt63-297). Sweetgrass Co.: 171-(Mt64-99).

Staurastrum pingue Teil., Bot. Notiser, p. 66, figs. 3,4,5. 1942. var. pingue

Pl. 108 figs. 1,2.

Measurements: TL. 36.0-50.0μ; TB. 47.0-55.0μ; BI. 6.0-7.0μ; LSP. 23.0-26.0μ.

This species had a wide distribution, being known from the northwest, south-central and northeastern parts of the state.

Moderately rare.

Distribution: Daniels Co.: 187-(Mt64-6). Lincoln Co.: 2-(Mt63-144); 17-(Mt63-116); 20-(Mt63-90,92). Missoula Co.: 101-(Mt64-70). Ravalli Co.: 120-(Mt63-312). Sweetgrass Co.: 171-(Mt64-99). Valley Co.: 184-(Mt64-15).

Staurastrum pingue Teil. var. tridentata Nygaard., Kgl. danske Vidensk. Selskab., Biol. Skr., 7(1): p. 101, figs. 53 a-f. 1949.

Pl. 108 fig. 5.

Measurements: TL. 52.0-61.0μ; TB. 70.0-79.0μ; BI. 5.5-6.0μ; LSP. 28.0-29.5μ.

This variety was found only at one locality. It occurred along with the typical form. The shape of the semicells is reminiscent of some of the plants entered as St. longipes.

Distribution: Lincoln Co.: 20-(Mt63-90).

Staurastrum pinnatum var. subpinnatum (Schmidle) West & West, Trans. Linn. Soc. Bot., 6. p. 182, pl. 21, fig. 33. 1902.

Pl. 101 figs. 12,13.

Measurements: TL. 23.5-29.0μ; TB. 30.0-37.0μ; BI. 10.0-11.5μ.

Under this variety are included two forms which occur together, and for which dichotypical specimens exist. The plants illustrated in figs. 12 and 13 represent the typical form of the variety. The form in figs. 10 and 11 lack the emarginate verrucae (secondary processes) and are reminiscent of the plant identified as St. subpolymorphum Borge by Thomasson (Figs. 20 a and 20b, 1960). Thomasson does not indicate a basal ring of granules, nor is the apical ornamentation in his plant exactly the same as that in the Montana plants.

Very rare.

Distribution: Ravalli Co.: 114-(Mt63-256); 115-(Mt63-265,270).

Staurastrum pinnatum Turn. var. subpinnatum fa. (=St. subpolymorphum Borge?)

Pl. 101 figs. 10,11.

Measurements: TL. 24.0-29.0μ; TB. 30.0-42.0μ; BI. 10.0-12.0μ.

Quadriradiate forms of this plant were also encountered.

Distribution: Ravalli Co.: 115-(Mt63-265,270).

Staurastrum pinnatum Turn. var. turbinatum var. nov.

Pl. 101 fig. 14.

Measurements: TL. 27.0-30.0μ; TB. 37.0-40.0μ; BI. 8.5-9.0μ.

Semicells in face view turbinate, apex convex and undulate; ventral margins slightly retuse; processes 5, subparallel to somewhat upwardly curved; apical ornamentation consisting of 35 granules in two rings, the upper containing 15, the lower 20, and arranged so that there are groups of 4 granules between processes and 3 granules above the processes; processes flanked on either side by short emarginate projections (secondary processes). This plant is distinguished from the type by the elevated apex, slightly retuse ventral margins and nature and arrangement of granules. Very rare.

Distribution: Lincoln Co.: 5-(Mt63-137).

Staurastrum planctonicum Teil. var. ornatum (Grönbl.) Teil, Svensk. Bot. Tidskrift, p. 227, fig. 15.1947.

Pl. 95 figs. 9, 10.

Measurements: TL. 68.0-128.0μ; TB. 96.0-112.0μ; BI. 11.0-12.5μ; LSP. 46.5-51.0μ.

Cells lacking the supra-isthmal row of granules characteristic of this variety. Similar to Hirano's illustration (pl. 45, fig. 2, 1959) of the variety under the name St. dorsidentiferum var. ornatum Grönblad.

Teiling (47) considers this desmid as representing an intermediate evolutionary stage in the reduction of the ornamentation leading to the planktic end stage (i.e., St. planctonicum), as he does St. sebaldi var. ornatum f. planctonica (in this text = St. manfeldtii var. planctonicum.) Very rare. Known from only two localities in the northwest.

Distribution: Granite Co.: 125-(6Mon44). Powell Co.: 106-(Mt64-74).

Staurastrum planctonicum Teil. fa. (=St. longiradiatum sensu Smith, Bull. Wis. Geol. Nat. Hist. Surv., 57: p. 90, pl. 74, figs. 5-11. 1924.)

Pl. 96 figs. 1,2,3.

Measurements: TL. 47.0-102.0μ; TB. 78.0-128.0μ; BI. 9.0-11.0μ; LSP. 40.0-60.0μ.

I have entered these plants here following the suggestion by Florin (57), although with some reservations, for I am not completely convinced that it belongs to the St. planctonicum group.

The plants exhibited a considerable degree of variation in the length of the processes, and in the presence and development of ornamentation on the corpus.

These plants are identical to those identified as St. longiradiatum by Smith (22). Smith based his determination upon a comparison of his material from Wisconsin, with that from Yan Yean (Australia) from the G.S. West collection. I believe Smith did indeed identify his plant correctly with the plant from Australia, but I also think that the plant identified by the Wests from Yan Yean is not their previously described St. longiradiatum. Staurastrum longiradiatum does occur in Montana, and the plant is similar to the original illustration, and the plant entered here is not identical to it, nor intergrades with it.

This was a common desmid and widely distributed.

Distribution: Chateau Co.: 156-(Mt64-46,47). Deer Lodge Co.: 129-(Mt63-383). Fergus Co.: 162-(Mt64-28). Flathead Co.: 30-(Kidd*). Garfield Co.: 191-(Mt64-27). Lake Co.: 93-(Schindler*). Madison Co.: 139-(Mt63-371). McCone Co.: 192-(Mt64-21). Missoula Co.: 103-(Mt63-234). Sanders Co.: 76-(Mt63-192); 77-(Mt63-194). Teton Co.: 68-(Mt64-51). Valley Co.: 183-(Mt64-11); 184-(Mt64-15); 185-(Mt64-17).

Previously reported by Schindler (54) for collection locality 93, under the name St. longiradiatum.

Staurastrum polonicum Racib., Spraw. Kom. fizyjogr. Akad. Umiej., 19: p. 17, t. 1, fig. 10.1884. var. polonicum

Pl. 86 figs. 2,3,5.

Measurements: TL. 42.0-44.0μ; TB. 28.0-30.5μ; BI. 15.5-16.5μ.

This was a rare species. Known only from collections taken west of the continental divide. The typical form was most abundantly seen. The number of angles per semicell varied from 5-8.

Distribution: Granite Co.: 126-(6Mon42); 127-(6Mon38).

Staurastrum polonicum Racib. var. coronulatum Pres., Pap. Mich. Acad. Sci. Arts and Letters, 21: p. 140, pl. 15, figs. 11-15. 1936.(=Euastridium verrucosum Carter)

Pl. 86 fig. 4.

Measurements: TL. 48.0-50.0μ; TB. 37.0-38.5μ; BI. 16.5μ.

Very rare. Known from a single locality, a high-altitude lake (7000 feet) in the northwest.

Distribution: Beaverhead Co.: 135-(Mt63-332).

Staurastrum polymorphum Bréb., in Ralfs' Brit. Desmid., p. 135, t. 22, fig. 9, t-34, fig. 6. 1848.var. ploymorphum

Pl. 104 figs. 6,7,8,9,10,11.

Measurements: TL. 21.0-30.0μ; TB. 26.0-46.0μ; BI. 5.5-9.0μ.

This variable species was of common occurrence in western Montana. The number of processes per semicell ranged from 3 to 5 and numerous specimens were seen in which the number present on one semicell differed from what was present on the other semicell. The length of the process is also quite variable as is the development of granules and even verrucae. The desmid in fig. 7 is a form with greatly developed, apical emarginate verrucae. Such plants intergrade completely with the typical form. Common.

Distribution: Beaverhead Co.: 133-(Mt63-318). Flathead Co.: 22-(6Mon4); 25-(Mt63-409); 27-(Mon25 , Mt63-450); 28-(Mt63-500); 29-(H.L.1); 39-(Mt63-78,79). Glacier Co.: 54-(Mt62-24,11). Granite Co.: 127-(6Mon38).

Lake Co.: 81-(Mt63-206); 84-(X_8); 92-(Mt63-40); 95-(Mt62-56); 96-(Mt63-44); 97-(Mt63-33). Lincoln Co.: 2-(Mt63-141); 10-(Mt63-157,158); 11-(Mt63-124); 15-(Mt62-28); 17-(Mt63-117); 19-(Mt63-111); 20-(Mt63-91); 21-(Mt63-101). Madison Co.: 137-(Mt63-377). Missoula Co.: 101-(Mt64-72). Ravalli Co.: 119-(Mt63-301). Sanders Co.: 70-(Mt63-161); 74-(Mt63-171); 76-(Mt63-176).

Staurastrum ploytrichum (Perty) Rabenh., Flor. Europ. Alg.p. 218. 1868.var. ploytrichum

Pl. 74 fig. 2.

Measurements: TL. 58.0-68.0μ; TB. 58.0-71.0μ; BI. 18.0-20.0μ; LSS. 51.0-64.0μ; BSS. 48.0-62.0μ.

This species was of moderately common occurrence. It was only encountered in the northwest.

Distribution: Flathead Co.: 22-(6Mon4); 29-(H.L.1); 41-(Mt63-59); 42-(Mon16). Ravalli Co.: 112-(Mt63-260). Sanders Co.: 76-(Mt63-176); 77-(Mt63-194).

Staurastrum polytrichum (Perty) Rabenh. var. polytrichum morpha

Pl. 74 fig. 1.

Measurements: TL. 67.0-68.0μ; TB. 72.0μ; BI. 21.0μ; LSS.64.0μ; BSS. 59.0μ.

Plant differing from the type in possessing broader spines.

Distribution: Flathead Co.: 22-(6Mon4).

Staurastrum polytrichum (Perty) Rabenh. var. polytrichum morpha

Pl. 74 fig. 3.

Measurements: TL. 72.0μ; TB. 68.0μ; BI. 20.0μ; LSS. 67.0μ; BSS. 59.0μ.

Plant differing from the type in having the semicells rhomboid and with a greater number of spines.

Distribution: Sanders Co.: 76-(Mt63-176).

Staurastrum polytrichum (Perty) Rabenh. f. biseriatum Kaiser, Kryptog. Forsch. 1(7): p. 441 fig. 47. 1924.

Pl. 74 figs. 4,5.

Measurements: TL. 53.0-67.0μ; TB. 57.0-72.0μ; BI. 18.0-20.0μ; LSS. 51.0-58.0μ; BSS. 45.0-53.0μ.

Moderately rare. Known only from the northwest.

Distribution: Flathead Co.: 39-(Mt63-78). Glacier Co.: 63-(Mt63-218). Lincoln Co.: 9-(Mt63-154); 20-(Mt63-94). Ravalli Co.: 115-(Mt63-270). Sanders Co.: 74-(Mt63-170).

Staurastrum proboscidium (Bréb.) Arch.

The plants entered here are separated into three major groups which can be identified with the following taxa: St. proboscidium, St. borgeanum, and St. aculeatum var. ornatum. Because of the considerable degree of overlapping which exists among the characteristics distinguishing these taxa, I thought it best to enter them together under the same species name. As a group, this was a moderately common desmid in Montana.

Staurastrum proboscidium (Bréb.) Arch. in Pritch. Infus., p. 742. 1861.var. proboscidium

Pl. 102 fig. 1

Measurements: TL. 36.0-41.0μ; TB. 37.0-42.5μ; BI. 11.0-14.0μ.

This plant was of moderately rare occurrence. Known from the northern and southern montane regions and from the northeast.

Distribution: Beaverhead Co.: 132-(Mt63-185). Flathead Co.: 24-(Mt63-411); 25-(Mt63-407): 27-(Mt63-451). Granite Co.: 128-(Mt63-386). Sheridan Co.: 188-(Mt63-16,17,21). Silverbow Co.: 136-(Mt63-379).

Staurastrum proboscidium (Bréb.) Arch. var. *proboscidium* morpha

Pl. 102 fig. 4.

Measurements: TL. 49.0μ; TB. 47.0μ; BI. 15.0μ.

Differing from the type in larger size and greater development of apical verrucae.

Distribution: Beaverhead Co.: 132-(Mt63-185).

Staurastrum proboscidium (Bréb.) Arch. (=*St. borgeanum* Schm., Bih. K. Sven. Vet.-Akad. Handl. Bd. 24 afd. III. no. 8: p. 60, t. 3, fig. 7. 1898).

Pl. 102 figs. 2,5.

Measurements: TL. 32.0-36.0μ; TB. 43.5-46.5μ; BI. 12.0-14.0μ.

Thomasson (57) has done an excellent job of discussing the variability of this plant under the name *St. borgeanum* especially with regard to the development (extension) of the processes. The Montana plants also showed comparable variability. The short-armed forms intergrade considerably into *St. proboscidium* so that I do not believe the two species can be adequately separated. Since *St. proboscidium* is the older name the plants have been included under this species. Rare. Known only from the north-west.

Distribution: Flathead Co.: 23-(Mt63-400). Lincoln Co.: 13-(Mt63-73). Sanders Co.: 78-(Mt63-181).

Staurastrum proboscidium (Bréb.) Arch. (=*St. aculeatum* var. *ornatum* Nordst., Öfv. K. Vet-Akad. Förhandl., 6: p. 40 1872?)

Pl. 102 fig. 3.

Measurements: TL. 34.0-38.0μ; TB. 34.0-44.0μ; BI. 12.0-15.5μ.

Similar to plants entered by Croasdale (57,65) from Alaska, and from Devon Island (Canada) under the name of *St. aculeatum* var. *ornatum*. She also indicates under her discussion of _St_. _aculeatum_ var. _ornatum_ f. _simplex_ Boldt, that another possible identification of her plant (f. _simplex_) is as a form of _St_. _borgeanum_. With this I would agree completely. The variability in development of ornamentation, present in the Montana specimens clearly indicates this plant's closer affinity to _St_. _borgeanum_. Consequently, it is placed here in this text. Moderately rare. Known only from western Montana.

Distribution: Flathead Co.: 28-(Mt63-445); 31-(4181). Glacier Co.: 54-(Mt62-11,13,2Mon8). Granite Co.: 126-(6Mon42). Lake Co.: 86-(Mt62-80).

Staurastrum sp. 2 (=_St_. _pseudopachyrhynchum_ Wolle?)

Pl. 67 figs. 3,4.5.

Measurements: TL. 24.5-28.0μ; TB. 21.0-27.0μ; BI. 5.0-7.0μ.

Cells small, longer than broad with or without a small papilla (or spine) on the usually angular corners; isthmus elongate; sinus angular. Semicells angular (fig. 3) more rarely elliptical. Apical view triangular, sides concave, angles broadly rounded and with or without a short papilla or spine.

In face view most resembling _St_. _pseudopachyrhynhum_ but differing from that species in usually possessing the short papillae at the corners. This characteristic may not be sufficient to exclude the plant from _St_. _pseudopachyrhynchum_, especially after reading Teiling's (67) treatment of the genus _Staurodesmus_. Moderately rare. Known only from the northwest. The plant reported by Schindler (54) as _St_. _mucronatum_ from collection locality 91, is included here.

Distribution: Flathead Co.: 22-(6Mon5); 29(H.L.1). Lake Co.: 91-(Schindler*); 95-(Mt62-60). Lincoln Co.: 4-(Mt63-135); 5-(Mt63-137); 19-(Mt63-110,112).

Staurastrum pseudotetracerum (Nordst.) West & West, Trans. Linn. Soc. Lond., (2): p.79, t. 8, fig. 39. 1895.

Pl. 97 figs. 10,11,12.

Measurements: TL. 18.5-30.0μ; TB. 24.0-35.0μ; BI. 5.0μ; LSP. 16.0-21.0μ; BSP. 9.0-11.0μ; LP. 8.5-14.5μ.

The Montana plants most resemble Bohlin's illustration (t.1, fig. 16.1901) of the species. There was some variation in the length of the processes, and short-armed forms occurred along with longer-armed forms. Plants with the longest processes are reminiscent of *St. paradoxum* var. *parvum* West. However, the body measurements of the Montana specimens are larger than in West's taxon. Rare.

Distribution: Flathead Co.: 37-(Mt63-82). Lincoln Co.: 12-(Mt63-70); 13-(Mt63-75); 17-(Mt63-117).

Staurastrum punctulatum Bréb.

This was a common species occurring in the western montane and in the central and south-central piedmont regions. It was encountered in both lentic and lotic environments at altitudes ranging from 2100 to 7000 feet. In addition to the typical form, a variety was also identified. Two distinctive, but unnamed forms were also encountered and they are listed separately below.

Staurastrum punctulatum Bréb. in Ralfs' Brit. Desmid., p. 133, t. 22, fig. 1. 1848. var. *punctulatum*

Pl. 87 figs. 1,2,3.

Measurements: TL. 26.0-47.0μ; TB. 25.5-43.0μ; BI. 9.0-17.0μ.

The typical form of the species was the most frequently collected. Common. Known from western Montana and the central and south-central parts of the state.

Distribution: Beaverhead Co.: 131-(Mt63-184); 132-(Mt63-185); 135-(Mt63-333). Carbon Co.: 178-(Mt64-109). Cascadi Co.: 159-(Mt64-87,88,89). Flathead Co.: 22-(6Mon4); 24-(Mt63-411); 25-(Mt63-407,410); 41-(Mt63-57). Lake Co.: 85-(Mt63-47); 98-(Mt63-62). Missoula Co.: 102-(Mt62-4). Ravalli Co.: 120-(Mt63-308); 121-(Mt63-288,289); 123-(Mt63-286). Sanders Co.: 70-(Mt63-161); 73-(Mt63-169); 78-(Mt63-181); 79-(Mt63-179).

The species was previously reported for the Glacier National Park region by Vinyard (51) but no illustration was given.

Staurastrum punctulatum var. *kjellmanii* Wille, Öfvers. K. Vet. Akad. Förh. No. 5: p. 50, t. 13, figs. 50-53. 1879.

Pl. 87 figs. 9,10.

Measurements: TL. 38.5-47.5μ; TB. 31.0-36.5μ; BI. 16.0-19.0μ.

Very rare. Known only from the northwest.

Distribution: Flathead Co.: 28-(Mt63-442,443). Lake Co.: 81-(Mt63-208).

Staurastrum punctulatum Bréb. fa.

Pl. 7,8 fig.5 & Pl. 88 fig. 1.

Measurements: TL. 36.5-42.0μ; TB. 37.0-42.0μ; BI. 13.0-15.0μ.

Plants differing from the typical form in having more produced angles. Rare.

Distribution: Beaverhead Co.: 132-(Mt63-185). Powell Co.: 107-(Mt64-79). Ravalli Co.: 119-(Mt63-301).

Staurastrum punctulatum Bréb. fa.

Pl. 87 figs. 4,6,7,8.

Measurements: TL. 35.0-44.0μ; TB. 30.5-42.0μ; BI. 13.5-17.0μ.

Cells differing from the typical form in the more angular form of the semicell, and in apical view in having the margins commonly straight, as opposed to distinctly convex.

Distribution: Flathead Co.: 24-(Mt63-411); 25-(Mt63-410). Glacier Co.: 55-(Mon28). Lake Co.: 85-(Mt63-47). Ravalli Co.: 121-(Mt63-288); 123-(Mt63-286).

Staurastrum pygmaeum Bréb., in Ralfs' Brit. Desmid., p. 213, t. 35. fig. 26. 1848. var. pygmaeum f. pygmaeum

Pl. 88 figs. 6,7.

Measurements: TL. 24.0-35.0µ; TB. 20.0-30.0µ; BI. 8.0-14.5µ.

This species was of moderately common occurrence. Known from western, north-central, south-central and northeastern parts of the state. This species is considered a variety of St. punctulatum by West and West (12). As here distinguished, the angles of these plants are more acute than those present in St. punctulatum.

Distribution: Beaverhead CO.: 134-(Mt63-322). Blaine Co.: 152-(Mt63-32). Carbon Co.: 178-(Mt64-109). Flathead Co.: 28-(Mt63-442,444,447, 449). Granite Co.: 127-(6Mon38). Lake Co.: 81-(Mt63-213). Lincoln Co.: 8-(Mt63-151); 9-(Mt63-154); 13-(Mt63-73); 15-(Mt62-26). Missoula Co.: 100-(Mt63-420). Ravalli Co.: 114-(Mt63-256). Sheridan Co.: 188-(Mt63-16). Silverbow Co.: 136-(Mt63-379).

Staurastrum pygmaeum Bréb. var. pygmaeum f. major Wille, Öfvers. K. Sv. Vet.-Akad. Förh., No. 5: p. 51, t. 13, fig. 54. 1875.

Pl. 88 figs. 9, 10.

Measurements: TL. 37.0-40.0µ; TB. 33.0-39.0µ; BI. 15.0-19.0µ.

Rare. Known from both the northern and southern montane regions. Collected in the latter at high altitudes (6100 and 7000 feet).

Distribution: Beaverhead Co.: 132-(Mt63-185); 134-(Mt63-324). Flathead Co.: 24-(Mt63-411).

Staurastrum pterosporus Lund., Nova Acta Reg. Soc. Sci. Upsal. ser. 3, vol. 8: p. 60, t. 3, fig. 29. 1871.

Pl. 62 fig. 18.

Measurements: TL. 15.0-16.0μ; TB. 17.0-20.0μ; BI. 6.5-7.0μ; BSS. 15.5-17.0μ.

This plant is entered here with some reservation since it may be a triradiate facies of an Arthrodesmus (see A. tortus fa.), and because no zygospore was seen. Very rare.

Distribution: Flathead Co.: 29-(H.L.1).

Staurastrum quadrangulare Bréb. var. armatum West & West, Trans. Linn. Soc. sec. ser. Bot., 5: p. 257, pl. 16, fig. 18. 1896.

Pl. 80 fig. 8.

Measurements: TL. 22.0-24.0μ; TB. 23.0-28.0μ; BI. 10.0μ.

Very rare. Known only from the northwest.

Distribution: Glacier Co.: 54-(Mt62-14). Lake Co.: 95-(Mt62-60).

Staurastrum rugosum Irénée-Marie

This was a most variable species and numerous forms which differ in some way from the type were encountered. Many transitional plants were also collected. Only one variety (excluding the typical form) has been named below, the remainder being entered as morphae. This was a common desmid, but the plant which is closest to type was the very rarest found.

Staurastrum rugosum Irénée-Marie, Flore Desmidiale de la Region de Montreal-Laprairie, Canada; p.311, pl. 59, figs. 4,5. 1939. var. rugosum.

Pl. 92 fig. 5.

Measurements: TL. 32.0-34.0μ; TB. 43.0-45.0μ; BI. 13.0-14.0μ; BSP. 36.0-37.0μ.

Complete intergradation existed between the typical form of this species and the plants entered below as morphae of the type, and those entered as var. coronulatum. As described by Irénée-Marie, very rarely seen in the collection. In apical view the plants never have the verrucae in as circular a pattern as indicated in fig. 5 of the original illustrations. Very rare. Known from a single locality in the northwest. Distribution: Lake Co.: 87-(Mt64-64).

Staurastrum rugosum Irénée-Marie var. rugosum morpha (1)

Pl. 92 figs. 4,8,9,10.

Measurements: TL. 26.0-37.0μ; TB. 34.0-53.0μ; BI. 9.5-14.0μ; BSP. 33.5-38.0μ.

Plants differing from the type in having bifurcate processes as opposed to trifurcate processes, and in lacking the characteristic apical emarginate verrucae (only granules present). The processes are quite variable in length and in some specimens completely wanting. This was the most frequently collected and abundant form of the species. Moderately common. The plant questionably entered by Kidd (63) as St. avicula for collection localities 56 and 63 are included here.

Distribution: Flathead Co.: 24-(Mt63-411); 36-(Mt63-396); 47-(Mt63-413); Gallatin Co.: 140-(Mt64-129). Glacier Co.: 56-(Kidd*); 63-(Kidd*). Judith Basin Co.: 161-(Mt64-94). Lake Co.: 87-(Mt64-64); 92-(Mt63-38). Lincoln Co.: 4-(Mt63-129); 20-(Mt63-94); 21-(Mt63-99).

Staurastrum rugosum Irénée-Marie var. rugosum morpha (2)

Pl. 92 fig. 7.

Measurements: TL. 35.0μ; TB. 44.0μ; BI. 9.5μ; BSS. 37.0-40.0μ.

Plant differing from the type in its greatly reduced processes (now spines), less convex dorsal margin and lack of apical verrucae.

Reminiscent of St. avicula. Very rare.

Distribution: Flathead Co.: 24-(Mt63-411).

Staurastrum rugosum Irénée-Marie var. coronulatum (Wade) Jackson comb. nova. (=St. avicula var. coronulatum Wade, Revue Algologique, No.4: p. 263, pl. 2, fig. 7.1957)

Pl. 92 figs. 2,3.6.

Measurements: TL. 29.0-34.0μ; TB. 35.0-44.0μ; BI. 8.0-10.5μ; BSS. 33.5-35.0μ.

In his original description Wade (57) stated that his plant should be compared with St. rugosum. He indicated that it differs from Irénée-Marie's plant in possessing two spines at the angles (as opposed to trifurcate processes (spines)) and in addition, in apical view, his variety has two linear series of four verrucae each within the lateral margin (St. rugosum has verrucae in a circular pattern). From the degree of variability which exists in the Montana material regarding these characteristics, I do not believe one can adequately separate Wade's plant from St. rugosum. Consequently, it has been transferred here. At collection locality 87, the two taxa occur together and transitional forms exist. Very rare.

Distribution: Lake Co.: 87-(Mt64-64).

Staurastrum rugosum Irénée-Marie fa.

Pl. 92 fig. 1.

Measurements: TL. 32.0μ; TB. 35.5μ; BI. 9.0μ; BSS. 33.5-34.0μ.

Differing from the type in possessing a more elevated dorsal margin in face view; lacking trifurcate processes (spines) and instead having two small spines at the angles; and in apical view having verrucae (five in a row) in linear series forming a triangular pattern. Very rare.

Known from a single collection locality west of the continental divide.
Distribution: Lincoln Co.: 20-(Mt63-94).

Staurastrum sebaldi Reinsch, Acta Societ. Senckenb. vol. 6, p. 133, t. 24 D, figs. 1-3, 1867. var. sebaldi

Pl 94 figs. 10,11,13.

Measurements: TL. 75.0-77.0μ; TB. 73.0-110.0μ; BI. 20.0-29.0μ.

In some of the Montana material studied there was so much intergradation between the typical form and var. ornatum Nordst., that it was difficult to distinguish one from the other. Consequently, one might question the soundness of considering var. ornatum a distinct variety. The presence of granules or other ornamentation on the corpus is quite variable ranging from forms almost devoid of them (fig. 13) to forms similar to Reinsch's original illustration. Rare. Known only from the northwest.

Distribution: Granite Co.: 125-(6Mon49). Lake Co.: 86-(Mt62-79,80, Sieminska*). Lincoln Co.: 8-(Mt63-152).

Previously reported by Sieminska (65) for collection locality 86.

Staurastrum sebaldi Reinsch. var. ornatum Nordst., Acta Univ. Lund. vol. 9, p. 34, t. 1, fig. 15. 1873.

Pl. 94 figs. 8,9,12.

Measurements: TL. 83.0-94.0μ; TB. 109.0-126.0μ; BI. 21.0-23.0μ.

The Montana specimens observed never quite attained the breadth of Nordstedt's plant. As indicated above, they intergrade completely with plants considered the typical form. Rare. Encountered only in the northwest. See discussion under St. manfeldtii.

Distribution: Glacier Co.: 64-(Mt61-2). Granite Co.: 125-(6Mon49). Lake Co.: 81-(Mt63-206); 86-(Mt62-79, Sieminska*).

Previously reported by Sieminska (65) for collection locality 86.

Staurastrum senarium (Ehrenb.) Ralfs, Brit. Desmid., p. 216. 1848.

Pl. 80 figs. 11,12,13.

Measurements: TL. 36.0-43.0μ; TB. 28.0-41.0μ; BI. 8.0-10.5μ; LSP. 27.0-32.0μ; BSP. 24.0-28.0μ.

Figure 12 illustrates a form in which the accessory processes, which usually flank the processes at the angles, have been replaced by simple spines.

Rare. Known only from the northwest.

Distribution: Flathead Co.: 28-(Mt63-445). Lake Co.: 81-(Mt63-209). Missoula Co.: 100-(Mt63-419).

Staurastrum setigerum Cleve f. alaskanum Croasd., Trans. Amer. Micr. Soc., vol. 76 (2): p. 148, fig. 86. 1957.

Pl. 76 figs. 6,7,8.

Measurements: TL. 42.0-49.0μ; TB. 50.0-59.0μ; BI. 12.0-14.0μ; LSS. (34.0) 36.0-39.0μ; BSS. 36.0-48.0μ.

St. setigerum f. alaskanum was of moderately common occurrence. As indicated by Croasdale (57) this form approaches var. pectinatum West & West, especially the smaller specimens. It is larger than var. pectinantum, and without spines, it is equal to or broader than long, as opposed to being longer than broad. In the Montana material the spines vary in number and size while the outline of the plant is fairly constant. Transitional forms exist between this taxon and var. occidentale West & West on one side, and with the plants entered in the text as St. subteliferum Roy & Bisset. There is also some indication that the plant may be closely related to St. teliferum Ralfs.

Distribution: Flathead Co.: 36-(Mt63-393). Lake Co.: 83-(Mt63-205);

87-(Mt64-64); 94-(7Mon15); 97-(Mt63-33). Lincoln Co.: 2-(Mt63-141); 4-(Mt63-129); 12-(Mt63-67); 15-(Mt62-26,28); 21-(Mt63-97).

Staurastrum setigerum Cleve var. occidentale West & West, Trans. Linn. Soc. Lond. sec. ser. Bot., vol. 5 (5): p. 260, t. 16, fig. 27. 1896.

Pl. 76 figs. 9,10,11.

Measurements: TL. 39.0-50.0μ; TB. 56.05-65.0μ; BI. 10.0-13.0μ; LSS. 34.0-40.0μ; BSS. 37.0-47.0μ.

The smaller forms of this variety intergrade with St. setigerum f. alaskanum. Moderately rare. Encountered only west of the continental divide.

Distribution: Flathead Co.: 29-(H.L.1); 37-(Mt63-82). Lake Co.: 87-(Mt64-64); 95-(Mt62-60); 97-(Mt63-33). Lincoln Co.: 12-(Mt63-71); 19-(Mt63-111). Missoula Co.: 101-(Mt64-70). Sanders Co.: 76-(Mt63-160).

Staurastrum sexcostatum Bréb., in Ralfs' Brit. Desmid., p. 129, t. 23, fig. 5. 1848 var. sexcostatum

Pl. 102 figs. 6,7.

Measurements: TL. 38.5-42.0μ; TB. 33.0-40.0μ; BI. 15.0-16.0μ.

Very rare. The typical form is only known from two high altitude (6800 and 7000 feet) bogs in the northwest.

Distribution: Granite Co.: 127-(6Mon38). Missoula Co.: 100-(Mt63-419, 420).

Staurastrum sexcostatum Bréb. var. productum West, Journ. Roy. Micr. Soc., p. 733, t. 9, fig. 34. 1892.

Pl. 102 fig. 8.

Measurements: TL. 37.0-40.0μ; TB. 39.0-40.5μ; BI. 14.0μ.

Cells intergrading into the type. Quadriradiate form also found at collection locality 28. Very rare. Known only from the northwest.

Distribution: Beaverhead Co.: 135-(Mt63-332). Flathead Co.: 28-(Mt63-447).

Staurastrum sexcostatum Bréb. fa.

Pl. 102 fig. 9.

Measurements: TL. 40.0-42.0µ; TB. 40.0-43.0µ; BI. 14.5µ.

Plant differing from the type in having more produced angles and lacking apical verrucae. In apical view cells possessing 30 granules (ten groups of 3 granules in a ring). Very rare. Known from a single locality, a swamp, in the northwest.

Distribution: Lincoln Co.: 9-(Mt63-154).

Staurastrum smithii (Smith) Teil. fac. triradiatum Florin. Acta Phytogeogr.Suec. 37, p. 133, fig. 29: 2-4. 1957.

Pl. 108 figs. 6,7.

Measurements: TL. 52.0-62.0µ; TB. 57.0-76.0µ; BI. 5.0-6.0µ; LSP. 19-22.0µ; BSP. 8.0-10.5µ; LP. 33.0-38.0µ.

Plants similar to those illustrated by Thomasson (Figs. 31-33, 1960). As he did,I have placed my plants with St. smithii, following the interpretation given by Florin (57).

Rare. Known from western and central Montana.

Distribution: Flathead Co.: 32-(Mt63-217). Liberty Co.: 149-(Mt64-58). Lincoln Co.: 21-(Mt63-97). Wheatland Co.: 164-(Mt63-465).

Staurastrum spongiosum Bréb.

This was a moderately rare species. Encountered in both the northern and southern montane. In addition to the typical form one variety and a reduced form which appears to be identical to St. monticulosum var.

groenlandicum Grönbl. f. hastatum (Lütkem.) Grönbl., were also found.

Staurastrum spongiosum Bréb. in Ralfs' Brit. Desmid., p. 141, t. 23, fig. 4, 1848 var. spongiosum

Pl. 93 fig. 7.

Measurements: TL. 44.0-60.0μ; TB. 40.0-57.0μ; BI. 11.0-17.5μ.

The typical form was collected in the northern and southern montane regions but was of rare occurrence.

Distribution: Beaverhead Co.: 132-(Mt63-185). Flathead Co.: 24-(Mt63-411); 25-(Mt63-407,410).

Staurastrum spongiosum Bréb. var. perbifidum West, Journ. Linn. Soc. Bot., 29: p. 175, t. 23, fig. 3. 1892.

Pl. 93 figs. 4,8.

Measurements: TL. 42.0-62.0μ; TB. 36.0-48.0μ; BI. 10.5-15.0μ.

Most frequently collected form of the species. Variety integrading into the plant listed below, which is identified as St. monticulosum var. groenlandicum f. hastatum.

Rare. Known only from the northwest.

Distribution: Flathead Co.: 28-(Mt63-500). Glacier Co.: 54-(2Mon9). Lake Co.: 81-(Mt63-206); 86-(Mt62-73, 79). Lincoln Co.: 8-(Mt63-152).

Staurastrum spongiosum Bréb. fa. (=St. monticulosum Bréb. var. groenlandicum Grönbl. f. hastata (Lütkem.) Grönbl., Acta Soc. Fauna Fl. Fenn. 47, 4: p. 70, t. 1, figs. 17-18,1920)

Pl. 93 figs. 3,5,6.

Measurements: TL. 38.0-47.0μ; TB. 33.0-47.0μ; BI. 12.0-15.0μ; LSP. 33.0-37.0μ; BSP. 30.0-37.0μ.

Schmidle (95) published two figs. (pl. 17 figs. 6,7) of a plant

which he identified as St. megalonatum Nordst. f. hastata Lutkemuller. The Montana specimens entered here are believed to be similar to Schmidle's plant. Grönblad (20) later transferred Lütkemullar's plant to St. monticulosum as a forma of var. groenlandicum. West, West and Carter (23) listed Schmidle's plant in synonymy with St. spongiosum. The Montana material studied, from collection locality 28, indicates that this plant should be considered as belonging to St. spongiosum.

Figure 4 represents what is regarded here as a small form of var. perbifidum, the lower semicell, with the exception of size, being similar to that illustrated in fig. 8. The upper semicell differs in the nature of the apical processes. Transitional forms exist between this small form (fig. 4) and the plant illustrated in fig. 5. It is this plant (figs. 5 and 6) which I consider to be Schmidle's. Figure 6 is the apical view of another plant from the same population. Figure 3 illustrates continued reduction of processes and spines, accompanied by changes in the shape of the semicells. The upper semicell in fig. 3 exhibits a form reminiscent of St. monticulosum. I believe the similarity between this latter named taxon and the plant listed here is superficial. Very rare. Known only from two localities in the northwest.

Distribution: Flathead Co.: 28-(Mt63-443). Granite Co.: 127-(6Mon41).

Staurastrum striolatum (Nag.) Arch., in Pritch. Infus. p. 740. 1861.

Pl. 89 figs. 1,2,3,4,5.

Measurements: TL. 20.0-22.0μ; TB. 18.0-23.0μ; BI. 6.0-7.5μ.

Extension of the angles variable in the Montana material. At times very slightly produced as in fig. 1, at other times well developed as in figs. 4 and 5. Encountered primarily in the northwest but also known from the northeast. Moderately rare.

Distribution: Daniels Co.: 187-(Mt64-7). Flathead Co.: 29-(H.L.1): 31-(4181). Granite Co.: 126-(6Mon42); 127-(6Mon41). Lake Co.: 87-(Mt64-64). Lincoln Co.: 10-(Mt63-157). Ravalli Co.: 115-(Mt63-266).

Staurastrum subavicula West & West, Journ. Roy, Micr. Soc., p. 12. 1894.

Pl. 91 figs. 3,4.

Measurements: TL. 23.0-34.0μ; TB. 28.0-39.0μ; BI. 8.5-10.5μ; LSP. 23.0-29.0μ.

Like the Labrador specimens reported by Croasdale (64), some of the Montana specimens had extra spines at the angles and/or lacked the accessory apical, bifurcate processes characteristic of the species. Rare. Known from both the northern and southern montane regions. In the south collected from a high altitude lake (7000 feet) and in the north occurring at lower elevations (4000-4200 feet).

Distribution: Beaverhead Co.: 134-(Mt63-324). Flathead Co.: 31-(4181). 39-(Mt63-78,79).

Staurastrum subcruciatum Cooke & Wills. in Cooke, Brit. Desmid., p. 148, t. 51, fig. 3 1887.

Pl. 91 figs. 9,10.

Measurements: TL. 30.0-38.0μ; TB. 32.0-43.5μ; BI. 8.0-11.5μ.

Rare. Encountered in both the northern and southern montane regions. In the north at low elevations (2600-3800 feet); in the south at a higher elevation (7000 feet).

Distribution: Beaverhead Co.: 135-(Mt63-333). Granite Co.: 125-(6Mon51). Sanders Co.: 74-(Mt63-171); 76-(Mt63-191,192).

Staurastrum submanfeldtii West, Trans. Linn. Soc. sec. ser. Bot. vol. 6: p. 188, t. 22, fig. 16. 1902.

Pl. 96 figs. 6,7.

Measurements: TL. 40.0-46.0µ; TB. 61.0-86.0µ; BI. 11.0-12.5µ.

Rare. Known only from the northwest. It may be that *St. johnsonii* is a biradiate facies of this species.

Distribution: Flathead Co.: 36-(Mt63-393). Lake Co.: 80-(4Mon52); 83-(Mt 63-205). Lincoln Co.: 10-(Mt63-157); 17-(Mt63-116).

Staurastrum subpygmaeum West, Journ. Linn. Soc. Bot. vol. 29: p. 178 t. 23, fig. 8. 1892.

This species was reported by Vinyard (51) for the Glacier National Park region but he gives no illustration.

Staurastrum subteliferum Roy & Biss., Journ. Bot., 24: p. 238, fig. 1. 1886.

Pl. 76 figs. 1,2,3.

Measurements: TL. 43.0-46.0µ; TB. 47.5-52.0µ; BI. 11.5-14.5µ; LSS. 37.0-39.5µ; BSS. 36.5-39.0µ.

There was some overlapping between characteristics of this species and those of *St. teliferum* Ralfs and *St. setigerum* f. *alaskanum* Croasdale. According to the original description this species differs from *St. teliferum* essentially in possessing spines of two sizes, as well as in the form of the semicells. However, specimens were noted in which all spines were alike (fig. 1) and transitional forms from one extreme to the other occurred. The shape of the semicells, although considerably more constant, varies depending upon the degree of spine dimorphism, and the number and placement of the spines.

Croasdale (57) indicates the similarity between her plant (f. *alaskanum* and St. subteliferum. She states that f. alaskanum differs from St. subteliferum in its proportions (not longer than broad), larger size and fewer spines. In the Montana specimens the proportions overlap, there is essentially no size difference(the measurements given by Roy and Bisset for St. subteliferum, according to my calculations, are for the plant without spines) and the difference in the number ofspines is as noted by Croasdale.

Comparing figs. 3,4 and 6, one observes the similarities between these two taxa.

Very rare. Known from a single collection locality in the northwest.

Distribution: Lincoln Co.: 21-(Mt63-97).

Staurastrum teliferum Rafls, Brit. Desmid., p. 128, t. 22, fig. 4, t. 34, fig. 14. 1848. var. teliferum

Pl. 76 fig. 5.

Measurements: TL. 44.0-59.0μ; TB. 52.0-56.0μ; BI. 12.0-13.0μ; LSS. 38.0-42.0μ; BSS. 38.0-41.5μ.

Not all specimens seen possessed spines as stout as those illustrated in fig. 5. Plants which had differing numbers of spines per semicell were also noted. At collection locality 21, this species occurred along with St. subteliferum and St. setigerum f. alaskanum, to which it bears some similarities. Very rare.

Distribution: Lake Co.: 87-(Mt64-64). Lincoln Co.: 21-(Mt63-97).

Staurastrum tetracerum Ralfs, Brit. Desmid., p. 137, t. 23, fig. 7. 1848.var. tetracerum f. tetracerum

Pl. 97 figs. 7,8,13.

Measurements: TL. 18.0-35.0μ; TB. 21.0-45.0μ; BI. 4.0-6.0μ; LSP. 8.0-13.0μ.

This was a common desmid. Occurring with one exception (central Montana) exclusively in the northwest.

Distribution: Flathead Co.: 23-(Mt63-399); 27-(Mon25, Mt63-450); 29-(H.L.1); 36-(Mt63-396); 37-(Mt63-82). Glacier Co.: 54-(Mt62-13,25). Lake Co.: 82-(Mt63-199); 83-(Mt63-204); 86-(Mt63-186, Sieminska*); 87-(Mt64-66); 94-(7Mon15). Lincoln Co.: 1-(4184); 5-(Mt63-137); 15-(Mt62-28); 20-(Mt63-91). Missoula Co.: 101-(Mt64-72). Ravalli Co.: 115-(Mt63-267). Sanders Co.: 76-(Mt63-193). Sweetgrass Co.: 171-(Mt64-99).

Previously reported by Sieminska (65) for collection locality 86.

Staurastrum tetracerum Ralfs. var. tetracerum f. trigona Lund., Nova Acta Reg. Soc. Sci. Upsal. ser. 3(8): p. 69. 1871

Pl. 97 figs. 6,9.

Measurements: TL. 16.0-26.0μ; TB. 24.0-35.0μ; BI. 4.0-6.0μ; LSP. 10.0-12.5μ.

Moderately rare.

Distribution: Flathead Co.: 35-(Mt63-391); 36-(Mt63-393); 47-(Mt63-413) Glacier Co.: 54-(Mt62-19). Lake Co.: 86-(Mt63-186, Sieminska*). Lincoln Co.: 19-(Mt63-111);21-(Mt63-103). Sanders Co.: 76-(Mt63-160).

Previously reported by Sieminska (65) for collection locality 86.

Staurastrum thunmarkii Teil., Bot. Notiser, Hafte 1: p. 82, fig. 19. 1946.

Pl. 105 fig. 4.

Measurements: TL. 57.0-60.0μ; TB. 84.0-86.0μ; BI. 8.0-8.5μ; LSP. 30.0-32.0μ.

Very rare. Known from a single locality, a high altitude (7000 feet) oligotrophic lake in the northwest.

Distribution: Beaverhead Co.: 135-(Mt63-334).

Staurastrum tortum (Lagerh. & Nordst.) West & West, Mongr. Brit. Desmid., vol. 4: p. 161, pl. 125, fig. 9.1912.

Pl. 71 figs. 3,4.5.

Measurements: TL. 17.0-21.5μ; TB. 15.5-17.5μ; BI. 10.0μ; T. 10-11.5μ.

Plants identical to figure given by West and West. The plant reported by Sieminska (65) questionably as this species, for collection locality 86,is not West & West's plant.

Very rare. Known from a single collection locality in the northwest.

Distribution: Lincoln Co.: 8-(Mt63-152).

Staurastrum trifidum (Nordst.) var. inflexum West & West, Trans. Linn. Soc. Lond. sec. ser. Bot., vol. 5: p. 258, pl. 16, fig. 22. 1896.

Pl. 85 figs. 1,2.

Measurements: TL. 28.0-33.0μ; TB. 38.0-46.0μ; BI. 9.0-13.5μ.

Moderately rare. Known only from the northwest.

Distribution: Flathead Co.: 27-(Mon25); 39-(Mt63-77). Glacier Co.: 54-(Mt62-25). Lake Co.: 84-(X_8); 86-(Mt63-187, Sieminska*). 88-(Mt63-197); 89-(Mt63-389).

Previously reported by Sieminska (65) for collection locality 86.

Staurastrum trihedrale Wolle, Bull. Torr. Bot. Club. 10: p. 20, pl. 27, fig. 20.1883.

Pl. 71 fig. 8.

Measurements: TL. 42.0-44.0μ; TB. 31.0-33.0μ; BI. 9.0-10.0μ.

Very rare. Known only from a river plankton sample.

Distribution: Missoula Co.: 102-(Mt62-4).

Staurastrum tumidum Bréb., in Ralfs' Brit. Desmid., p. 126, t. 21, fig. 6, 1848.

Pl. 72 fig. 5.

Measurements: TL. 111.0-121.0u; TB. 97.0-105.0u; BI. 36.0-56.0u.

Very rare. Known only from the Glacier National Park region.

Distribution: Flathead Co.: 28-(Mt63-442,443,444). Glacier Co.: 54-(2Mon9).

Staurastrum turgescens deNot., Desmid. Ital., p. 51, t. 4, fig. 43, 1867.

Pl. 86 figs. 6,8.

Measurements: TL. 31.0-34.0µ; TB. 24.5-27.0µ; BI. 10.5-12.0µ.

The plant illustrated in Fig.6, with the angles less produced, approaches var. arcticum Wille. in form. Very rare. Known from a single collection locality in the northwest.

Distribution: Flathead Co.: 41-(Mt63-57, 60).

Staurastrum turgescens deNot.,fa. Desm. Ital, p. 51, t. 4, fig. 43, 1867. fa.

Pl. 86 fig. 7.

Measurements: TL. 33.0-34.0µ; TB. 31.5-32.0µ; BI. 12.0µ.

Plant differing from the type in having the sinus more widely open, granules in regular series and apices flattened. Similar to the forma illustrated by Gronblad (fig. 7, 1947). Very rare. Collected from a river in the northwest.

Distribution: Missoula Co.: 102-(Mt62-5).

Staurastrum unicorne Turn., K. Sv. Vet. Akad. Handl., 25(5), p. 107, t. 15, fig. 16. 1892.

Pl. 64 figs. 10,11 & Pl. 65 fig. 7.

Measurements: TL. 21.5-25.0µ; TB. 27.0-38.0µ; BI. 4.0-4.5µ; BSS. 18.0-21.5µ; LS. 5.0-12.0µ.

This plant is identical to that illustrated by Borge (t. 1, fig. 8, 1909) as St. mamillatum. Plant differs from the type in apical view by possessing an indentation in the center of the semicell margins. The capitate angles usually bear very long converging and reflexed spines. Plants closest to measurements of St. unicorne var. gracile Iyengar & Vimala. Rare. Known from three localities in the northwest.

Distribution: Lake Co.: 86-(Mt63-186); 88-(Mt63-197); 89-(Mt63-389).

Staurastrum varians Racib., Pamietnik Wydz III Akad. Umiej. w. Krakowie v. 10: p. 86, t. 12, fig. 1. 1885.

Pl. 88 fig. 8.

Measurements: TL. 30.0-33.5µ; TB. 32.0-34.0µ; BI. 13.5µ.

Very rare. Collected from a swamp in the northwest.

Distribution: Lincoln Co.: 9-(Mt63-154).

Staurastrum vestitum Ralfs, Brit. Desmid., p. 142, t. 23, fig. 1, 1848.

Pl. 98 figs. 3,4,5,6 & Pl. 99 figs. 4,5.

Measurements: TL. 32.0-39.0µ; TB. 51.0-73.0µ; BI. 7.5-13.0µ.

This species exhibited considerable variation in the length of the processes, ranging from forms in which they are scarcely produced (entered below separately and illustrated in figs. 1 and 2), to forms in which they attain a considerable length (fig. 6). The pair of furcate spines located in the middle of the lateral margin, the primary diagnostic characteristic of the species. (West, West and Carter, 1922) may be completely wanting, or there may be more than two (fig. 5). Moderately common. Encountered in the northwest.

Distribution: Flathead Co.: 27-(Mon25); 29-(H.L.1); 31-(Kidd*). Lake Co.: 83-(Mt63-202,204); 84-(X_8); 86-(Mt63-186); 95-(Mt62-59). Lincoln Co.: 10-

(Mt63-158); 15-(Mt62-27). Missoula Co.: 101-(Mt64-70). Ravalli Co.: 116-(Mt63-276). Sanders Co.: 74-(Mt63-171).

Previously reported by Schindler (54) for ponds in the area south of Ronan (See collection locality 93) and by Kidd (63) for collection locality 31.

Staurastrum vestitum Ralfs morphae

Pl. 98 figs. 1,2.

Measurements: TL. 30.0-38.0μ; TB. 40.0-46.0μ; BI. 11.0-12.5μ.

Plants differing from the typical form in their greatly reduced processes. The two prominent emarginate or bifurcate spines may or may not be present. Occurring and intergrading with the typical form at both localities.

Distribution: Lake Co.: 84-(Mt63-204). Sanders Co.: 74-(Mt63-171).

Staurastrum sp. 3

Pl. 99 fig. 1.

Measurements: TL. 22.0-26.0μ; TB. 25.0-28.0μ; BI. 7.0-7.5μ.

Not enough material was seen to identify these plants to species with certainty. Consequently, they are entered only to the generic level Collected in the northwest.

Distribution: Lincoln Co.: 9-(Mt63-154). Sanders Co.: 74-(Mt63-171).

13 Onychonema Wallich, 1860.

This genus is only known from collections west of the continental divide, being represented in our material by two species. With one exception (Bog 7000 feet), it was gathered from lakes and ponds at or below 4400 feet. (See Map no. 27.)

Onychonema filiforme (Ehrenb.) Roy & Bess., Journ. of Bot., 24, p. 242. 1886.

Pl. 111 figs. 2,3.

Measurements: LSP. 10.5-13.5μ; TB. 11.5-16.0μ; BI. 3.0-4.2μ.

This was surprisingly common in our collections.

Distribution: Flathead Co.: 22-(6Mon4); 27-(Mon25); 28-(Mt63-447); 29-(H.L.1). Granite Co.: 127-(6Mon 41). Lake Co.: 81-(Mt63-210); 83-(Mt63-204); 84-(86); 87-(Mt64-64). Lincoln Co.: 1-(4184); 4-(Mt63-135); 15-(Mt62-27); 21-(Mt63-101). Ravalli Co.: 115-(Mt63-266).

Onychonema laeve Nordst. var. micracanthum Nordst., Acta Univ. Lund. 16: p. 3. 1880.

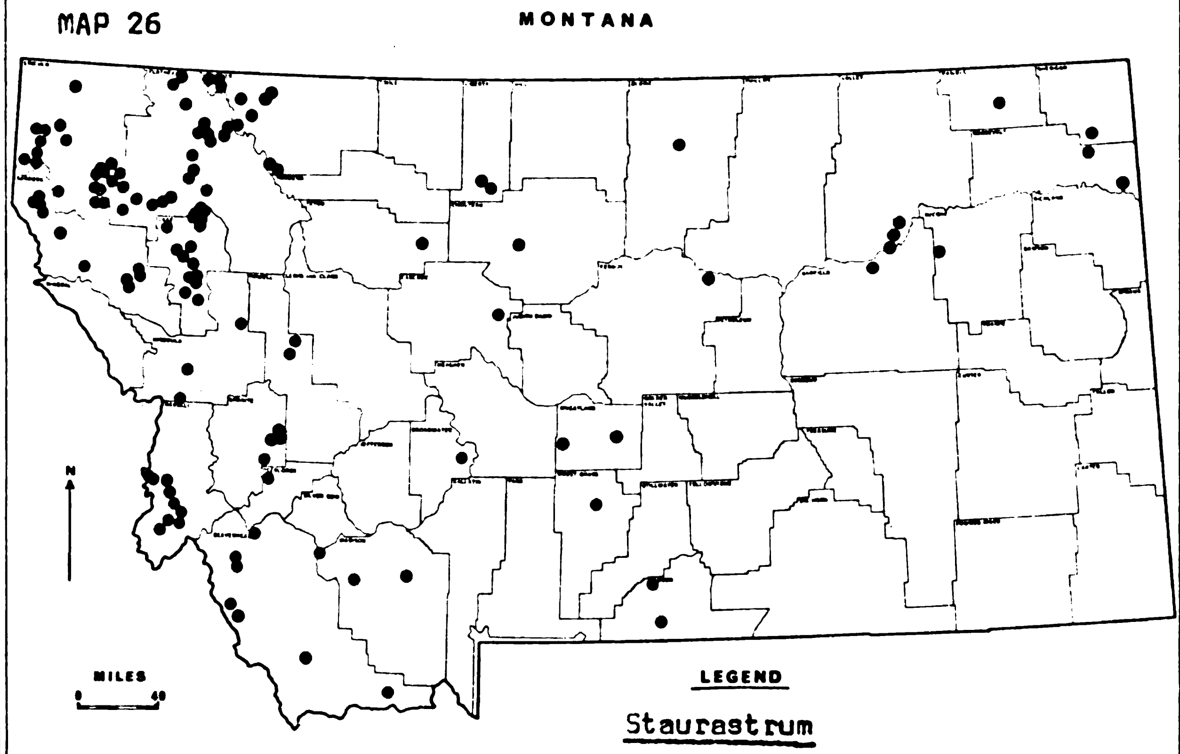
Pl. 111 fig. 1.

Measurements: LSS. 15.5-16.0μ; TB. 22.0-23.0μ; BI. 4.0-4.5μ; BSS. 17.5-19.0μ; LS. 1.5-2.0μ.

Very rare. Only a single filament was found.

Distribution: Lake Co.: 87-(Mt64-64).

MAP 26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MILES
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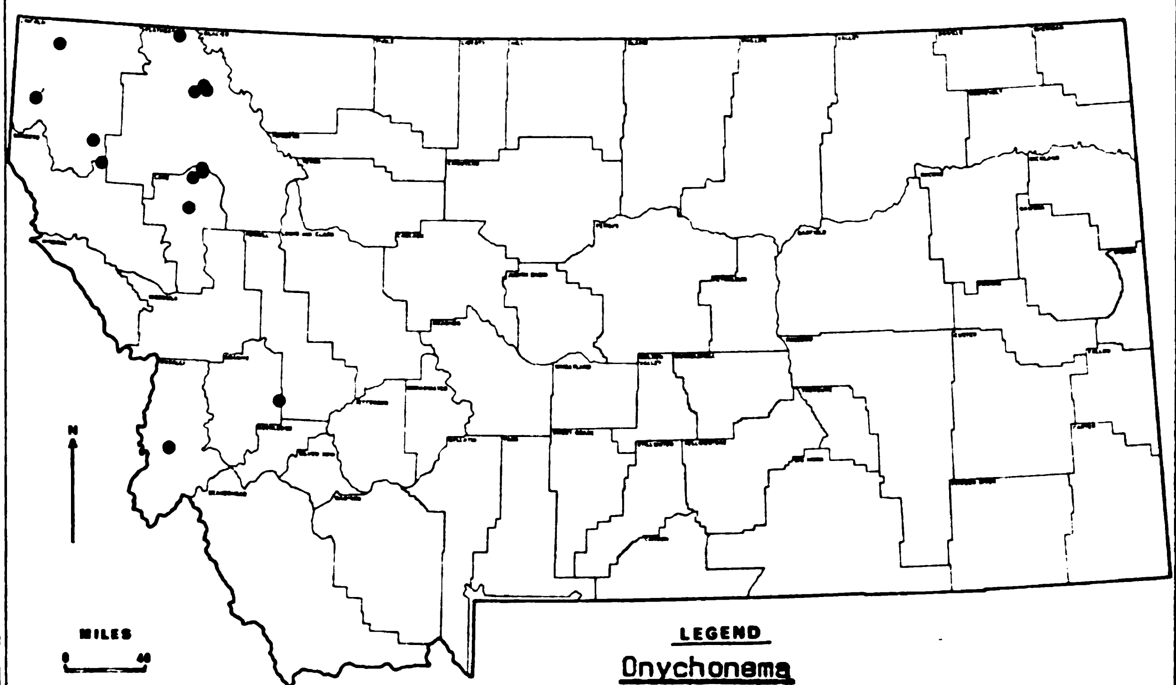
LEGEND
Staurastrum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LEGEND
Onychonema

MAP 27

14. Sphaerozosma Corda, 1934.

This genus is represented in our collections by six species encompassing eight varieties, one unnamed forma and one morpha. Only S. granulatum Roy & Biss., was encountered with any frequency, the other taxa being rare.

With the exception of one locality in the southwest all other reports of the genus are from the northwest. It was gathered from a variety of habitats (lakes, pond, bog, river) at varying elevations (2200-7000 feet). (See map No. 28).

Sphaerozosma aubertianum W. West, Journ. of Bot. 27: p. 206, pl. 291, fig. 17. 1889. var. aubertianum.

Pl. 111 fig. 10.

Measurements: TL. 19.0-20.0µ; TB. 16.5-18.0µ; BI. 6.5-8.0µ; LSS. 16.0-17.0µ.

Very rare.

Distribution: Lake Co.: 91-(Schindler*). Lincoln Co.: 8-(Mt63-152).

Previously reported by Schindler (54) from collection locality 91.

Sphaerozosma aubertianum var. archeri (Gutw.) West & West, Trans. Linn. Soc. 2nd ser. Bot. 5: p. 230. 1896.

Pl. 111 figs. 13,14.

Measurements: TL. 18.0-23.0µ; TB. 26.5-30.5µ; BI. 7.0-9.0µ; LSS. 16.5-19.0µ.

Rare. More commonly encountered than the typical form and occurring in greater abundance. One of the few taxa of this genus found at high elevations (7000 feet).

Distribution: Granite Co.: 125-(6Mon49). Lake Co.: 95-(Mt62-59). Sanders Co.: 76-(Mt63-192).

Sphaerozosma excavatum Ralfs

This was the only species of this genus identified in collections from both the northern and southern montane regions.

Two varieties were present, the typical form being the least encountered.

Sphaerozosma excavatum Ralfs, Brit. Desmid., p. 67, t. 6, fig. 2. 1848. var. excavatum

Pl. 111 fig. 5.

Measurements: TL. 8.5-9.5μ; TB. 8.0-10.0μ; BI. 4.5-5.0μ.

Very rare. Known only from a collection taken from a high altitude bog (6800 feet) west of the continental divide.

Distribution: Missoula Co.: 100-(Mt63-419).

Sphaerozosma excavatum Ralfs var. subquadratum West & West, Monogr. Brit. Desmid., vol. 5, p. 212, t. 160, figs. 4,5. 1923.

Pl. 111 fig. 4.

Measurements: TL. 9.0-11.5μ; TB. 11.0-12.5μ; BI. 5.0-5.5μ.

Rare. This variety was collected at low (3600 feet) and high (7000 feet) altitudes.

Distribution: Beaverhead Co.: 135-(Mt63-330). Lincoln Co.: 12-(Mt63-67); 13-(Mt63-73,74,75).

Sphaerozosma granulatum Roy & Biss., Journ. Bot., 24, p. 242, fig. 17. 1886. var. granulatum

Pl. 111 figs. 8,9.

Measurements: TL. 6.5-12.0μ; TB. 8.0-12.0μ; BI. 4.0-5.7μ.

This was the most frequently collected and abundant species of this genus. Only known from the northwest and chiefly from lakes and ponds at altitudes between 3200-4400 feet.

Distribution: Flathead Co.: 27-(Mt63-450): 28-(Mt63-442); 31-(4182); 37-(Mt63-82); 42-(Mon16). Glacier Co.: 54-(Mt62-11). Lake Co.: 83-(Mt63-204); 86-(Mt62-75, Sieminska*). Lincoln Co.: 2-(Mt63-142); 5-(Mt63-137); 19-(Mt63-112); 20-(Mt63-93); 21-(Mt63-97). Ravalli Co.: 114-(Mt63-256).

Previously reported by Sieminska (65) from collection locality 86.

Sphaerozosma granulatum Roy & Biss., morpha.

Measurements: TL. 9.0-12.0μ; TB. 11.5-13.0μ; BI. 5.5-7.0μ.

Cells differing from the type in their generally greater breadth and larger isthmus. They somewhat resemble var. trigranulatum West & West as illustrated by Gronblad (pl. 3 fig. 124) in 1926, but the Montana plants are larger.

Rare.

Distribution: Flathead Co.: 29-(H.L.1) Lake Co.: 86-(Mt62-79); 89-(Mt63-388). Sanders Co.: 73-(Mt63-169); 76-(Mt63-191).

Sphaerozosma punctulatum West & West, Journ. of Bot., 29. p. 353, t. 315, fig. 1,2. 1891.

Pl. 111 figs. 11,12.

Measurements: TL. 13.5-14.5μ; TB. 18.5-21.5μ; BI. 10.0-11.0μ.

This was a very rare species, but many filaments were observed at collection locality 115.

Distribution: Flathead Co.: 27-(Mon25). Ravalli Co.: 115-(Mt63-265, 269, 273).

Sphaerozosma vertebratum Ralfs, Brit. Desmid., p. 65, t.6, fig. 1, t. 32, fig. 2. 1848.

This species is known to the writer only from an illustration by

Schindler who reports it from collection locality 91.

Distribution: Lake Co.: 91-(Schindler*).

Sphaerozosma wallichii Jacobs. var. anglicum West & West, Journ. Roy. Micro. Soc., p. 497, t. 6, fig. 6, 1897.

Pl. 111 fig. 7.

Measurements: TL. 8.5-11.0µ; TB. 10.5-12.0µ; BI. 4.5-6.0µ.

Cells differing from the typical form of the variety by the apex of the semicells being straight as opposed to slightly convex.

Rare.

Distribution: Lake Co.: 81-(Mt63-211); 88-(Mt63-197); 89-(Mt63-389). Lincoln Co.: 10-(Mt63-157). Ravalli Co.: 115-(Mt63-273). Sanders Co.: 74-(Mt63-170).

Sphaerozosma wallichii Jacobs. var. anglicum West & West, fa.

Pl. 111 fig. 6.

Measurements: TL. 7.0-8.2µ; TB. 8.5-9.0µ; BI. 4.0-4.5µ.

Cells differing from the typical form of the variety by their smaller size and straight apex.

Very rare.

Distribution: Glacier Co.: 64-(Mt61-2). Lake Co.: 86-(Mt63-186).

15. Spondylosium De Brébisson, 1844.

This genus is known only from localities west of the continental divide. It is represented in our collections by four species, none of which were encountered in any abundance. (See map no. 29).

Spondylosium moniliforme Lundell, Nova Acta Reg. Soc. Scient. Upsal. 3 ser. 8: p. 92, pl. 5, fig. 16, 1871.

Pl. 111 fig. 16.

Measurements: TL. 25.0-27.0μ; TB. 16.0-19.0μ; BI. 8.5-9.5μ.

Very rare. Only a few filaments observed.

Distribution: Lincoln Co.: 5-(Mt63-136).

Spondylosium planum (Wolle) West & West, Journ. Linn. Soc. Bot., 40: p. 430, pl. 19, figs. 5-8. 1912.

Pl. 112 figs. 1,2.

Measurements: TL. 10.0-16.0μ; TB. 12.5-14.5μ; BI. 5.0-6.5μ.

The most fewquently collected and abundant species of this genus.

Distribution: Flathead Co.: 29-(H.L.1); 35-(Mt63-391); 36-(Mt63-394). Missoula Co.: 101-(Mt64-70). Ravalli Co.: 115-(Mt63-269). Sanders Co.: 76-(Mt63-176).

Spondylosim pulchellum Arch., in Pritch. Inf., p. 724, t. 3, fig. 10. 1861.

Pl. 111 fig. 15.

Measurements: TL. 11.0-13.0μ; TB. 9.5-11.0μ; BI. 2.5-3.0μ.

Very rare.

Distribution: Flathead Co.: 39-(Mt63-78). Lincoln Co.: 14-(Mt63-76).

Spondylosium pygmaeum var. monile (Turn.), West & West, Monogr. Brit. Desmid. vol. 5, p. 221, pl. 160, figs. 20-21. 1922.

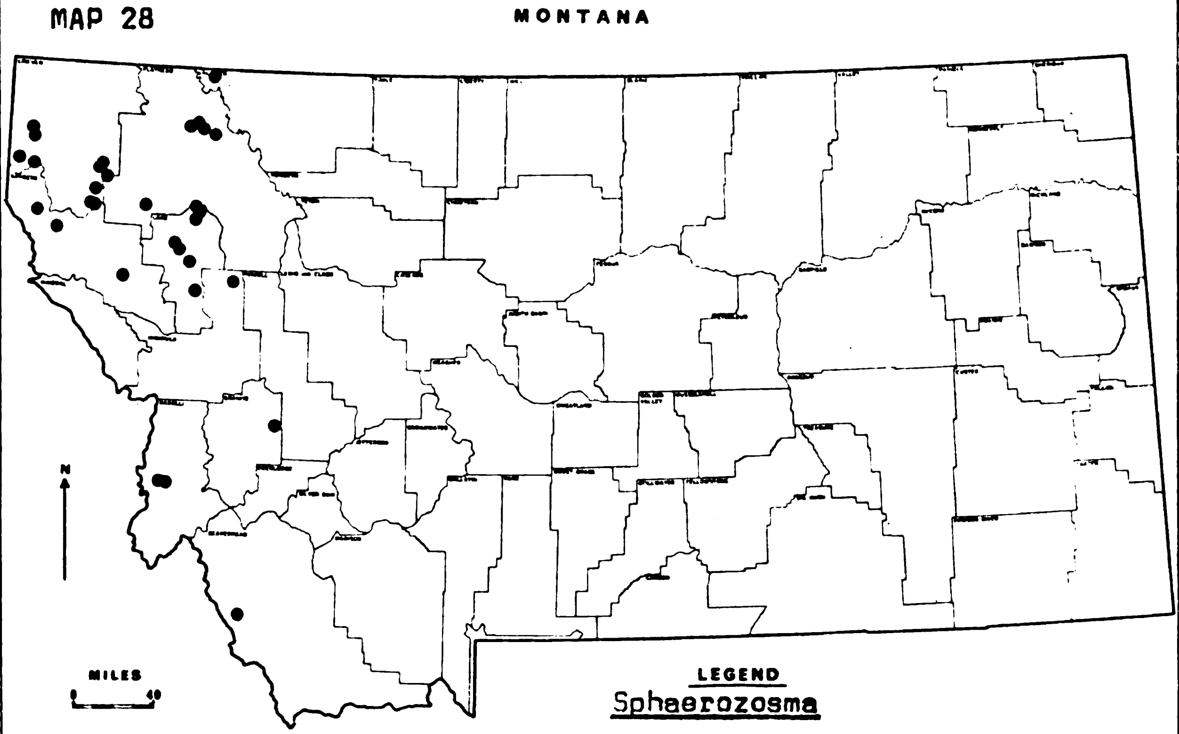
Pl. 112-fig. 3.

Measurements: TL. 8.0-9.0μ; TB. 4.5-5.0μ; BI. 3.5-4.5μ.

Very rare. A single filament seen.

Distribution: Ravalli Co.: 115-(Mt63-266).

MAP 28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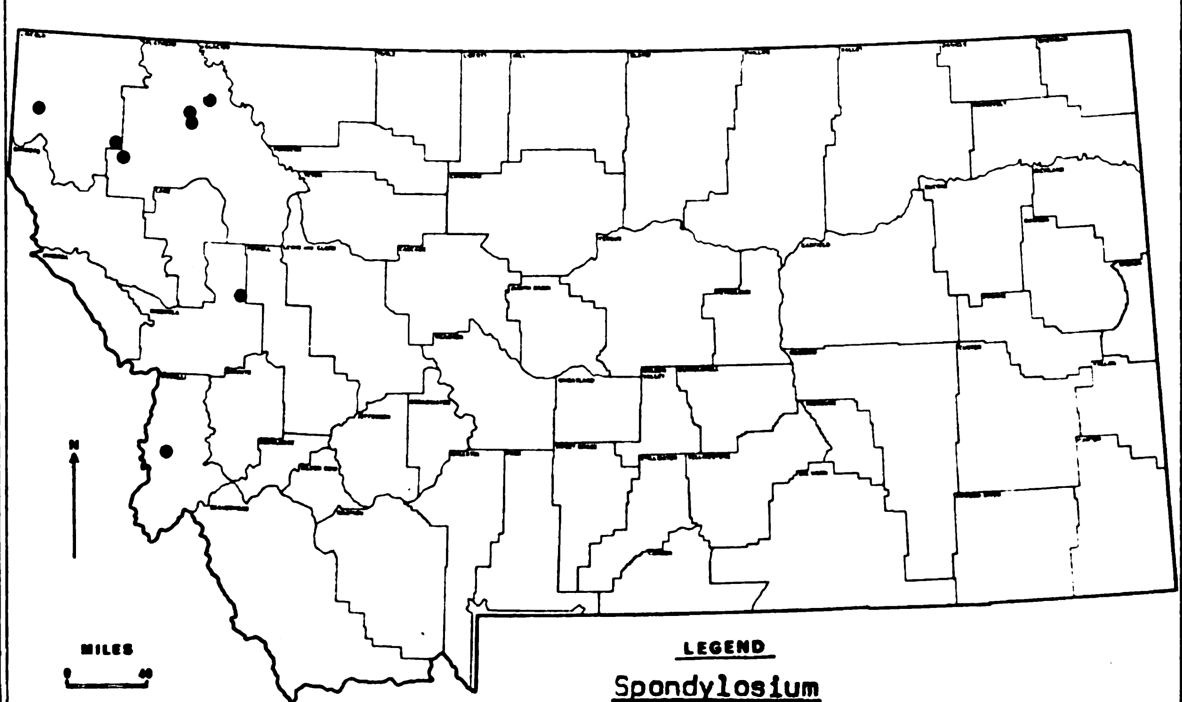
Sphaerozosma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LEGEND
Spondylosium

MAP 29

16. Hyalotheca Ehrenberg, 1841.

The genus Hyalotheca is very common in northwestern Montana, and is also known from the southwest and south-central parts of the state (see map no. 30).

Three species encompassing five taxa and one unnamed plant are included here.

Hyalotheca dissiliens (Smith) Bréb., in Ralfs' Brit. Desmid., p. 51, t. 1, fig. 1, 1848. var. dissiliens.

Pl. 112 figs. 8,11.

Measurements: TL. 12.0-21.0μ; TB. 19.5-30.5μ; BI. 18.0-29.0μ.

A very common, almost ubiquitous desmid in the northwest. Also known to the writer from the southern montane and south-central region of the state. With reference to frequency of occurrence, abundance at a locality, and geographical range, rivalling Desmidium swartzii Agardh, as the most important filamentous desmid in the state.

Distribution: Beaverhead Co.: 132-(MT63-185); 134-(Mt63-319). Carbon Co.: 178-(Mt64-108). Flathead Co.: 22-(6Mon4): 24-(Mt63-411); 25-(Mt63-410); 27-(Mt63-450, Mon 25); 28-(Mt63-448); 29-(H.L.1); 35-(Mt63-390); 36-(Mt63-393); 37-(Mt63-82). Glacier Co.: 54-(Mt62-11, 2Mon8). Granite Co.: 125-(6Mon51). Lake Co.: 81-(Mt63-206); 83-(Mt63-203); 86-(Mt63-186); 87-(Mt64-64); 95-(Mt62-56); 97-(Mt63-33). Lincoln Co.: 4-(Mt63-129); 9-(Mt63-154); 10-(Mt63-155,157,158); 12-(Mt63-71); 15-(Mt62-26,27); 17-(Mt63-119); 19-(Mt63-108); 20-(Mt63-91); 21-(Mt63-97); Missoula Co.: 100-(Mt63-419). Ravalli Co.: 115-(Mt63-271). Sanders Co.: 70-(Mt63-161); 72-(Mt63-162).

Previously reported by Kidd (63) for collection locality 31, and Schindler (54) for 91.

Hyalotheca dissiliens (Smith) Bréb., var. *minor* Delp., Mem. Reale Acad. Sci. Torino, 2(28): p. 59 t. 1, figs. 2,5,6,8,9. 1873.

Pl. 112-fig. 12.

Measurements: TL. 12.0-14.0μ; TB. 17.0-19.0μ; BI. 16.0-18.0μ.

Rare. Known only from collections west of the continental divide.

Distribution: Flathead Co.: 28-(Mt63-442). Granite Co.: 127-(5Mon41). Lake Co.: 83-(Mt63-204); 84-(86). Lincoln Co.: 8-(Mt63-151).

Hyalotheca mucosa (Mert.) Ehrenb., in Ralfs' Brit. Desmid., p. 53. pl. 1, figs. 2a-d. 1848.

Pl. 112-figs. 6,7.

Measurements: TL. 17.0-23.5μ; TB. 16.5-22.5μ.

This species was only encountered in our collections from the northwest where it is of moderate occurrence.

Distribution: Flathead Co.: 24-(Mt63-406). Glacier Co.: 56-(Kidd*). Lake Co.: 95-(Mt62-60). Lincoln Co.: 2-(Mt63-141); 4-(Mt63-134); 6-(Mt63-145); 10-(Mt63-157). Ravalli Co.: 122-(Mt63-297). Sanders Co.: 76-(Mt63-192).

Previously reported by Kidd (63) for collection locality 56.

Hyalotheca undulata Nordst. in Wittr. & Nordst. Alg. exsic. no. 248. 1879. var. *undulata*.

Pl. 112 fig. 4.

Measurements: TL. 10.5-14.5μ; TB. 6.5-7.5μ; BI. 5.0-6.0μ.

A very rare desmid in our collections. Few filaments seen.

This species was previously reported by Sieminska (65) for collection locality 86, In her discussion of the taxon, she indicates that in her specimens some cells were similar to var. *perundulata* Grönbl., having undulate margins. Indeed her figure indicates this characteristic, so I have placed her plant under var. *perundulata*, which I also found at collection locality 86.

Distribution: Flathead Co.: 31-(4182). Glacier Co.: 54-(Mt62-14).

Hyalotheca undulata Nordst. var. perundulata Grönb., Bot. Notiser, p. 63, pl. 4, fig. 2, 1938.

Pl. 112 fig. 5.

Measurements: TL. 13.5-16.0μ; TB. 6.0-7.0μ; BI. 4.0-5.0μ.

Very rare.

Distribution: Lake Co.: 86-(Mt63-186, Sieminska*).

Hyalotheca sp.

Pl. 112 fig. 9.

Measurements: TL. 12.0-13.5μ; TB. 14.5-17.5μ; BI. 14.0-14.5μ.

Cells small, spool-like, slightly broader than long, sinus shallow, consisting of a slight concavity in the middle of the lateral margins; apex of the semicell truncate, broader than the isthmus; lateral margins slightly concave; vertical view elliptical. Filaments enveloped in a gelatinous sheath.

Cells somewhat remindful of H. dissiliens, but differing from that taxon by the apices being broader than the isthmus and in the elliptical shape of the semicell in vertical view.

Cells equal in size to H. dissiliens var. minor but differing in cell shape, as above.

Very rare.

Distribution: Flathead Co.: 27-(Mon25); 28-(Mt63-447).

17. Bambusina Kuetzing, 1845.

The genus Bambusina was found only in collections from the northwest where it is of moderately rare occurrence. It is represented in our material by two varieties belonging to a single species. The varieties were encountered equally as often as one another. (See map no. 31).

<u>Bambusina</u> <u>borreri</u> (Ralfs) Cleve, Öfvers. K. Sv. Vet.-Akad. Förhandl. 20:p. 496. 1864. var. <u>borreri</u>.

Pl. 112 fig. 14.

Measurements: TL. 23.0-29.5μ; TB. 19.0-23.0μ; BI. 17.5-21.0μ.

Moderately rare.

Distribution: Flathead Co.: 29-(H.L.1); 39 (Mt63-77,79); 46-(Mt62-1). Glacier Co.: 54-(Mt62-19). Lake Co.: 86-(Mt62-80). Lincoln Co.: 10-(Mt63-156).

<u>Bambusina</u> <u>borreri</u> (Ralfs) Cleve, var. <u>gracilescens</u> Nordst., in Wittr. & Nordst. Alg. exs. 7, 180, no. 367, & fasc. 21, p. 34. 1889.

Pl. 112 figs. 10,13.

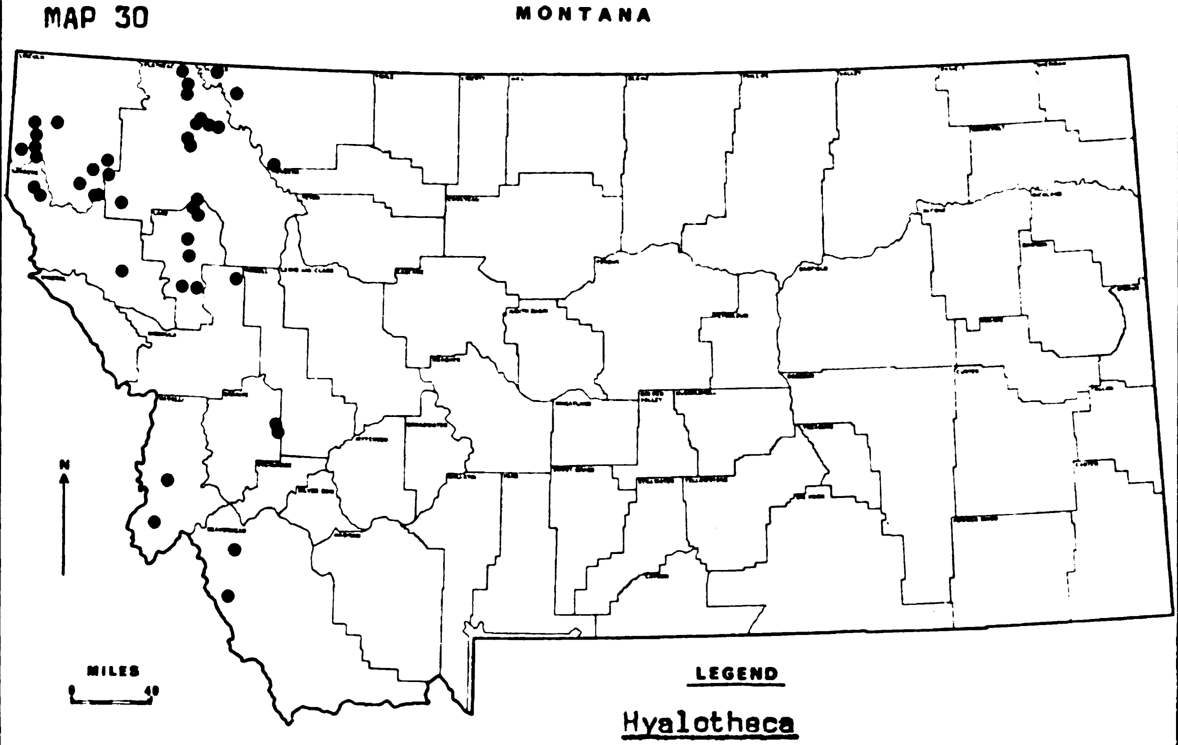
Measurements: TL. 23.0-29.0μ; TB. 15.2-17.0μ; BI. 15.0-16.0μ.

Moderately rare.

Distribution: Flathead Co.: 27-(Mon25). Glacier Co.: 54-(Mt62-11). Lake Co.: 84-(86); 86-(Sieminska*). Lincoln Co.: 16-(Mt63-113).

Previously reported by Sieminska (65) for collection locality 86, under the name <u>B</u>. <u>moniliformis</u> Ehrenb. var. <u>gracilescens</u> Nordst.

MAP 30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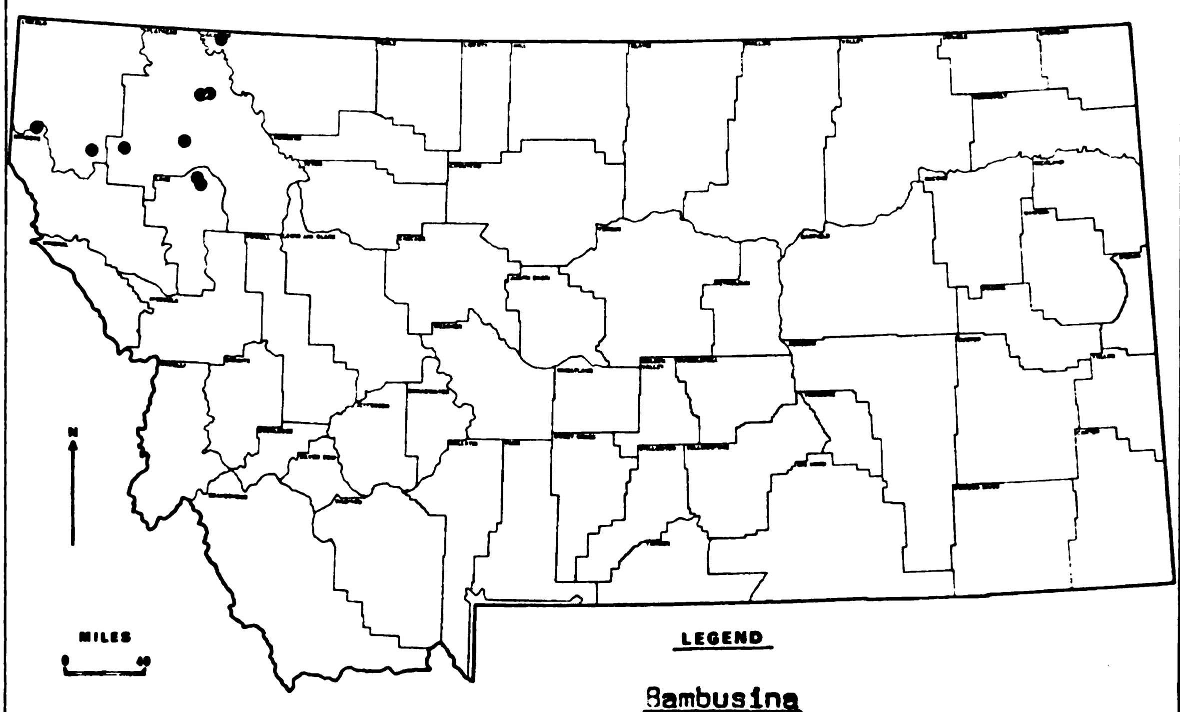
Hyalotheca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LEGEND
Bambusina

MAP 31

18. *Desmidium* Agardh, 1825.

The genus *Desmidium* was the most frequently encountered filamentous desmid. It is known from the northwest (very common), southwest (very rare) and north-central (very rare) parts of the state. It was gathered from a variety of aquatic habitats (ponds, lakes, bogs, sloughs, rivers, at varying altitudes (2000-7000 feet))and often appeared in abundance. Seven species have been identified.

Desmidium aptogonum (Ehrenb.) Bréb., Ralfs' Brit. Desmid., p. 64, t. 32, fig. 1. 1848. var. *aptogonum*.

Pl. 114 fig. 1,2,5.

Measurements: TL. 16.0-20.7μ; TB. 22.5-30.0μ; BI. 16.0-24.0μ.

Of common occurrence in the northwest.

Distribution: Flathead Co.: 27-(Mon25); 29-(H.L.1); 36-(Mt63-397); 42-(Mon16). Glacier Co.: 54-(Mt62-20). Granite Co.: 125-(6Mon49); 126-(6Mon43); 127-(6Mon41). Lake Co.: 81-(Mt63-206,207); 83-(Mt63-203); 87-(Mt64-64); 93-(Schindler*). Lincoln Co.: 15-(Mt62-28). Sanders Co.: 72-(Mt63-167).

Previously reported by Schindler (54) for collection locality 93.

Desmidium aptogonum Bréb. var. *acutius* Nordst., Alg. Sandvic. p. 11, t. 1, figs. 21,22. 1878.

Pl. 114 figs. 4,7,8.

Measurements: TL. 14.0-18.0μ; TB. 28.0-42.0μ; BI. 24.5-36.0μ.

Primarily collected west of the continental divide.

Moderately rare.

Distribution: Beaverhead Co.: 132-(Mt63-185). Flathead Co.: 23-(Mt63-399); 27-(Mon25); 28-(Mt63-445). Lake Co.: 84-(X8). Lincoln Co.: 3-(Mt63-140); 4-(Mt63-129).

<u>Desmidium</u> <u>asymmetricum</u> Grönbl., Acta. Societ. pro Fauna, Fl. Fenn., 47, p. 85 t. 1, figs. 5-7. 1920.

Pl. 113 fig. 1.

Measurements: TL. 17.0-21.0μ; TB. 25.0-27.0μ; BI. 17.0-21.0μ.

This very rare species is known only from a wet meadow in Glacier National Park. Abundant in our collections.

Distribution: Flathead Co.: 28-(Mt63-442,447,500).

<u>Desmidium</u> <u>baileyi</u> (Ralfs) Nordst. Acta Univ. Lund. Vol. 16:p. 4. 1880.

Pl. 113 figs. 3,4.

Measurements: TL. 20.0-23.0μ; TB. 21.0-22.5μ.

Rare. Known only from lentic habitats in Glacier National Park.

Distribution: Flathead Co.: 27-(Mon25); 29-(H.L.1); 31-(Kidd*). Glacier Co.: 54-(Mt62-21).

Previously reported by Kidd (63) for collection locality 31.

<u>Desmidium</u> <u>coarctatum</u> Nordst., Bot. Notiser, p. 155. 1887.

Pl. 113 fig. 6.

Measurements: TL. 23.5-30.0μ; TB. 40.5-45.0μ; BI. 35.0-37.0μ.

This species is very rare and only a few filaments were observed. Known only from the northwest.

Distribution: Lake Co.: 86-(Mt62-72).

<u>Desmidium</u> <u>grevillii</u> (Kuetzing) de Bary, Unters. u.d. Fam. d. Conj., p. 42, 44, 76, pl. 4, figs. 30, 31. 1858.

Pl. 113 fig. 5.

Measurements: TL. 22.0-24.0μ; TB. 46.0-50.0μ; BI. 39.5-42.5μ.

Of rare occurrence west of the continental divide.

Distribution: Flathead Co.: 31-(4182); 39-(Mt63-77). Lake Co.: 81-(Mt63-207,209); 83-(Mt63-204). Lincoln Co.: 10-(Mt63-157).

Desmidium occidentale West & West, Trans. Roy. Soc. Edinb., 41(3); p. 505, t.6, figs. 3,4. 1905.

Pl. 113 fig. 2.

Measurements: TL. 24.0-25.0μ; TB. 27.5-29.0μ; BI. 23.0-23.5μ; BA. 21.0-22.0μ.

Very rare.

Distribution: Blaine Co.: 152-(Mt63-32).

Desmidium swartzii Agardh, in Ralfs' Brit. Desmid., p. 61, t.4. figs. a,b,c,d,e,f. 1848.

Pl. 114 figs. 3,6,9.

Measurements: TL. 14.0-21.0μ; TB. 32.0-45.0μ; BI. 25.0-38.5μ.

It is stated in West, West and Carter (23) that the spaces between the cells are not visible, or recognizable only with difficulty. In Montana specimens, there were times when it was not difficult to see spaces, at least between the short connecting processes and the apices of the cells.

This was the most frequently encountered species of the genus, being almost ubiguitous in the northwest. Known also from the southern Montana and the north-central region of the state. Generally gathered in large numbers.

Distribution: Beaverhead Co.: 132-(Mt63-185). Flathead Co.: 22-(6Mon5); 23-(Mt63-399); 27-(Mt63-450); 29-(H.L.1); 31-(4181, Kidd*); 36-(Mt63-393); 37-(Mt63-82); 39-(Mt63-77); 46-(Mt62-1). Glacier Co.: 54-(Mt62-11); 63-(Mt63-218). Lake Co.: 81-(Mt63-206); 83-(Mt63-204); 84-(Q1, X8); 86-(Mt63-186); 87-(Mt64-64); 88-(Mt63-198); 92-(Mt63-38); 93-(Mt63-35); 94-(7Mon15); 95-(Mt62-57,58); 97-(Mt63-33). Lincoln Co.: 2-(Mt63-141); 5-(Mt63-136); 6-(Mt63-145); 9-(Mt63-154); 10-(Mt63-156,157); 12-(Mt63-67); 17-(Mt63-116); 19-(Mt63-111); 20-(Mt63-91,94); 21-(Mt63-101). Missoula Co.: 102-(Mt62-5). Ravalli Co.: 111-(Mt63-249); 115-(Mt63-273); 119-(Mt63-304). Sanders Co.: 70-(Mt63-161); 71-(Mt63-164); 74-(Mt63-170,171); 76-(Mt63-191).

Previously reported by Kidd(63) for collection locality 31.

19. Cosmocladium de Brébisson, 1856.

This genus is known from both the northern and southern montane region, but was primarily encountered in the north. It did not generally occur in any abundance. (See map. no. 33).

Cosmocladium constrictum (Archer) Joshua, Journ. of Bot., vol. 21, p. 292. 1883.

Pl. 26 fig. 1.

Measurements: TL. 14.0-17.0μ; TB. 7.0-9.0μ; BI. 5.5-7.0μ.

Very rare. Collected from two widely separated localities in western Montana, both lakes, one at a low (3800 feet) the other at a high (7000 feet) altitude. It occurred in the plankton or along the benthic shore region.

Distribution: Beaverhead Co.: 135-(Mt63-339). Sanders Co.: 76-(Mt63-175).

Cosmocladium pusillum Hilse, In Bericht. d. Schles. Ges., p. 117. 1865.

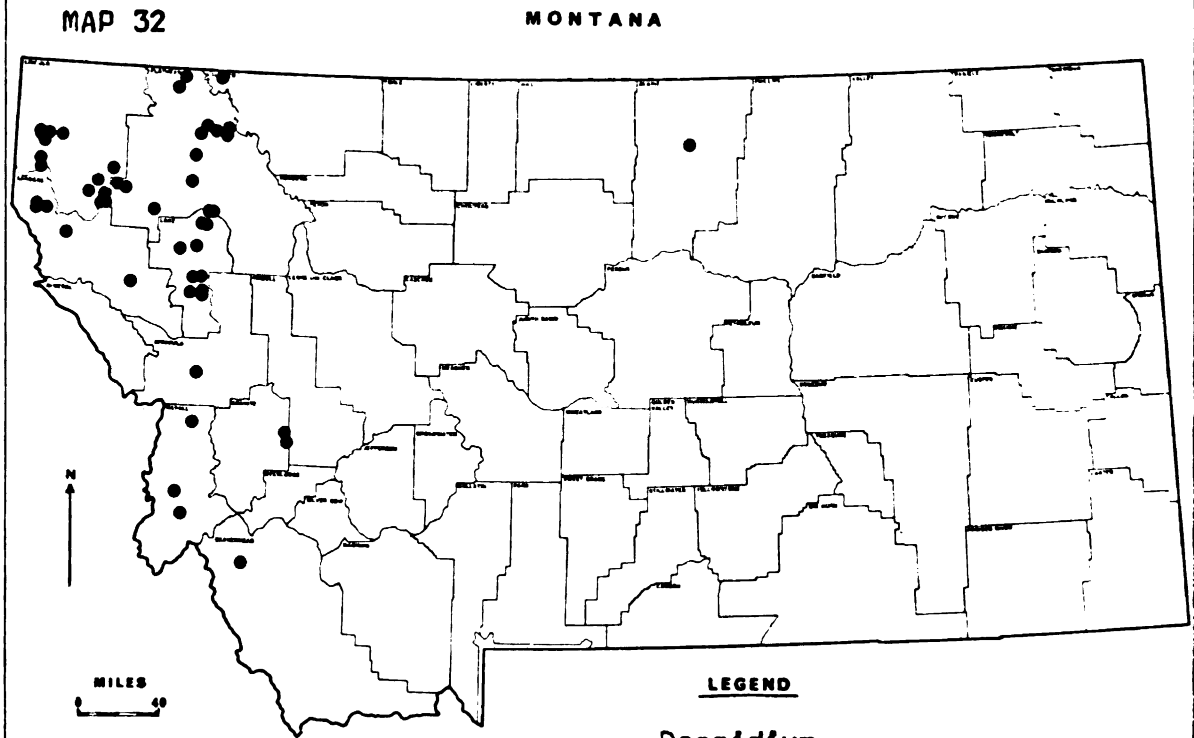
Pl. 26 figs. 2,3.

Measurements: TL. 7.5-12.5μ; TB. 7.2-9.0μ; BI. 2.0-3.0μ.

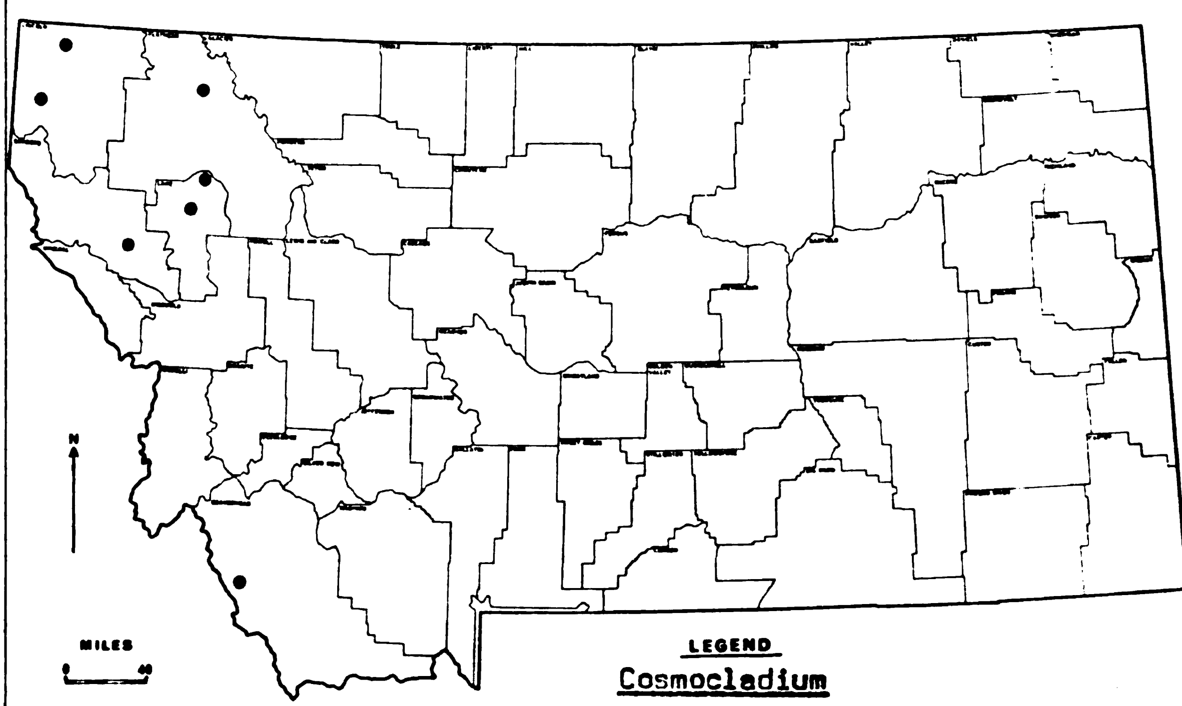
This species is of rare occurrence and only known from collections from the northwest. It was gathered from lentic habitats at low elevations (2000-3885 feet). At collection locality 83, it was encountered in abundance.

Distribution: Flathead Co.: 28-(Mt63-442). Lake Co.: 83-(Mt63-204, 205); 87-(Mt64-65). Lincoln Co.: 1-(4184); 5-(Mt63-137).

MAP 32



Desmidium



Cosmocladium

MAP 33

Summarizing the desmid flora of Montana presented in this text, the author has identified 557 taxa; (317 species, 176 additional varieties, and 64 formae). Additional unnamed formae and morphae, and a number of plants entered only to the generic level, increases the number of distinquishable desmids to over 600. These desmids are distributed among the three families as indicated below in Table 1.

Two species, four varieties and seven formae are entered and described as new to science. Three new combinations are made.

Based upon the 7000+ illustrations made, the author estimates the total desmid flora of Montana to be between 850-900 taxa. One would thus conclude that the state is rich in the number of desmid taxa.

These figures may be compared to what is known in the literature for other regions where studies have been made on the desmids: North Carolina, 497 taxa (Kim,1967); Michigan, 752 taxa (Wade,1952); Montreal 527 taxa (Irenee-Marie, 1939). No comparative figures for the Gulf states are cited here because comprehensive tabulations were not available. However, Scott and Prescott (42) already indicated the identification of over 300 species from Mississippi and Louisiana, and Scott and Grönblad (57) stated that the 200 species previously reported from Florida was only a small fraction of the total number subsequently found.

TABLE 1

SUMMARY OF THE DESMID FLORA OF MONTANA INCLUDED IN THIS STUDY

Genera	Total Number of Species	Number of New Species	Tot. No. of Additional Varieties	Number of New Varieties	Tot. No. of Additional Formae	Number of New Formae	Unnamed species	Unnamed Formae	Unnamed Morphae
Gonatozygaceae									
Gonatozygon	3	0	4	1	0	0	0	0	0
Mesotaeniaceae									
Roya	2	0	0	0	0	0	0	0	0
Cylindrocystis	2	0	2	0	0	0	0	1	0
Spirotaenia	2	0	0	0	0	0	0	0	0
Netrium	3	0	4	0	0	0	0	0	0
Desmidiaceae									
Actinotaenium	13	0	4	0	6	0	1	1	0
Penium	8	0	2	0	0	0	0	0	0
Closterium	51	0	36	1	10	2	4	6	6
Spinoclosterium	1	0	0	0	0	0	0	0	0
Pleurotaenium	10	0	9	0	0	0	0	1	2
Triploceras	1	0	0	0	0	0	0	0	0
Tetmemorus	3	0	1	0	0	0	0	0	0
Euastrum	27	1	27	0	9	2	2	8	3
Micrasterias	20	0	11	0	3	0	0	5	4

TABLE 1--continued

Genera	Total Number of Species	Number of New Species	Tot. No. of Additional Varieties	Number of New Varieties	Tot. No. of Additional Formae	Number of New Formae	Unnamed Species	Unnamed Formae	Unnamed Morphae
Desmidiaceae (cont.)									
Xanthidium	5	0	13	0	23	1	0	5	2
Arthrodesmus	11	1	10	0	0	0	0	5	1
Cosmocladium	2	0	0	0	0	0	0	0	0
Staurastrum	130	0	47	2	13	1	1	27	9
Onychonema	2	0	0	0	0	0	0	0	0
Sphaerozosma	6	0	2	0	0	0	0	0	0
Spondylosium	4	0	0	0	0	0	0	0	0
Hyalotheca	3	0	2	0	0	0	1	0	0
Bambusina	1	0	1	0	0	0	0	0	0
Desmidium	7	0	1	0	0	0	0	0	0
	317	2	176	4	64	6	9	59	27

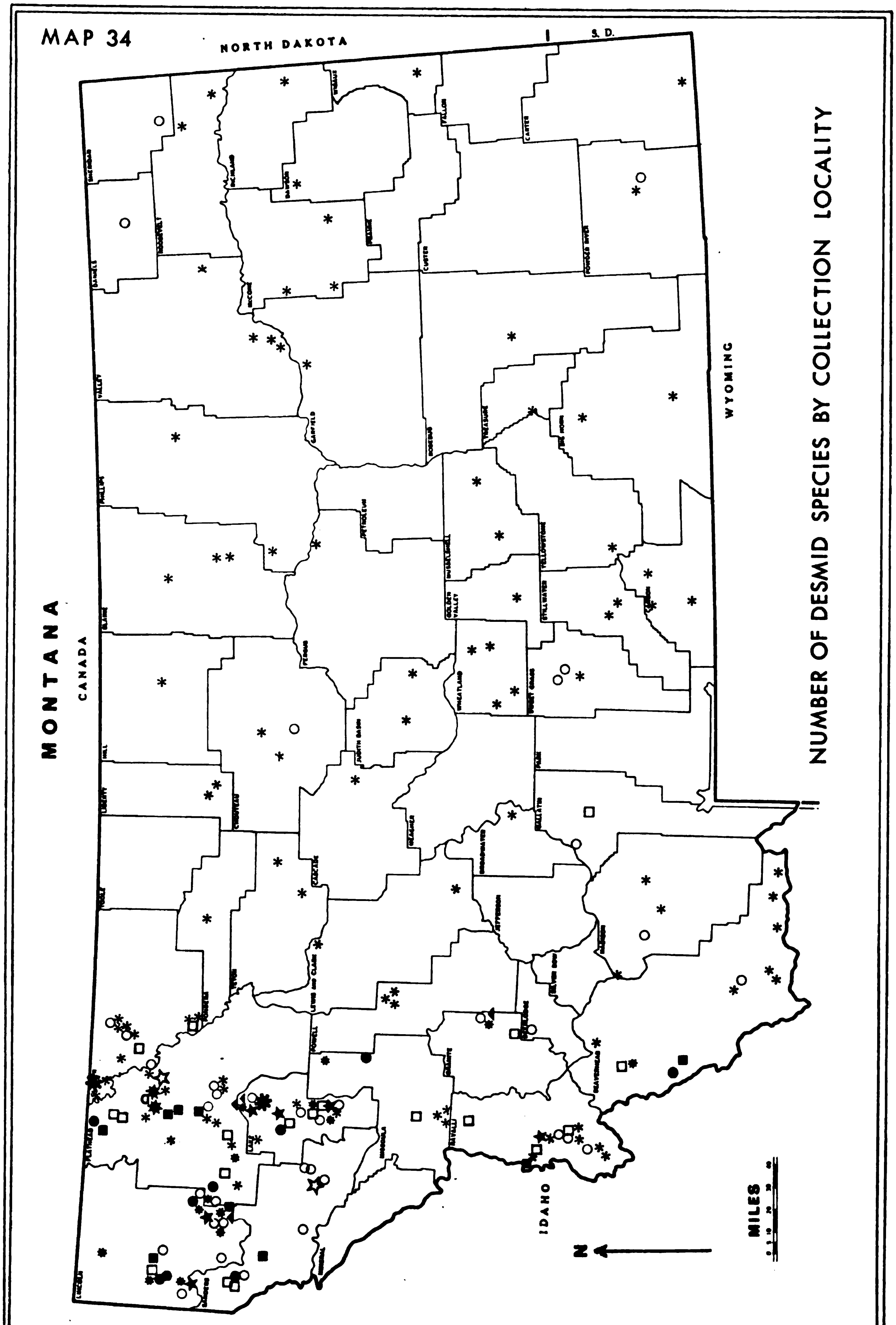
MAP 34

LEGEND

Number of Desmid Species by Collection Locality

A symbol is used to indicate the total
number of species present at a
collection locality and represents a range

Symbol		Number of Species (range)
*	=	0-10
○	=	11-20
□	=	21-30
•	=	31-40
●	=	41-50
■	=	51-60
▲	=	61-70
★	=	71-80
☆	=	81-90
⌂	=	91-100
✱	=	101-110
×	=	111-120 (none)
✸	=	121-130


MAP 34
NORTH DAKOTA
S.D.
WYOMING
MONTANA
CANADA
IDAHO
MILES
N
NUMBER OF DESMID SPECIES BY COLLECTION LOCALITY

Ecology and Distribution

Various theories have been advanced, endeavoring to explain or relate the occurrence and abundance of desmids in particular areas, and although we have learned a great deal about the types of habitats where desmids flourish, the exact determining factors are still not known. Wesenburg-Lund (1905) in discussing the richness of the desmid flora of Scottish lakes, indicated that peaty water rich in humic acid seemed to be required by desmids, while West and West (1904) believed that the chief factor determining desmid abundance in a locality was the nature of the geological formation in the region. They indicated that in limestone districts desmid species were few, while they were generally abundant in regions of older Palaeozoic rock, or of rocks of igneous or metamorphic character. Later, in their study of the British phytoplankton, the Wests (1909) acknowledged that desmids could be found in abundance in peaty water as contended by Wesenburg-Lund, but they pointed out that desmids did not primarily thrive there and cited evidence of habitats with similar characteristics which possessed poor desmid floras. Thus they concluded that the presence of peaty water did not necessarily insure richness, and re-emphasized the importance of the geology of the drainage area in determining the occurrence and abundance of these organisms. In addition to showing a correlation between areas where desmids flourished and the regions where geological formations were older than the Carboniferous (primarily mountainous regions with considerable outcrops of igneous rock), they also indicated that these areas corresponded, although less closely, with the regions of greatest rainfall (45-100 inches). The Wests furthermore intimated that chemical factors were probably responsible for the relationship which existed between the geology of a region and desmid richness, and thus chemistry most likely played an important role in desmid distribution.

Since these early studies others have pursued investigations along these lines. Strom (1926), in his studies of Norwegian algae, emphasized the role of water chemistry (and its relationship to geological formations) and stated "The majority of the desmids, which determine the qualitative richness of the flora, are calciphob (sic); they thus occur in the districts poor in lime in all localities, but most abundant in those moderately aerated with a reaction approaching the neutral; in the lime-rich districts they only occur in any real qualitative abundance in the localities which are more or less self-contained, and not directly influenced by the geological strata, i.e. in the acid peaty bogs, though they are never so richly represented there as in the clear waters." Pearsall (1921) pointed out that lakes in which the sodium-potassium/calcium-magnesium ratio is high are characterized by desmids. In contrast, where the ratio is low the diatoms and blue-green algae predominate. Other factors, e.g. temperature, which Prescott (1948) indicates appears to determine the number of individuals, have been and undoubtedly will continue to be studied, in the quest for a clearer understanding of desmid ecology. Prescott (1948) discusses some of these findings and for a review of them and other pertinent information on desmids his publication is recommended.

Of the more commonly accepted ideas regarding desmids and their occurrence and distribution, one may state that they are considered generally to be calciphobic and are mostly found in acid or soft-water habitats, or in shallow poorly aerated waters where there is a high concentration of humic acids, and that their optimum pH range apparently is between 5.4 and 6.8 (Kim, 1967; Prescott, 1968).

Desmid Distribution in Montana In reading the systematic account, one becomes aware of the fact that the majority of the desmid taxa treated are only known from the northwest. Correlating with this, the habitats possessing the greatest number of desmid species are located in that region of the state. This is clearly evident in Map 34 which indicates the number of desmid species known from each collection locality. In constructing this map, distributional data on the genus Cosmarium was included, although the genus was not treated here taxonomically. This was done because of the importance, qualitatively and quantitatively, of Cosmarium. It was the most often collected genus and possessed the largest number of taxa. Consequently, by its inclusion a more complete picture of the distribution of the known desmids of Montana is obtained.

Although the number of desmid taxa reported in the systematic summary is large, the number of habitats possessing a rich desmid flora was in fact small (2%). The basis for determining the comparative richness of the flora was as follows: a locality with a poor desmid flora contains 20 species or less; moderately poor, 21-40 species; moderate, 41-80 species; moderately rich, 81-100 species; and rich, over 100 species. As a comparison, West and West (09) report rich desmid areas as having 150-200 (300) species.

Of the 202 collection localities included here, 133 or 66% had a poor desmid flora and 97 of these sites had 10 species or less. Thirty six localities or 16% ranked as moderately poor, and 29 or 14.5% had a moderate flora. Three localities (1.5%) were moderately rich, and only 4 could be classified as rich desmid habitats.

On a regional basis it is noted from Map 34 that in the piedmont and midland areas (Great Plains region) no known collection locality had more than 20 species, and the majority (87%) had 10 species or less. Thus they were all poor desmid habitats. Furthermore, in 70% of the localities not more than two genera were present. The genera Closterium and Cosmarium were the primary contributors to the desmid flora of this region, usually occurring together. More rarely these genera occurred separately as the sole contributor to the flora, or in combination with another genus such as Staurastrum, Pleurotaenium or Euastrum. There were 4 localities (183,184,189, 192), all in the northwestern midland region in which the genus Staurastrum was the only one present. In the majority of cases where three genera contributed to the desmid flora those involved were Closterium, Cosmarium and Staurastrum. In those rare instances where Pleurotaenium, Euastrum, Hyalotheca or Desmidium were encountered, they were generally represented by a single species and usually by the most commonly occurring species in the genus.

The western montane region, although having the habitats with the greatest number of species, also had a substantial number of sites (110 or 76%) classified as poor or moderately poor. Nineteen percent had a moderate flora and the remaining 5% had moderately rich to rich ones. The poor desmid habitats in the west, compared with those of the piedmont and midland regions, on the whole had a greater number of species. While the number of genera contributing to the desmid flora in the Great Plains regions ranged from 1 to 4, in the west it ranged from 1 to 10. Habitats with moderately poor floras numbered 33, having on the average 29 species. The number of genera contributing taxa at these sites ranged from 4 to 11. Twenty nine localities had moderate floras, averaging 59 species within 8 - 16 genera. Only two of these habitats occurred in the southern montane region, both being high altitude (7000 feet) lakes in the Bitterroot Mountains. In the northwest the moderate desmid habitats were generally encountered at or below 4200 feet. Rich, or moderately rich, desmid floras were only found in the northern montane but this, in part, may have reflected the fact that a smaller number of habitats were sampled in the southern montane region. Two of the three moderately rich sites occurred in Glacier National Park. One was a small Sphagnum bog lake (locality 31) from which 85 species within 15 genera were identified (see Kidd (63) for chemical characteristics of the water), and the other was a marsh (locality 28) in which 16 genera encompassing 92 species were found. The third site (No. 76) was a lake in Sanders County southwest of Flathead Lake. Eighty six species representing 15 genera were identified from this locality, and the lake had an abundant desmid plankton.

Three of the four rich desmid floras encountered were also from collecting sites in Glacier National Park. These sites were a pond (locality 27: 16 genera, 106 species), a lake (locality 29: 17 genera, 110 species), and a Sphagnum bog (locality 54: 16 genera, 123 species). The fourth and richest desmid habitat was a pond (collection locality 86: 17 genera, 126 species) located in the Mission Mountains.

A more detailed analysis of the total number of species, by genus, encountered at each collecting site, and an indication of the total number of taxa found, is given in Table 2 located at the end of this section. Over-all, the number of taxa present at each site equals the number of species reported for the site, and generally only in moderately rich or rich desmid habitats is there much of a difference between these.

From the previous discussion on the factors affecting desmid occurrence and distribution it is apparent that since early investigations, the chemistry of the water has been considered of primary importance, the chemistry being dependent upon geology and soils, as well as many other ecological factors. Unfortunately, comparable chemical data from all collection localities is not available and that which is, in most instances, represents only a single sampling period, the time of algal collecting. Thus, commentary on the distribution of Montana desmids in relation to the chemical nature of the water must be of a limited extent and viewed in this light.

In comparing Map 34 and Map 9 it appears that, in general, desmid abundance and distribution correlates with the hardness of the surface waters. In those regions of the state where hard-waters were present (Great Plains region), habitats with poor desmid floras were encountered. In the areas where soft-waters were most abundant (northwest), habitats with richer floras occurred. Looking at individual collecting sites, in those cases where chemical data was available, a comparison between desmid richness and water hardness tended to support the correlation. However, exceptions were noted.

In the Great Plains region with two exceptions (localities 160 + 178, both soft-water streams) results of the chemical analyses indicated that all sites were alkaline, hardwater habitats with the pH ranging from 7.2 to 9.6.

Analyses of the surface waters in the western montane region showed that these waters, especially in the northwest, could be much harder than inferred from Map 9. Poor and moderately poor floras in this area were found in both soft-water and hard-water situations, and with the pH of these ranging from 5.7 to 9.8. Moderate floras were likewise encountered in soft and hard-water habitats, and the richer floras were not restricted to the softer water, i.e. collection locality 87, with a pH of 7.6, total alkalinity of 224 ppm, calcium hardness of 126 ppm., and a total hardness of 200 ppm., had an abundant flora as well as a fairly large number of species (75) present.

Chemical data from localities with moderately rich and rich desmid floras is meager and limited to 3 collecting sites (27,28 and 31). These were soft-water situations with their pH being 6.9, 6.5, 6.8

respectively. For the richest habitat (86) studied, only the pH is known and Sieminska (1965) states this to be approximately 6.7, according to information provided to her. However, Hoham (1966) states he never recorded the pH that low, and indicates that during his investigation the pH varied between 7.2 and 8.3.

In resume, based upon the conditions existing during the time of collecting, it appears that although desmid richness correlates inversely with the hardness of the surface water in general, with rich desmid floras existing in soft-water, the presence of hard-water does not necessarily predicate their absence. In addition, desmids can occur in abundance (numbers of species) where the pH is considerably above their reported optimum range.

TABLE 2.

NUMBER OF SPECIES PER GENUS AT EACH COLLECTION LOCALITY

Collection Locality	Gonatozygon	Roya	Cylindrocystis	Spirotaenia	Netrium	Actinotaenium	Penium	Closterium	Spinoclosterium	Pleurotaenium	Triploceras	Tetmemorus	Euastrum	Micrasterias	Xanthidium	Arthrodesmus	Staurastrum	Onychonema	Sphaerozosma	Spondylosium	Hyalotheca	Bambusina	Desmidium	Cosmocladium	Cosmarium	Total No. of Species	Total No. of Taxa*
1	1	0	0	0	0	0	0	5	0	1	0	0	5	0	1	3	4	1	0	0	0	0	0	1	17	39	*
2	0	0	0	0	0	0	0	6	0	1	0	0	0	3	1	0	9	0	1	0	1	0	1	0	12	35	*
3	1	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	4	0	0	0	0	0	1	0	14	22	*
4	1	0	0	0	0	0	0	8	0	3	0	0	2	1	0	0	15	1	0	0	2	0	1	0	22	56	*
5	1	0	0	0	0	0	0	2	0	2	0	0	1	1	1	0	15	0	1	1	0	0	1	1	18	45	*
6	1	1	0	0	1	0	0	8	0	2	0	0	0	2	1	0	14	0	0	0	1	0	1	0	18	50	*
7	1	0	0	0	0	1	0	5	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	5	13	*
8	0	0	0	0	0	0	1	1	0	0	0	0	1	0	1	0	7	0	1	0	1	0	0	0	7	20	*
9	0	0	0	0	1	0	0	4	0	1	0	0	3	4	1	0	8	0	0	0	1	0	1	0	8	32	*
10	1	0	0	0	1	0	1	18	0	3	0	0	6	4	2	3	10	0	1	0	2	1	2	0	25	81	*
11	0	0	0	0	0	0	0	5	0	1	0	0	1	0	0	0	2	0	0	0	0	0	0	0	7	16	*
12	1	0	0	0	0	0	0	3	0	1	0	0	1	2	0	0	12	0	1	0	1	0	1	0	23	46	*
13	0	0	0	0	0	0	0	5	0	2	0	0	0	1	0	1	14	0	1	0	0	0	0	0	13	37	*

*The symbols used to indicate the total number of taxa present at a locality represent ranges, the upper limits of which are as indicated below: * 20; * 40; * 60; * 80; * 100; * 120; * 140; * 160.

TABLE 2. Continued

Collection Locality	Gonatozygon	Roya	Cylindrocystis	Spirotaenia	Netrium	Actinotaenium	Penium	Closterium	Spinoclosterium	Pleurotaenium	Triploceras	Tetmemorus	Euastrum	Micrasterias	Xanthidium	Arthrodesmus	Staurastrum	Onychonema	Sphaerozosma	Spondylosium	Hyalotheca	Bambusina	Desmidium	Cosmocladium	Cosmarium	Total No. of Species	Total No. of Taxa*
14	0	0	0	0	0	1	0	1	0	0	0	0	1	0	0	0	6	0	0	1	0	0	0	0	4	14	*
15	1	0	0	0	0	3	0	7	0	0	0	0	3	3	1	1	21	1	0	0	1	0	1	0	30	73	*
16	0	0	0	0	0	0	0	5	0	1	0	0	0	1	0	0	1	0	0	0	0	1	0	0	5	14	*
17	1	1	0	0	0	0	0	6	0	2	0	0	0	1	0	0	10	0	0	0	1	0	1	0	3	36	*
18	0	0	0	0	1	0	0	4	0	0	0	0	0	0	1	0	2	0	0	0	0	0	0	0	4	12	*
19	0	0	0	0	1	0	0	5	0	2	0	0	2	6	1	0	15	0	1	0	1	0	1	0	26	61	*
20	0	0	0	0	1	0	1	3	0	2	0	0	2	0	1	0	8	0	1	0	1	0	1	0	18	39	*
21	0	0	0	0	0	0	0	5	0	2	0	0	3	0	1	0	14	1	1	0	1	0	1	0	22	51	*
22	1	0	0	0	0	0	0	4	0	2	0	0	3	1	1	2	10	1	0	0	1	0	1	0	21	48	*
23	0	0	0	0	1	0	0	5	0	2	0	0	4	3	1	0	12	0	0	0	0	0	2	0	26	56	*
24	1	0	0	0	0	0	0	1	0	0	0	0	3	0	1	0	8	0	0	0	2	0	0	0	7	23	*
25	0	0	0	0	0	0	0	1	0	0	0	0	3	0	0	0	8	0	0	0	1	0	0	0	8	21	*
26	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	5	8	*
27	2	0	0	0	0	2	0	20	0	3	0	0	8	5	3	1	18	1	2	0	2	1	3	0	35	106	*
28	2	0	0	0	1	3	2	5	0	2	0	0	10	1	0	1	27	1	1	0	1	0	2	1	32	92	*
29	2	0	0	0	1	0	1	9	0	3	0	0	7	4	3	7	32	1	1	1	1	1	3	0	32	110	*
30	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	3	*
31	1	0	0	0	1	1	1	4	0	4	0	0	10	8	2	1	25	0	1	0	2	0	3	0	21	85	*
32	0	0	1	0	0	1	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	4	8	*
33	0	0	0	0	0	3	0	0	0	0	0	0	1	1	0	0	1	0	0	0	0	0	0	0	9	15	*

TABLE 2. Continued

Collection Locality	Gonatozygon	Roya	Cylindrocystis	Spirotaenia	Netrium	Actinotaenium	Penium	Closterium	Spinoclosterium	Pleurotaenium	Triploceras	Tetmemorus	Euastrum	Micrasterias	Xanthidium	Arthrodesmus	Staurastrum	Onychonema	Sphaerozosma	Spondylosium	Hyalotheca	Bambusina	Desmidium	Cosmocladium	Cosmarium	Total No. of Species	Total No. of Taxa*
	Genus																										
34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	*
35	1	0	0	0	1	1	0	4	0	2	0	0	2	0	1	0	16	0	0	1	1	0	0	0	22	52	*
36	1	0	0	0	1	0	1	2	0	1	0	0	0	1	1	1	20	0	0	1	1	0	2	0	21	54	*
37	1	0	0	0	0	0	0	5	0	1	0	0	1	0	0	0	11	0	1	0	1	0	1	0	18	40	*
38	0	0	0	0	0	0	0	6	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	12	20	*
39	0	0	0	0	1	0	1	13	0	1	0	0	3	2	1	1	9	0	0	1	0	1	2	1	11	47	*
40	0	0	0	0	0	0	0	4	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	3	9	*
41	0	0	0	0	0	0	0	6	0	1	0	0	0	0	0	0	9	0	0	0	0	0	0	0	11	27	*
42	1	0	0	0	1	0	0	3	0	1	0	0	1	0	1	1	7	0	1	0	0	0	1	0	16	34	*
43	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	4	10	*
44	0	0	0	0	0	0	0	3	0	1	0	0	0	0	0	0	4	0	0	0	0	0	0	0	17	25	*
45	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	5	*
46	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	0	0	0	0	1	1	0	1	6	*
47	1	0	0	0	1	0	0	6	0	2	0	0	2	1	0	0	15	0	0	0	0	0	0	0	26	54	*
48	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	12	14	*
49	1	0	2	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	14	19	*
50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	6	*
51	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14	14	*
52	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	2	4	*
53	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	*

TABLE 2. Continued

Collection Locality	Gonatozygon	Roya	Cylindrocystis	Spirotaenia	Netrium	Actinotaenium	Penium	Closterium	Spinoclosterium	Pleurotaenium	Triploceras	Tetmemorus	Euastrum	Micrasterias	Xanthidium	Arthrodesmus	Staurastrum	Onychonema	Sphaerozosma	Spondylosium	Hyalotheca	Bambusina	Desmidium	Cosmocladium	Cosmarium	Total No. of Species	Total No. of Taxa*
	Genus																										
54	0	0	0	0	2	5	3	15	0	2	0	2	10	9	2	3	25	0	1	0	2	1	3	0	37	123	*
55	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	5	8	*
56	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	1	0	0	0	0	5	*
57	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	6	12	*
58	0	0	0	0	0	0	0	2	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	6	10	*
59	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	2	*
60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	8	*
61	1	0	0	0	0	0	0	6	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	11	*
62	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	*
63	1	0	0	0	0	0	0	7	0	3	0	0	3	2	0	1	9	0	0	0	0	0	1	0	0	27	*
64	0	0	0	0	0	0	0	3	0	0	0	0	3	2	1	0	5	0	1	0	0	0	0	0	7	22	*
65	0	0	0	0	0	0	0	4	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	5	*
66	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	2	0	0	0	1	0	0	0	0	4	*
67	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	9	*
68	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	4	9	*
69	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	4	*
70	2	0	0	0	1	0	1	3	0	1	0	0	0	0	0	0	6	0	0	0	1	0	1	0	8	24	*
71	0	1	0	0	0	0	0	5	0	2	0	0	1	0	0	0	4	0	0	0	0	0	0	1	10	24	*
72	0	0	0	0	1	0	0	11	0	3	0	0	3	2	2	0	6	0	0	0	1	0	1	0	19	49	*
73	0	0	0	0	0	0	0	2	0	0	0	0	0	1	0	0	2	0	1	0	0	0	0	0	7	13	*

TABLE 2. Continued

Collection Locality	Gonatozygon	Roya	Cylindrocystis	Spirotaenia	Netrium	Actinotaenium	Penium	Closterium	Spinoclosterium	Pleurotaenium	Triploceras	Tetmemorus	Euastrum	Micrasterias	Xanthidium	Arthrodesmus	Staurastrum	Onychonema	Sphaerozosma	Spondylosium	Hyalotheca	Bambusina	Desmidium	Cosmocladium	Cosmarium	Total No. of Species	Total No. of Taxa*
	Genus																										
74	0	0	0	0	0	0	0	12	0	2	0	0	5	1	1	1	11	0	1	0	0	0	1	0	20	55	*
75	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	10	16	*
76	1	0	0	0	1	0	0	11	0	3	0	0	4	4	2	0	20	0	2	1	1	0	1	1	34	86	*
77	0	0	0	0	0	0	0	4	0	1	0	0	1	0	1	0	5	0	0	0	0	0	0	0	6	18	*
78	0	0	0	0	0	0	0	8	0	1	0	0	0	0	0	0	3	0	0	0	0	0	0	0	6	18	*
79	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	2	0	0	0	0	0	0	0	7	11	*
80	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	1	6	*
81	1	0	0	0	0	0	0	8	0	1	0	0	5	2	2	2	21	1	1	0	1	0	3	0	19	67	*
82	0	0	0	0	1	0	0	3	0	1	0	0	3	3	2	3	4	0	0	0	0	0	0	0	13	33	*
83	1	0	0	1	1	0	0	8	0	3	0	0	2	3	3	2	23	1	1	0	1	0	3	1	14	68	*
84	1	0	0	0	1	0	0	18	0	2	0	0	7	7	2	1	13	1	0	0	1	1	2	0	23	80	*
85	0	0	0	0	0	0	1	1	0	0	0	0	6	0	0	0	3	0	0	0	0	0	0	0	8	19	*
86	2	0	0	1	1	3	1	11	0	3	0	0	13	5	2	6	31	0	2	0	2	1	2	0	40	126	*
86a	0	0	1	0	1	3	0	10	1	4	0	0	4	2	2	1	25	0	0	0	1	1	1	0	20	68	*
87	0	0	0	0	1	0	0	9	0	2	0	0	3	4	1	0	19	2	0	0	1	0	2	1	31	75	*
88	0	0	0	2	1	1	2	9		1	0	0	5	0	0	2	6	0	1	0	0	0	1	0	13	44	*
89	0	0	0	0	0	0	1	4	0	1	0	0	2	0	0	2	7	0	2	0	0	0	0	0	7	26	*
90	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	*
91	0	0	0	0	0	0	0	1	0	2	0	0	1	2	0	0	4	0	2	0	1	0	1	0	5	19	*
92	0	0	0	0	0	0	0	5	0	1	0	0	0	0	0	0	4	0	0	0	0	0	1	0	15	26	*

TABLE 2. Continued

Collection Locality	Gonatozygon	Roya	Cylindrocystis	Spirotaenia	Netrium	Actinotaenium	Penium	Closterium	Spinoclosterium	Pleurotaenium	Triploceras	Tetmemorus	Euastrum	Micrasterias	Xanthidium	Arthrodesmus	Staurastrum	Onychonema	Sphaerozosma	Spondylosium	Hyalotheca	Bambusina	Desmidium	Cosmocladium	Cosmarium	Total No. of Species	Total No. of Taxa*
	Genus																										
93	1	0	0	0	0	0	0	9	0	2	0	0	0	0	0	1	4	0	0	0	0	0	2	0	13	32	*
94	0	0	0	0	0	0	0	1	0	1	0	0	1	1	0	0	9	0	0	0	0	0	1	0	11	25	*
95	0	0	0	1	0	0	0	10	0	3	0	0	5	3	4	1	19	0	1	0	2	0	1	0	28	78	*
96	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	13	16	*
97	0	0	0	0	0	0	0	6	0	1	0	0	1	1	0	0	5	0	0	0	1	0	1	0	16	32	*
98	0	0	0	0	0	0	0	4	0	1	0	0	0	0	0	0	3	0	0	0	0	0	0	0	12	20	*
99	0	0	0	0	0	1	0	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	6	*
100	0	0	0	1	1	2	1	4	0	0	0	0	6	2	0	0	8	0	1	0	1	0	0	0	9	36	*
101	1	0	0	0	0	0	0	5	0	0	0	0	1	0	0	0	19	0	0	1	0	0	0	0	22	49	*
102	1	0	0	0	1	0	0	3	0	1	0	0	1	1	0	0	6	0	0	0	0	0	1	0	9	24	*
103	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	2	5	*
104	0	0	0	0	0	0	0	3	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	5	*
105	0	0	0	0	0	0	0	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	4	*
106	1	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	3	10	*
107	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	1	3	*
108	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	*
109	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	4	*
110	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	*
111	1	0	0	0	1	0	0	4	2	0	0	0	3	2	1	0	0	0	0	0	0	0	1	0	12	27	*
112	0	0	2	1	2	3	2	4	0	1	1	2	11	5	2	2	2	0	0	0	0	0	0	0	12	52	*

TABLE 2. Continued

Collection Locality	Gonatozygon	Roya	Cylindrocystis	Spirotaenia	Netrium	Actinotaenium	Penium	Closterium	Spinoclosterium	Pleurotaenium	Triploceras	Tetmemorus	Euastrum	Micrasterias	Xanthidium	Arthrodesmus	Staurastrum	Onychonema	Sphaerozosma	Spondylosium	Hyalotheca	Bambusina	Desmidium	Cosmocladium	Cosmarium	Total No. of Species	Total No. of Taxa*
113	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	2	*
114	0	0	1	0	0	0	0	2	0	0	0	1	3	0	1	0	6	0	1	0	0	0	0	0	9	24	*
115	0	0	0	0	1	1	2	12	0	1	0	0	5	0	1	2	17	1	2	2	1	0	1	0	22	71	*
116	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	2	*
117	0	0	0	0	0	0	0	4	0	1	0	0	0	0	0	0	2	0	0	0	0	0	0	0	4	11	*
118	1	0	0	0	1	0	0	7	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	2	13	*
119	0	0	0	0	1	0	0	10	0	2	0	0	2	2	0	0	2	0	0	0	0	0	1	0	6	26	*
120	0	0	0	0	0	0	0	6	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	2	10	*
121	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	4	8	*
122	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	1	0	0	0	1	0	0	0	10	15	*
123	0	0	0	0	0	1	0	1	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	1	5	*
124	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	*
125	1	0	0	0	1	1	0	1	0	0	0	0	2	0	0	0	3	0	1	0	1	0	1	0	5	17	*
126	0	0	0	0	0	1	0	0	0	2	0	0	5	1	0	0	6	0	0	0	0	0	1	0	15	31	*
127	2	0	1	0	2	2	2	4	0	1	0	0	5	3	1	2	17	1	0	0	1	0	1	0	20	65	*
128	0	0	0	0	0	0	0	1	0	0	0	0	4	0	0	0	4	0	0	0	0	0	0	0	12	21	*
129	0	0	0	0	0	0	0	3	0	0	0	0	1	0	0	0	6	0	0	0	0	0	0	0	7	17	*
130	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	4	10	*
131	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	3	5	*
132	1	0	0	0	0	0	0	2	0	2	0	0	0	0	0	0	5	0	0	0	1	0	2	0	9	22	*

TABLE 2. Continued

Collection Locality	Gonatozygon	Roya	Cylindrocystis	Spirotaenia	Netrium	Actinotaenium	Penium	Closterium	Spinoclosterium	Pleurotaenium	Triploceras	Tetmemorus	Euastrum	Micrasterias	Xanthidium	Arthrodesmus	Staurastrum	Onychonema	Sphaerozosma	Spondylosium	Hyalotheca	Bambusina	Desmidium	Cosmocladium	Cosmarium	Total No. of Species	Total No. of Taxa*
	Genus																										
133	0	0	0	0	0	0	1	7	0	2	0	0	2	0	0	0	4	0	0	0	0	0	0	0	15	31	*
134	0	0	0	0	3	3	1	8	0	1	0	1	5	2	1	0	4	0	0	0	1	0	0	0	16	46	*
135	2	0	1	0	0	0	0	6	0	2	0	0	4	3	0	2	18	0	1	0	0	0	0	1	13	53	*
136	1	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	4	9	*
137	0	0	0	0	0	0	0	3	0	1	0	0	0	0	0	0	2	0	0	0	0	0	0	0	5	11	*
138	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	5	*
139	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	3	*
140	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	3	0	0	0	0	0	0	0	11	16	*
141	1	0	0	0	0	0	0	4	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	17	24	*
142	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	2	5	*
143	1	0	0	0	0	0	0	6	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	4	13	*
144	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	7	*
145	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	5	*
146	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	7	*
147	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	3	7	*
148	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	6	*
149	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	5	9	*
150	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	3	5	*
151	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	7	*
152	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	3	0	0	0	0	0	1	0	5	10	*

TABLE 2. Continued

Collection Locality	Genus: Gonatozygon	Roya	Cylindrocystis	Spirotaenia	Netrium	Actinotaenium	Penium	Closterium	Spinoclosterium	Pleurotaenium	Triploceras	Tetmemorus	Euastrum	Micrasterias	Xanthidium	Arthrodesmus	Staurastrum	Onychonema	Sphaerozosma	Spondylosium	Hyalotheca	Bambusina	Desmidium	Cosmocladium	Cosmarium	Total No. of Species	Total No. of Taxa*
153	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	7	*
154	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	10	*
155	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	*
156	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	4	*
157	0	0	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	11	*
158	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	5	*
159	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	3	*
160	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	*
161	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	2	*
162	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	2	*
163	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	5	*
164	0	0	0	0	0	0	0	2	0	1	0	0	0	0	0	0	2	0	0	0	0	0	0	0	4	9	*
165	0	0	0	0	0	0	0	3	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	10	*
166	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	5	8	*
167	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	*
168	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	4	*
169	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	3	*
170	0	0	0	0	0	0	0	5	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	14	*
171	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	11	17	*
172	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	8	*

TABLE 2. Continued

Collection Locality	Gonatozygon	Roya	Cylindrocystis	Spirotaenia	Netrium	Actinotaenium	Penium	Closterium	Spinoclosterium	Pleurotaenium	Triploceras	Tetmemorus	Euastrum	Micrasterias	Xanthidium	Arthrodesmus	Staurastrum	Onychonema	Sphaerozosma	Spondylosium	Hyalotheca	Bambusina	Desmidium	Cosmocladium	Cosmarium	Total No. of Species	Total No. of Taxa*
173	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	3	*
174	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	3	*
175	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3	*
176	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	2	4	*
177	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	2	6	*
178	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	3	0	0	0	1	0	0	0	2	8	*
179	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	3	*
180	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	*
181	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3	*
182	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	4	*
183	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	2	*
184	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	2	*
185	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	2	5	*
186	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	3	*
187	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	8	14	*
188	0	0	0	0	0	0	0	3	0	0	0	0	1	0	0	0	4	0	0	0	0	0	0	0	10	18	*
189	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	*
190	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	8	*
191	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	4	10	*
192	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	3	*

TABLE 2. Continued

Collection Locality	Gonatozygon	Roya	Cylindrocystis	Spirotaenia	Netrium	Actinotaenium	Penium	Closterium	Spinoclosterium	Pleurotaenium	Triploceras	Tetmemorus	Euastrum	Micrasterias	Xanthidium	Arthrodesmus	Staurastrum	Onychonema	Sphaerozosma	Spondylosium	Hyalotheca	Bambusina	Desmidium	Cosmocladium	Cosmarium	Total No. of Species	Total No. of Taxa*
	Genus																										
193	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	*
194	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	6	*
195	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	2	3	*
196	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	*
197	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	4	*
198	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	5	*
199	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	*
200	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	12	*
201	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	*

VI. SUMMARY

The desmids, collectively comprising the families Gonatozygaceae, Mesotaeniaceae, and Desmidiaceae, in the order Zygnematales, as a group have never been studied in the state of Montana. In fact, they have been very little investigated in the entire northwestern United States.

The present study covers the genera *Gonatozygon*, *Roya*, *Cylindrocystis*, *Spirotaenia*, *Netrium*, *Actinotaenium*, *Penium*, *Closterium*, *Spinoclosterium*, *Pleurotaenium*, *Triploceras*, *Tetmemorus*, *Euastrum*, *Micrasterias*, *Xanthidium*, *Arthrodesmus*, *Staurastrum*, *Onychonema*, *Sphaerozosma*, *Spondylosium*, *Hyalotheca*, *Bambusina*, *Desmidium*, and *Cosmocladium*. It is based upon collections from 202 localities primarily obtained by the author, or contributed by other collectors. Illustrations made of all the taxa encountered served as the basis for identification. A total of 557 taxa (317 species, 176 additional varieties, and 64 formae) were identified.

Entered as new are two species (*Arthrodesmus mooarii* and *Euastrum prescottii*), four varieties (*Closterium parvulum* var. *taylori*, *Gonatozygon brebissonii* var. *tenuis*, *Staurastrum corniculatum* var. *biunguiculatum* and *St. pinnatum* var. *turbinatum*), and seven formae (*Closterium angustatum* var. *gracile* fa. *elongatum*, *Cl. praelongum* fa. *elongatum*, *Euastrum crassum* var. *tumidum* fa. *suboblongum*, *E. verrucosum* var. *alatum* fa. *cyclops*, *Staurastrum dilatatum* fa. *fusiforme*, *St. lapponicum* fa. *depressum* and *Xanthidium cristatum* var. *uncinatum* fa. *ornatum*). Three are new combinations (*Staurastrum rugosum* var. *coronulatum*, *Euastrum everettense* var. *crassum* and *E. evolutum* var. *poriferum*).

With the inclusion of qualitative data on the genus Cosmarium, it is estimated that the total desmid flora of Montana is between 850-900 taxa.

The distribution of the desmid taxa is by no means equal throughout the state, with the majority of the taxa being at present only known from the northwest. This region receives the greatest amount of precipitation and is geologically an area where the mountains are primarily composed of sedimentary rocks of late Precambrium origin, and the intermountain valley floors are mostly of glacial deposits and alluvium.

In general the abundance (number of species) and distribution of desmids appears to correlate with the hardness of the surface waters, with hard-water regions (Great Plains area) possessing habitats with poor desmid floras, and the areas where soft-waters are more abundant (northwest) having the richer floras. Exceptions, however, were noted.

Over all, the majority (133) of the localities studied were poor desmid habitats (having 20 species or less), and only 4 had a rich desmid flora (over 100 species).

PLATES

—————— = 20μ

PLATE 1

GONATOZYGON

PLATE 2

ROYA, CYLINDROCYSTIS, SPIROTAENIA

PLATE 2

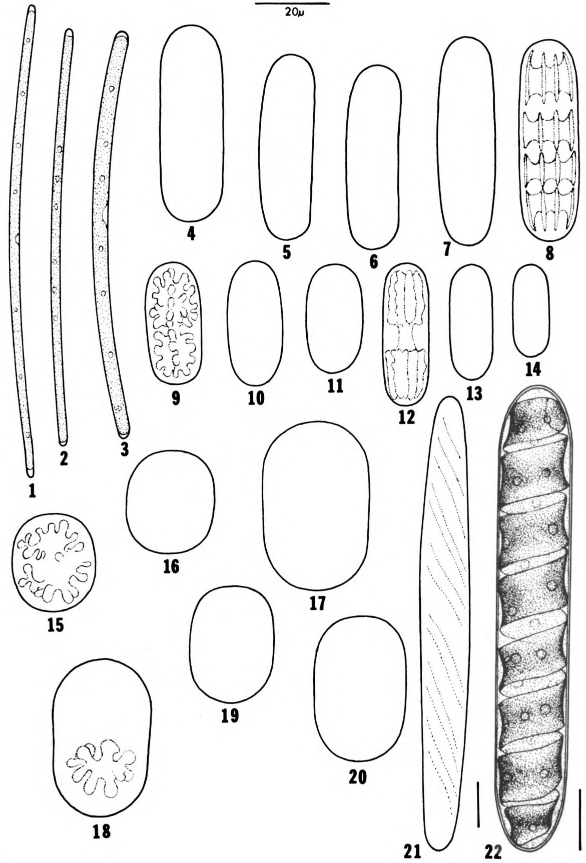


PLATE 3

NETRIUM

PLATE 3

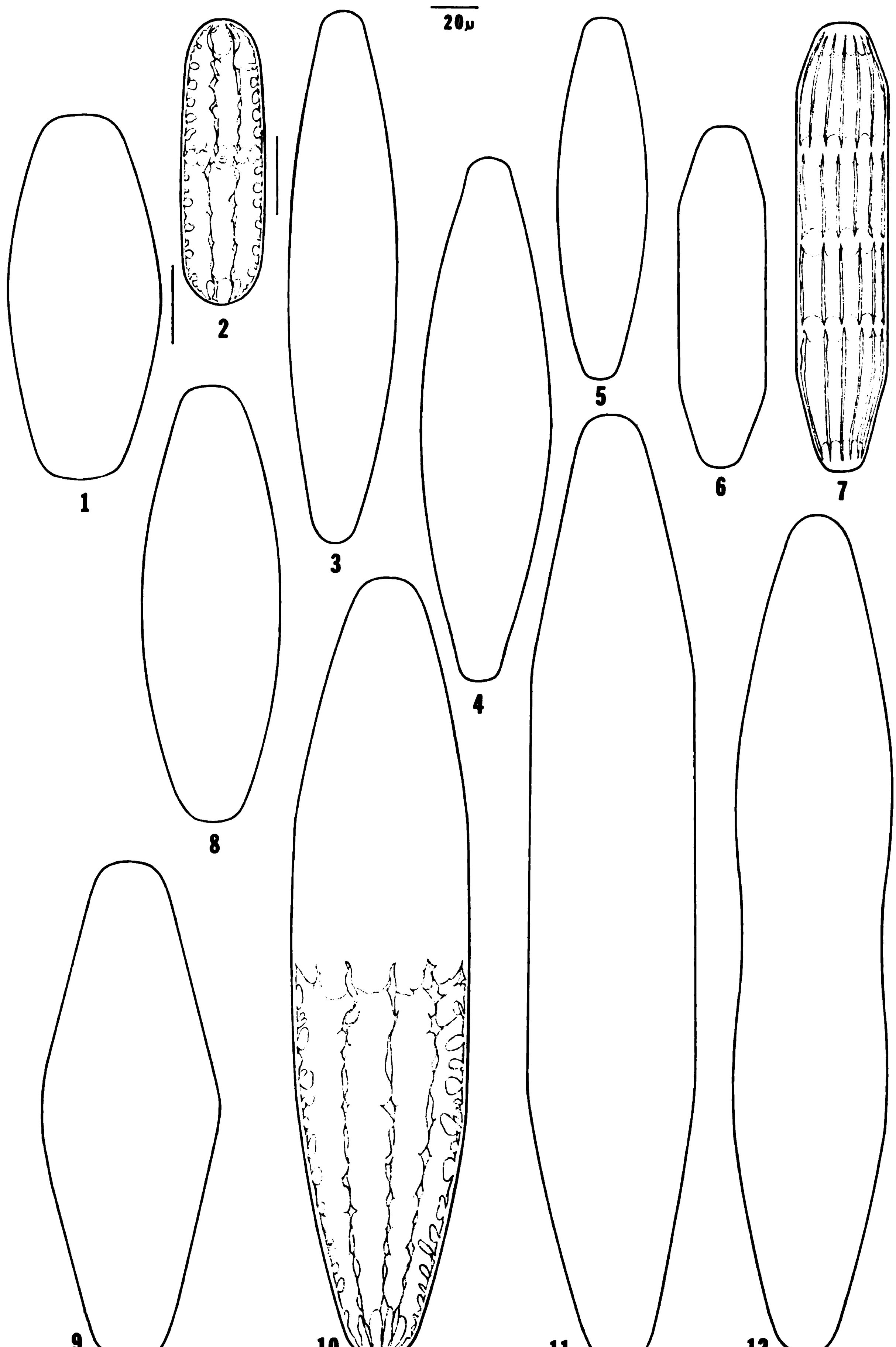


PLATE 4

ACTINOTAENIUM

PLATE 4

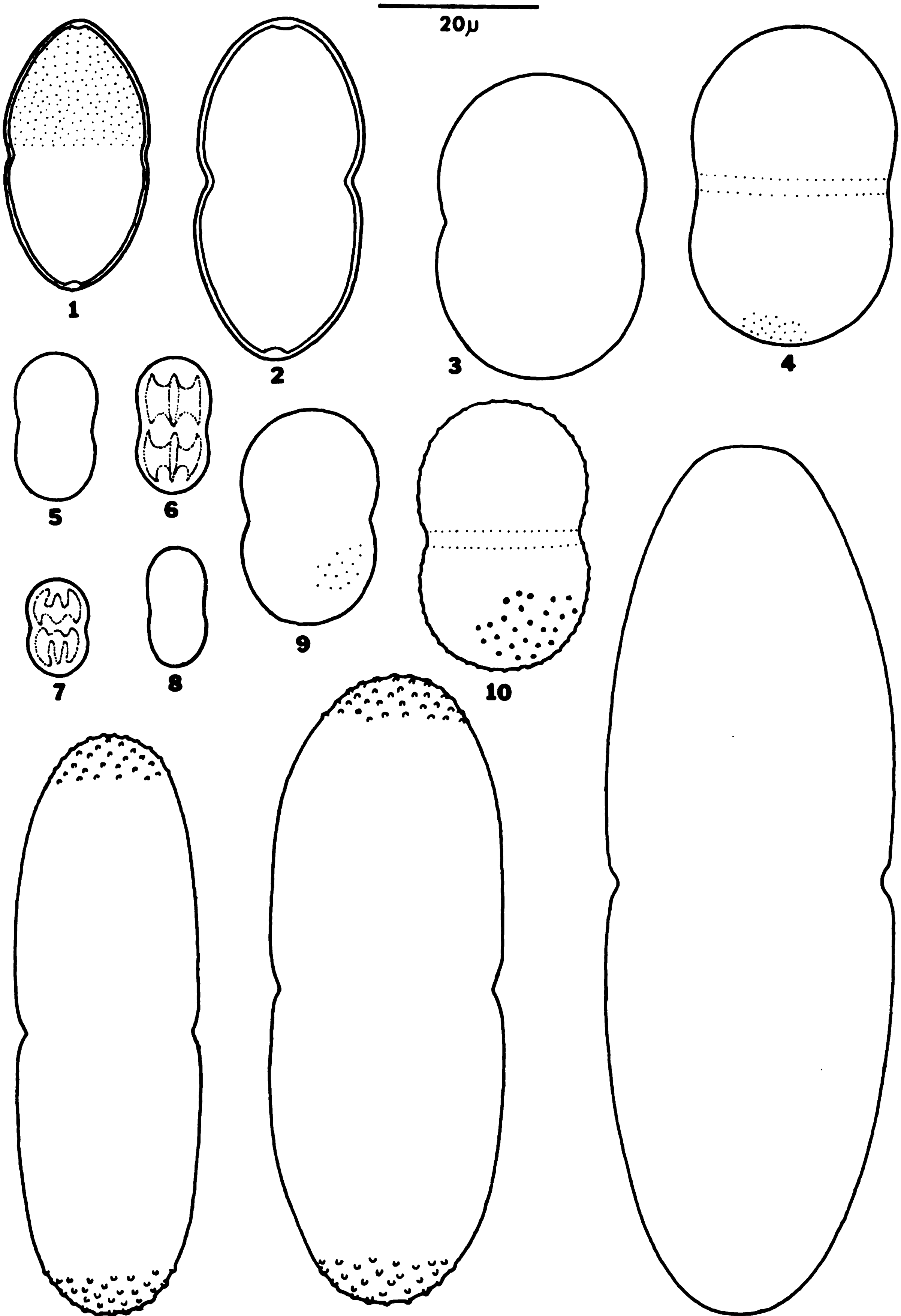


PLATE 5

ACTINOTAENIUM

Figs. Page

1,6. A. inconspicuum 81
1,6- Mt63-66

2,3. A. cucurbita var. cucurbita fa. cucurbita 76
2- Mt63-257
3- Mt63-260

4. A. cucurbita var. cucurbita fa. latius 77
4- Mt63-262

5. A. subtile 82
5- Mt63-76

7. A. diplosporum var. americanum fa. minus 80
7- 6Mon38

8. A. cucurbita var. attenuatum 77
8- Mt62-16

9. A. cucurbitinum var. minutum 79
9- Mt62-17

10. A. cucurbitinum var. cucurbitinum fa. minus 78
10- Mt63-327

11. A. cucurbitinum var. cucurbitinum fa. cucurbitinum 78
11- Mt62-28

12. A. diplosporum var. americanum fa. americanum 80
12- Mt62-28

13,14. A. diplosporum var. diplosporum 80
13- Mt62-72
14- Mt62-11

PLATE 6

ACTINOTAENIUM

PLATE 6

20µ

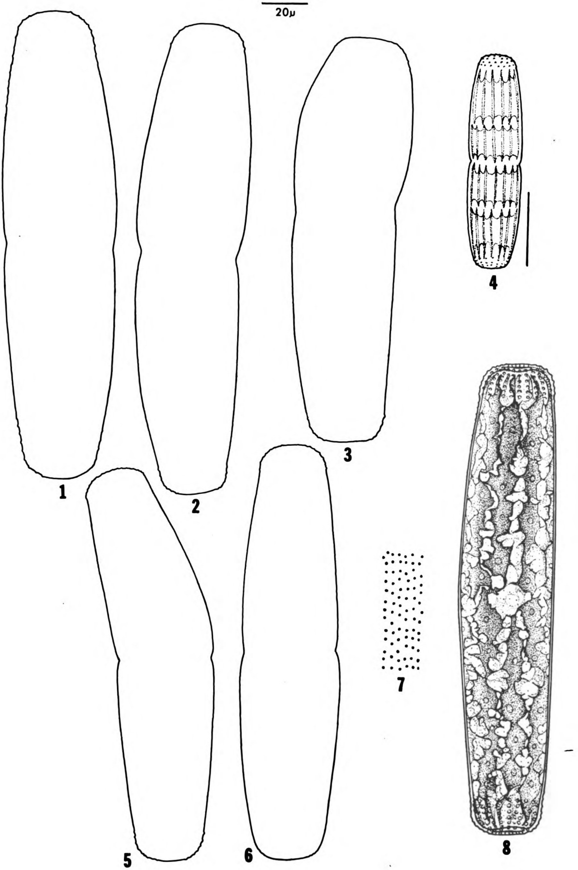


PLATE 7

PENIUM

PLATE 8

PENIUM

Figs.		Page
1.	*P. margaritaceum* var. *margaritaceum* .... 1 - Mt63-156	89
2.	*P. margaritaceum* var. *elongatum* .... 2 - H.L.1	89
3,4.	*P. spirostriolatum* .... 3 - Mt63-271 4 - Mt63-91	90
5,6.	*P. costatum* .... 5,6 - Mt63-265 6 - (enlarged portion under oil emersion objective to show cell wall)	87

Note change in magnification of figs. 2,3 and 6.

PLATE 8

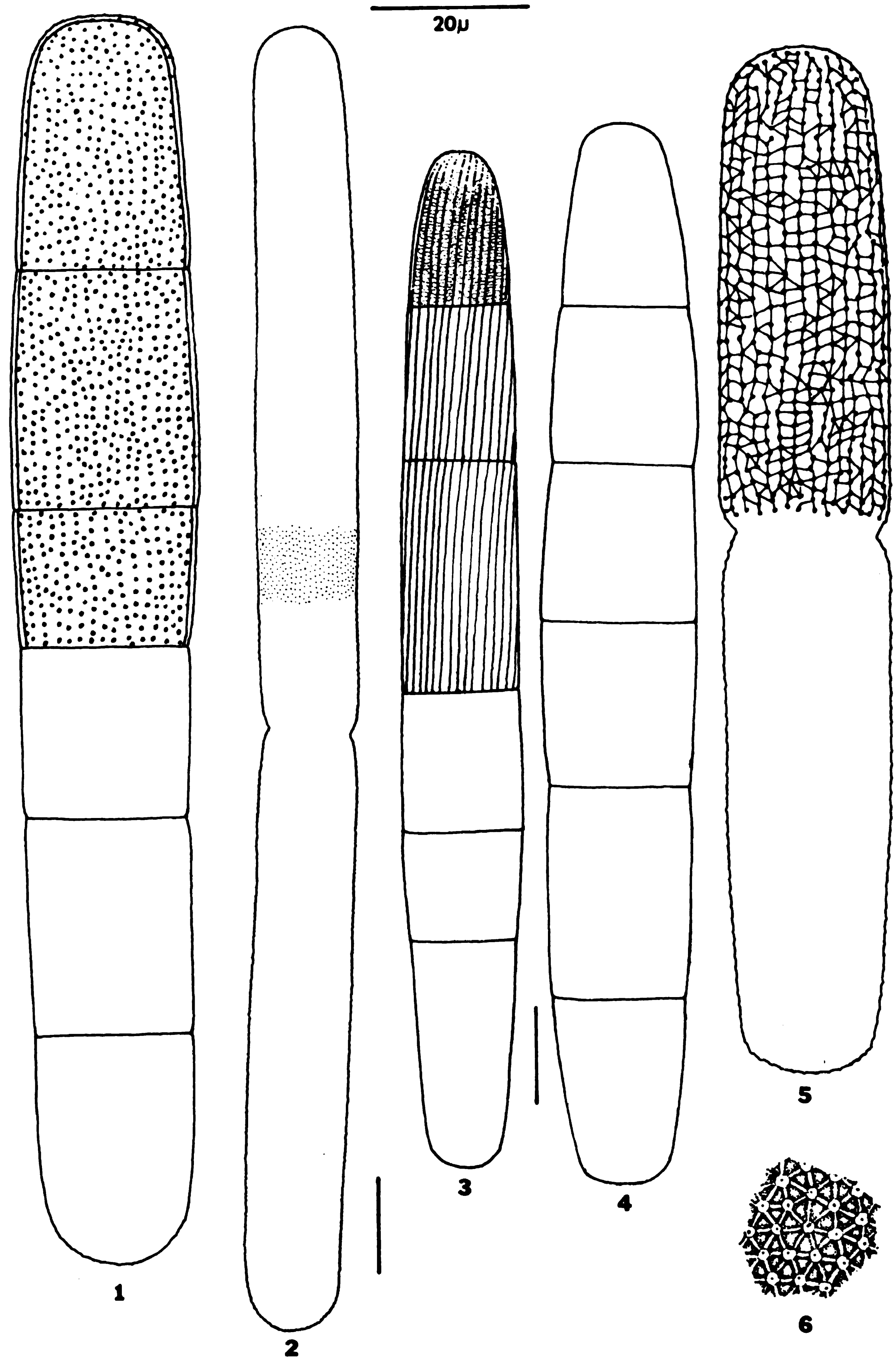


PLATE 9

CLOSTERIUM

Note change in magnification for figs. 3, & 6.

PLATE 9

20μ

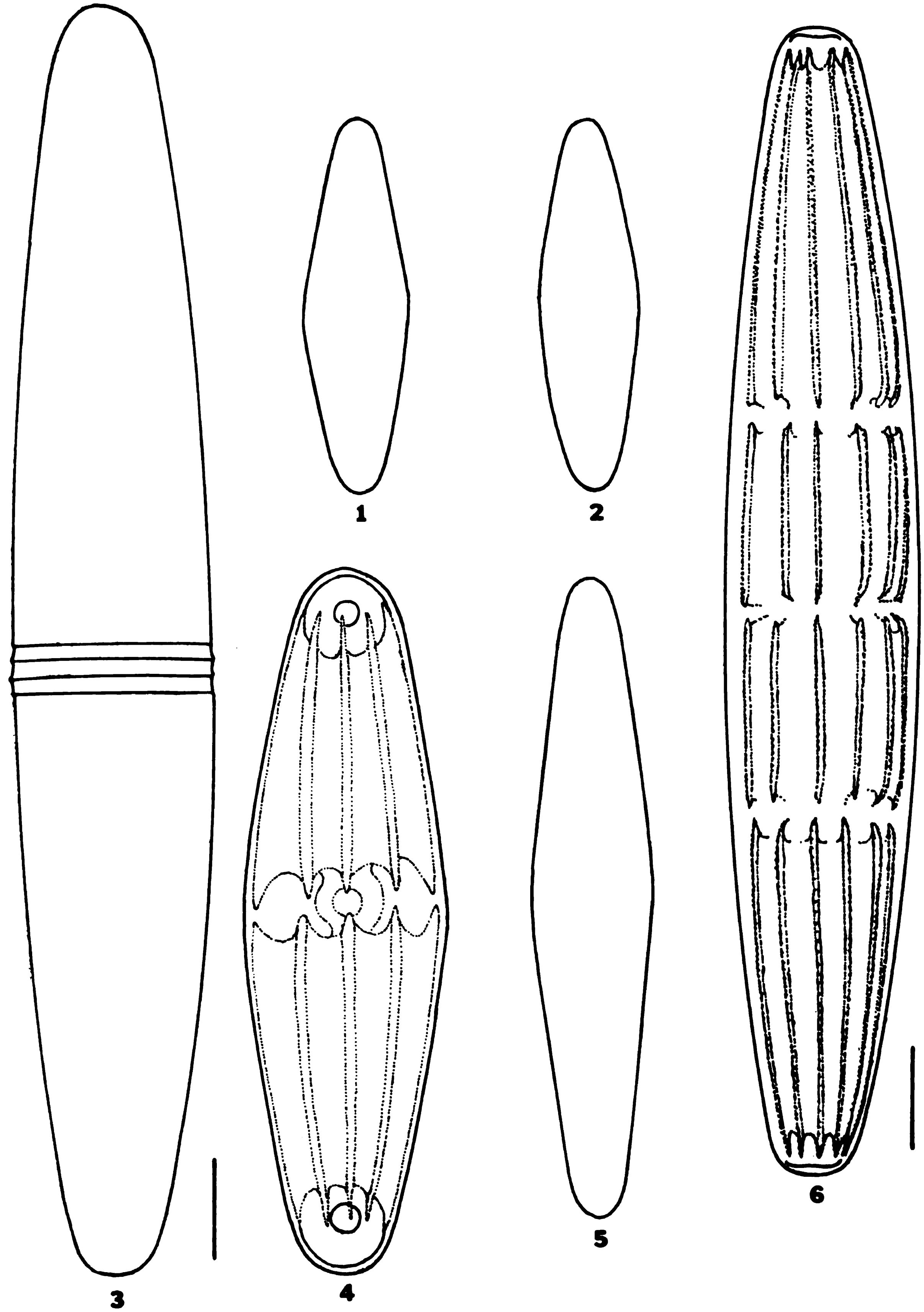


PLATE 10

CLOSTERIUM

PLATE 11

CLOSTERIUM

Figs. Page

Note change in magnification of figure 7.

PLATE 11

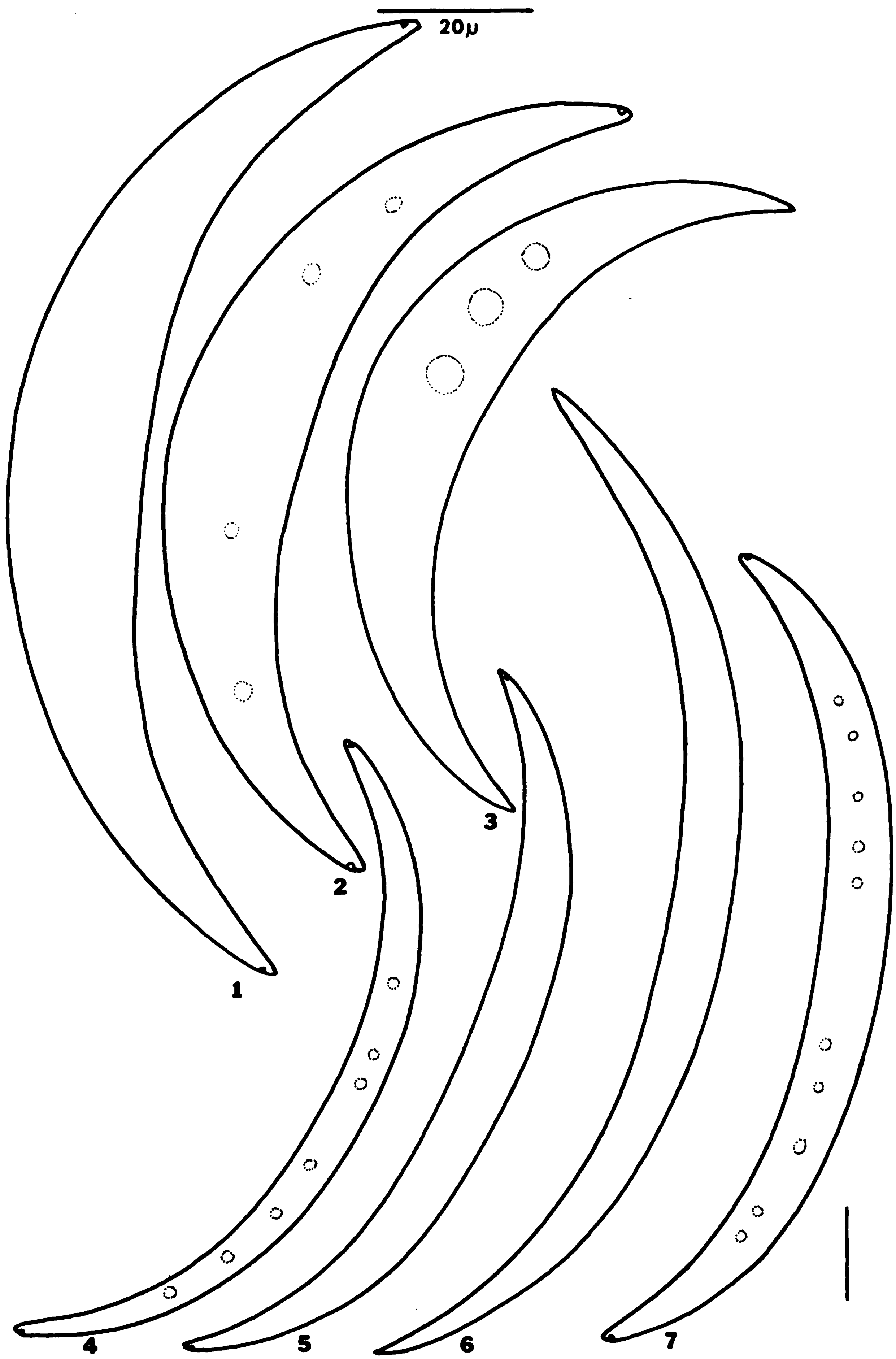


PLATE 12

CLOSTERIUM

Note change in magnification for figures 3,4 and 5.

PLATE 13

CLOSTERIUM

Note change in magnification for figures 1 and 2.

PLATE 13

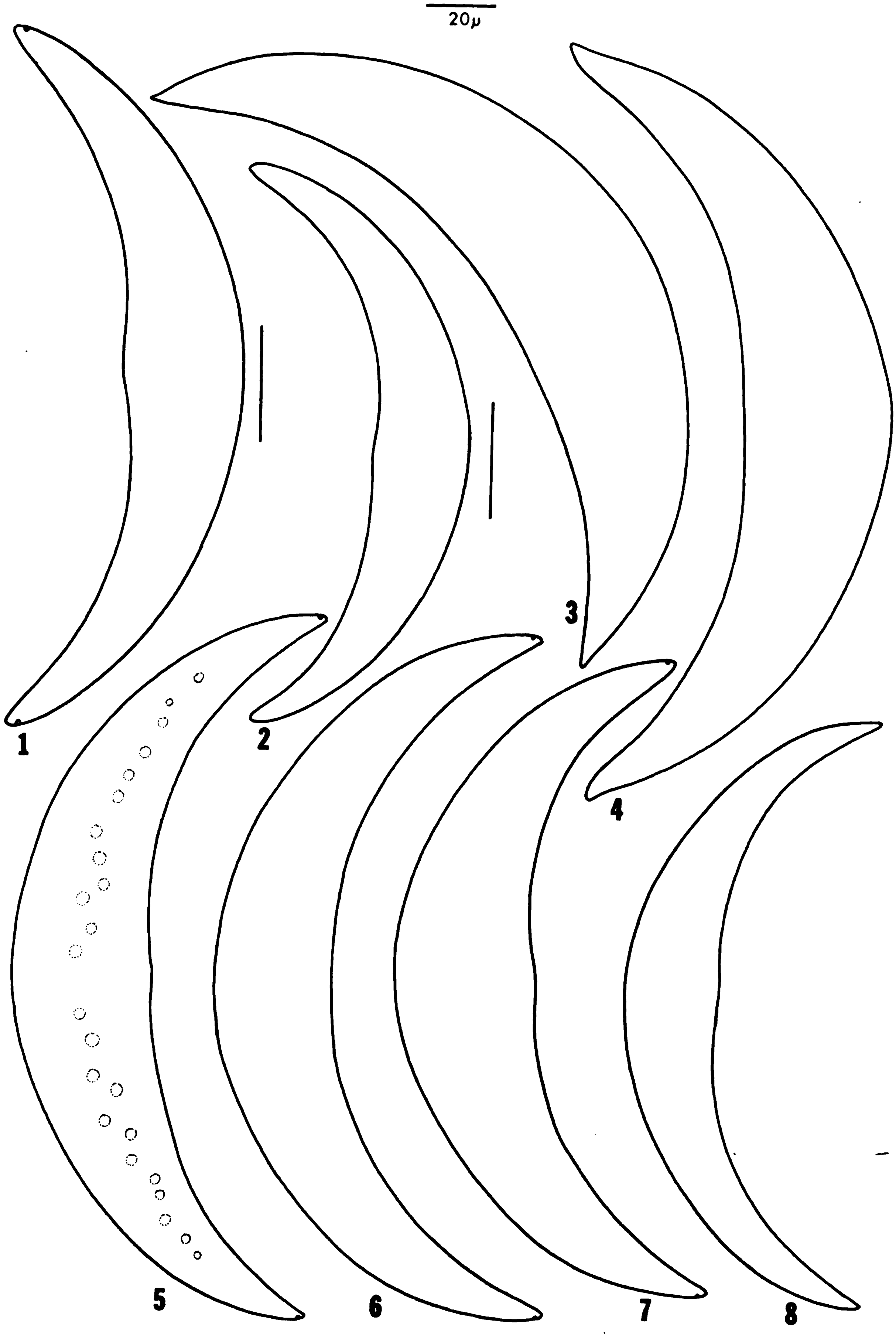


PLATE 14

CLOSTERIUM

PLATE 14

20μ

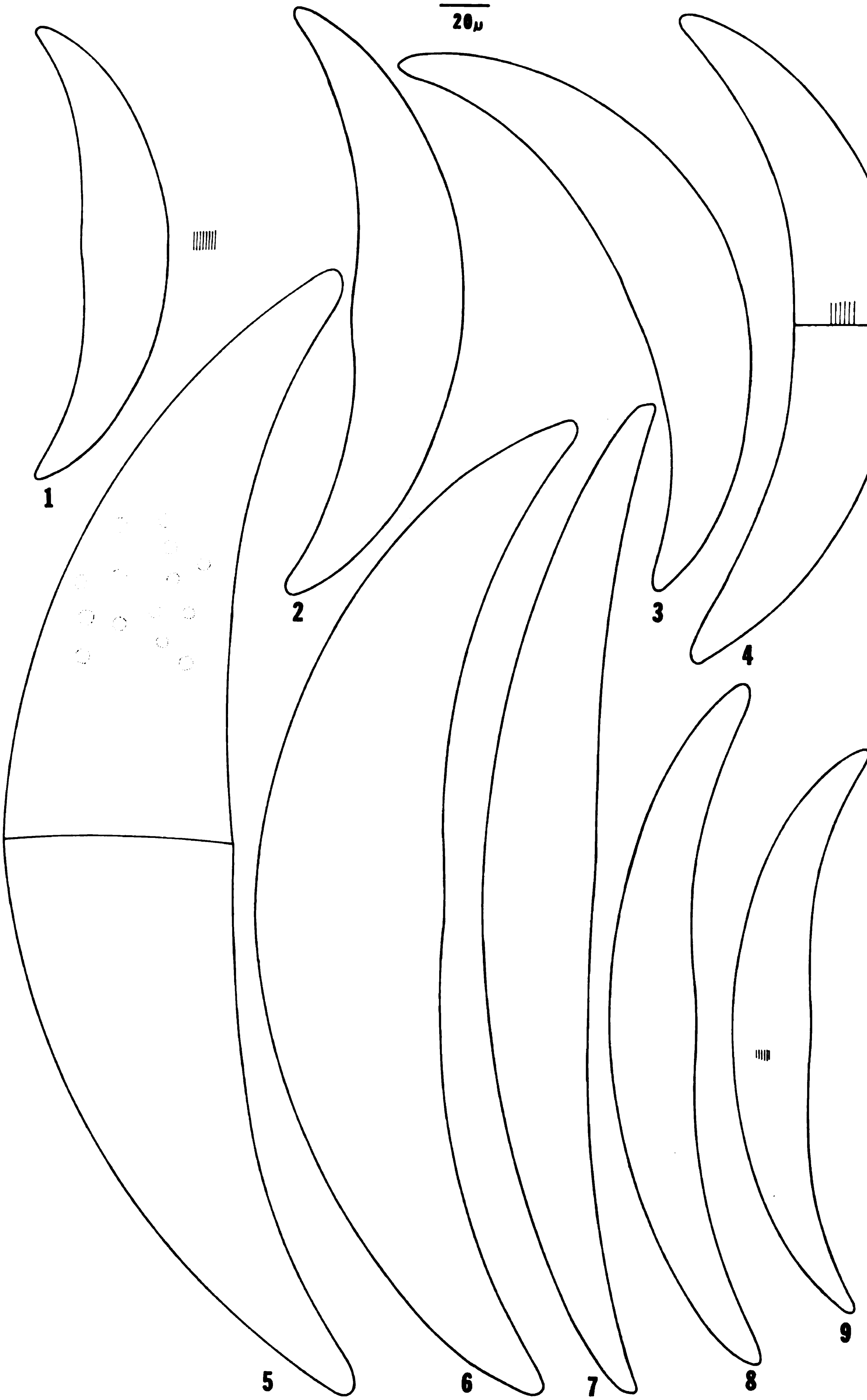


PLATE 15

CLOSTERIUM

Figs.		Page
1.	*Cl. aciculare* 1-Mt63-415	93
2.	*Cl. aciculare* var. *brevius* 2-Mt63-75	94
3.	*Cl. gracile* var. *gracile* 3-Mt63-157	106
4.	*Cl. gracile* var. *intermedium* 4-Mt63-162	106
5.	*Cl. gracile* var. *tenue* 5-Mt62-23	107
6.	*Cl. subulatum* morpha 6-Mon4184	132
7,8.	*Closterium* sp. 1..................................... 7-Mt63-144 8-Mt62-18	138
9.	*Cl. cornu* 9-Mt63-267	99
10.	*Cl. subulatum* 10-Mt62-57	123
11.	*Cl. pronum* 11-Mt63-186	129
12.	*Cl. strigosum* var. *strigosum* 12-Mt63-49	129
13.	*Cl. tumidum* 13-86	133
14. 15.	*Cl. limneticum* var. *fallax* 14,15-Mt63-432	113
16.	*Cl. subangulatum* 16-Mt63-132	130

PLATE 15

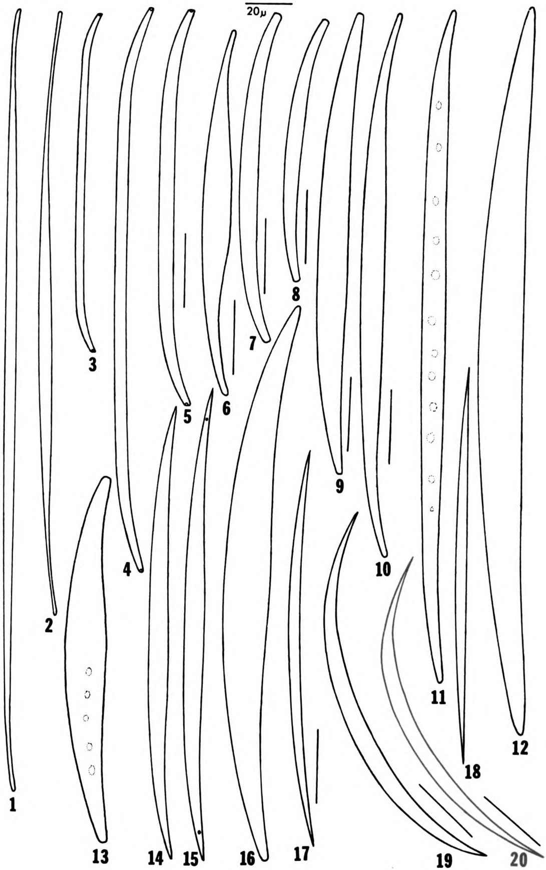
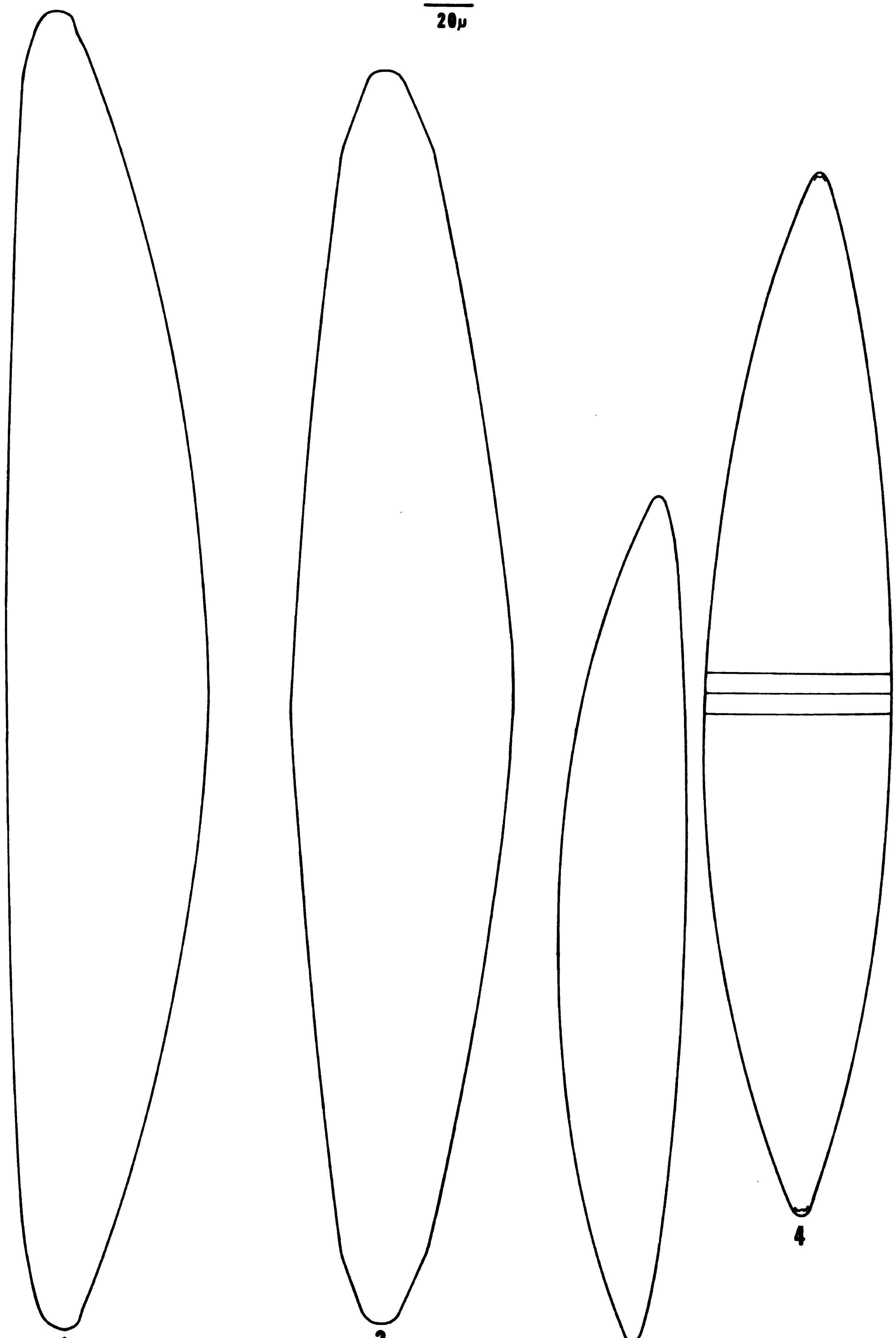


PLATE 16

CLOSTERIUM

PLATE 16

20μ



1 2 3 4

PLATE 17

CLOSTERIUM

Figs. Page

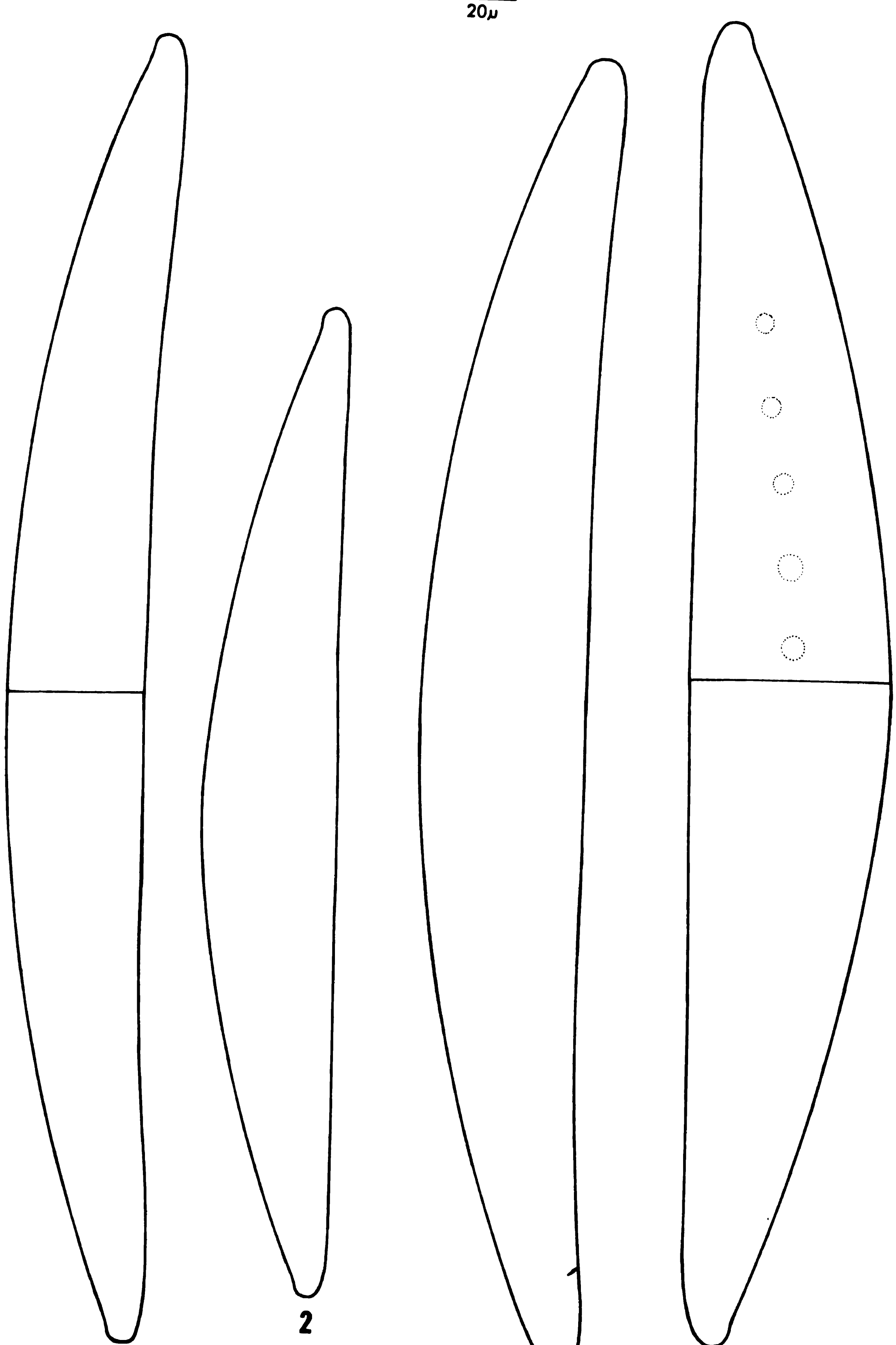
1. Cl. spetsbergense var. spetsbergense fa. longuis 128
   1- Mt64-89

2,3. Cl. spetsbergense var. subspetsbergense 129
   2,3- Mon25

4. Cl. spetsbergense var. spetsbergense fa. spetsbergense 128
   4- Mon25

PLATE 17

20μ



1 2 3 4

PLATE 18

CLOSTERIUM

PLATE 19

CLOSTERIUM

PLATE 19

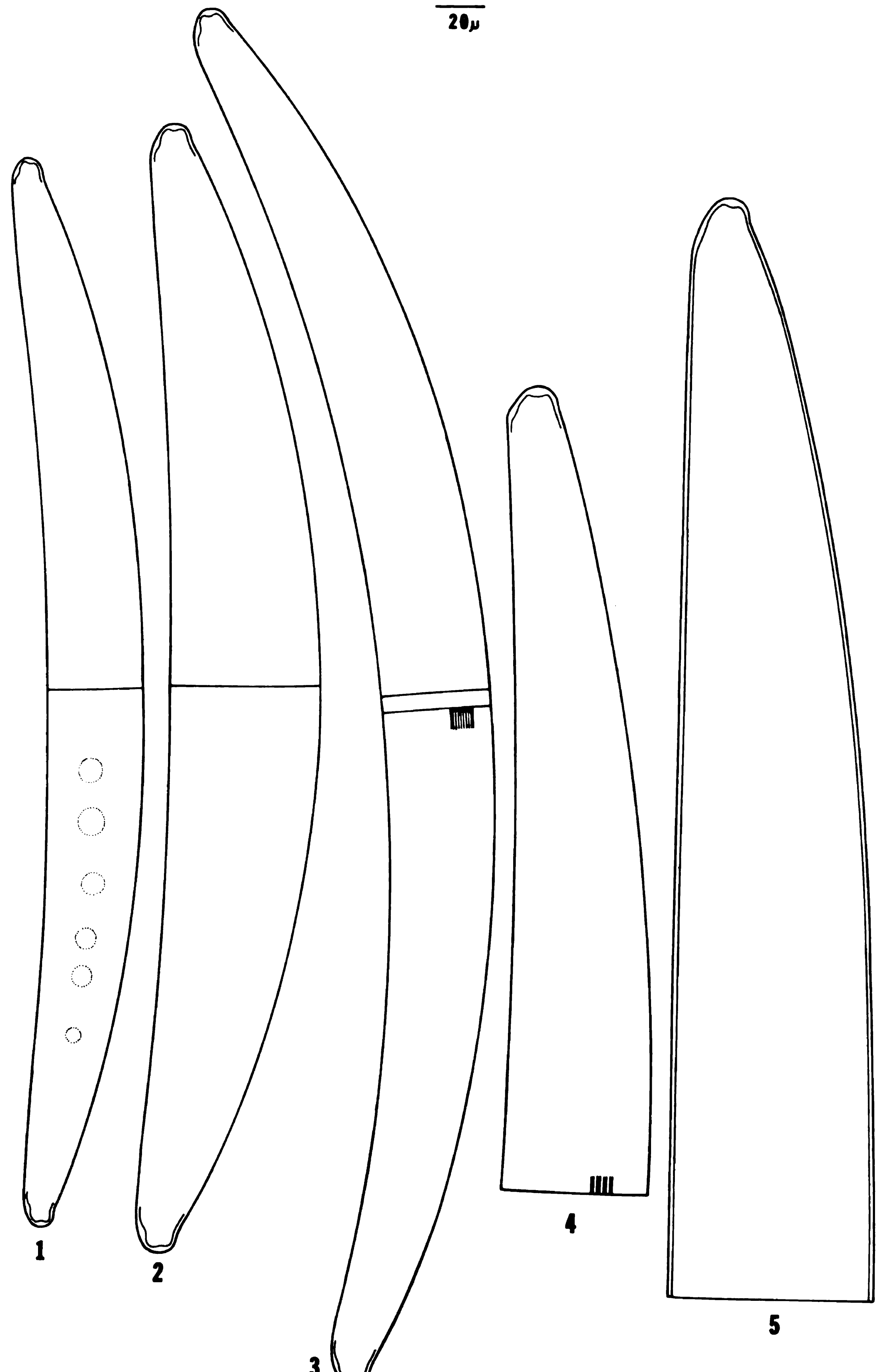


PLATE 20

CLOSTERIUM

PLATE 20

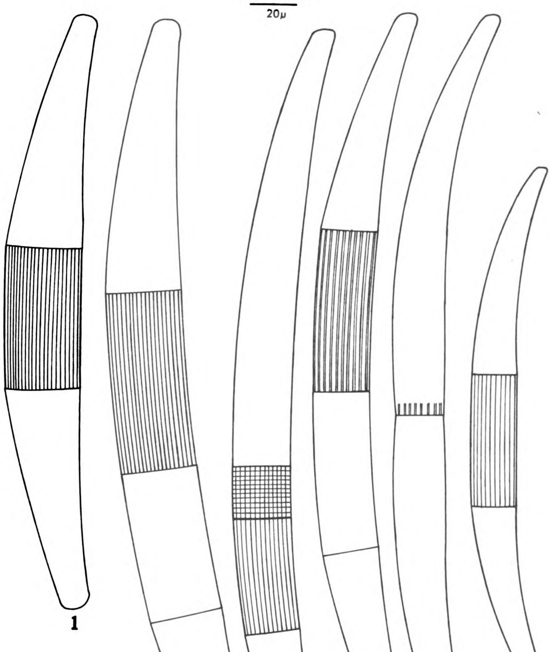


PLATE 21

CLOSTERIUM

Figs. Page

1,2. Cl. abruptum 91
1- Mt62-13
2- Mt63-274

3,14. Cl. juncidum var. brevius 109
3,14- Mt63-155

4,5. Cl. juncidum var. juncidum 109
4- Mt63-30
5- 86

6. Cl. macilentum var. macilentum morpha 117
6- Mt63-114

7. Cl. macilentum var. macilentum 116
7- Mt63-77

8,9. Cl. macilentum var. substriatum 117
8- Mt63-450
9- Mt62-13

10,12, 13. Cl. ulna var. ulna 135
10- Mt63-164
12- Mt63-396
13- Mt63-164

11. Cl. ulna var. recurvatum 135
11- Mt63-186

15. Cl. praelongum var. praelongum fa. brevior 122
15- Mt63-34

16,17. Cl. praelongum var. praelongum fa. praelongum 122
16- Mt63-170
17- Mt63-270

18. Cl. praelongum var. praelongum fa. elongatum 122
18- Mt63-188

PLATE 22

CLOSTERIUM

Figs. Page

1,2. *Cl. ralfsii* var. *kriegeri* (=*Cl. attenuatum*) 126
1- Mt63-77 (plus enlarged apical region)
2- Mt63-90

3. *Cl. braunii* 98
3- Mt63-77

4,5. *Cl. baillyanum* var. *baillyanum* 97
4- Mt63-443
5- Mt63-148 (plus enlarged apical region)

6. *Cl. baillyanum* var. *alpinum* 98
6- Mt63-155

PLATE 23

CLOSTERIUM

PLATE 23

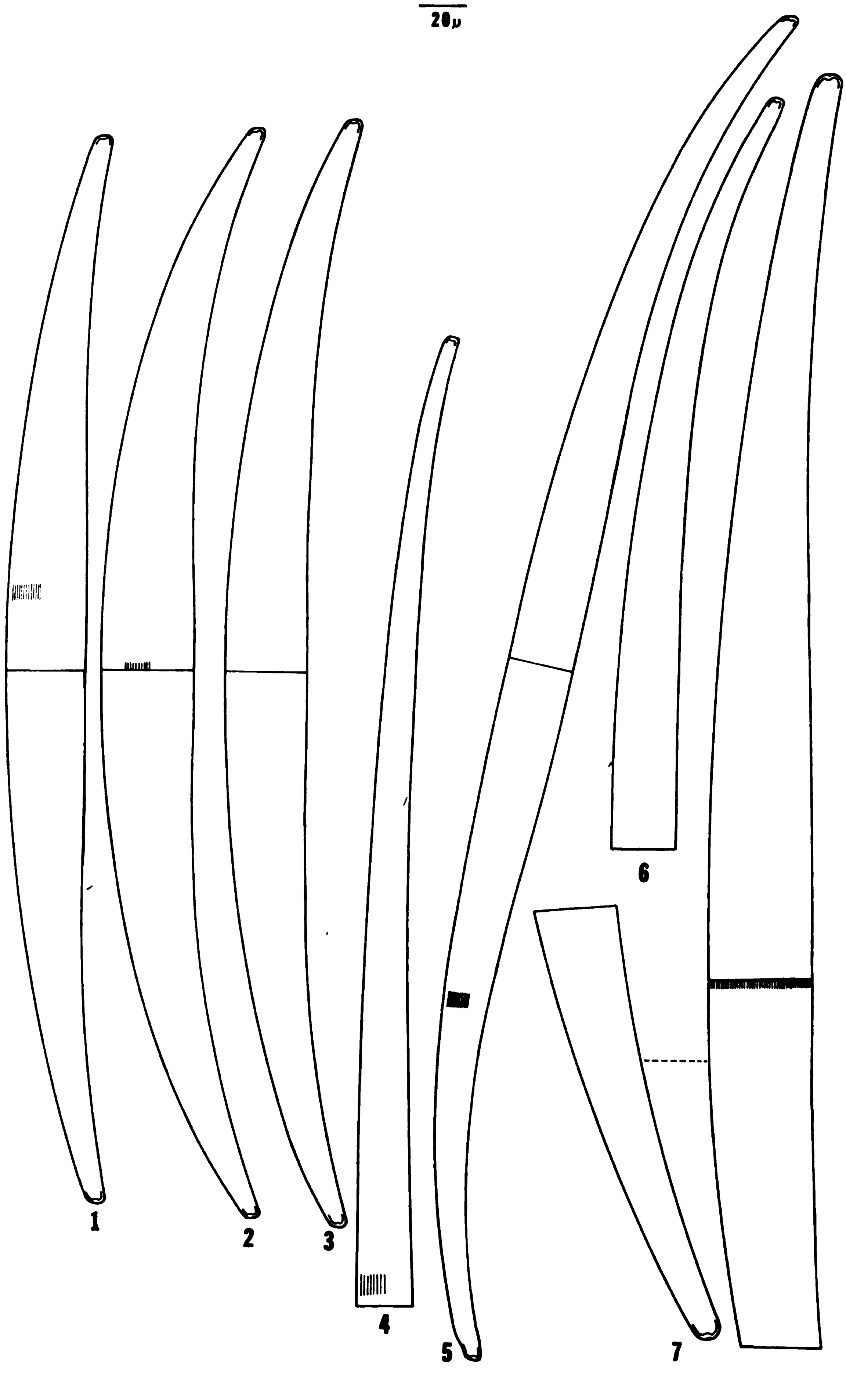


PLATE 24

CLOSTERIUM

Figs.		Page
1.	_Cl_. _rostratum_ 1-6mon38	127
2.	_Cl_. _kuetzingii_ 2-6Mon35	110
3. 7.	_Cl_. _setaceum_ 3-Mt63-249 7-Mt63-156	127
4,5. 6,8.	_Cl_. _costatum_ var. _costatum_ .... 4-Mt63-197 5-Mt62-58 6-Mto3-114 (with enlarged apical region) 8-Mt63-77 (with enlarged apical region)	100
9.	_Cl_. _costatum_ var. _westii_ 9-Mt63-324	100
10.	_Cl_. _angustatum_ var. _borgensii_ 10-Mt63-451	96
11.	_Cl_._angustatum_ var. _angustatum_ 11-Mt63-450	95
12.	_Cl_. _angustatum_ var. _gracile_ f. _gracile_............... 12-Mt63-156	96
13.	_Cl_. _angustatum_ var. _gracile_ f. _elongatum_ 13-Mt62-13	96

PLATE 24

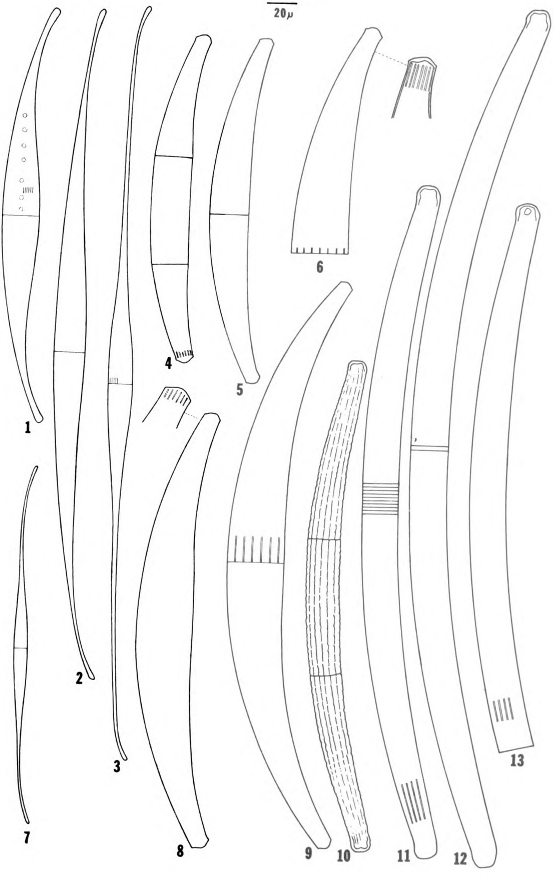


PLATE 25

CLOSTERIUM

PLATE 25

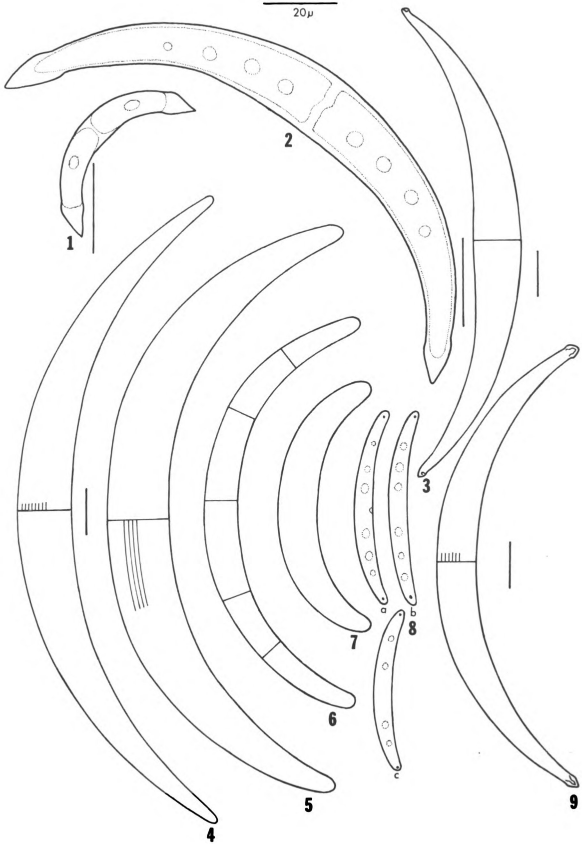
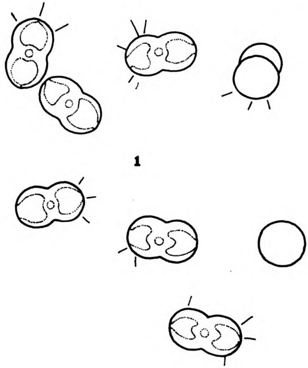


PLATE 26

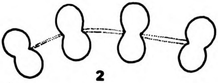
COSMOCLADIUM, SPINOCLOSTERIUM

PLATE 26

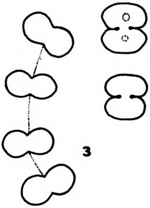
20μ



1

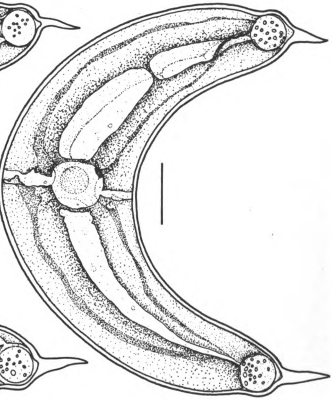


2



3

4



5

PLATE 27

PLEUROTAENIUM

PLATE 27

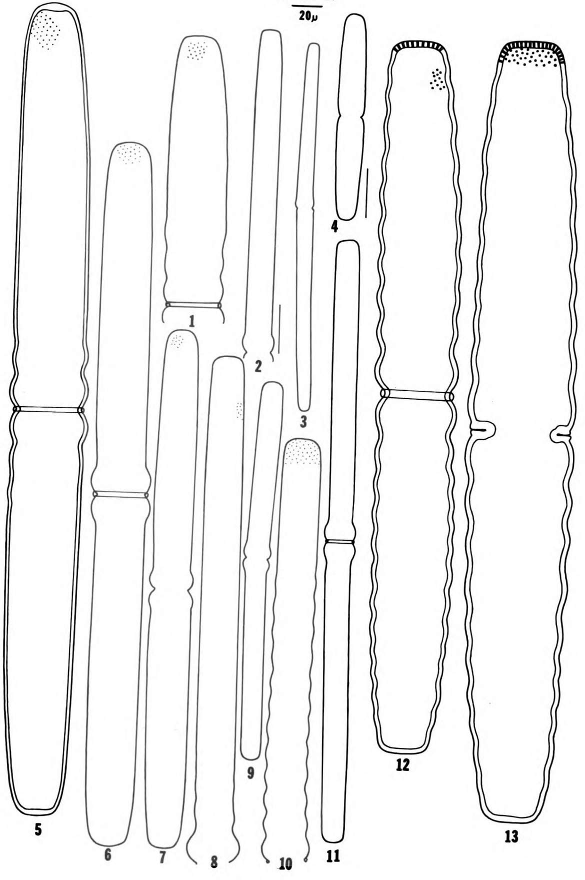


PLATE 28

<u>PLEUROTAENIUM</u>, <u>TRIPLOCERAS</u>

PLATE 28

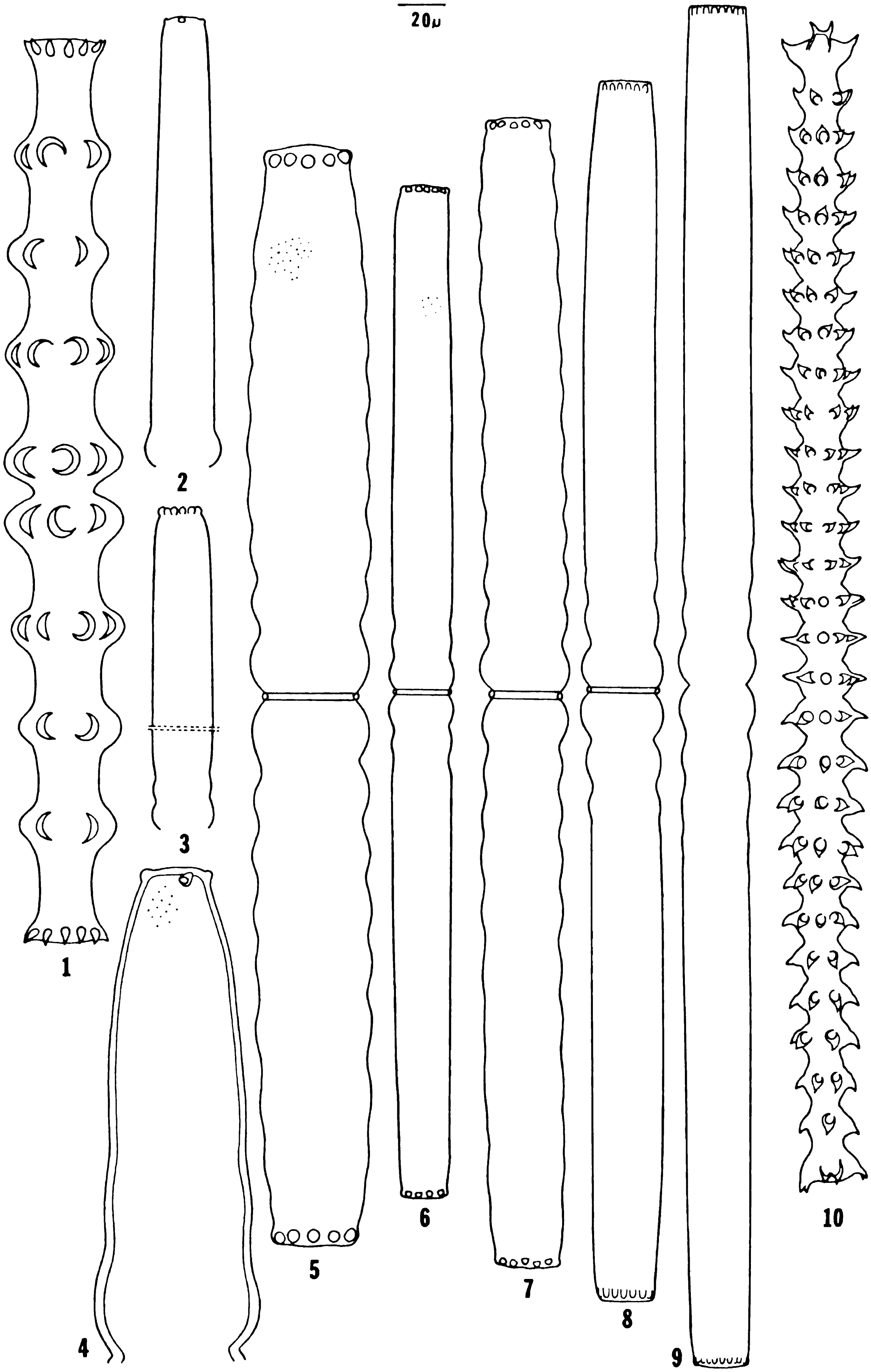


PLATE 29

TETMEMORUS

PLATE 29

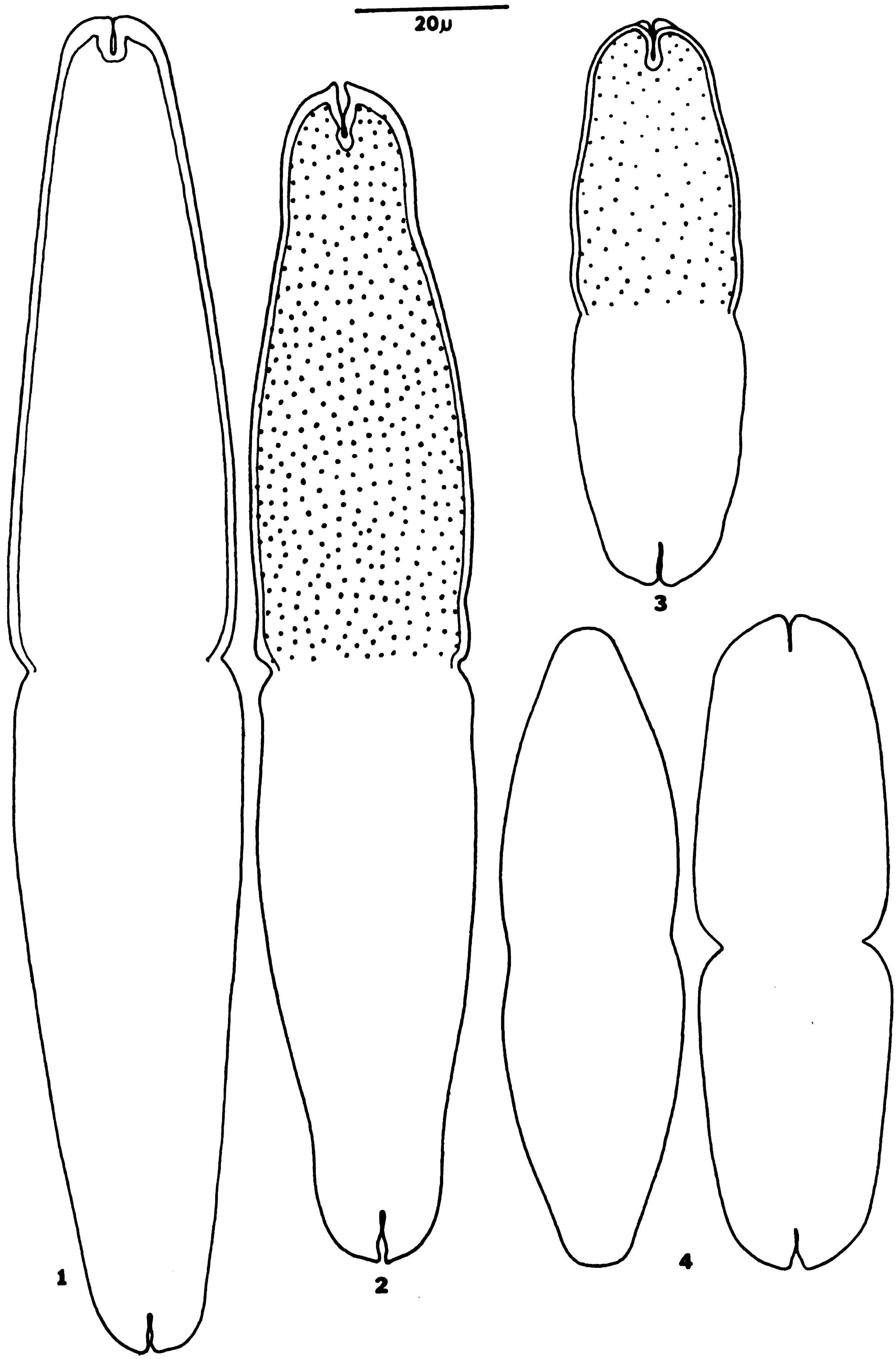
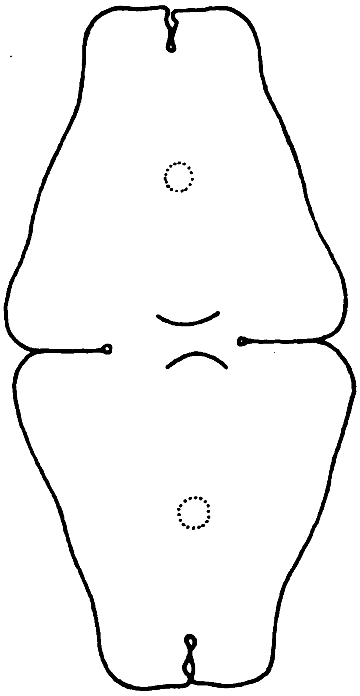


PLATE 30

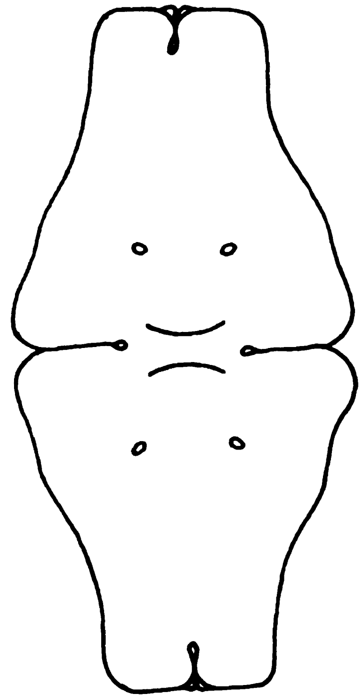
EUASTRUM

PLATE 30

20µ



1



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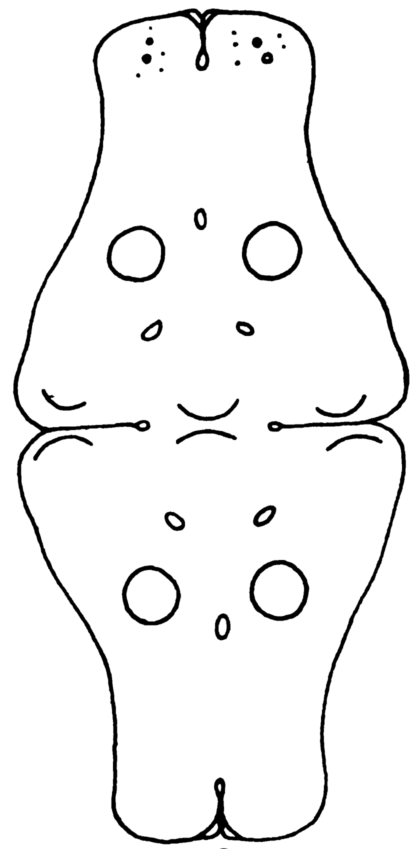

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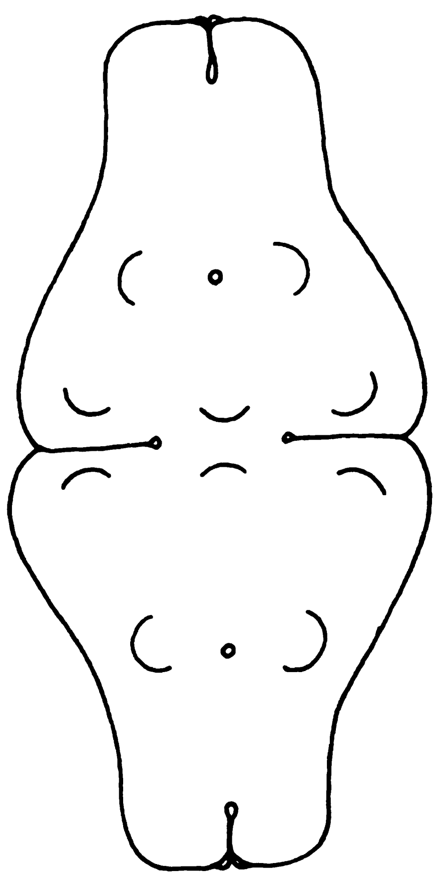

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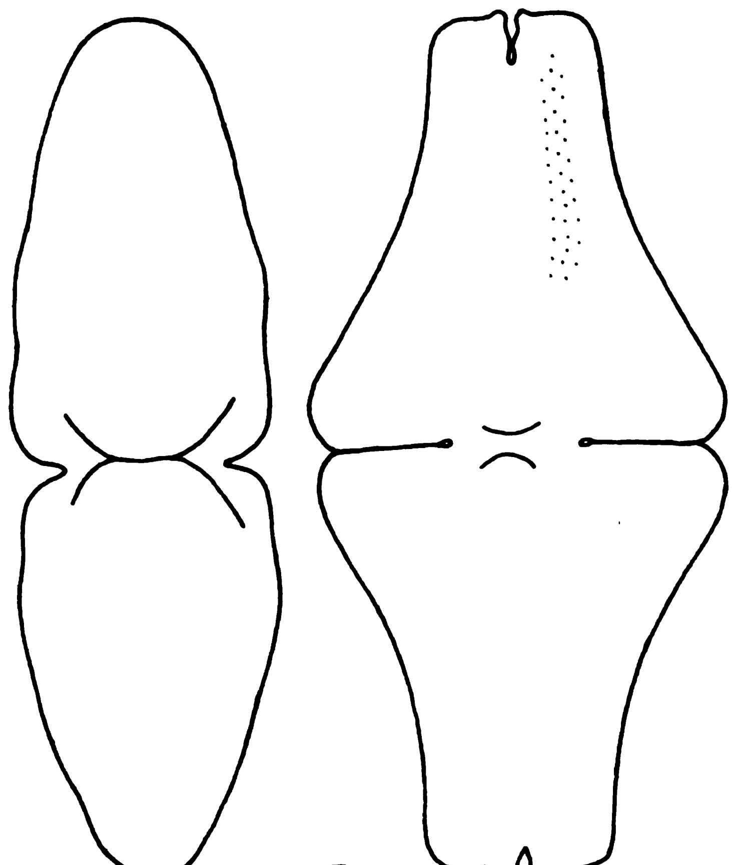


5

PLATE 31

EUASTRUM

PLATE 31

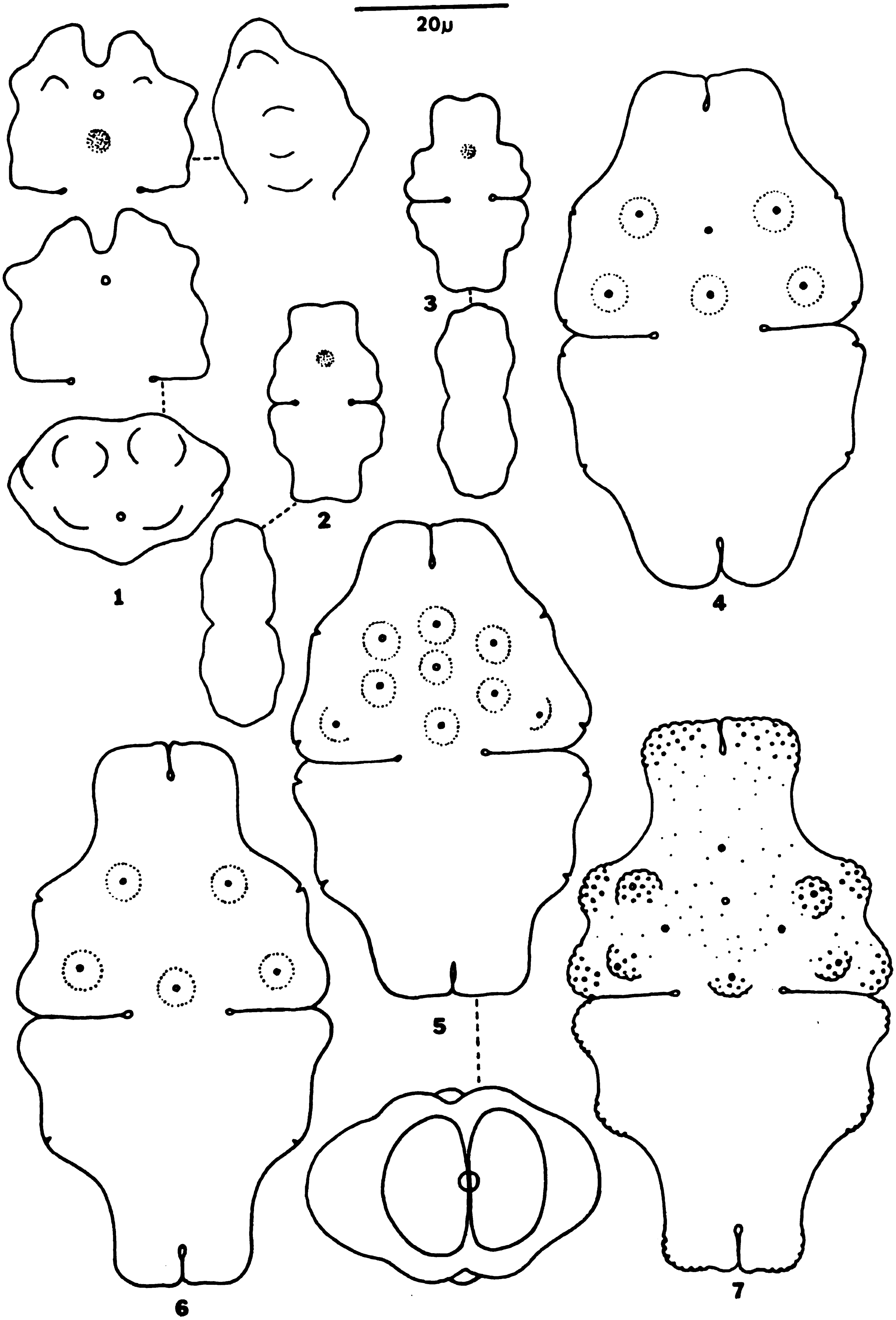


PLATE 31

EUASTRUM

PLATE 31

20μ

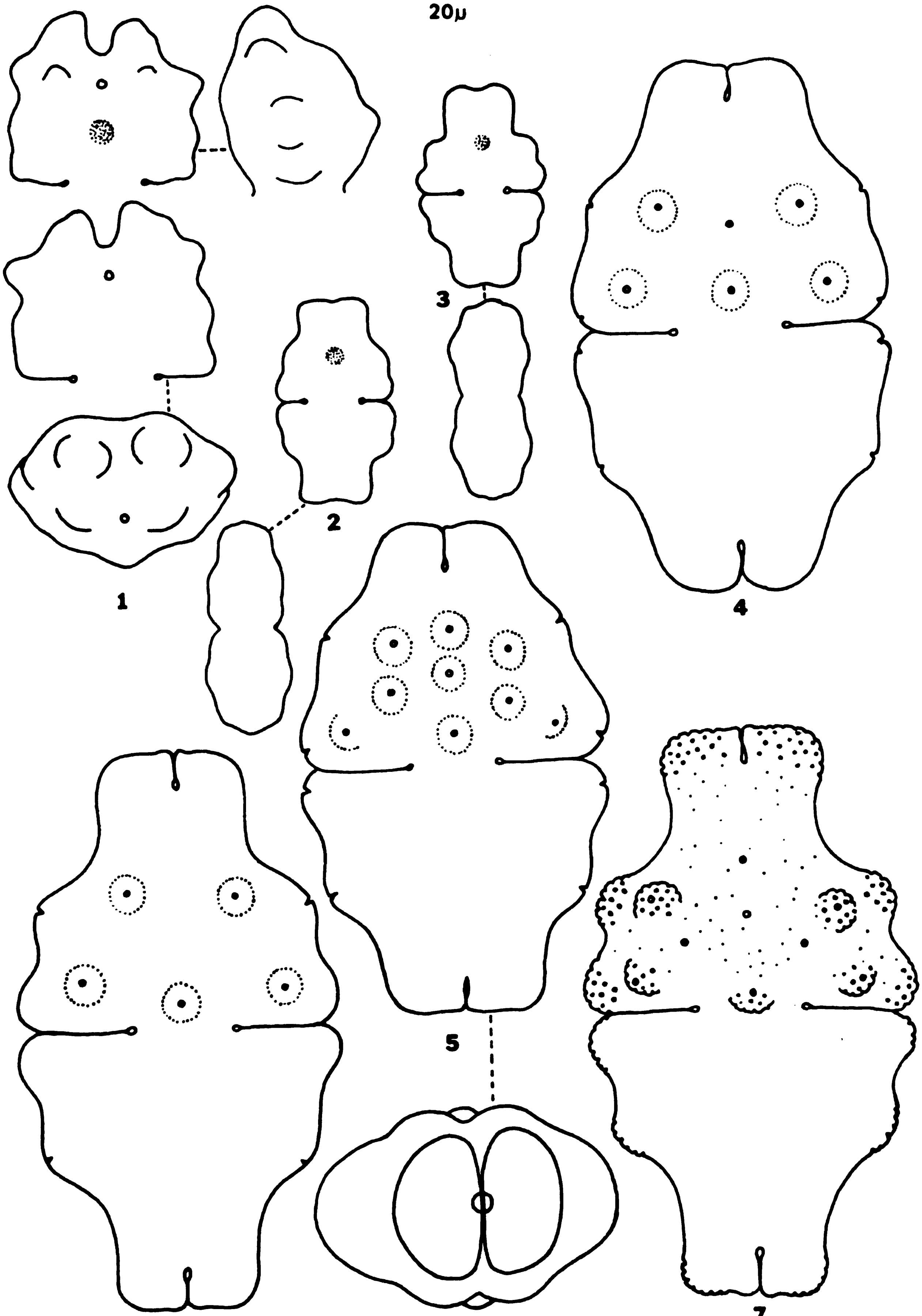


PLATE 32

EUASTRUM

Figs. Page

1. *E.* *crassum* var. *crassum* 163
   1-Mt.62-15

2. *E.* *crassum* var. *tumidum* 164
   2- Mt63-260

3. *E.* *crassum* var. *tumidum* fa. *suboblongum* 164
   3- Mt63-260

PLATE 32

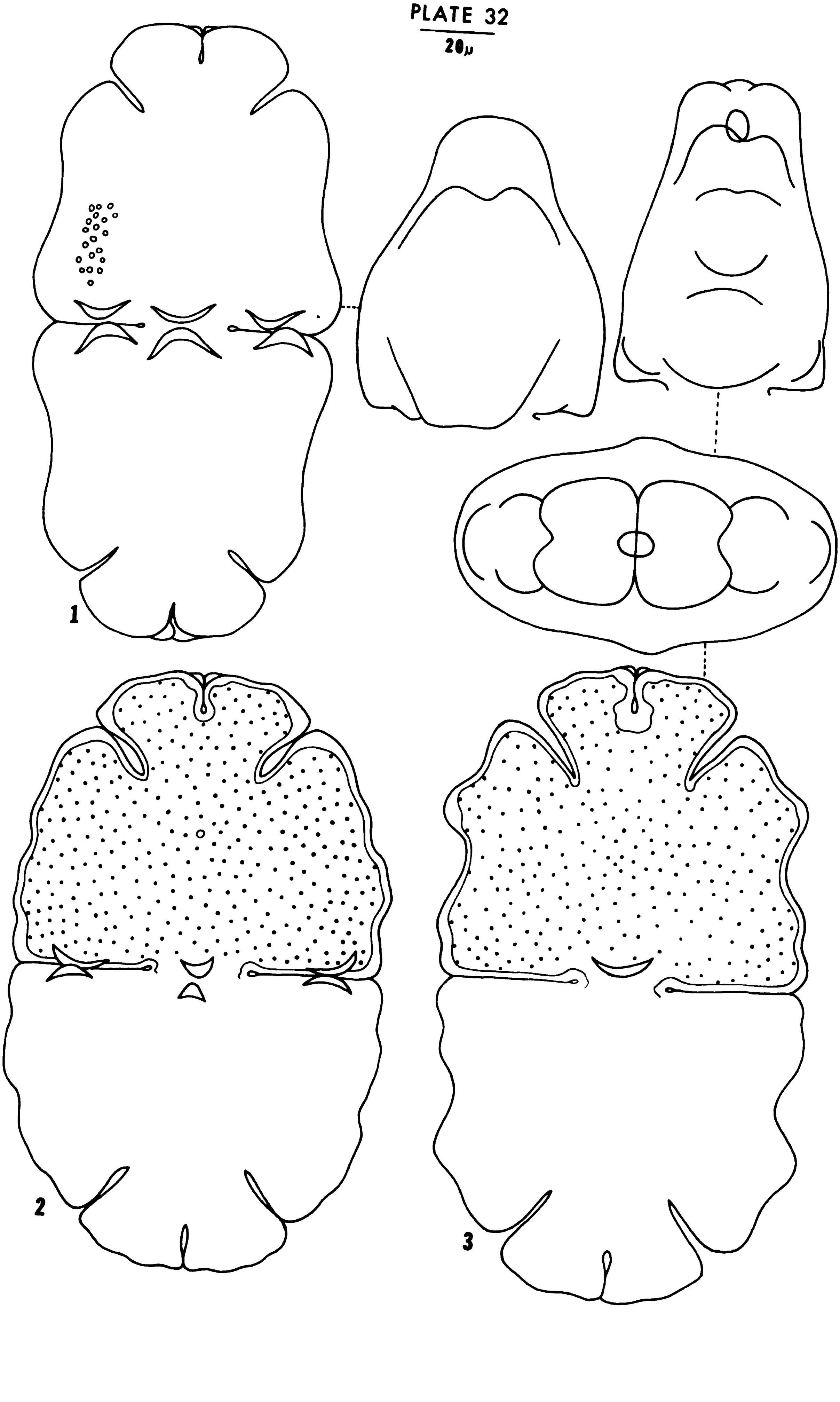


PLATE 33

EUASTRUM

Figs. Page

PLATE 33

20μ

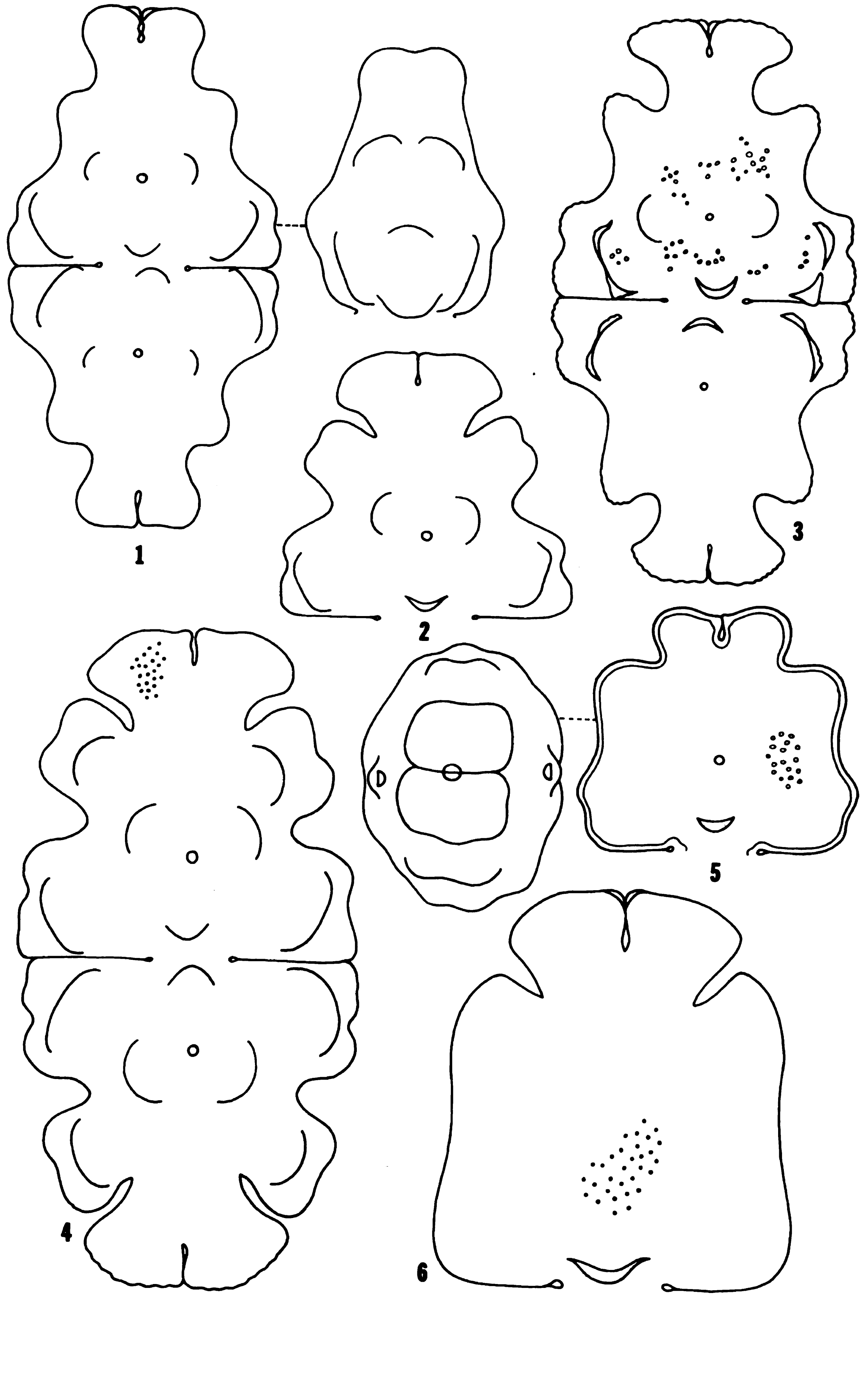


PLATE 34

EUASTRUM

PLATE 34

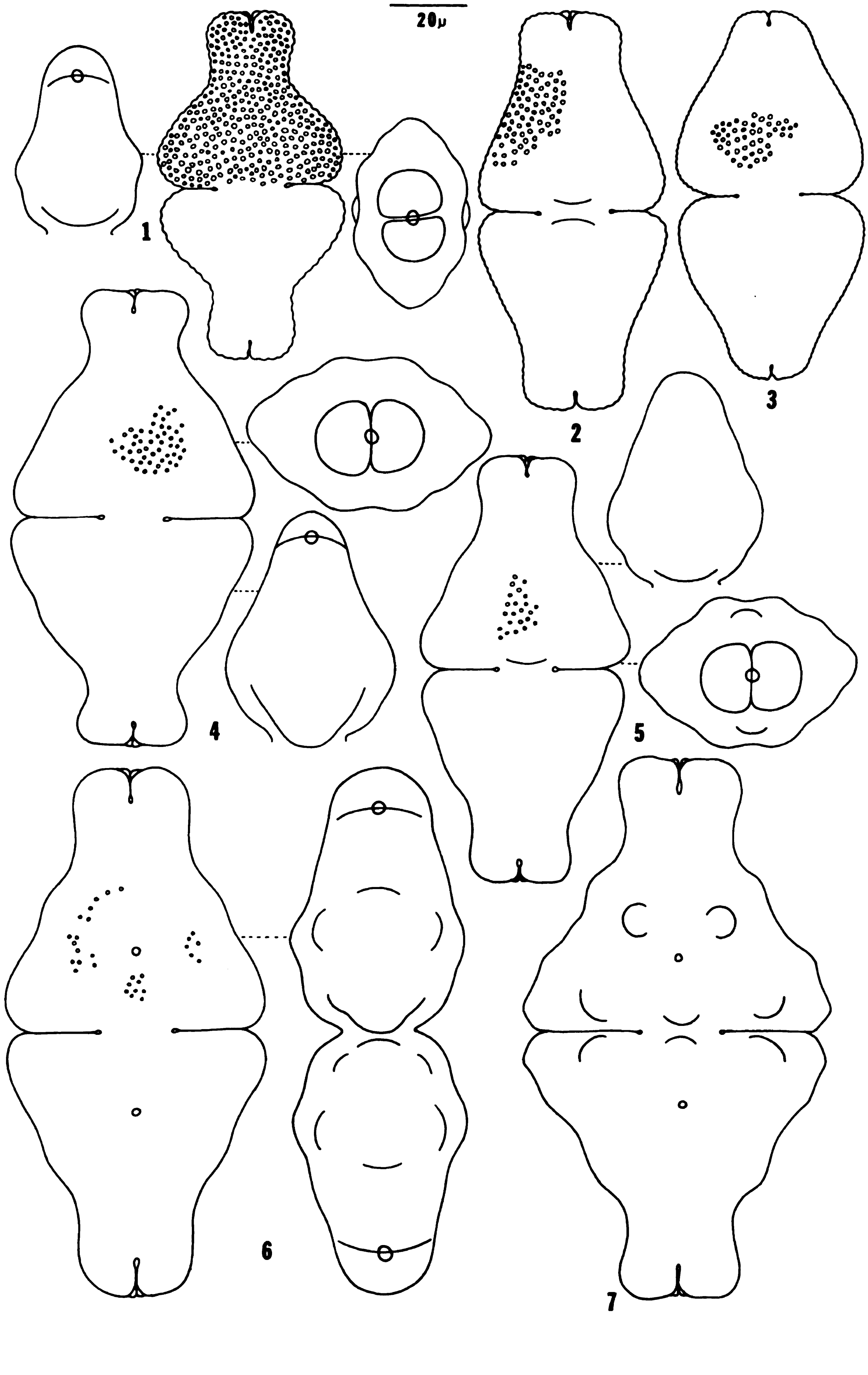
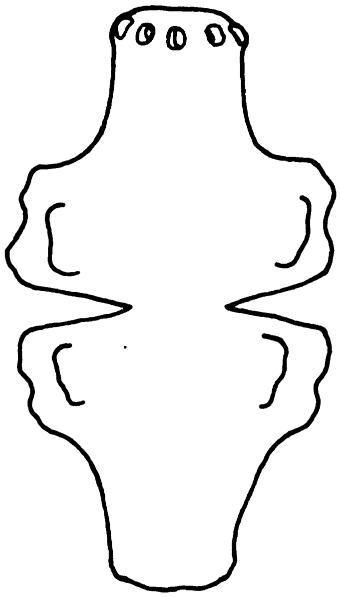


PLATE 35

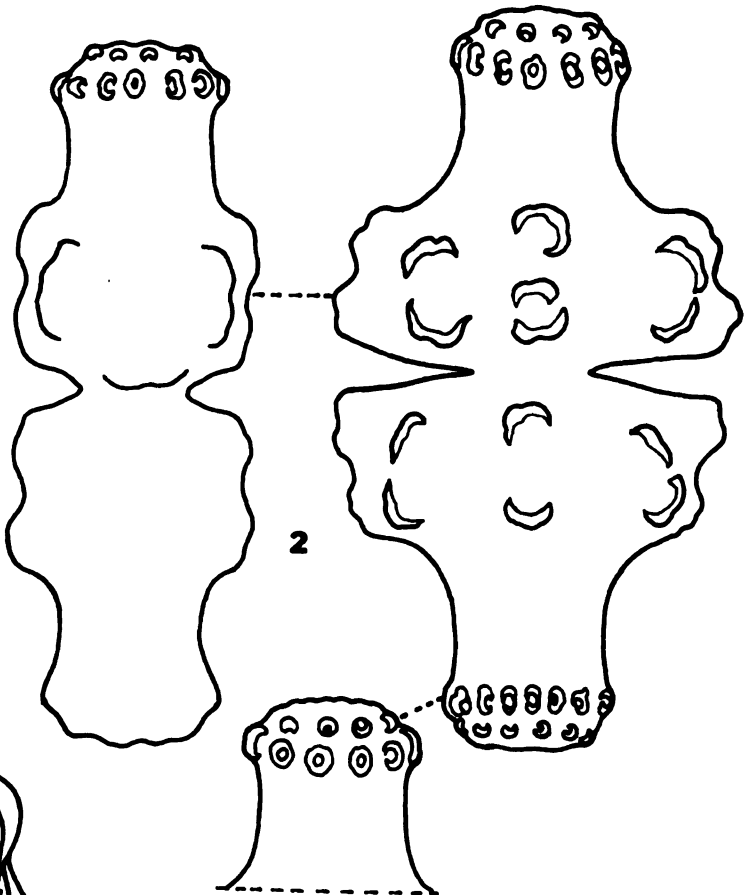
EUASTRUM

PLATE 35

20µ



1



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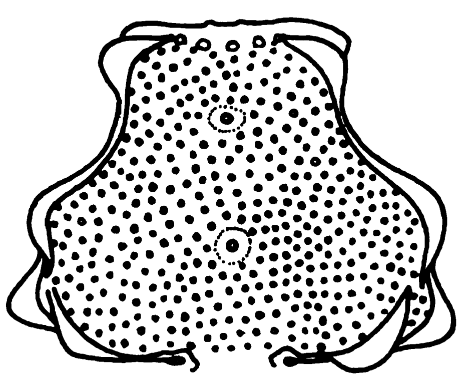

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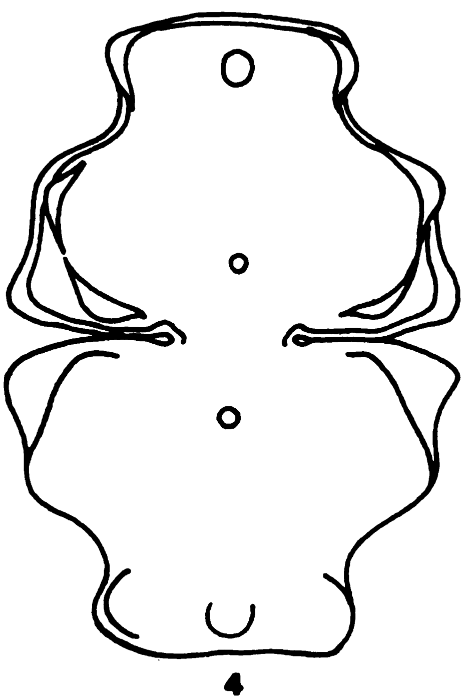

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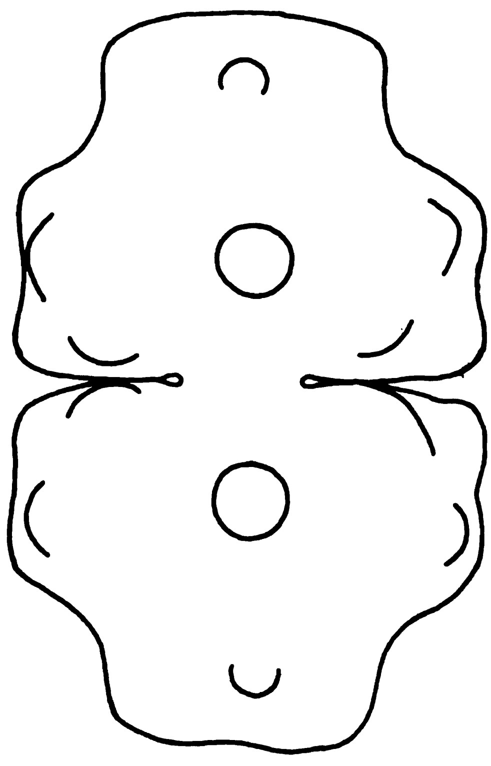


5

Figs. page

PLATE 36

EUASTRUM

Figs.		Page
1.	*E. validum* .... 1 - Mt63-188	182
2,3.	*E. montanum* .... 2,3 - Mt63-261	179
4.	*E. prescottii* .... 4 - Mt63-500	178
5.	*E. binale* fa. *minor* .... 5 - Mt63-399	162
6.	*E. insulare* var. *insulare* .... 6 - Mt63-419	176
7.	*E. insulare* var. *silesiacum* .... 7 - Mt63-154	177
8.	*E. binale* fa. *hians*.... .... 8 - Mon4182	162
9.	*E. binale* fa. *gutwinskii*.............................. 9 - Mt63-256	162
10.	*E. luetkemulleri* var. *carniolicum* .... 10 - Mt62-11	178
11.	*E. insulare* var. *basichondrum* .... 11 - Mt63-159	176
12.	*E. insulare* var. *lacustre* .... 12 - Mt63-103	177
13.	*Euastrum* sp. 1 .... 13 - Mt62-72	187
14.	*E. gayanum* .... 14 - Mt62-13	175
15.	*E. luetkemulleri* var. *luetkemulleri* .... 15 - Mt62-11	178
16.	*E. sibricum* .... 16 - Mt63-188	181

PLATE 36

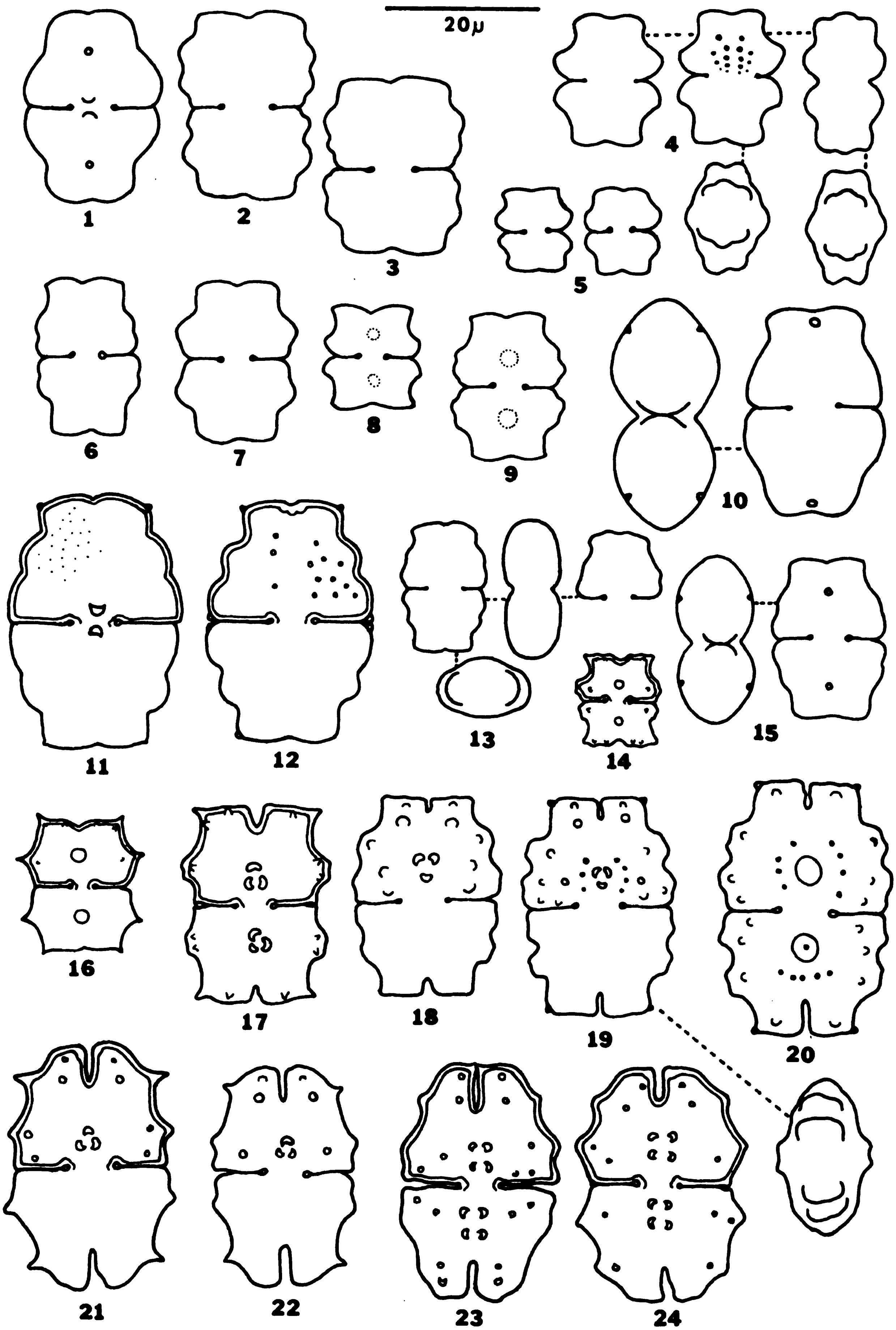


PLATE 37

EUASTRUM

PLATE 37

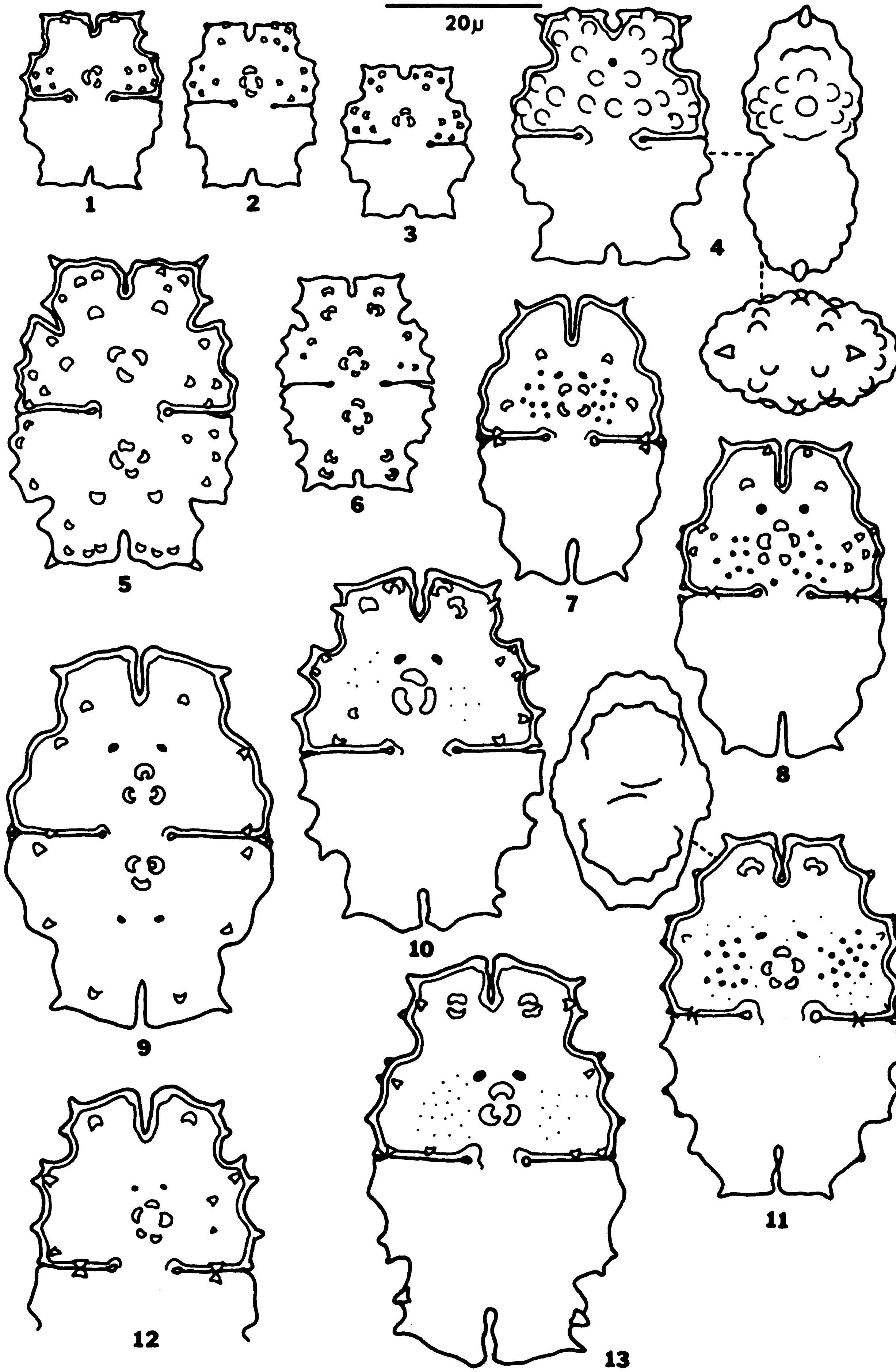


PLATE 38

EUASTRUM

PLATE 38

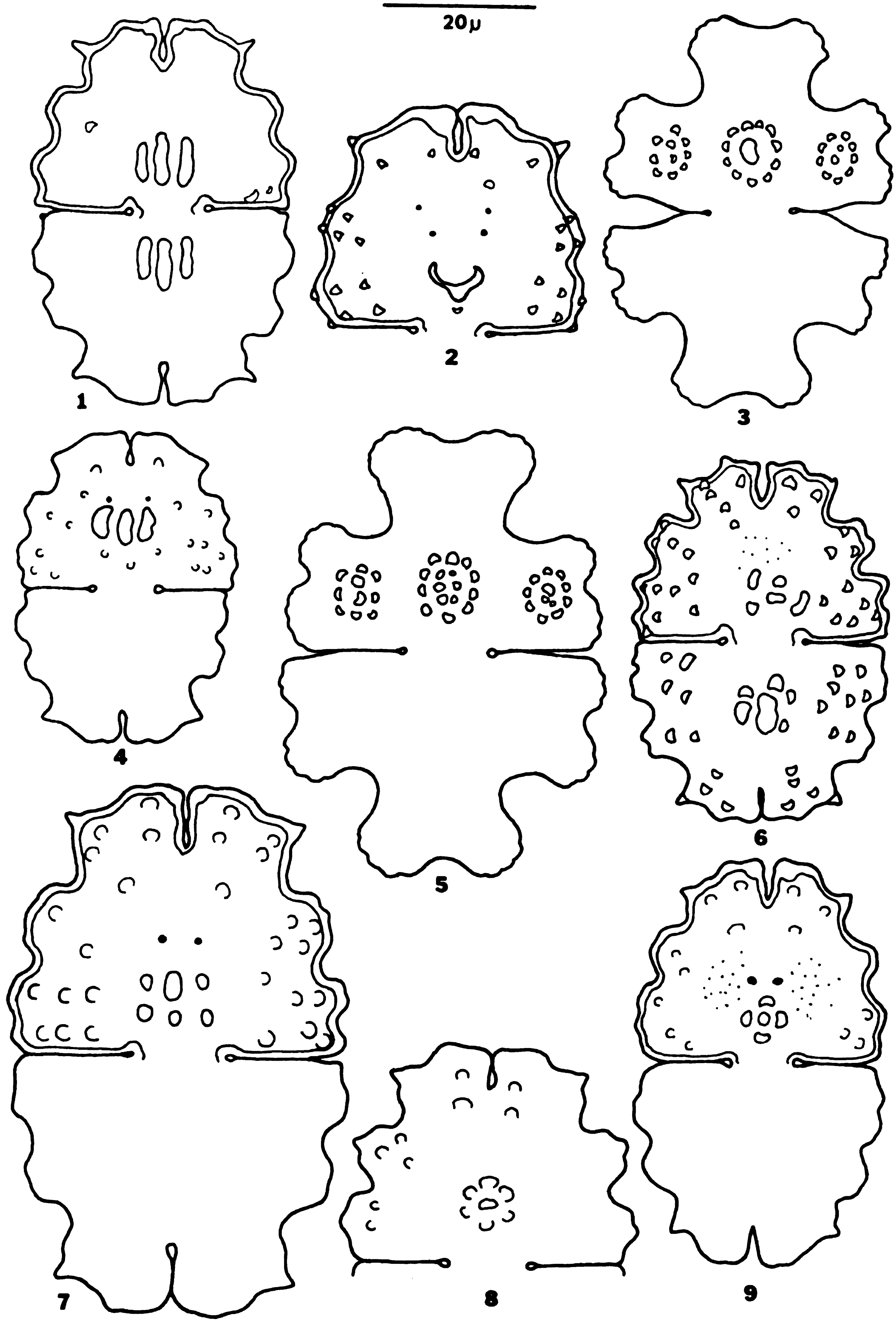
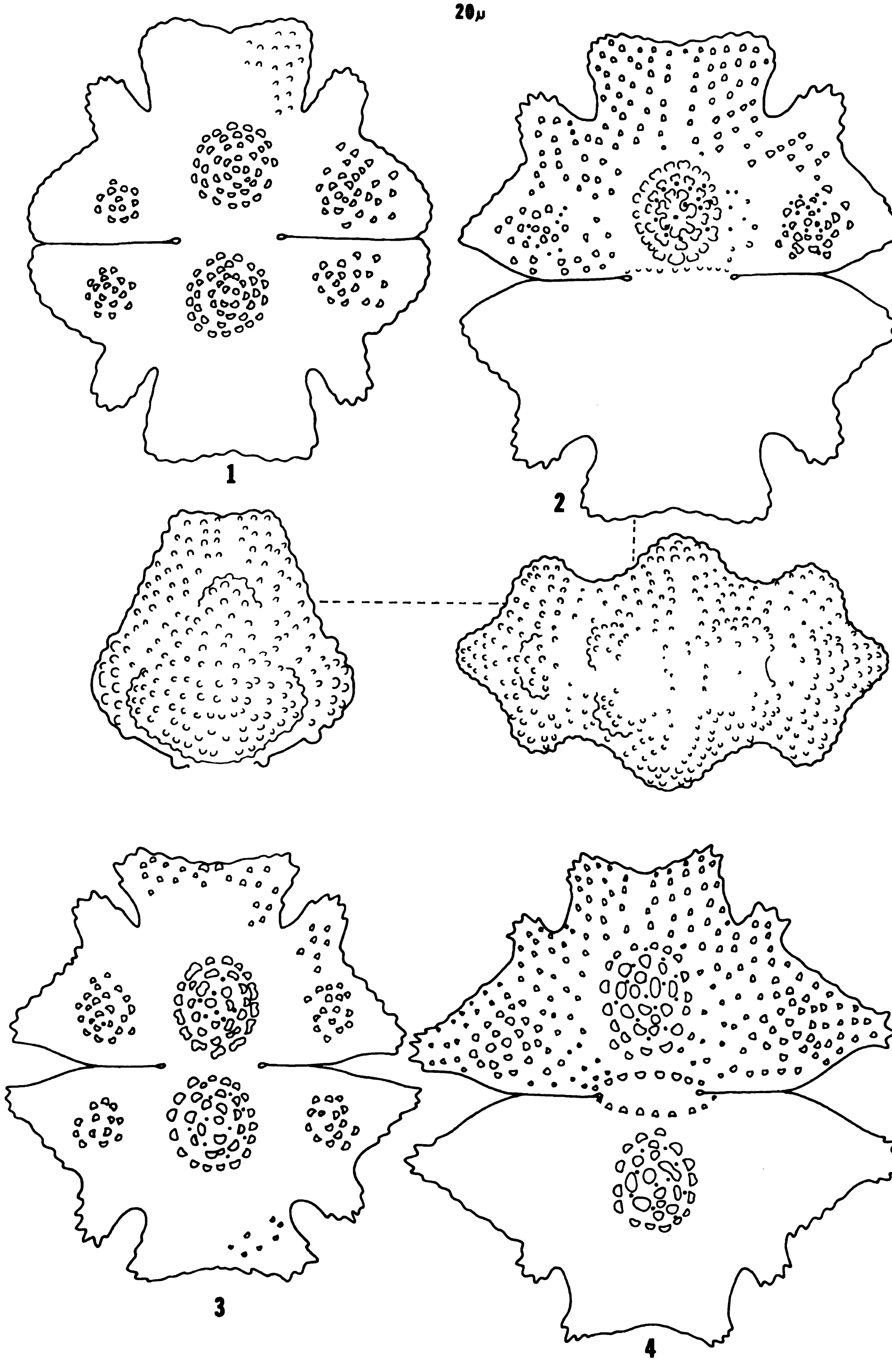


PLATE 39

EUASTRUM

PLATE 39

20μ



1

2

3

4

PLATE 40

EUASTRUM

PLATE 40

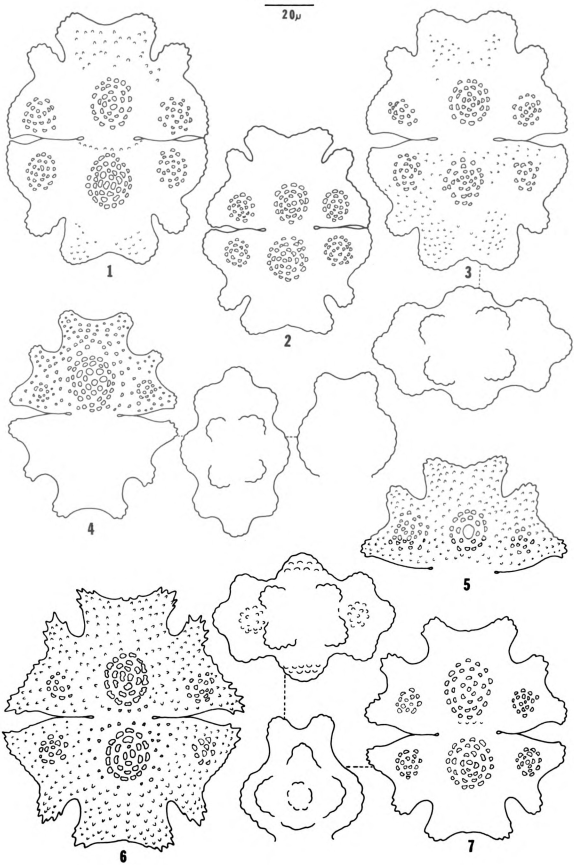


PLATE 41

EUASTRUM

PLATE 41

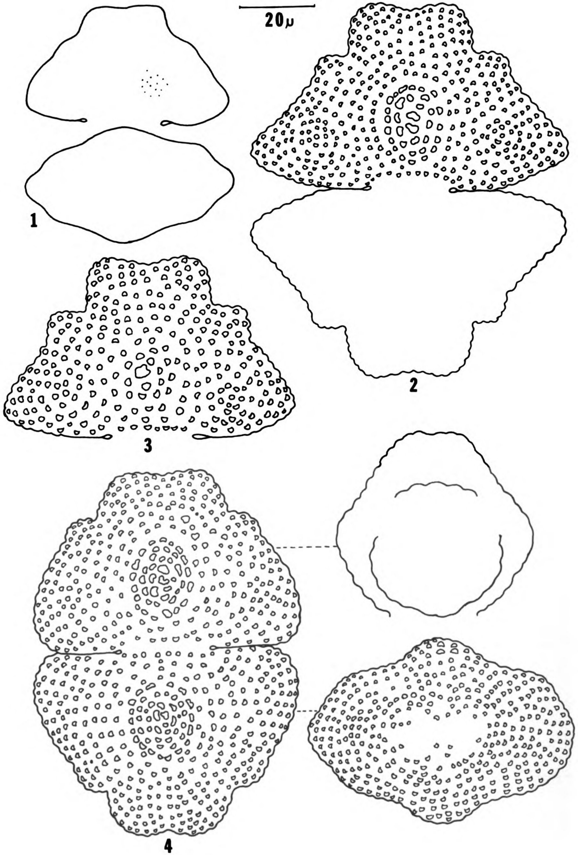


PLATE 42

MICRASTERIAS

PLATE 43

MICRASTERIAS

Figs.		Page
1,2,6.	*M. truncata* var. *uralensis* .... 1,2- Mt63-419 6- Mt62-25 (poorly developed)	205
3,4.	*M. truncata* var. *semiradiata* 3- Mt63-111 4- Mt63-137	205
5.	*M. truncata* var. *neodamens* 5- Mt62-16	205
7,8.	*M. truncata* var. *truncata* 7- Q1 8- Mt63-187	204
9.	*M. truncata* var. *mauricianum* 9- 6Mon38	204

PLATE 43

20μ

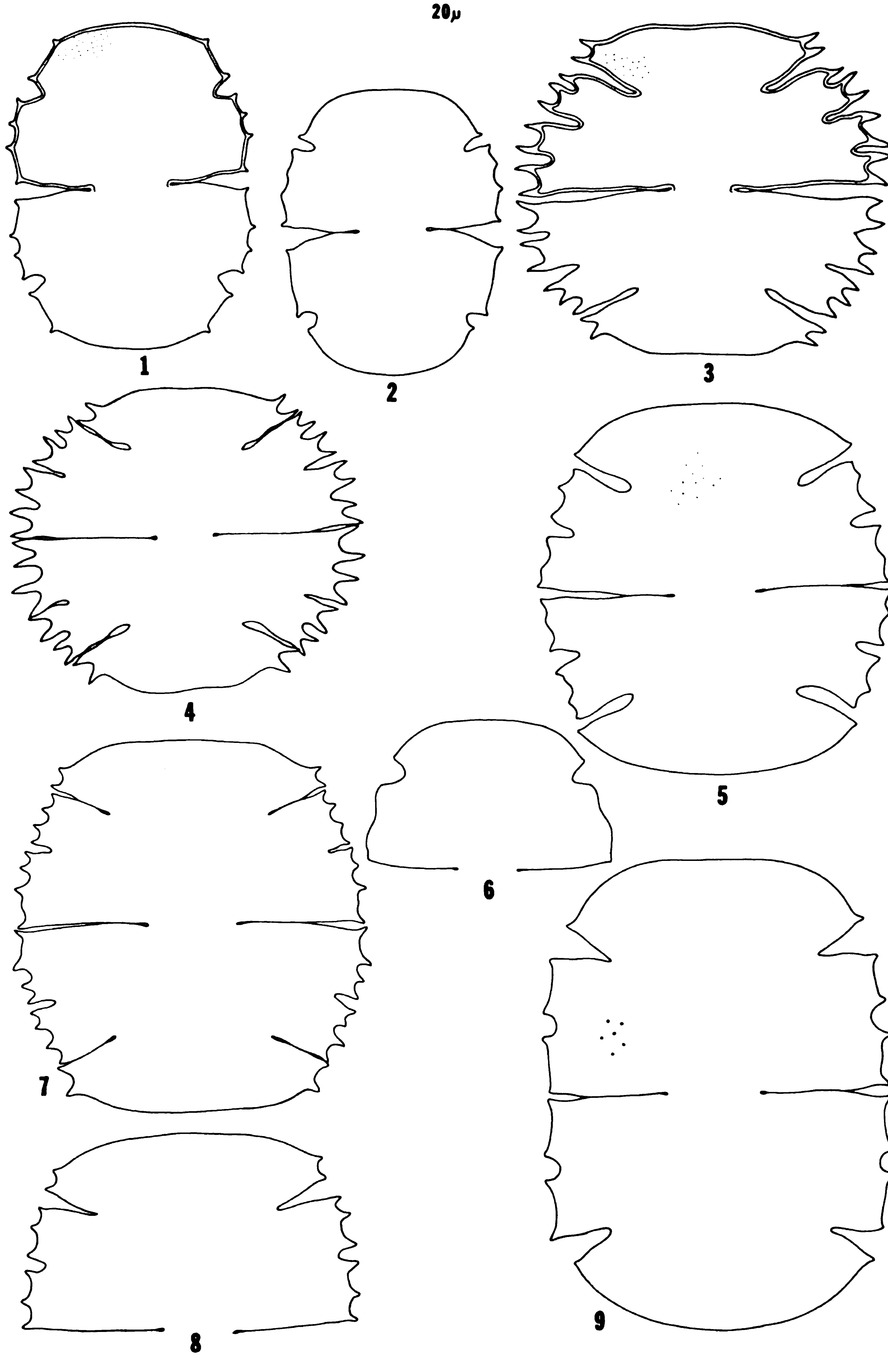


PLATE 44

MICRASTERIAS

Figs. Page

1,3. _M._ _crux-melitensis_ var. _crux-melitensis_ 193
1- Mt63-33
3- Mt63-111

2. _M._ _crux-melitensis_ var. _crux-melitensis_ fa. 193
2- Mt63-142

4. _M._ _decemdantata_ fa. 193
4- Mon4183

5. _M._ _muricata_ 196
5- Mt63-260

6. _M._ _depauperata_ var. _kitchelii_ 194
6- Mt63-260

PLATE 44

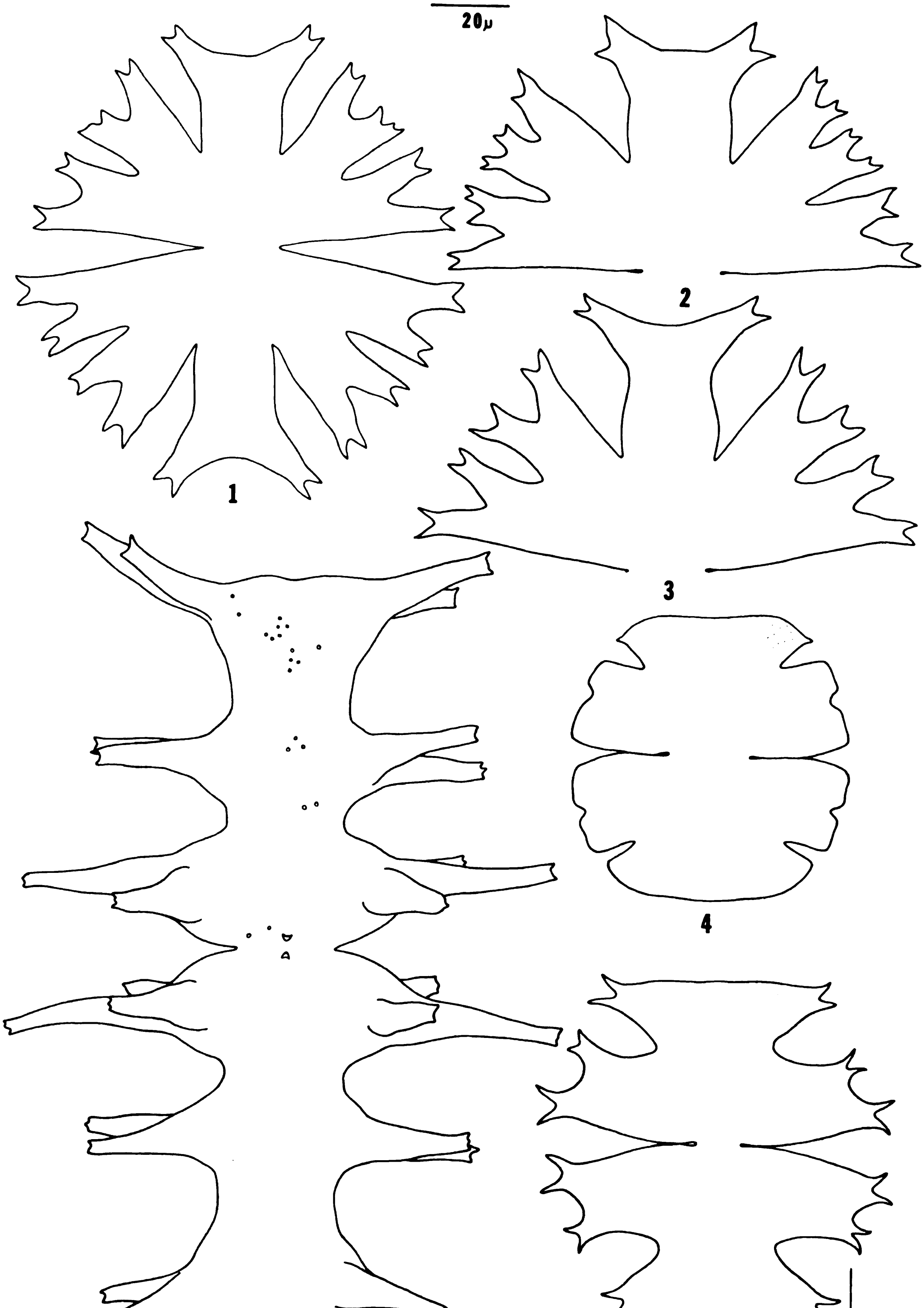
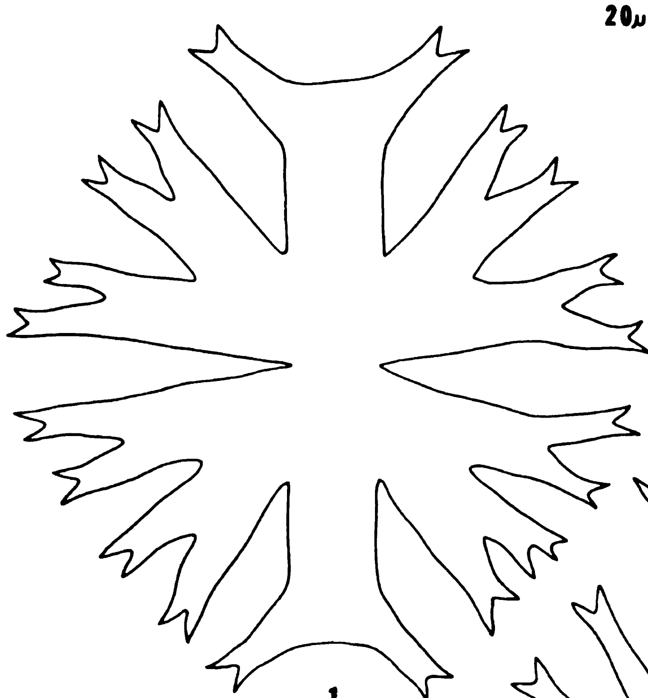


PLATE 45

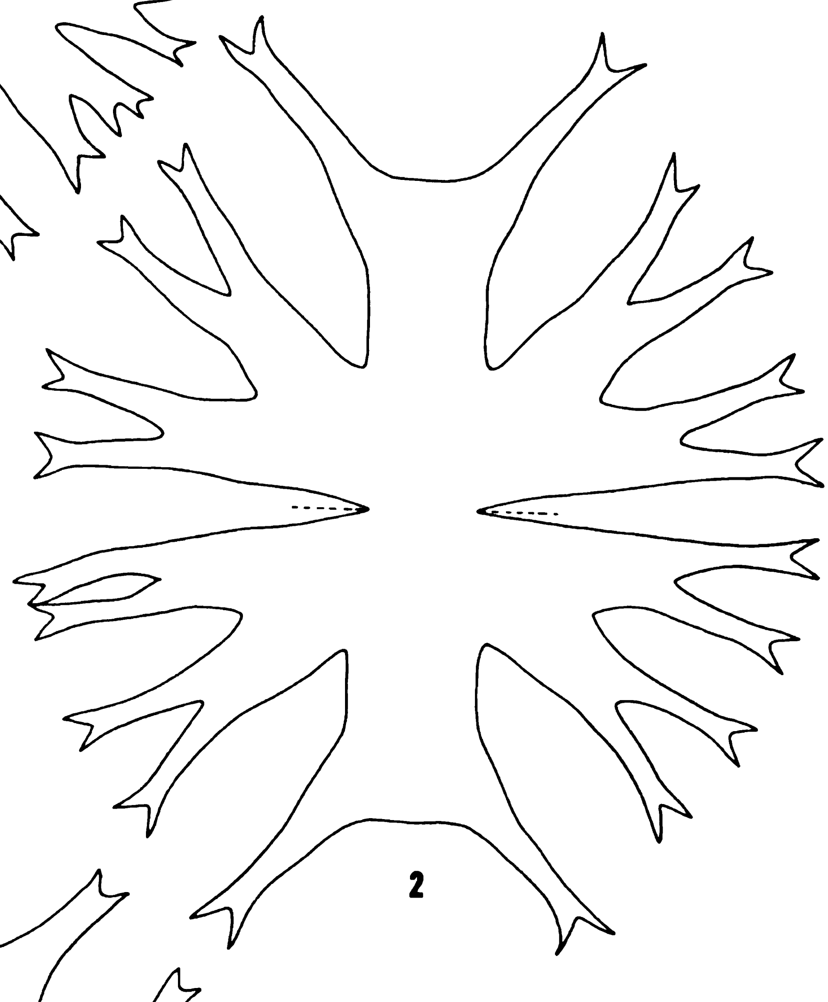
MICRASTERIAS

PLATE 45

20μ



1



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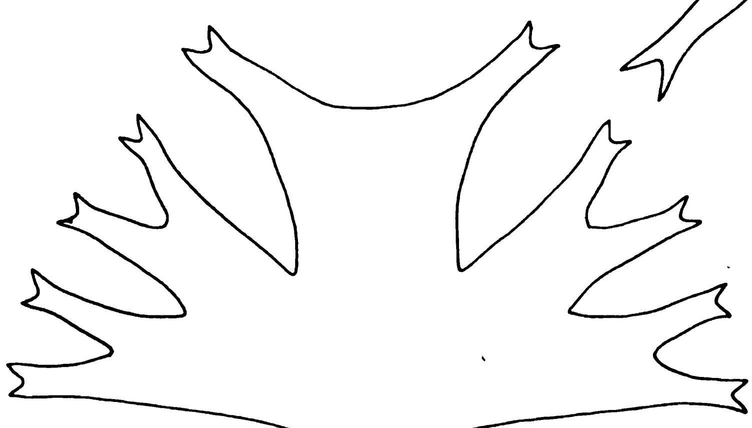


3

PLATE 46

MICRASTERIAS

PLATE 46

20μ

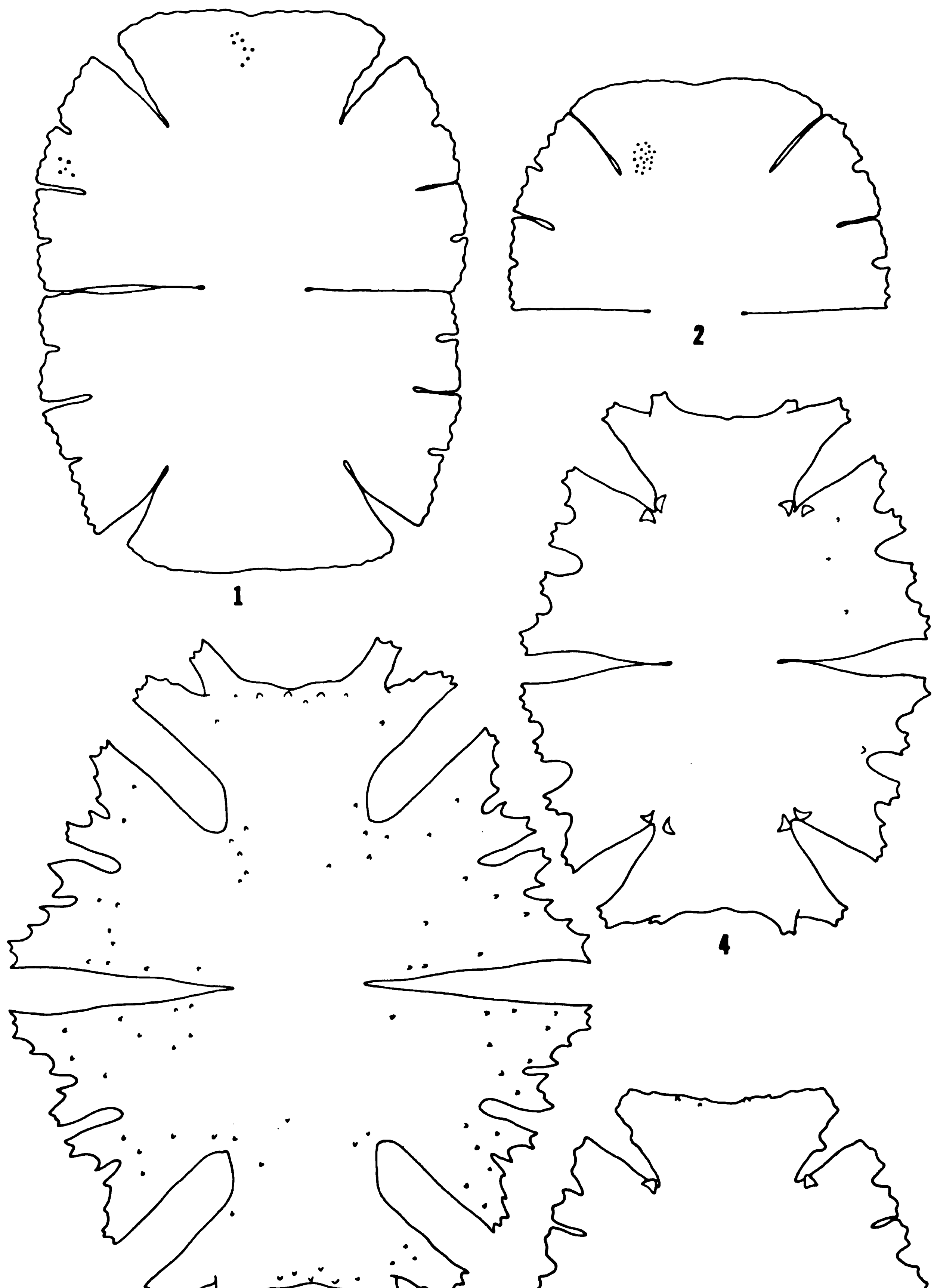


PLATE 47

MICRASTERIAS

Figs. Page

1. M. americana var. americana 188
   1- Mt63-302

2,3,4, M. americana (=var. nova?) 189
5,6,7.
   2- Mt63-67
   3- Mt63-339
   4- Mt63-451
   5- Mt63-176
   6- Mt62-5
   7- Mt63-206

PLATE 47

20μ

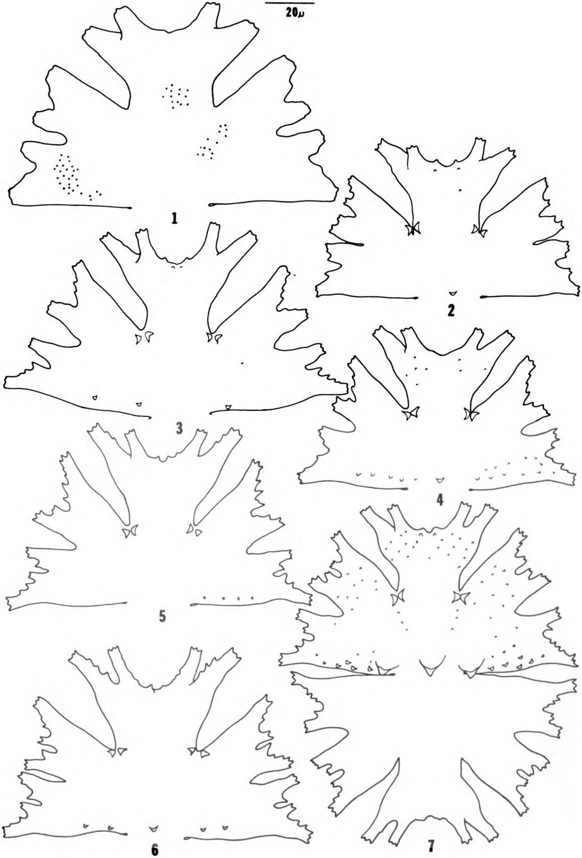


PLATE 48

MICRASTERIAS

PLATE 48

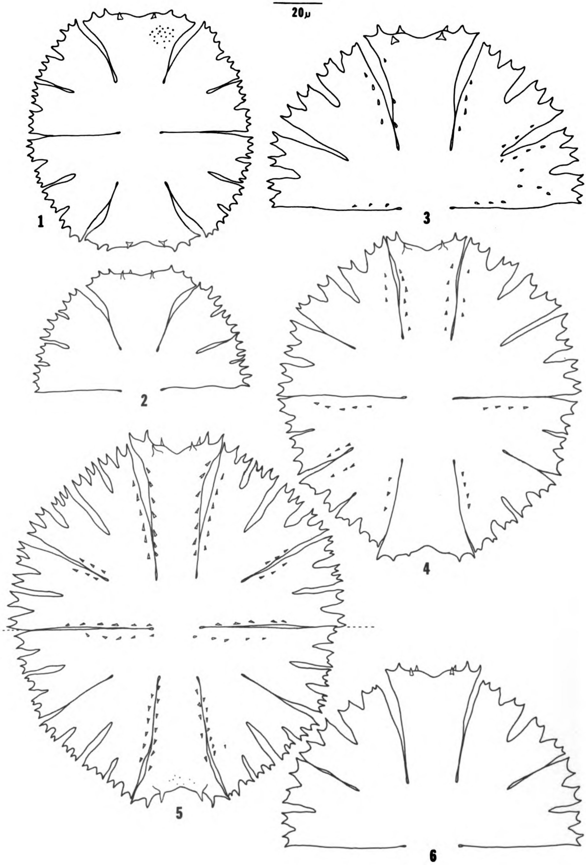


PLATE 49

MICRASTERIAS

PLATE 49

20μ

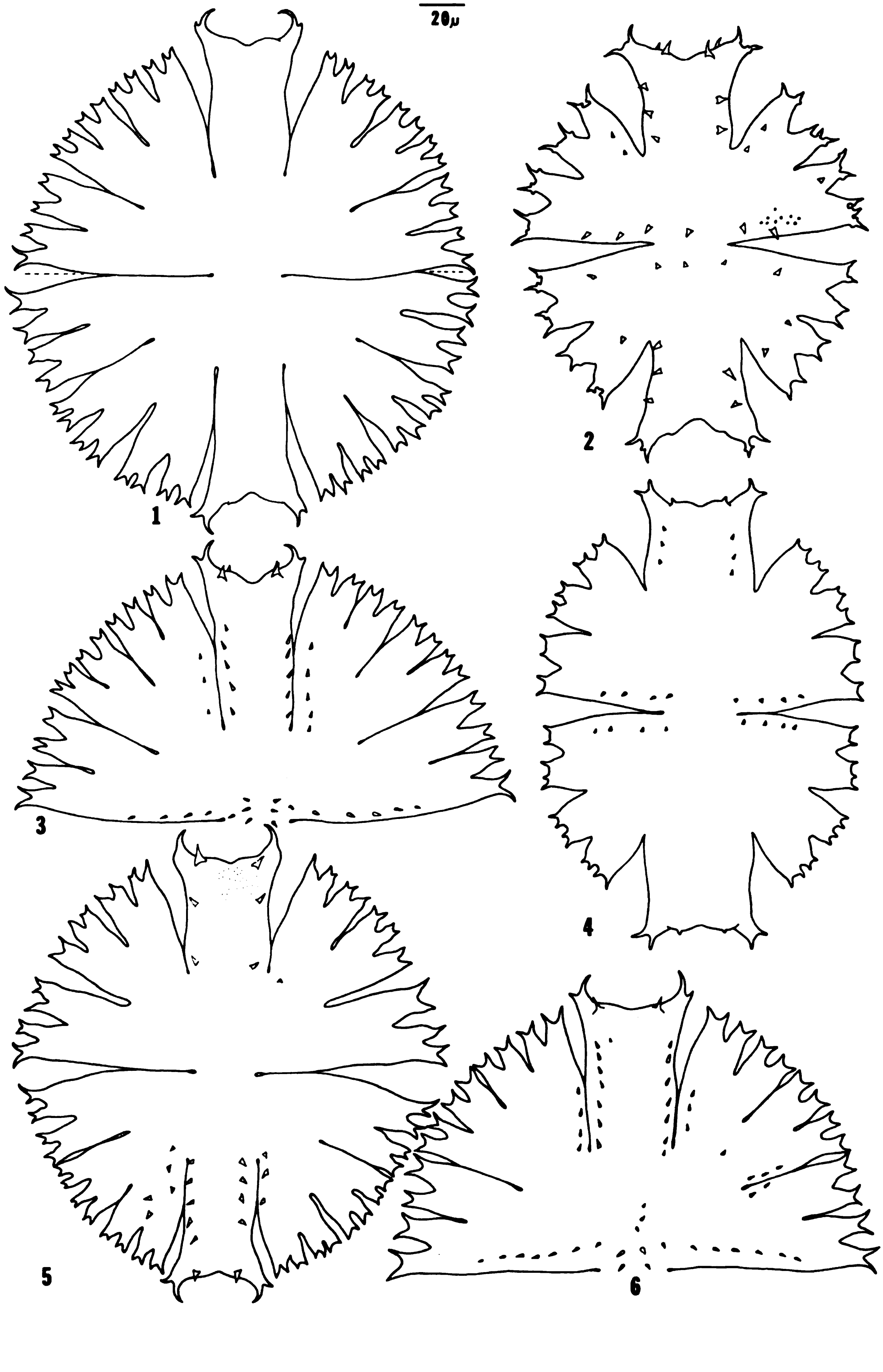


PLATE 50

MICRASTERIAS

PLATE 50

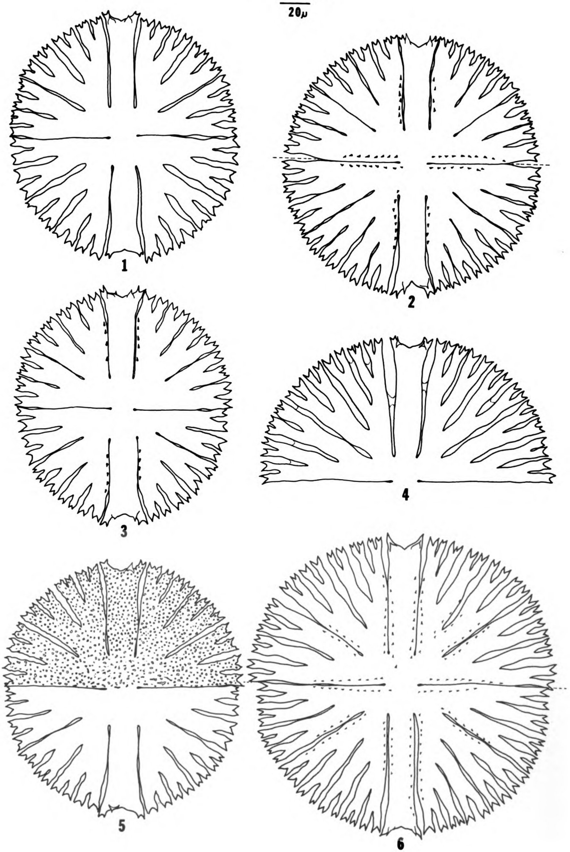
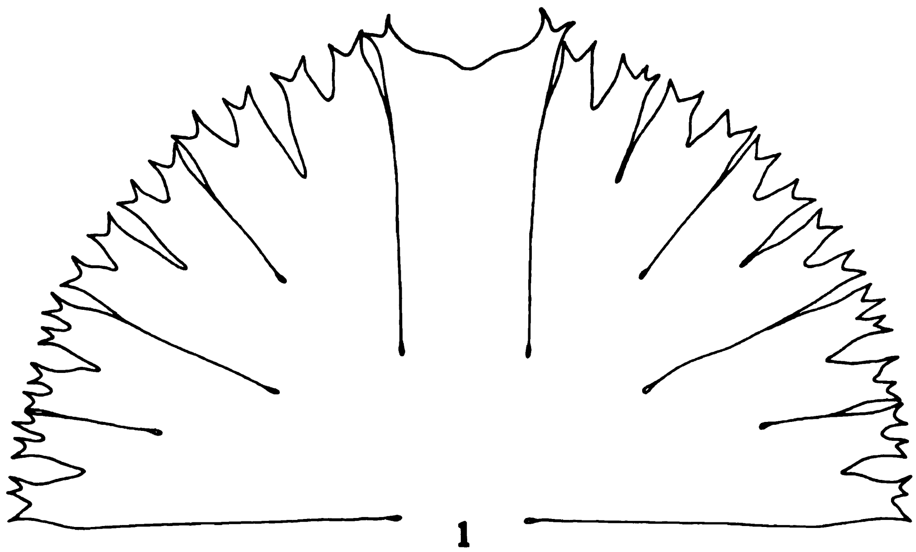


PLATE 51

MICRASTERIAS

PLATE 51

20μ


1

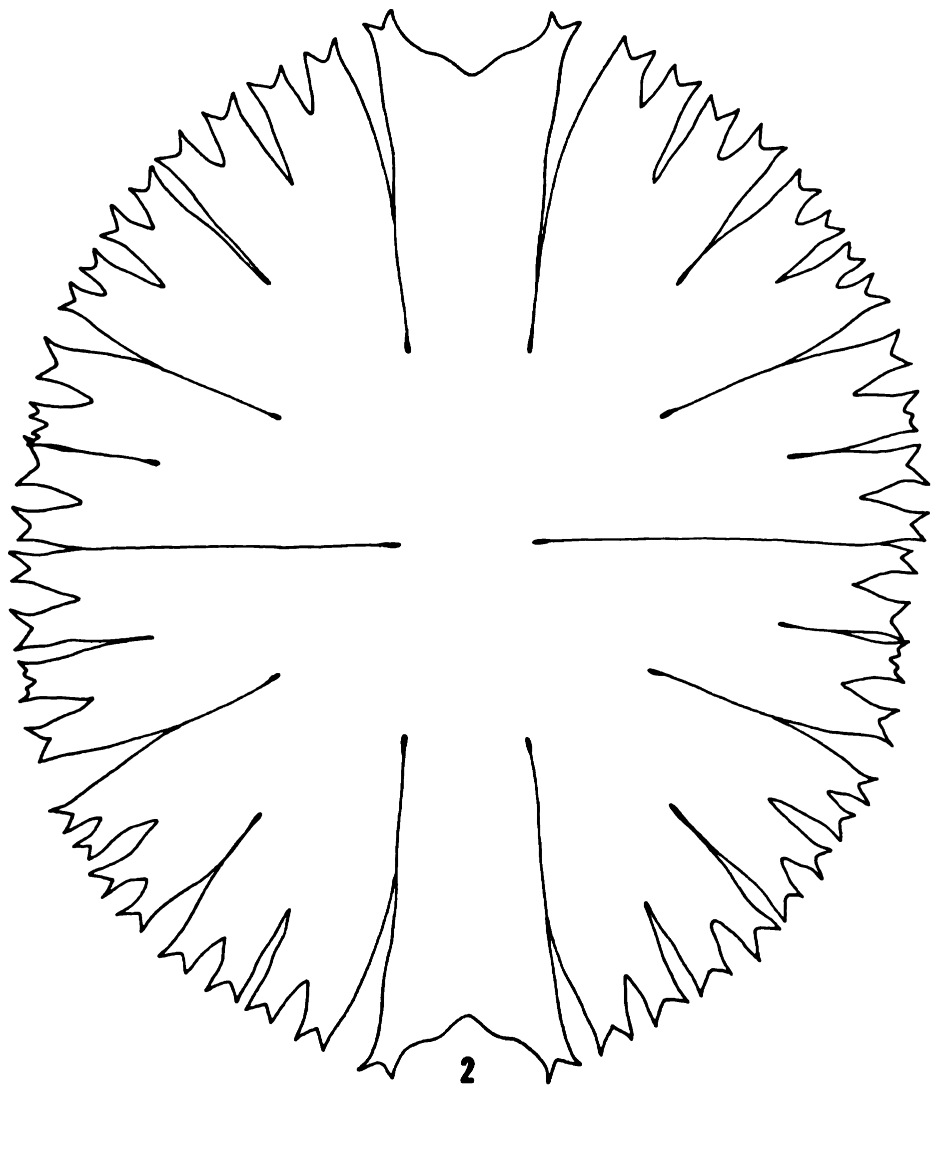
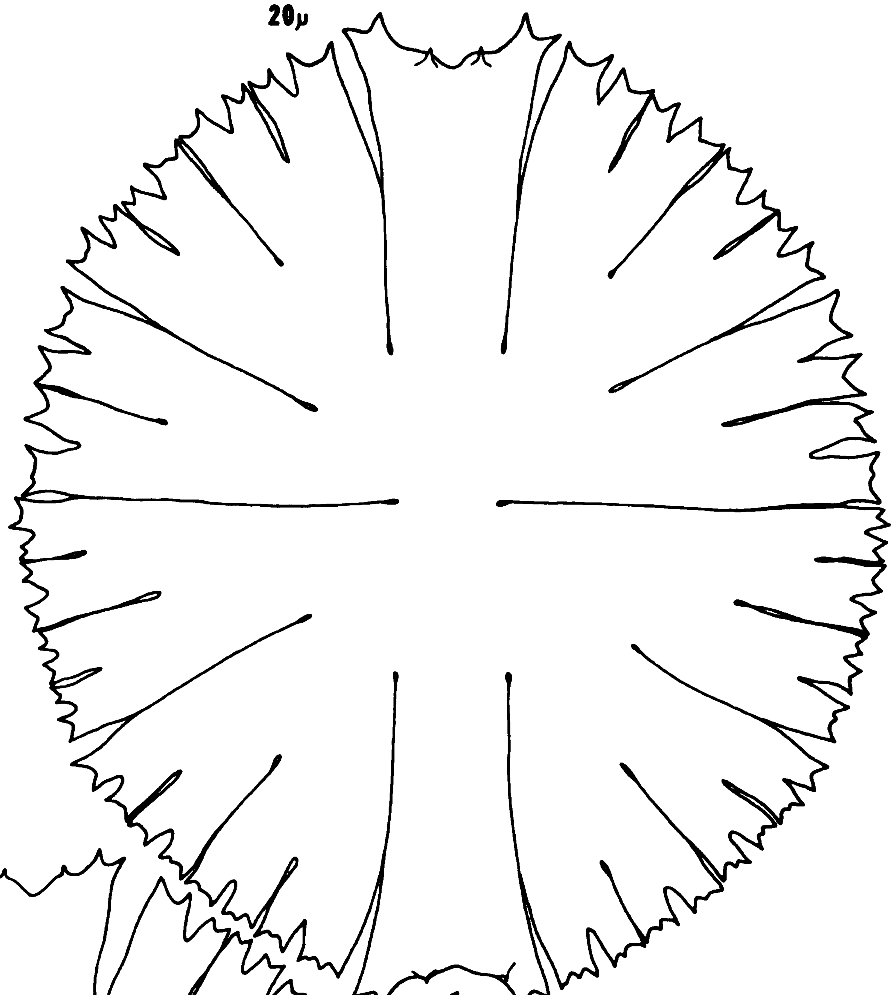

2

PLATE 52

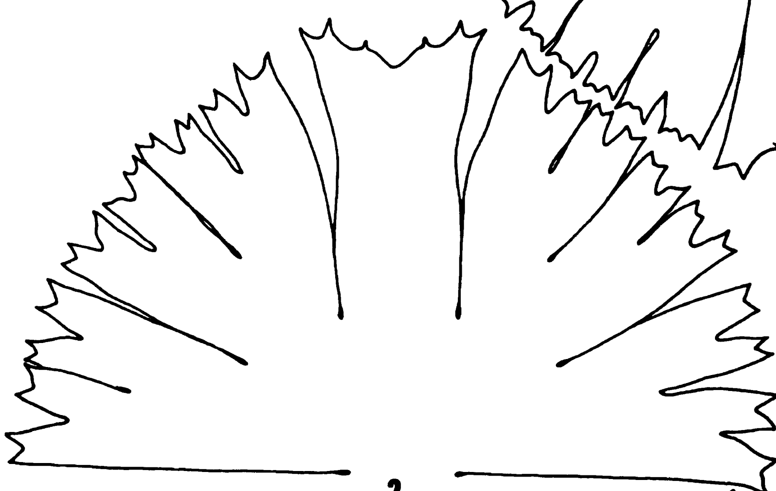
MICRASTERIAS

PLATE 52

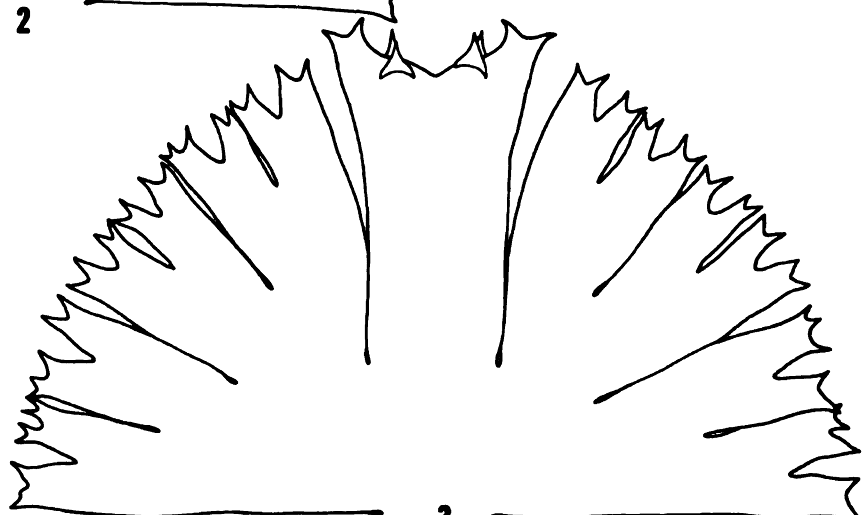
20μ



1



2



3

PLATE 53

MICRASTERIAS

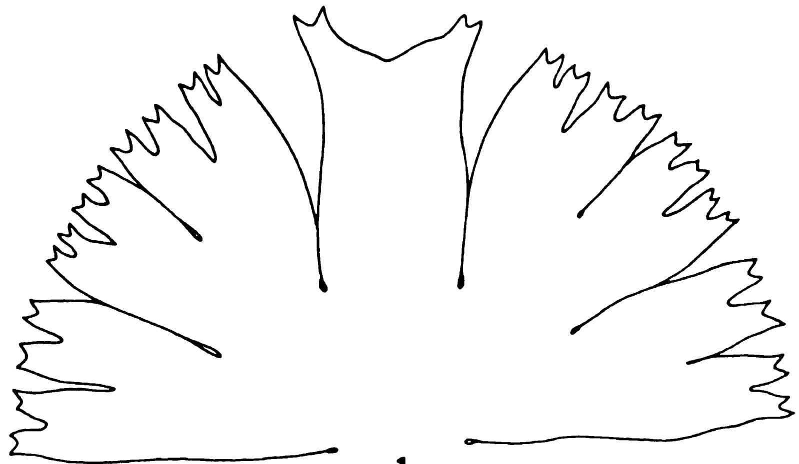
Figs. Page

1,2. *M. rotata* var. *rotata* morphae 202
1- Mon4181
2- Mt63-154

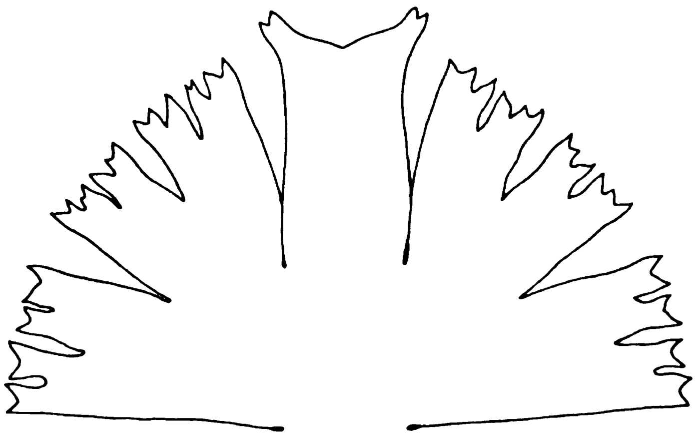
3,4. *M. rotata* morpha 202
3- Mt63-111
4- Mt63-77 (monstrosity)

PLATE 53

20μ



1



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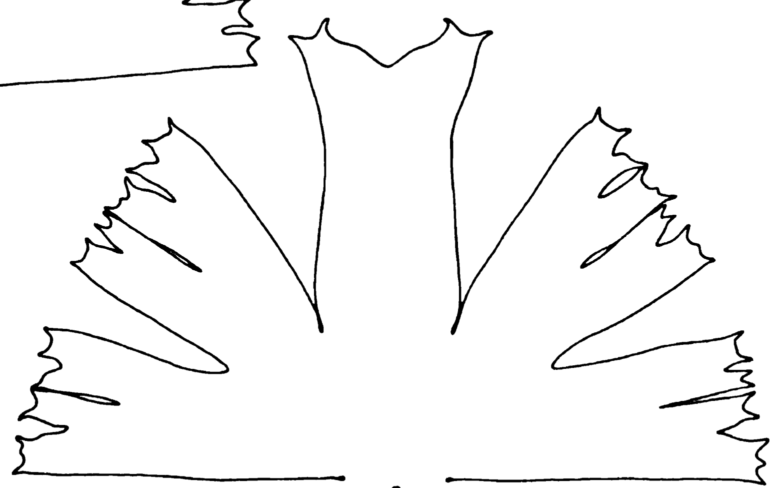

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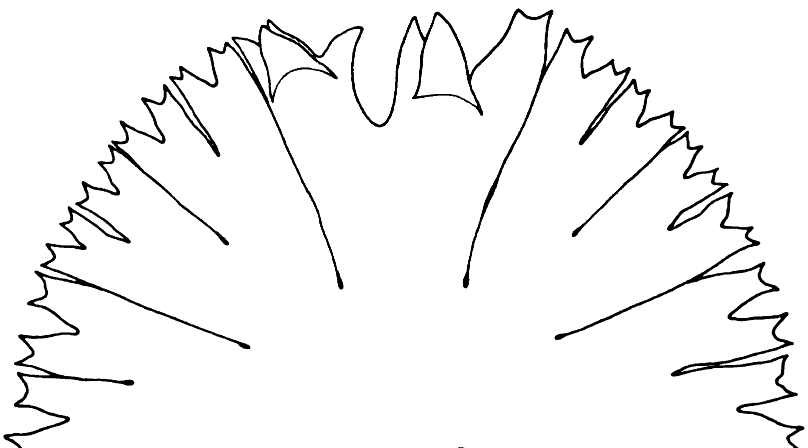


4

PLATE 54

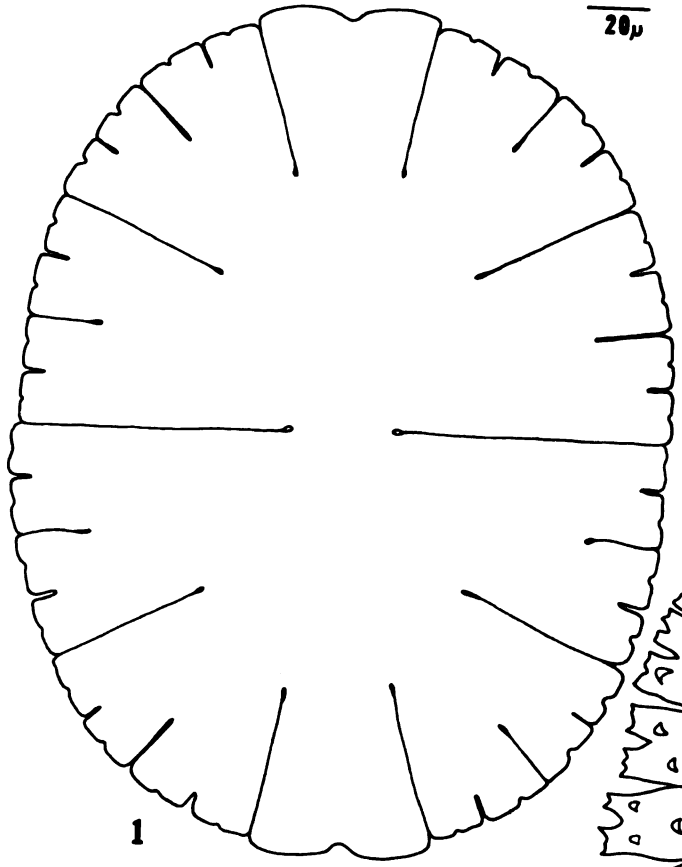
MICRASTERIAS

PLATE 55

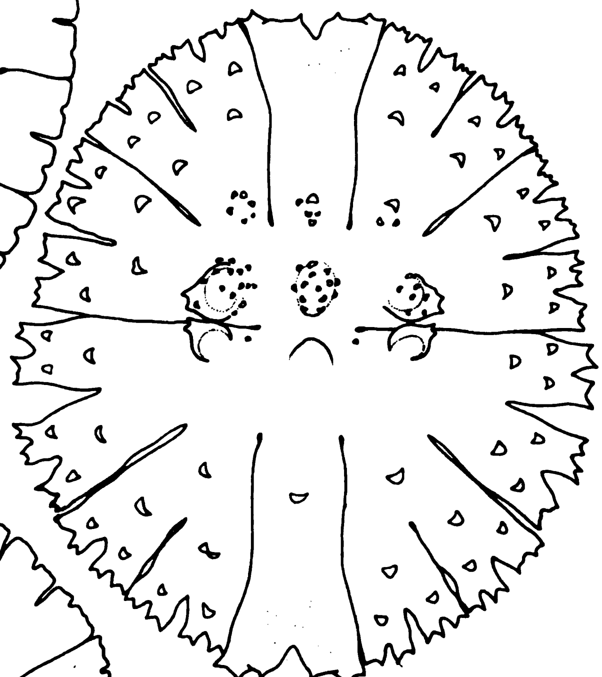
MICRASTERIAS

PLATE 55

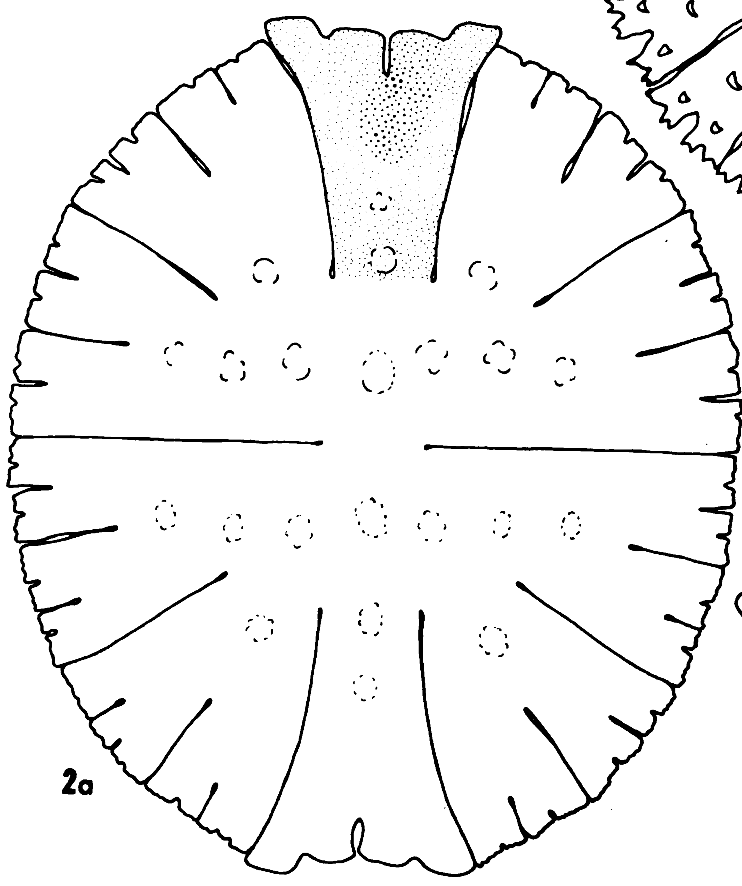
20μ



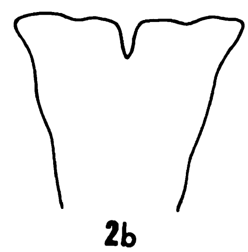
1



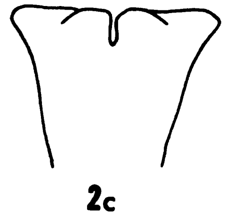
3



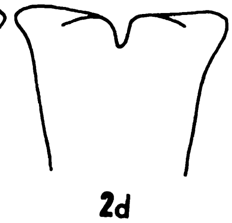
2a



2b



2c



2d

PLATE 56

XANTHIDIUM

Figs.		Page
1.	*X.* *fasciculatum* var. *oronense* 1-Mt63-	220
2,3. 11.	*X.* *cristatum* var. *cristatum* 2-Mt62-18 3-Mt63-157 11-Mt63-202	215
4.	*X.* *cristatum* var. *cristatum* fa. 4-X8	216
5.	*X.* *cristatum* var. *hipoarquii* 5-Mt63-187	218
6,7.	*X.* *cristatum* var. *leidodermum* 6-Mt63-267 7-Mt62-58	219
8,9.	*X.* *cristatum* var. *leiodermum* fa. 8-6Mon4 9-Mon16	219,220
10.	*X.* *cristatum* morpha 10-Mon4181	218
12.	*X.* *cristatum* var. *papilliferum* 12-Mt62-59	217
13,14.	*X.* *cristatum* var. *uncinatum* f. *ornatum* 13,14-Mt62-58	217

PLATE 56

20μ

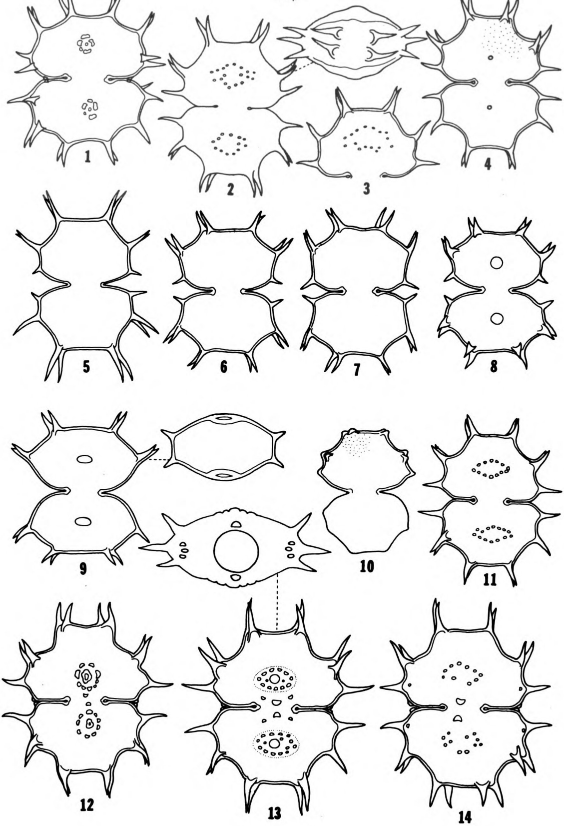


PLATE 57

XANTHIDIUM

Figs. Page

1\. X. antilopaeum var. planum 213
1- Mt63-154

2,3,4. X. antilopaeum var. polymazon fa. polymazon 213
2- Mon25
3- Mon4183
4- H.L. 1

5\. X. antilopaeum fa. 214
5- Mt63-142

6,9. X. antilopaeum var. minneapoliense fa. minneapoliense 212
6- X8
9- Mt62-59

7,8, 13. X. antilopaeum var. polymazon fa. maius 213
7- Mt63-200
8- Mt63-156
13- Mt63-248

10,11, 12. X. antilopaeum var. minneaopoliense morpha 212
10,12- Mt63-156
11- Mt63-200

PLATE 57

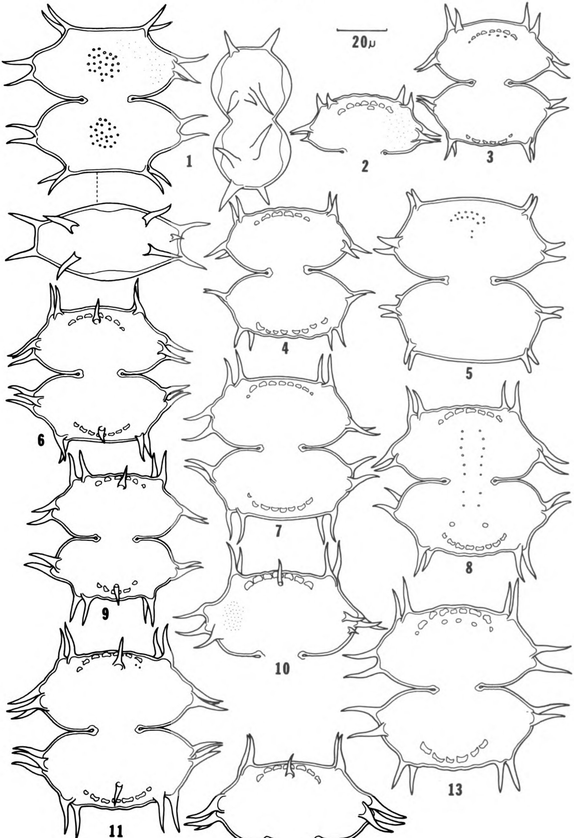


PLATE 58

XANTHIDIUM

Figs.		Page
1,2.	*X. antilopaeum* var. *antilopaeum* 1- Mt63-154 2- Mt63-210	209
3,4.	*X. antilopaeum* var. *crameri* 3- Mt63-111 4- Mt63-399	211
5.	*X. antilopaeum* var. *americanum* 5- Mt63-111	210
6.	*X. antilopaeum* var. *callosum* 6- Mt63-260	210
7,8.	*X. antilopaeum* var. *limneticum* 7- Mt63-260 8- Mt63-260	211

PLATE 58

20μ

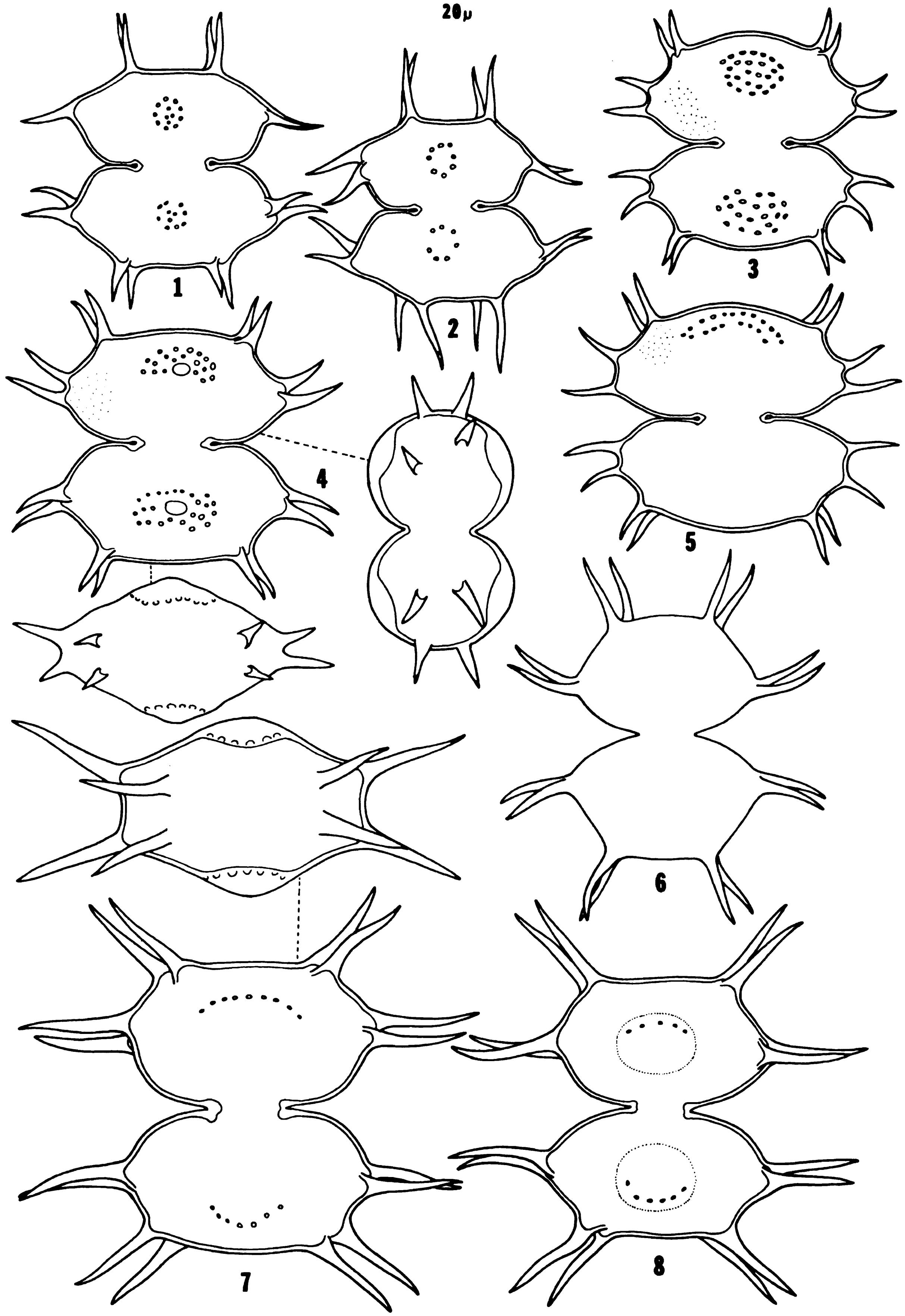


PLATE 59

XANTHIDIUM

PLATE 59

20μ

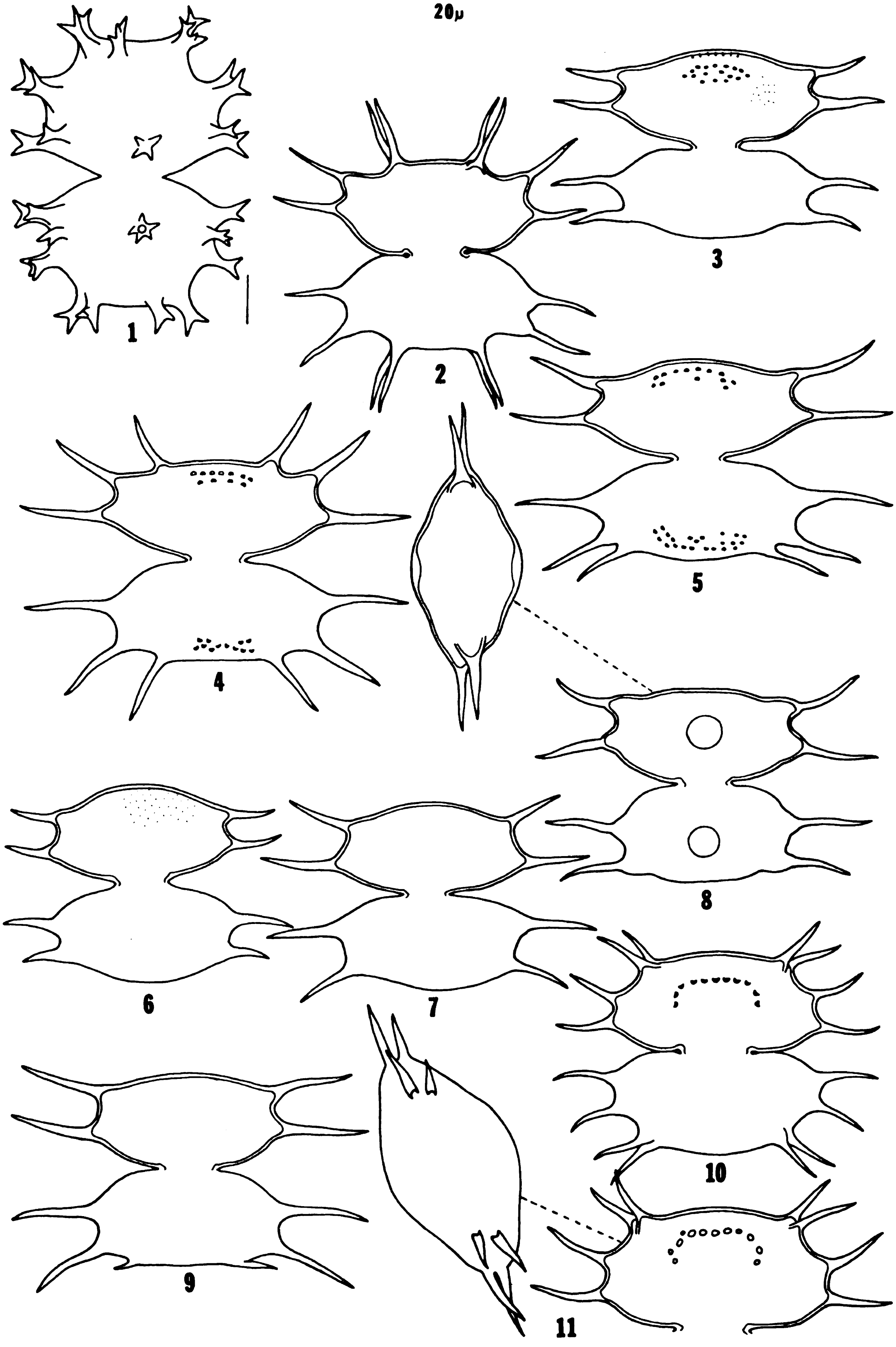


PLATE 60

ARTHRODESMUS

PLATE 60

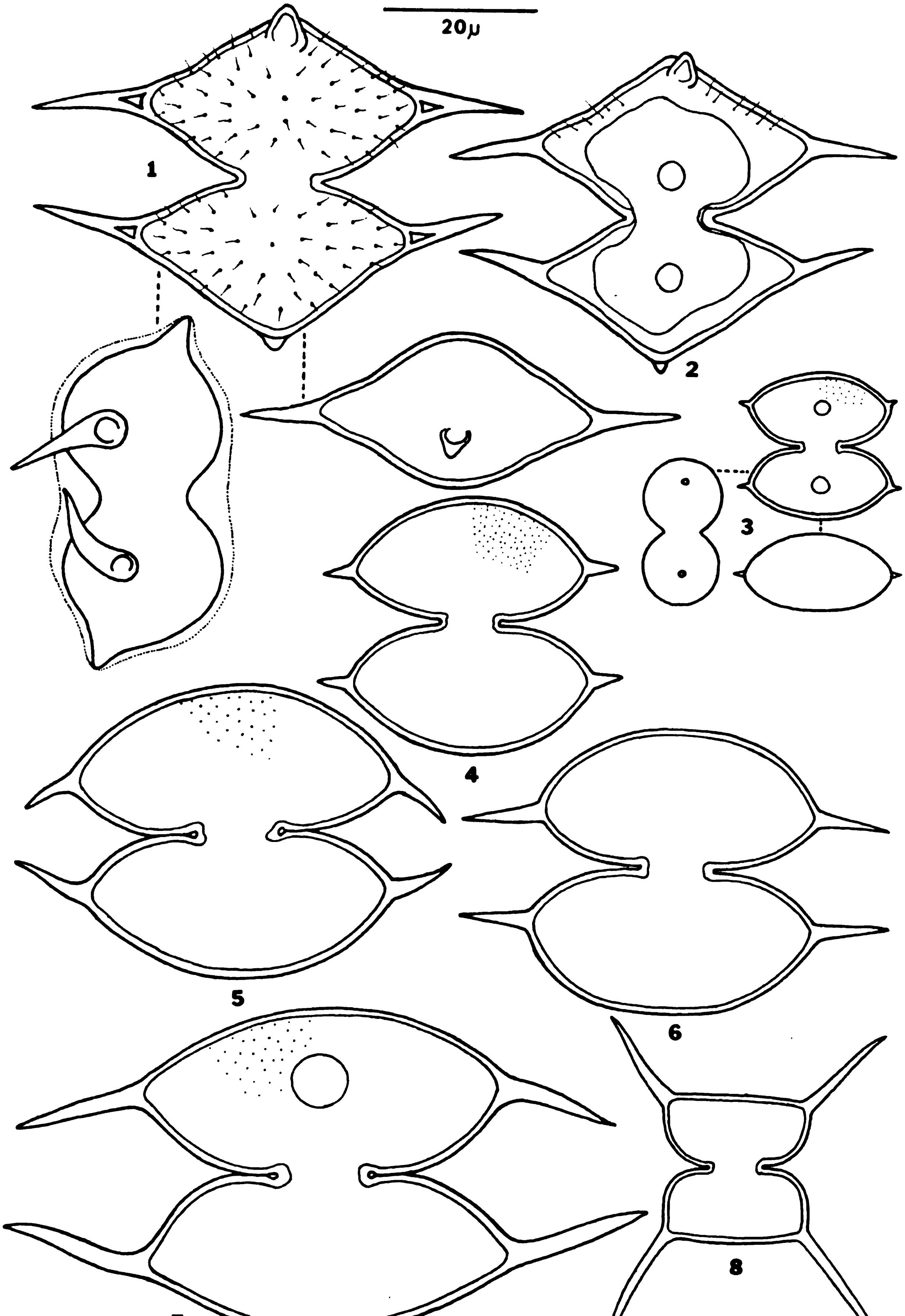


PLATE 61

ARTHRODESMUS

Figs.		Page
1.	*A. incus* var. *indentatus* morpha 1-Mt63-338	229
2.	*A. incus* var. *extensus* 2-Mt62-72	228
3.	*A. incus* var. *malaccensis* 3-Mt62-72	229
4.	*A. incus* var. *vulgaris* 4-6Mon5	229
5.	*A. incus* var. *indentatus* 5-Mt63-157	229
6.	*A. ralfsii* f. *latiscula* 6-H.L.1	232
7,8.	*A. phimus* var. *occidentalis* 7,8-Mt62-76	231
9.	*A. triangularis* var. *triangularis* 9-Mt63-78	233
10.	*A. triangularis* var. *inflatus* 10-Mt63-197	234
11,12.	*A. triangularis* var. *subtriangularis* 11-Mt63-157 12-Mt62-12	234

PLATE 61

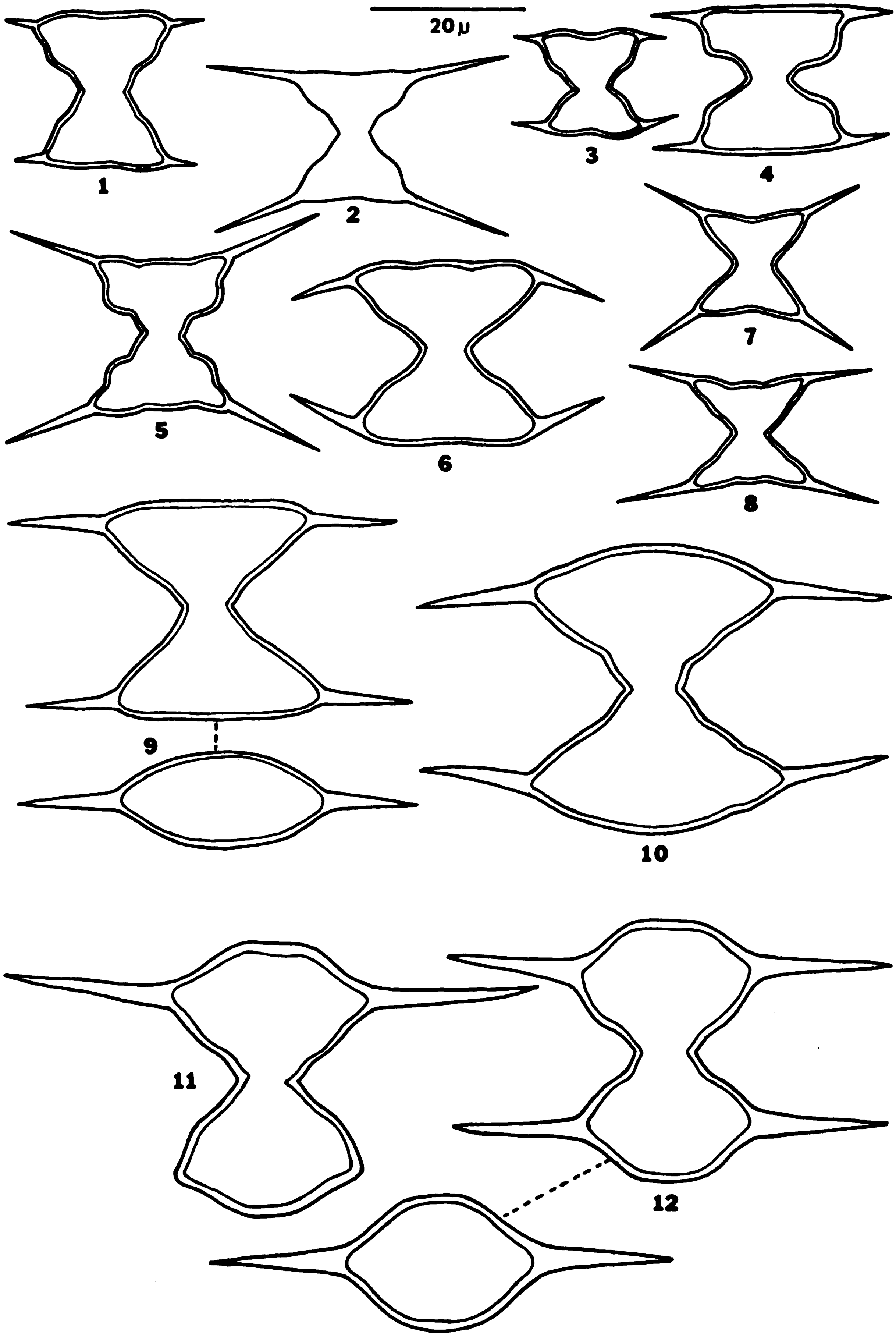


PLATE 62

<u>ARTHRODESMUS</u>, <u>STAURASTRUM</u>

Figs.		Page
1,3,4.	*Arthrodesmus octocornis* var. *octocornis* 1-Mt63-213 3-6Mon5 4-Mt62-66	230
2.	*A. octocornis* var. *tenuis* 2-Mt62-64	231
5.	*A. bifidus* fa. 5-Mt62-11	224
6.	*A. bifidus* var. *bifidus* 6-H.L.1	224
7.	*A. bifidus* var. *cruciatus* 7-Mt62-75	225
8,9.	*A. bifidus* var. *cruciatus* fa. .... 8-Mt62-75 9-Mt62-11 (tilted)	225
10,11. 12,13.	*A. tortus* 10-Mt63-73 11,12,13-Mt63-266	232
14,15.	*A. tortus* fa.(?) 14,15-H.L.1	232
16,17.	*Staurastrum omearii* 16-Mt63-500 17-Mt62-26	298
18.	*S. pterosporus* (?) 18-H.L.1	315
19,20.	*S. jaculiferum* var. *excavatum* .... 19 ,20-Mt63-186	281
21,22.	*S. jaculiferum* var. *jaculiferum* 21-Mt62-63 22-Mt62-73	280

PLATE 62

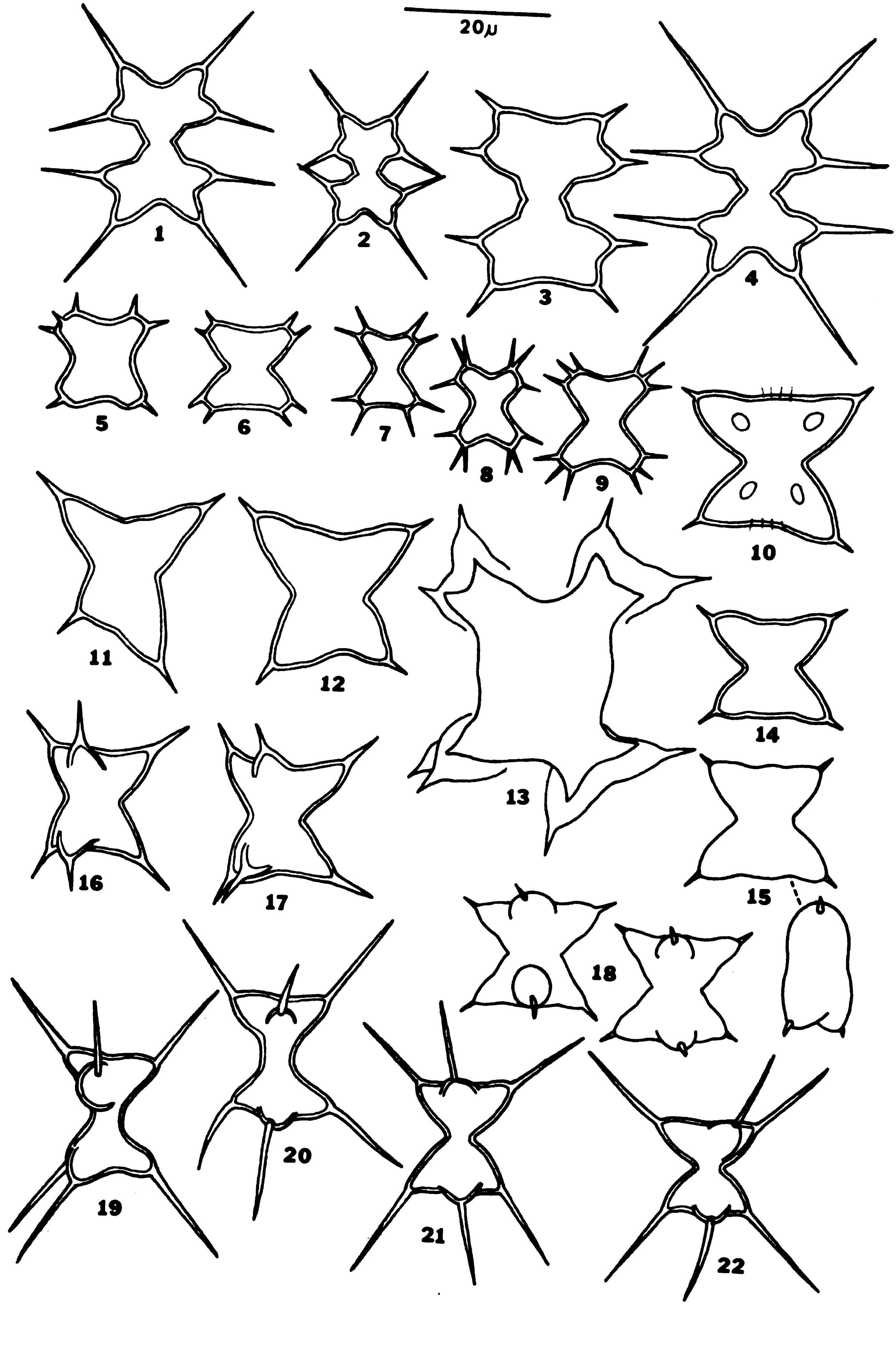


PLATE 63

STAURASTRUM

Figs.		Page
1.	*St.* *curvatum* f. *brevispina* 1-Mt63-192	253
2.	*St.* *curvatum* morpha 2-Mt62-17	253
3.	*St.* *connatum* fa. (?) 3-Mon4182	250
4.	*St.* *connatum* 4-Mt63-271	249
5.	*St.* *boldtianum* 5-Mt63-444	242
6,7.	*St.* *mucronatum* var. *mucronatum* 6,7-Mt63-73	295
8.	*St.* *dejectum* var. *patens* .... 8-Mt63-70 (tilted)	258
9,10. 11,12. 13.	*St.* *dejectum* var. *patens* fa (with developing zygospore) 9,10,11,12,13-Mt63-137	258
14.	*St.* *mucronatum* var. *subtriangulare* 14-Mt63-393	295

PLATE 63

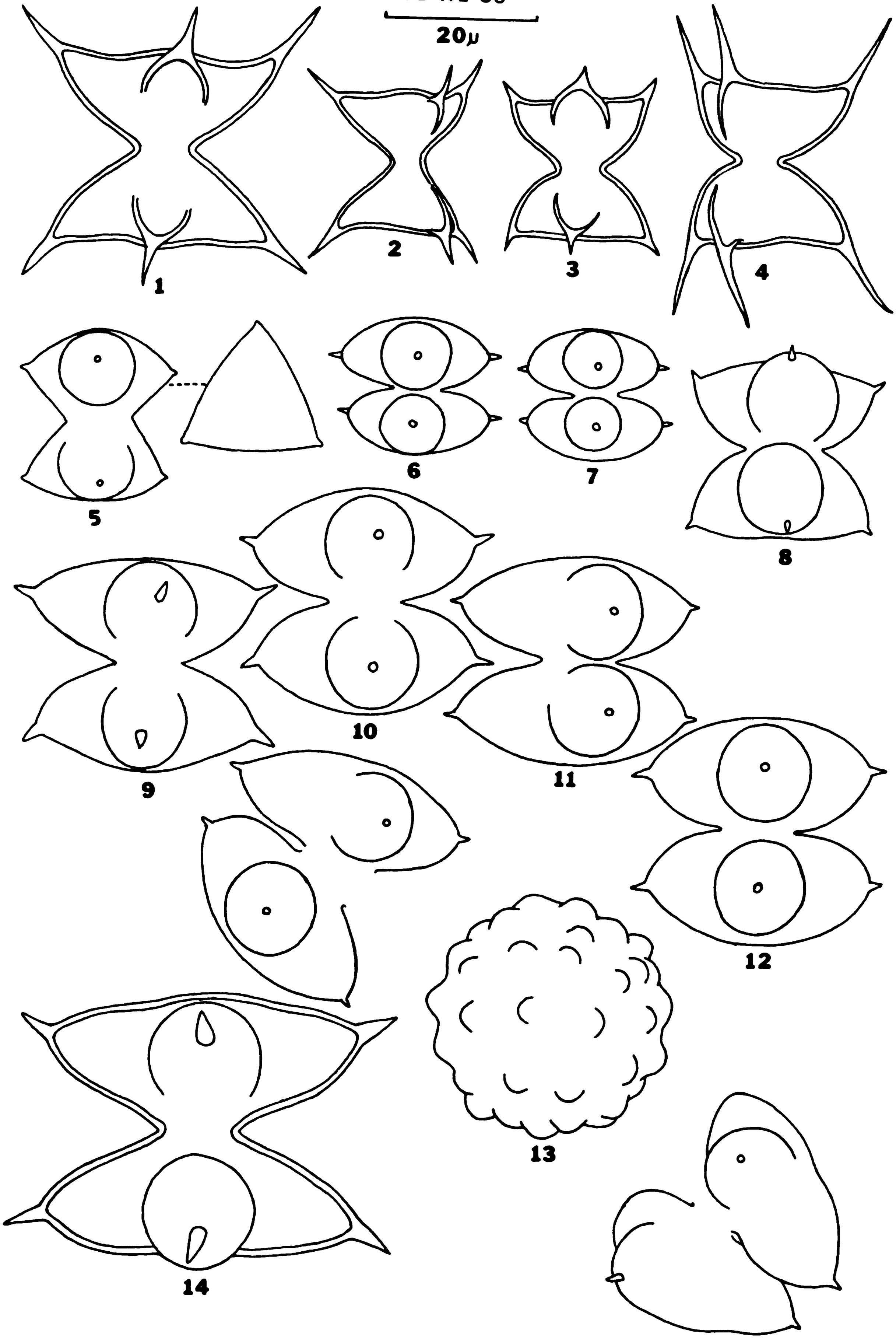


PLATE 64

STAURASTRUM

PLATE 65

STAURASTRUM

Fig.		Page
1,4. 6,9.	St. mamillatum (=St. cuspidatum var. maximum)	288
	1-Mt63-192 4-Mt63-202 6-Mt63-391 9-Mt63-218	
7.	St. unicorne	329
	7-Mt63-389	
2,3, 5,8.	St. mamillatum var. mamillatum	287
	2-Mt63-67 3-Mt63-191 5-Mon25 8-Mt63-389	
10.	St. mamillatum fa.	289
	10-Mt64-70	

PLATE 66

STAURASTRUM

PLATE 66

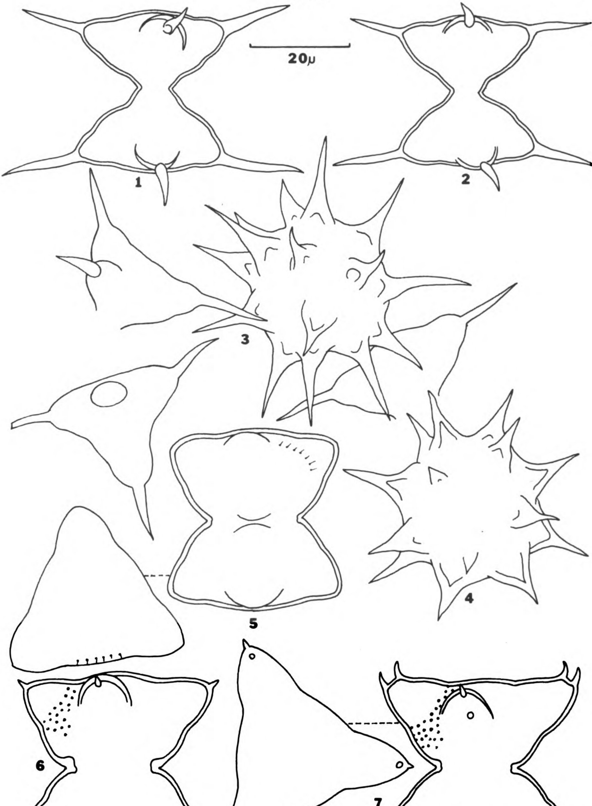


PLATE 67

STAURASTRUM

Figs.		Page
1,2.	St. aristiferum var. prescottii fa?	240
	1,2-Mt63-186	
3,4,5.	Staurastrum sp. 2 (=St. pseudopachyrhynchum?).......	311
	3-Mt63-112	
	4-H.L.1	
	5-Mt63-112	
6,7.	St. brevispinum var. brevispinum	246
10.	6-Mt63-330	
	7-Mt63-395	
	10-Mt63-134	
8.	St. brevispinum var. alatum	247
	8-Mt63-190	
9.	St. louisianicum fa.	286
	9-Mt63-118	

PLATE 67

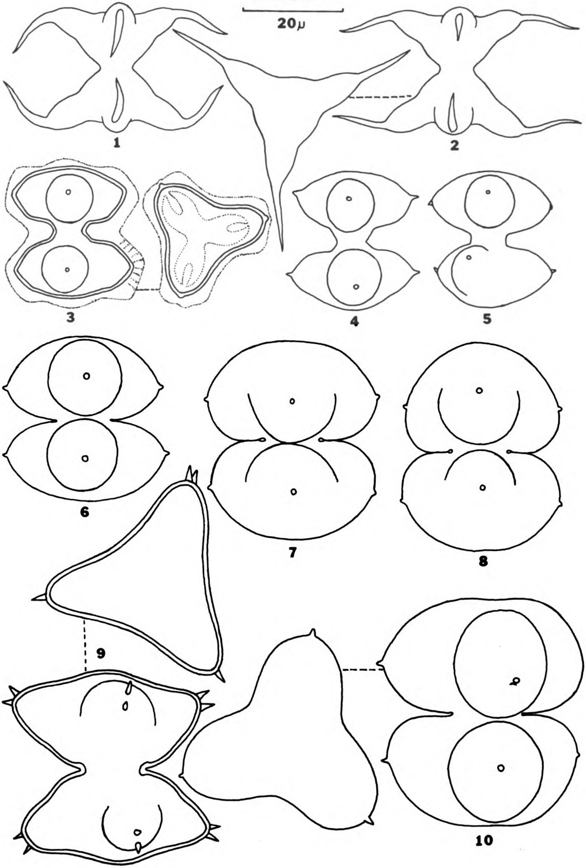


PLATE 68

STAURASTRUM

PLATE 68

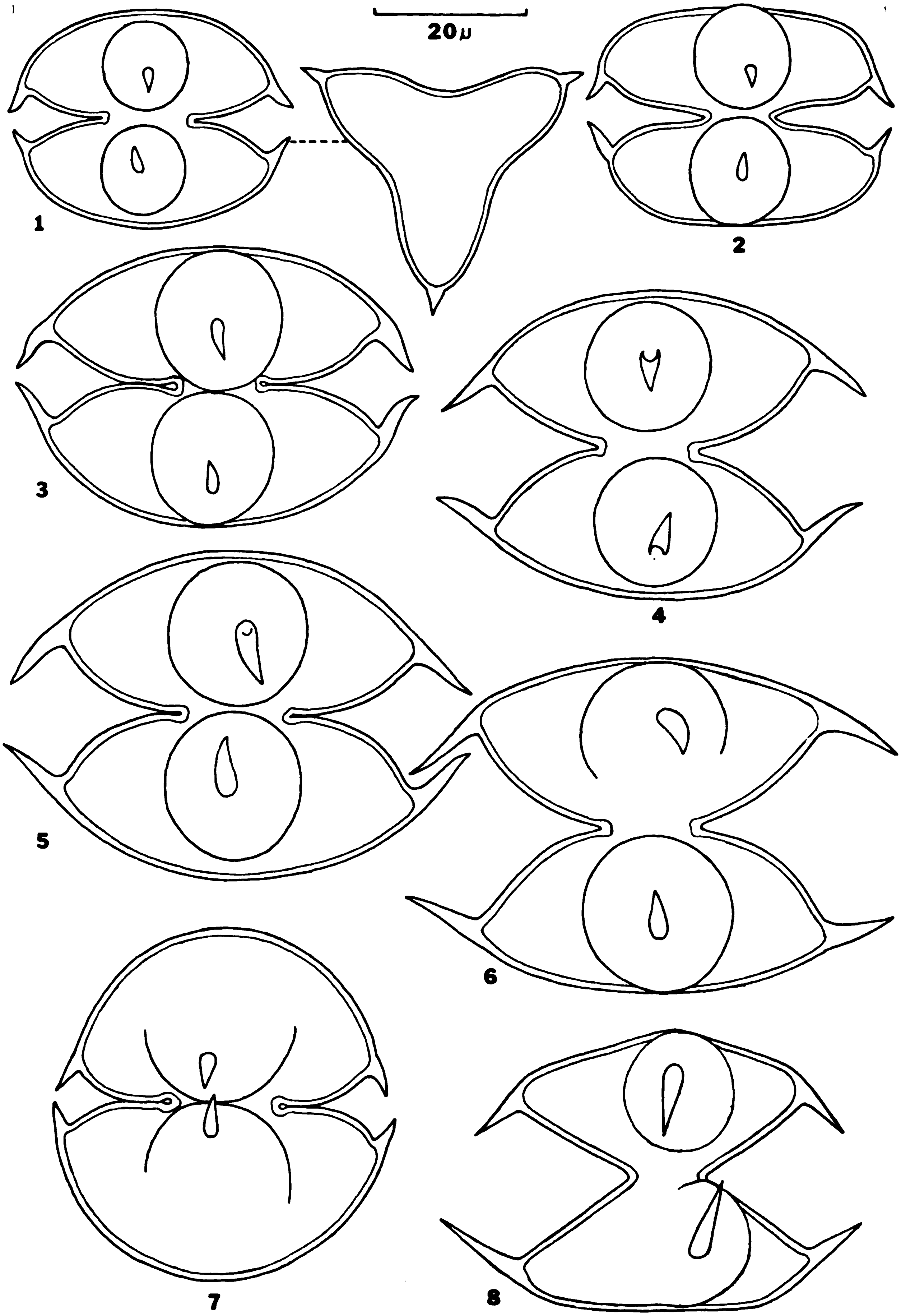


PLATE 69

STAURASTRUM

PLATE 70

STAURASTRUM

PLATE 70

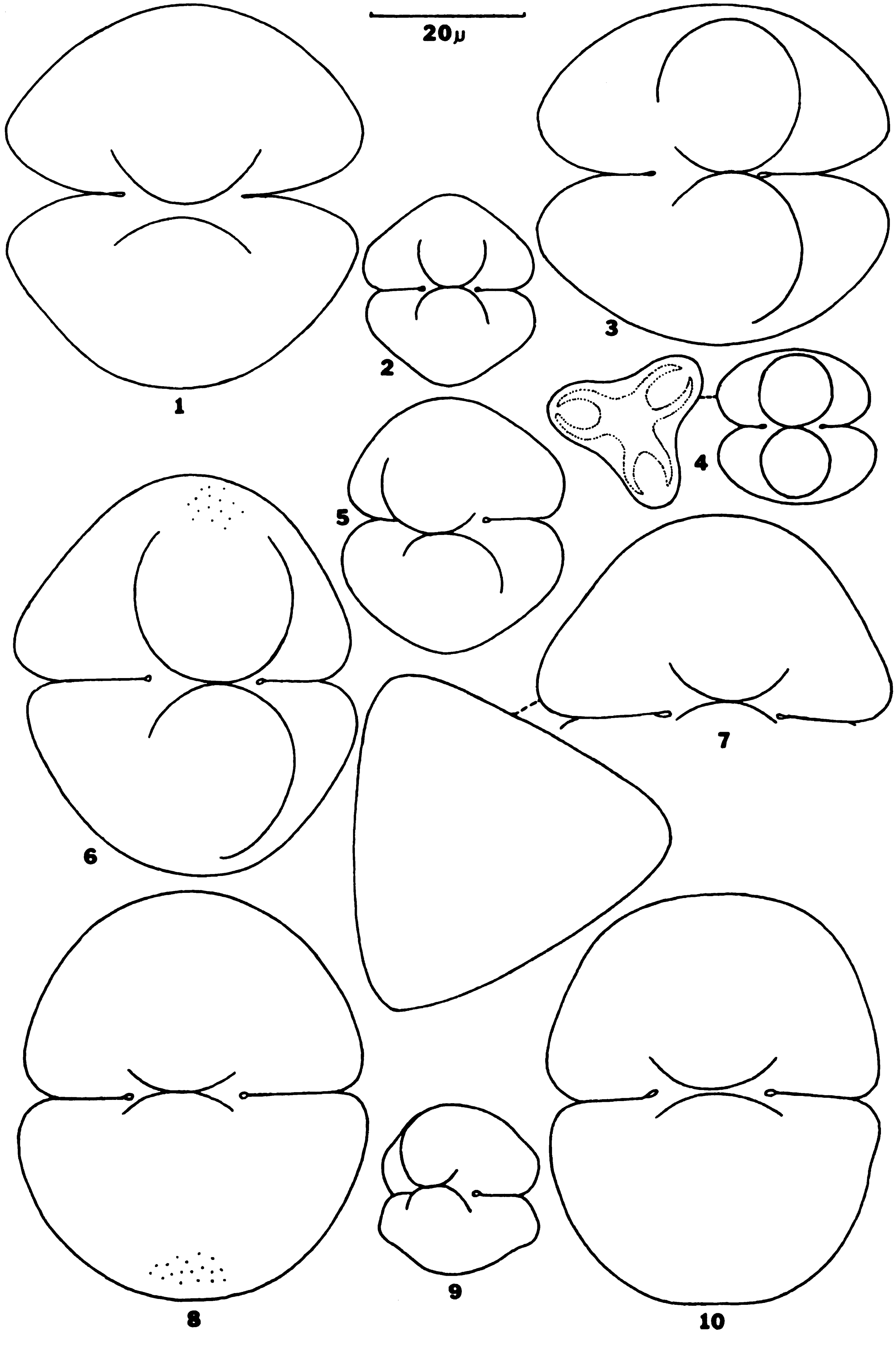


PLATE 71

STAURASTRUM

PLATE 72

STAURASTRUM

PLATE 72

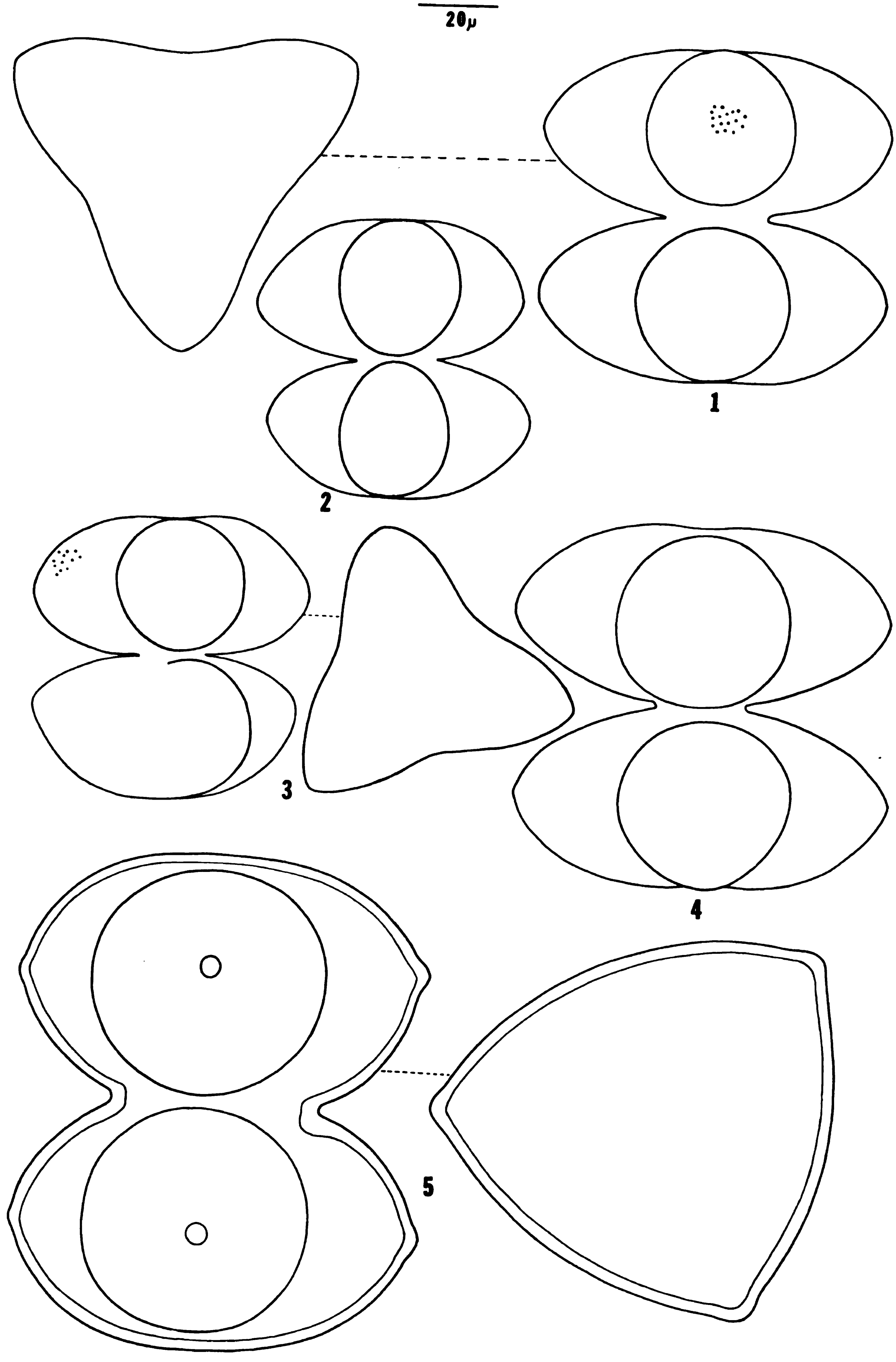


PLATE 73

STAURASTRUM

PLATE 73

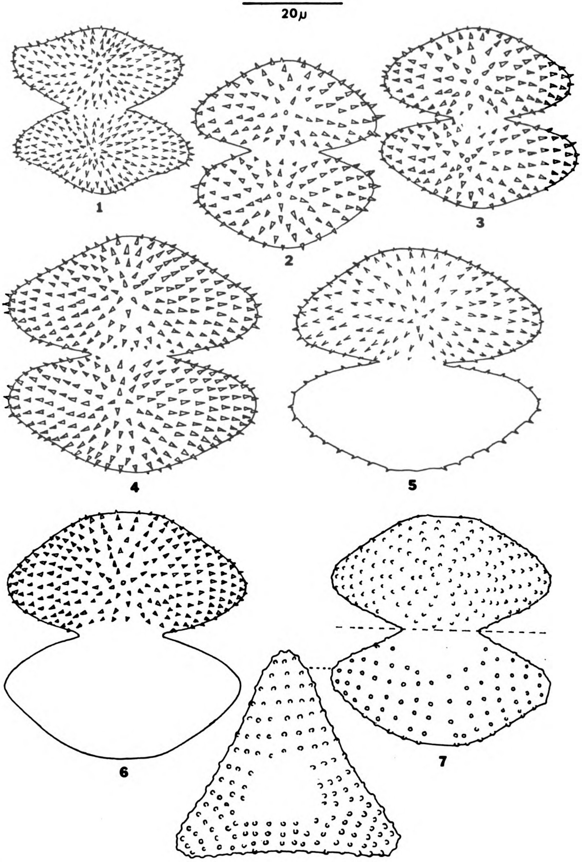


PLATE 74

STAURASTRUM

PLATE 74

20μ

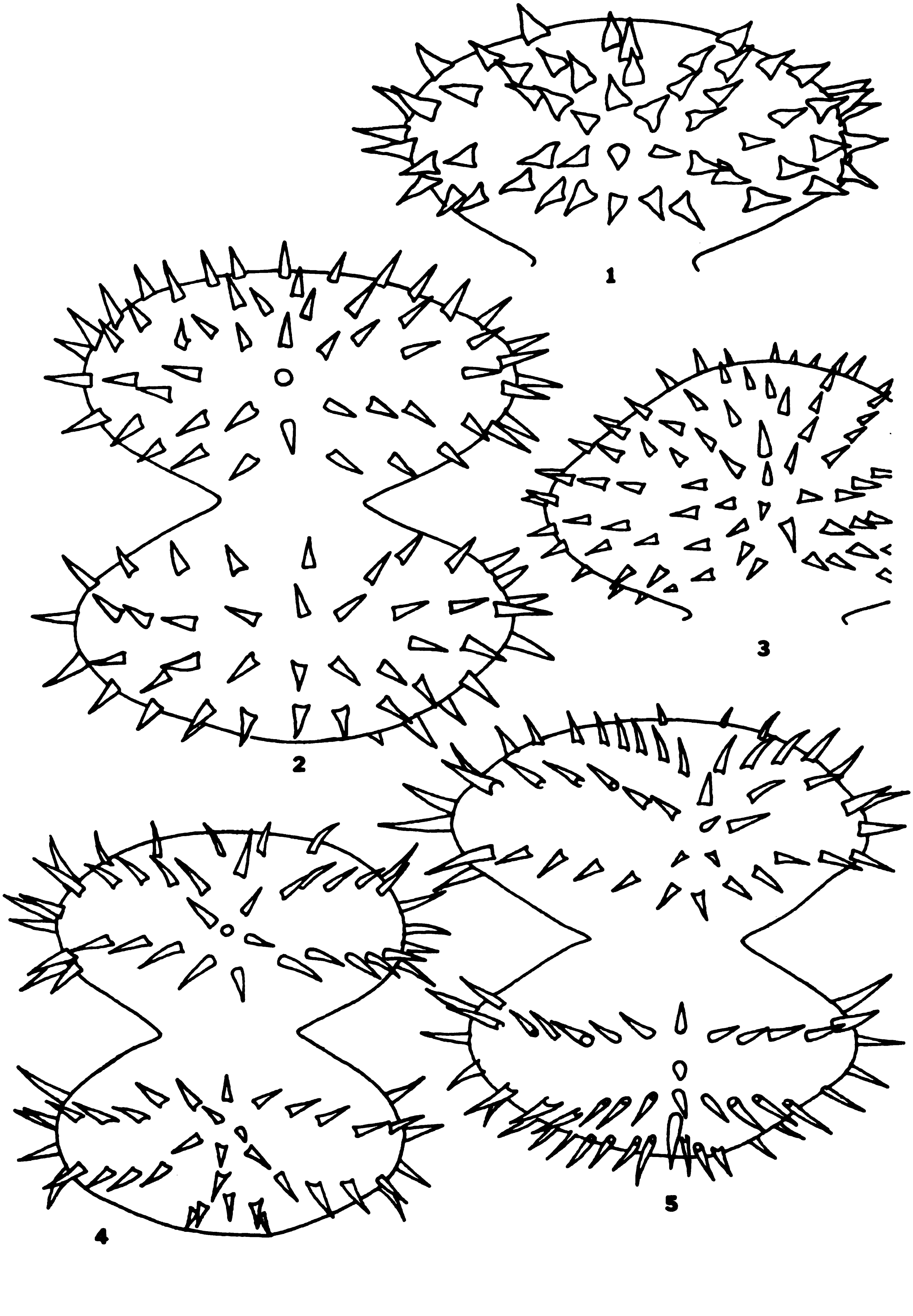


PLATE 75

STAURASTRUM

PLATE 75

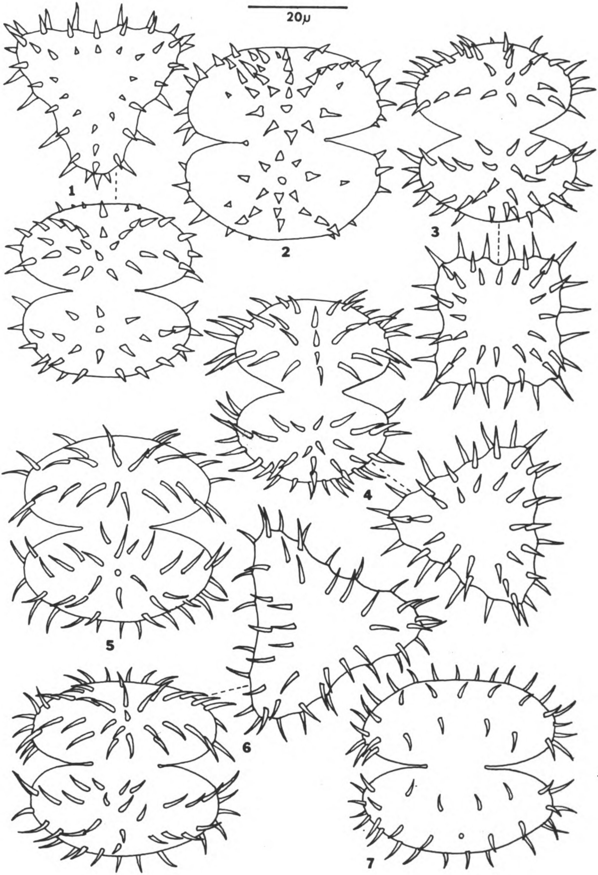


PLATE 76

STAURASTRUM

PLATE 76

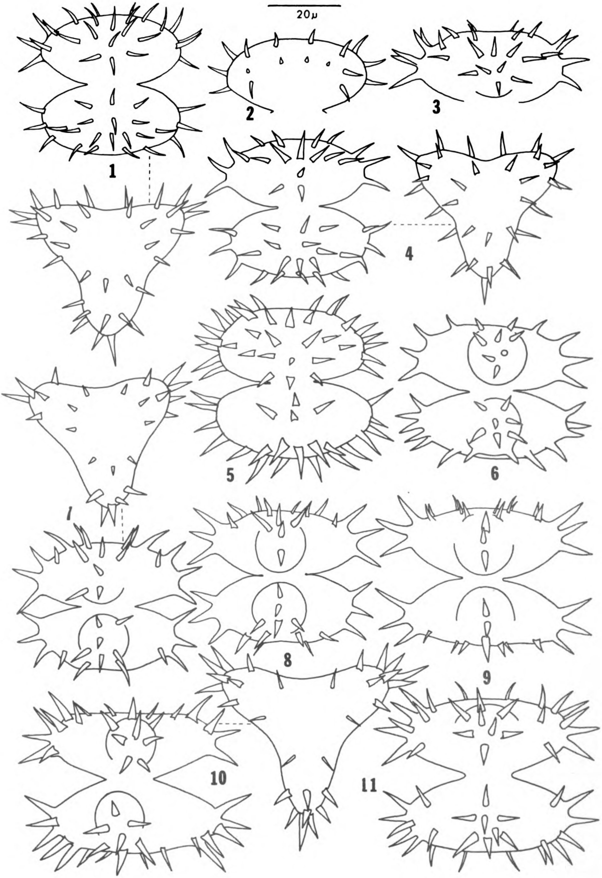


PLATE 77

STAURASTRUM

PLATE 78

STAURASTRUM

Figs.		Page
1.	*St. hantzschii* var. *hantzschii* .... 1 - Mt63-171	275
2,3, 4,5.	*St. hantzschii* var. *hantzschii* fa. .... 2,3,4,5 - Mt63-171	276
6,7.	*St. hantzschii* var. *hantzschii* and *St. tohopekaligense* var. *brevispinum* (dichotypical) .... 6,7 - 6Mon41 7 - (top view of bottom semicell)	276
8.	*St. hantzschii* fa. (=*St. tohopekaligense* var. *brevispinum*) .... 8 - Mt63-210	276
9.	*St. tohopekaligense* and var. *nananum* .... 9 - Mt63-205	277

PLATE 78

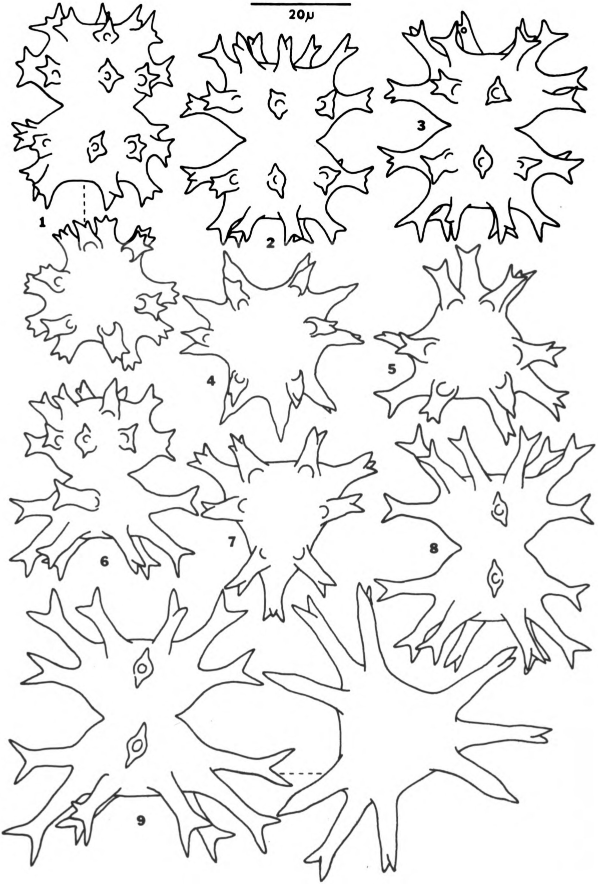


PLATE 79

STAURASTRUM

PLATE 79

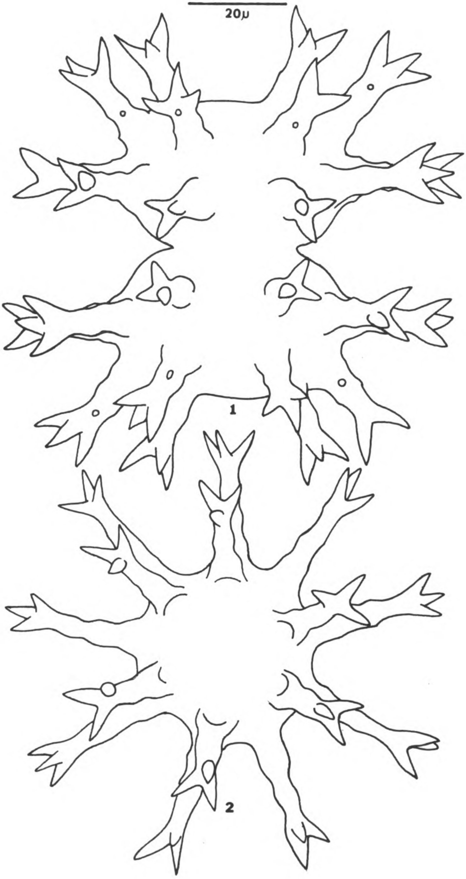


PLATE 80

STAURASTRUM

Figs.		Page
1,2.	*St. laeve*	281
	1,2-Mt63-110	
3,4.	*St. laeve* var. *latidivergens*	282
	3-Mt63-137 4-Mt63-413	
5.	*St. gemelliparum*	270
	5-Mt62-73	
6,7.	*St. arcuatum* f. *aciculifera*	239
	6-Mt62-63 7-6Mon41	
8.	*St. quadragulare* var. *armatum*	315
	8-Mt62-60	
9,10.	*St. furcatum* var. *furcatum*	267
	9-Mt63-271 10-Mt63-187	
11,12, 13.	*St. senarium*	319
	11-Mt63-445 12-Mt63-209 13-Mt63-419	
14.	*St. distentum*	264
	14-Mt63-206	
15.	*St. clevei*	249
	15-6Mon41	

PLATE 80

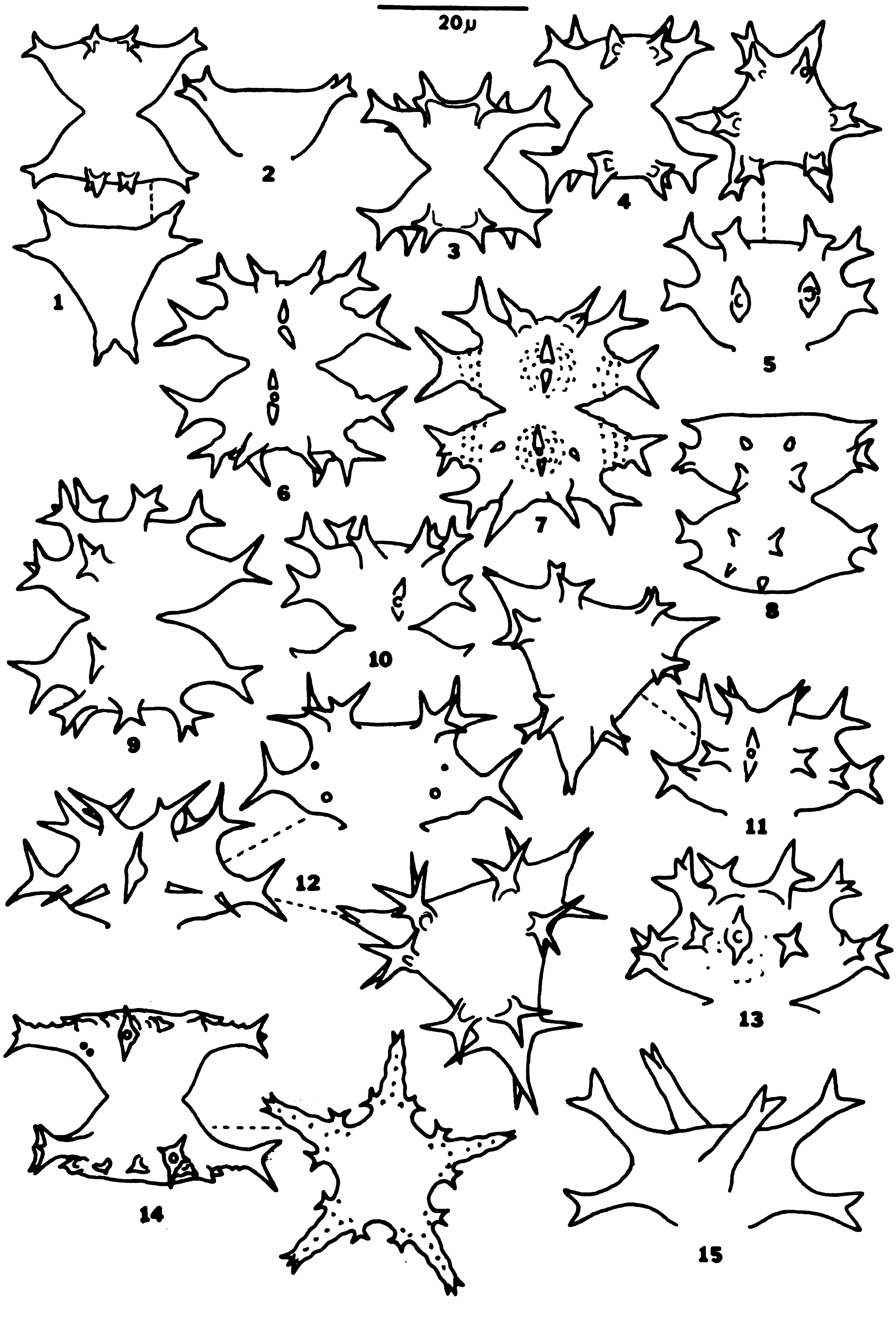
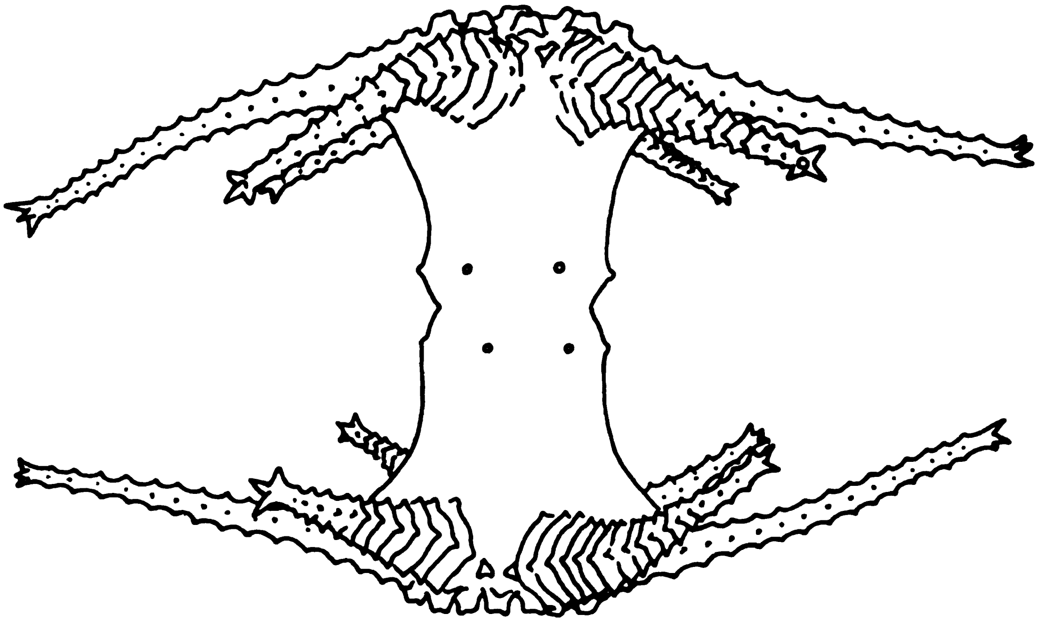


PLATE 81

STAURASTRUM

PLATE 81

20μ



1

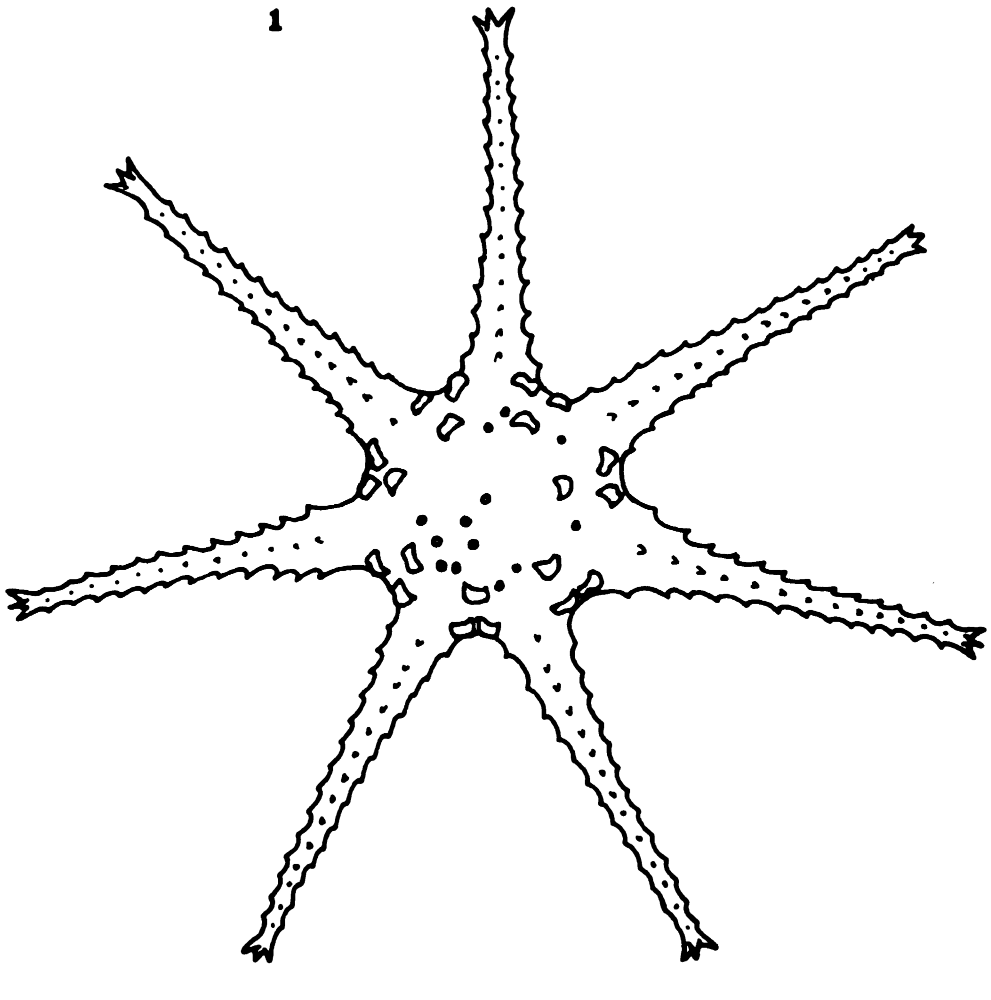


PLATE 82

STAURASTRUM

Figs.		Page
1,2,3.	*St. furcigerum* var. *furcigerum* f. *furcigerum*	268
	1-Mt63-111	
	2-6Mon5	
	3-Mt63-398	
4,5.	*St. furcigerum* var. *furcigerum* f. *eustephana*	269
	4-Mt63-141	
	5-Mt63-383	

PLATE 82

20µ

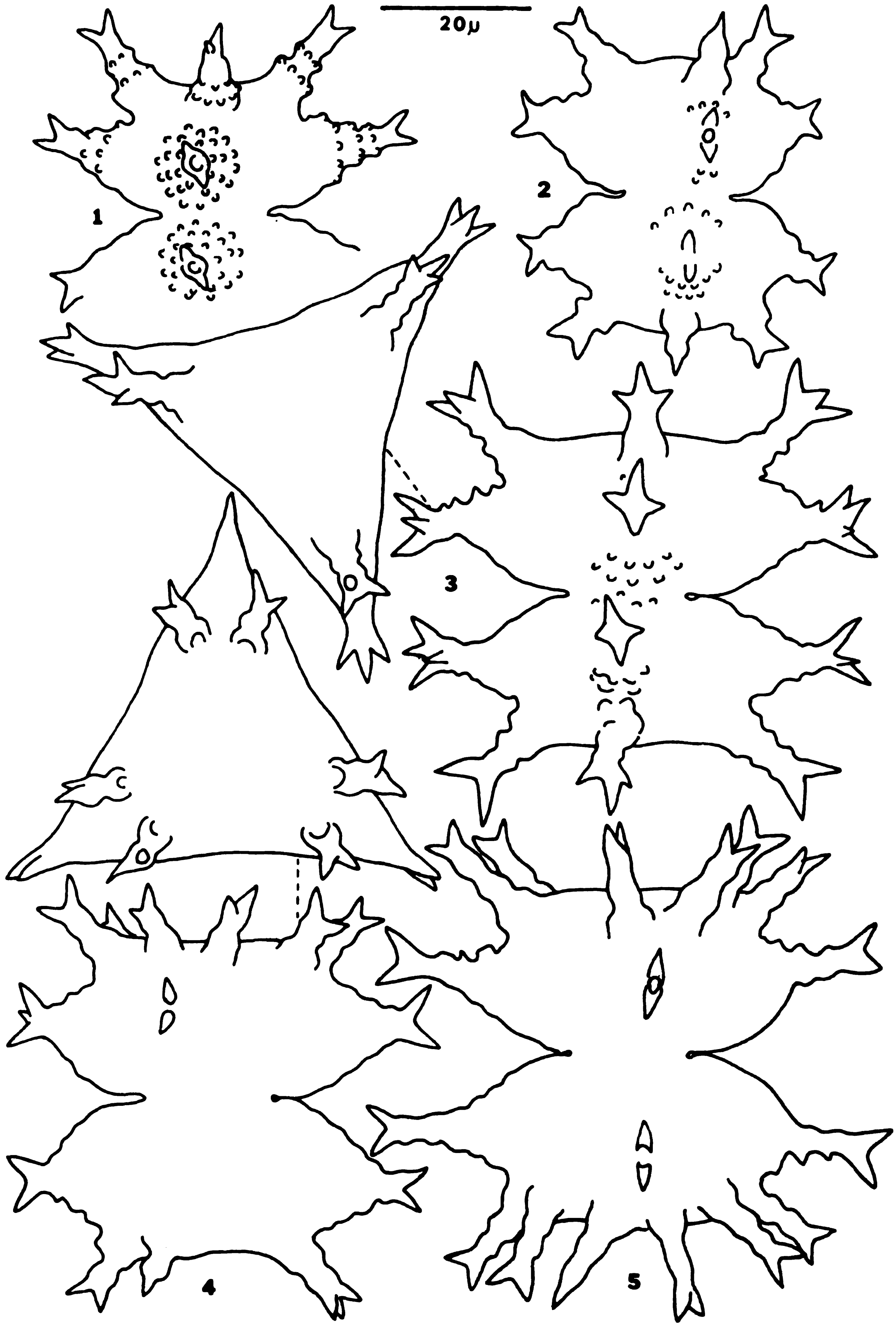


PLATE 83

STAURASTRUM

PLATE 83

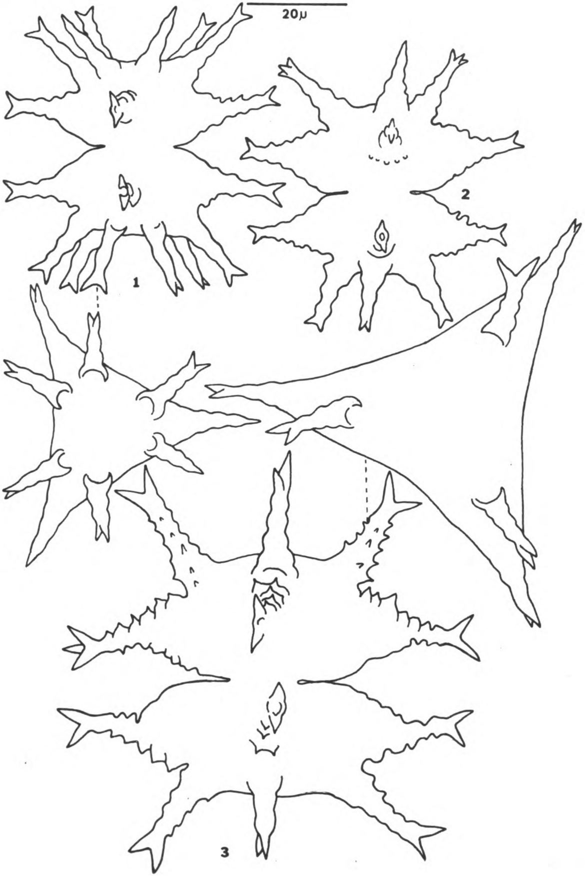


PLATE 84

STAURASTRUM

Fig.		Page
1,2,3.	*St.* *cornutum* 1-Mt62-62 2,3-H.L.1	252
4,5.	*St.* *forficulatum* var. *cornutiforme* 4,5-Mt63-187	266
6.	*St.* *forficulatum* var. *subheteroplophorum* fa. *simplex.* and *St.* *magnifurcatum* (dichotypical) 6-Mt62-80	267
7.	*St.* *forficulatum* var. *forficulatum* 7-Mt62-80	266

PLATE 84

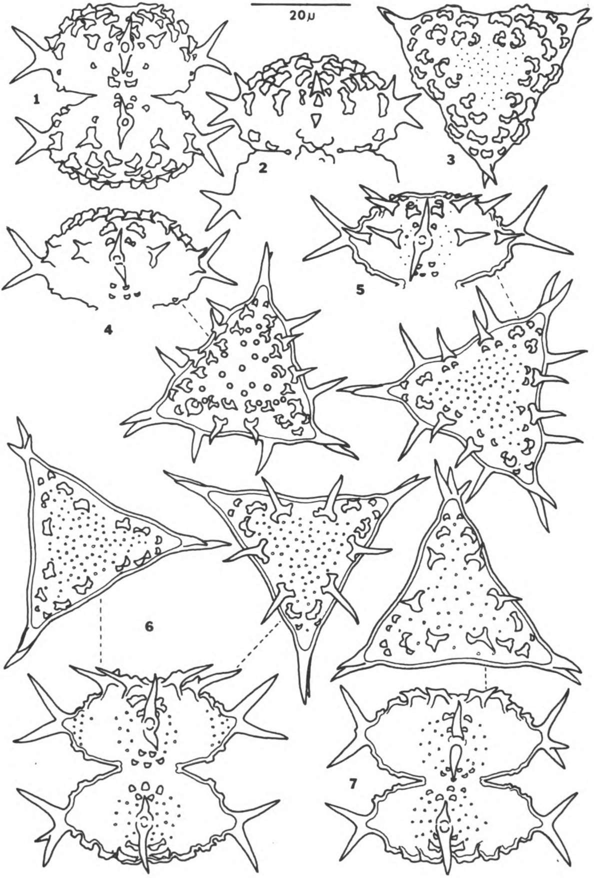


PLATE 85

STAURASTRUM

PLATE 85

20μ

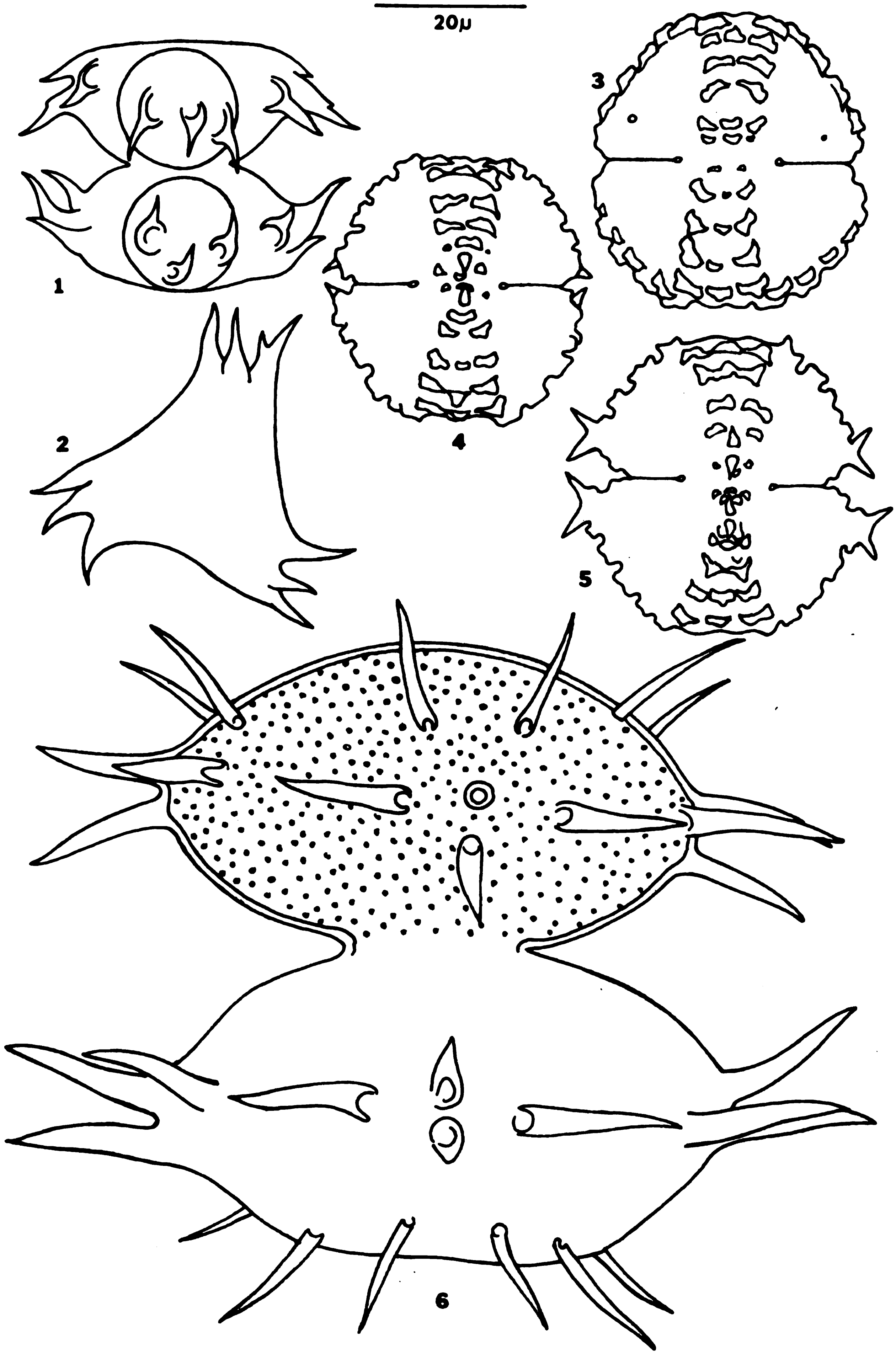


PLATE 86

STAURASTRUM

PLATE 86

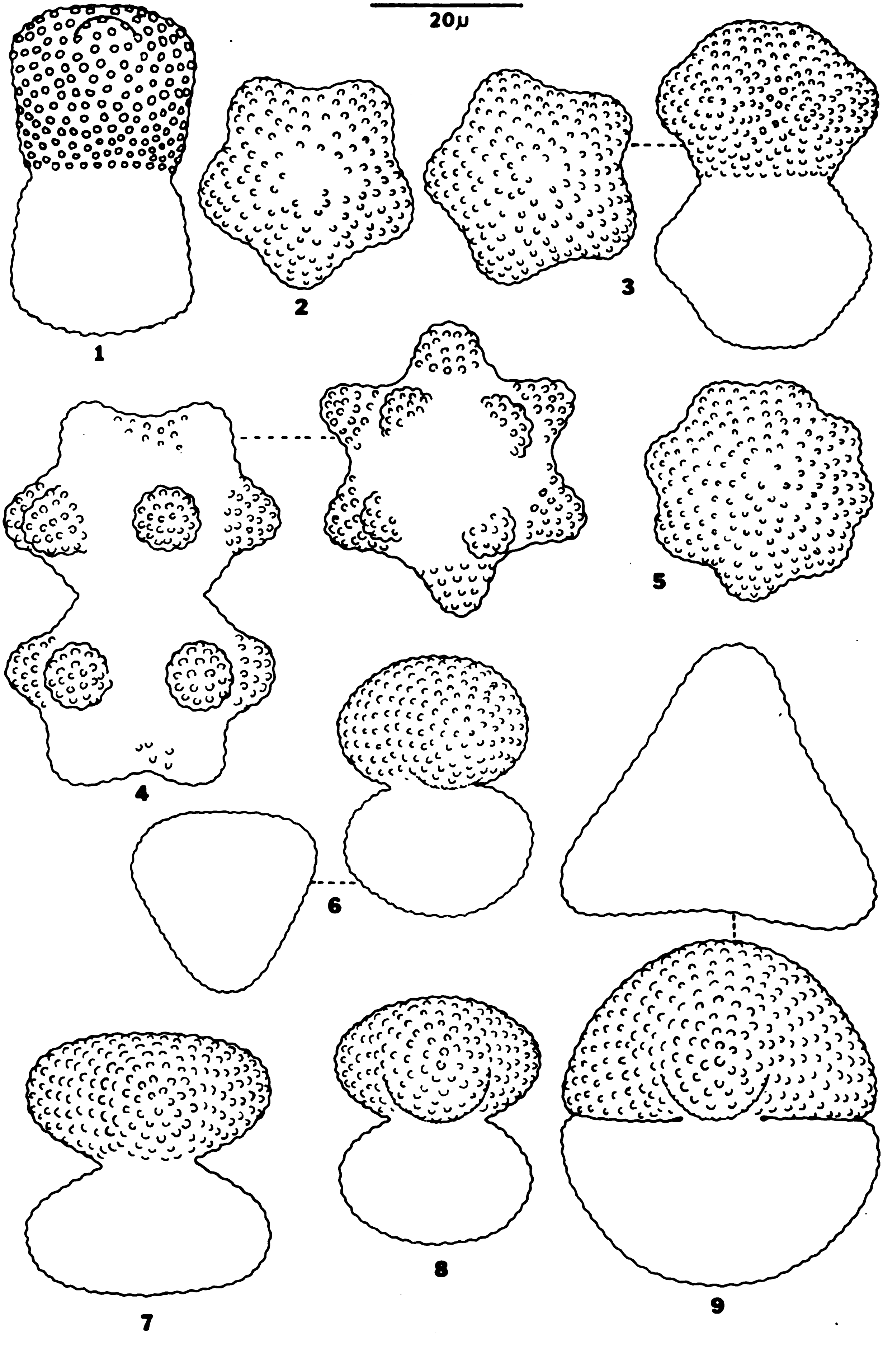


PLATE 87

STAURASTRUM

PLATE 87

20μ

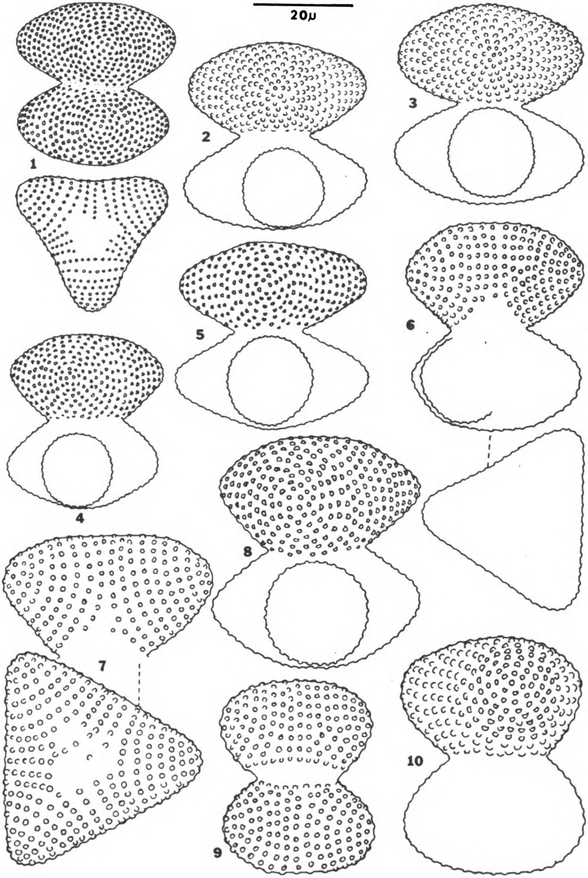


PLATE 88

STAURASTRUM

Figs.		Page
1.	St. punctulatum fa. 1-Mt63-301	313
2,3.	St. lapponicum var. lapponicum f. lapponicum 2-Mt63-194 3-Mt63-399	282
4,5.	St. lapponicum var. lapponicum f. deppresum 4-Mt64-65 5-Mt63-146	283
6,7.	St. pygmaeum var. pygmaeum 6-Mt63-154 7-Mt63-256	314
8.	St. varians 8-Mt63-154	330
9,10.	St. pygmaeum var. major 9-Mt63-185 10-Mt63-411	314

PLATE 88

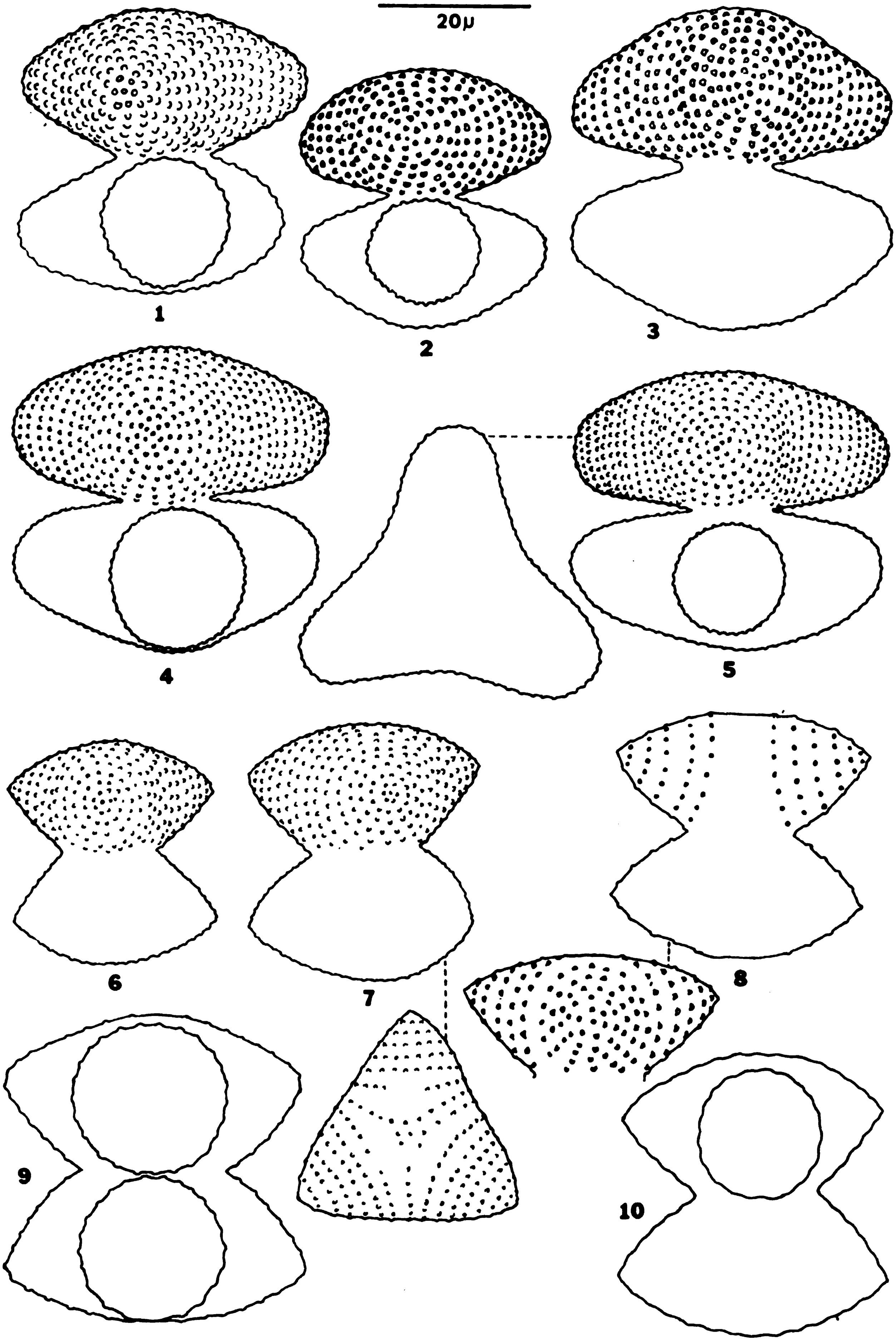


PLATE 89

STAURASTRUM

Figs.		Page
1,2,3, 4,5.	*St.* *striolatum*	323
	1 - Mon4181	
	2,3 - Mt63-266	
	4 - Mt64-64	
	5 - H.L.1	
6,7,8.	*St.* *alternans* var. *alternans*	237
	6 - Mt63-38	
	7 - Mt63-36	
	8 - Mt64-72	
9,10.	*St.* *alternans* var. *alternans* fa.	237
	9 - Mt63-391	
	10 - Mt63-101	
11,12, 13.	*St.* *dilatatum* var. *dilatatum*	263
	11 - Mt63-212	
	12 - Mt63-206	
	13 - 2Mon9	
14,15. 16.	*St.* *dilatatum* var. *dilatatum* fa. *fusiforme*	264
	14 - Mt64-65	
	15 - Mt63-112	
	16 - Mt63-129	

PLATE 89

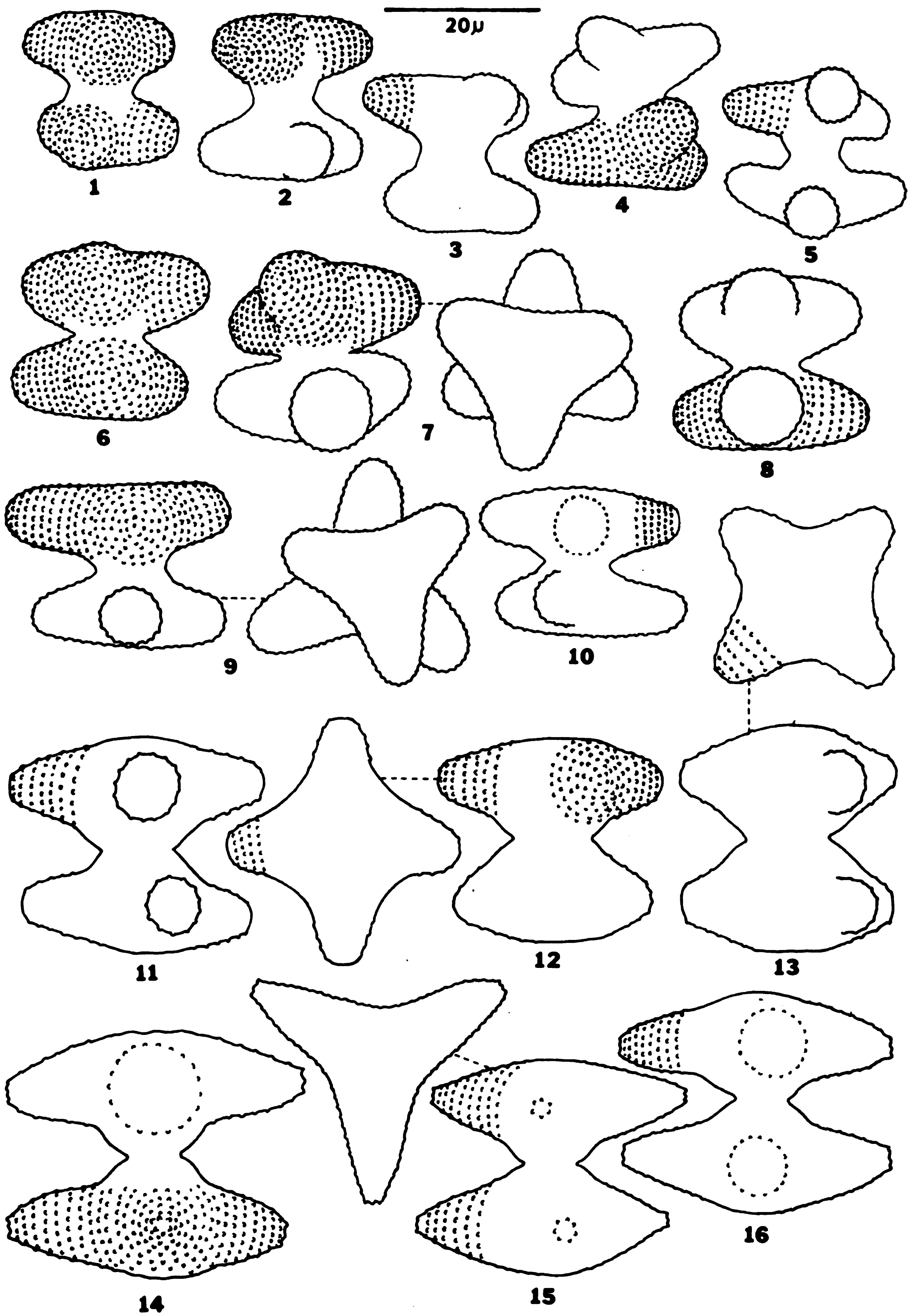


PLATE 90

STAURASTRUM

Figs.		Page
1,2,3, 4.	*St. lunatum* var. *lunatum*	286
	1 - Mt63-210	
	2 - Mt63-206	
	3 - Mt63-149	
	4 - Mt63-265	
5,6,7, 8.	*St. lunatum* fa.	286
	5 - Mt63-146	
	6 - Mt63-399	
	7 - Mt63-134	
	8 - Mt63-129	
9.	*St. denticulatum*	260
	9 - Mt63-152	
11,10.	*St. cristatum* var. *japonicum*	253
	10,11 - Mt63-121	

PLATE 90

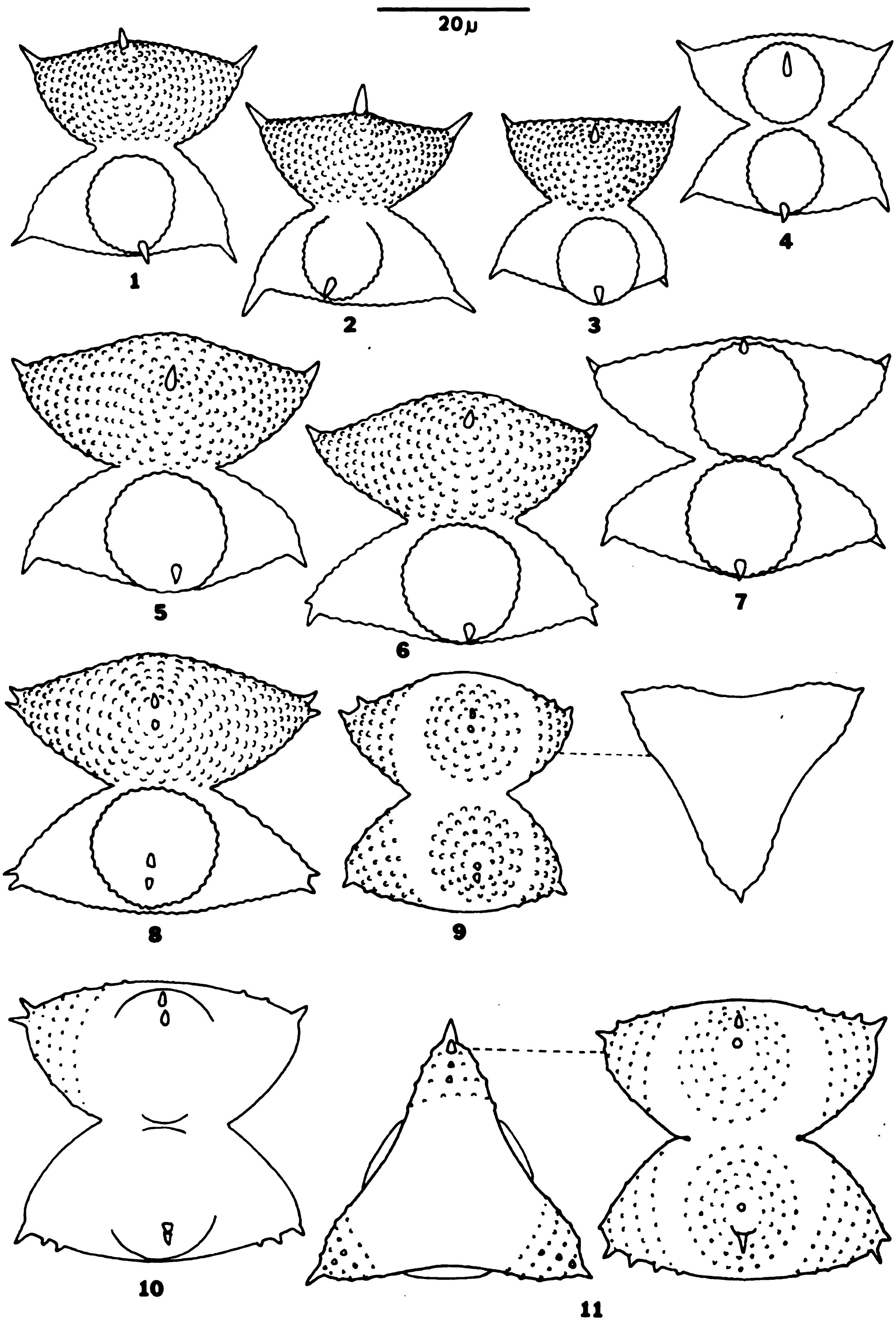


PLATE 91

STAURASTRUM

Figs.		Page
1,2.	St. avicula	240
	1- Mt63-121	
	2- H.L.1	
3,4.	St. subavicula	324
	3,4- Mt63-78	
5,6,7. 8.	St. arcuatum var. quitanense	239
	5- Mt62-26	
	6,7- H.L.1	
	8- Mt63-137	
9,10.	St. subcruciatum	324
	9- Mt63-192	
	10- Mt63-333	
11,12.	St. dakotii	256
	11- Mt62-213	
	12- Mt63-443	

PLATE 91

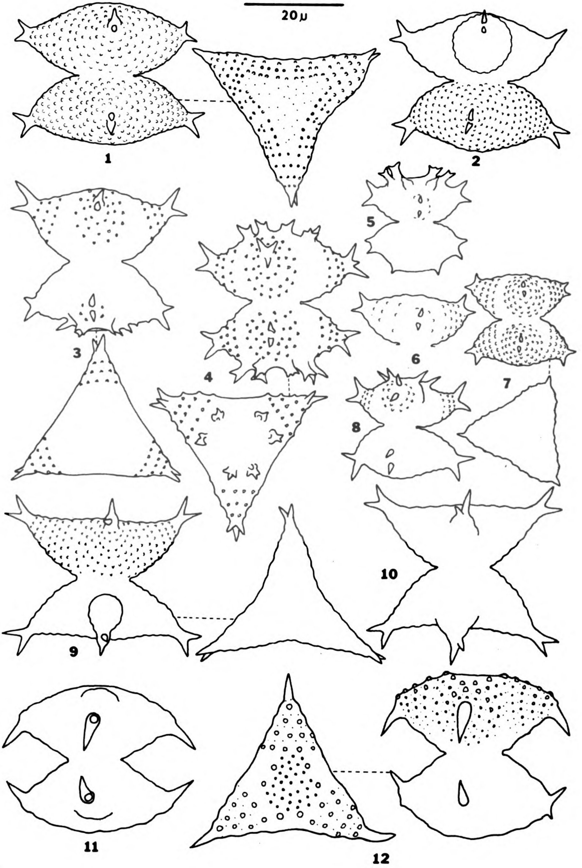


PLATE 92

STAURASTRUM

PLATE 92

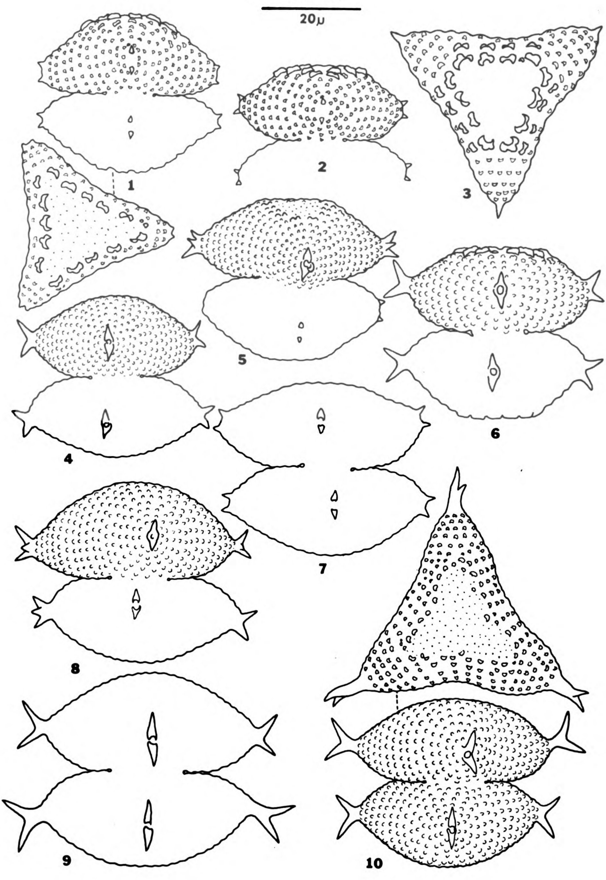


PLATE 93

STAURASTRUM

PLATE 93

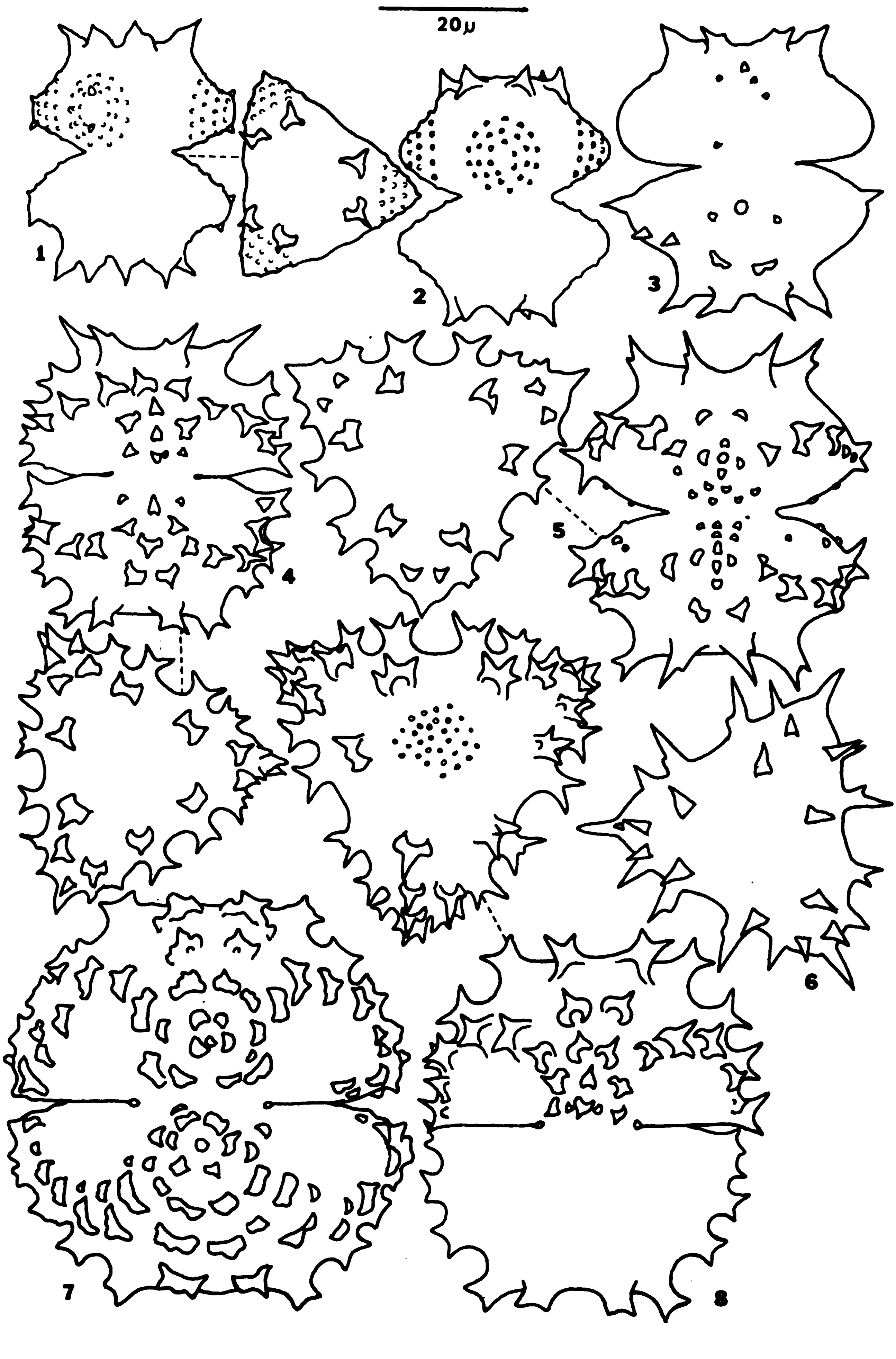


PLATE 94

STAURASTRUM

PLATE 94

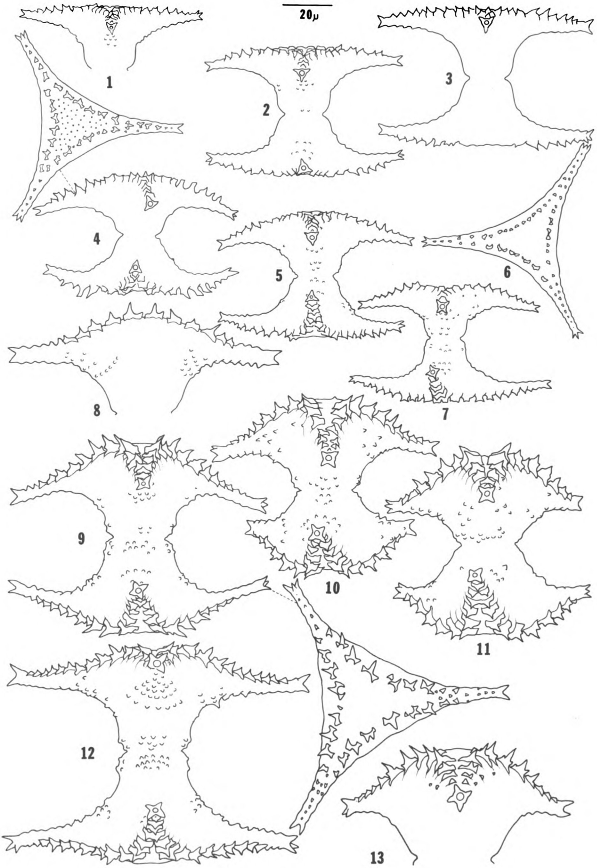


PLATE 95

STAURASTRUM

Figs. | | Page

Figs.		Page
1,2,3. 4,5,6	*St. manfeldtii*	292
	1- Mt63-145 (=var. *manfeldtii*)	
	2,5- Mt63-90 (=var. *manfeldtii*)	
	3,4,6- Mt64-70 (=*St. gracile* var. *cyathiforme*)	
7,8.	*St. manfeldtii* var. *planctonicum*	292
	7,8- Mt63-465 (=*St. sebaldi* var. *ornatum* f. *planctonica*)	
9,10.	*St. planctonicum*	305
	9,10- Mt64-74	

PLATE 95

20μ

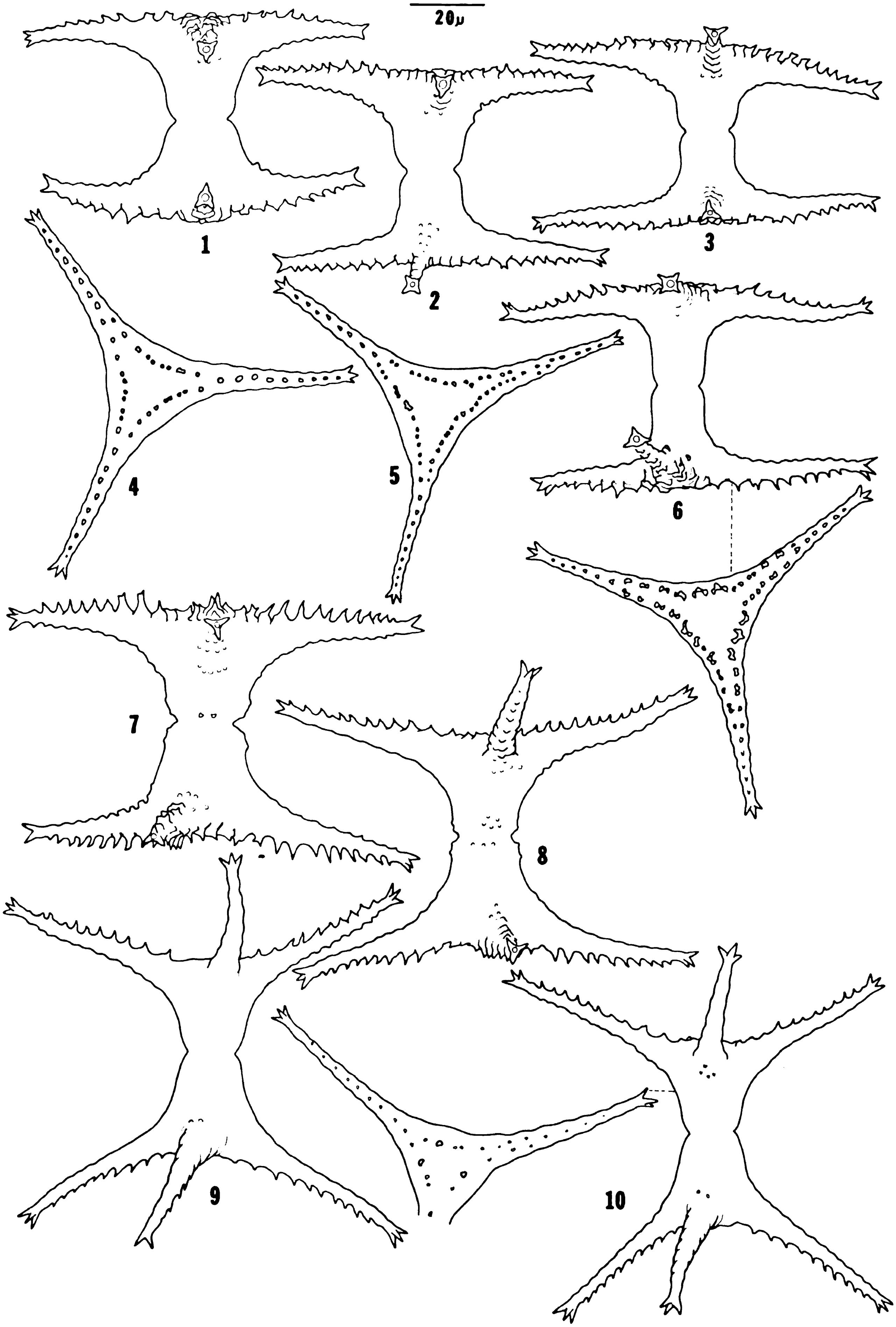


PLATE 96

STAURASTRUM

Figs.		Page
1,2,3.	*Staurastrum planctonicum* fa. (=*St. longiradiatum sensu Smith*)	305
	1 - Mt63-383	
	2 - Mt64-11	
	3 - Mt63-192	
4,5.	*St. johnsonii*	281
	4 - Mt62-20	
	5 - Mt63-204	
6,7.	*St. submanfeldtii*	325
	6,7 - Mt63-116	
8,9, 10,11, 12.	*St. bicorne*	241
	8 - Mt63-163	
	9 - Mt63-393	
	10 - Mt63-415	
	11 - Mt64-65	
	12 - Mt63-110	

PLATE 96

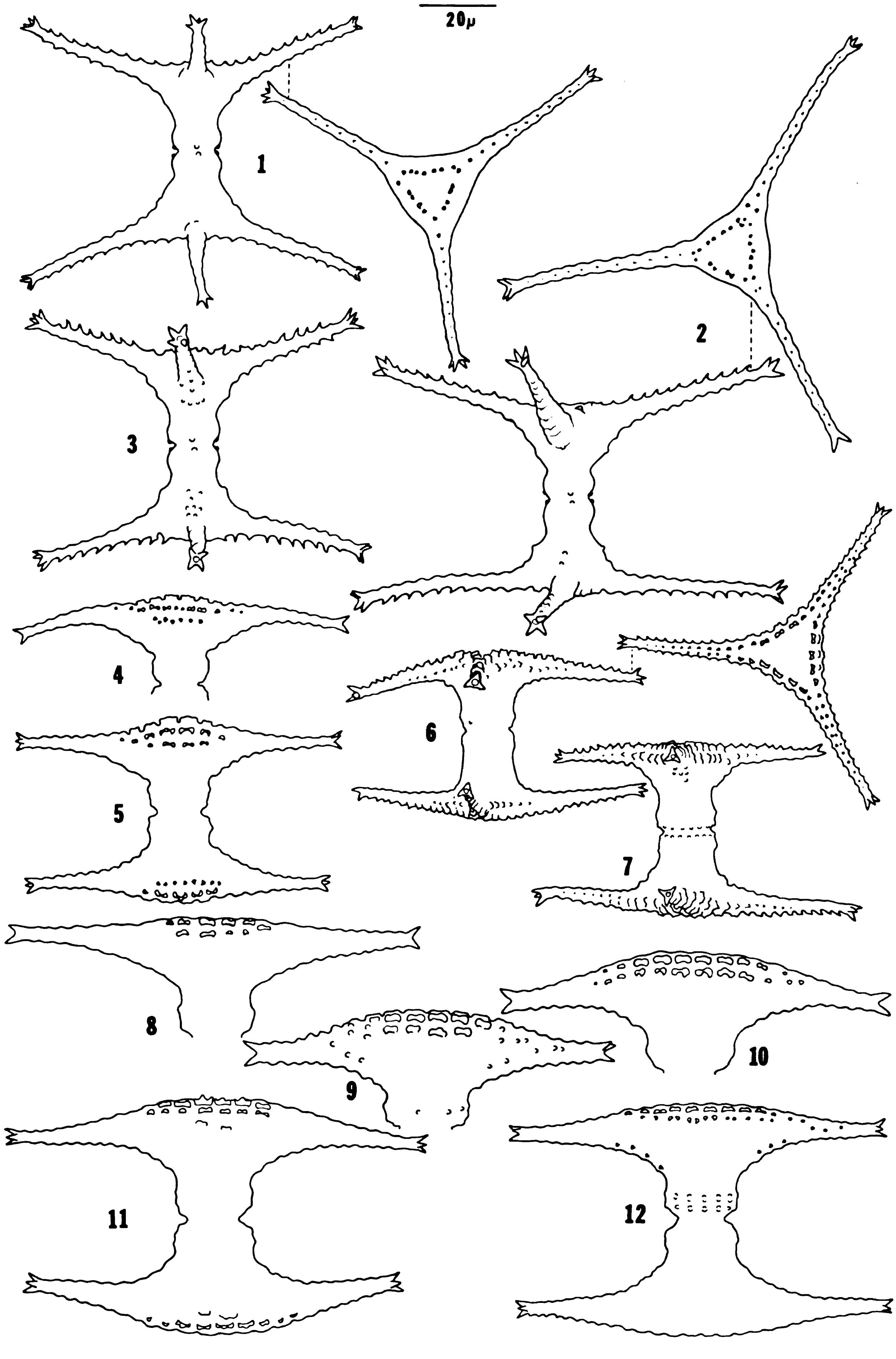


PLATE 97

STAURASTRUM

PLATE 97

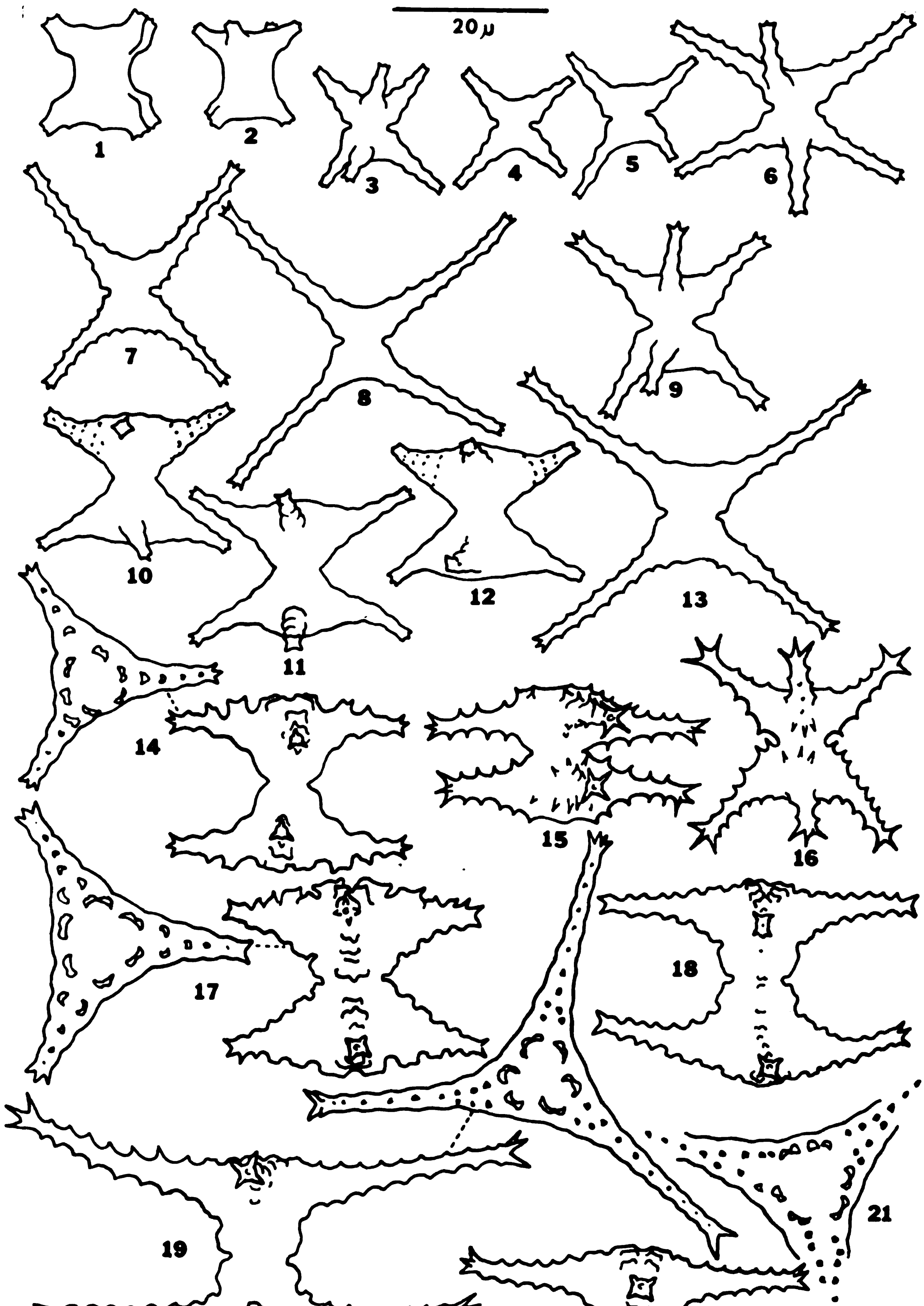


PLATE 98

STAURASTRUM

PLATE 98

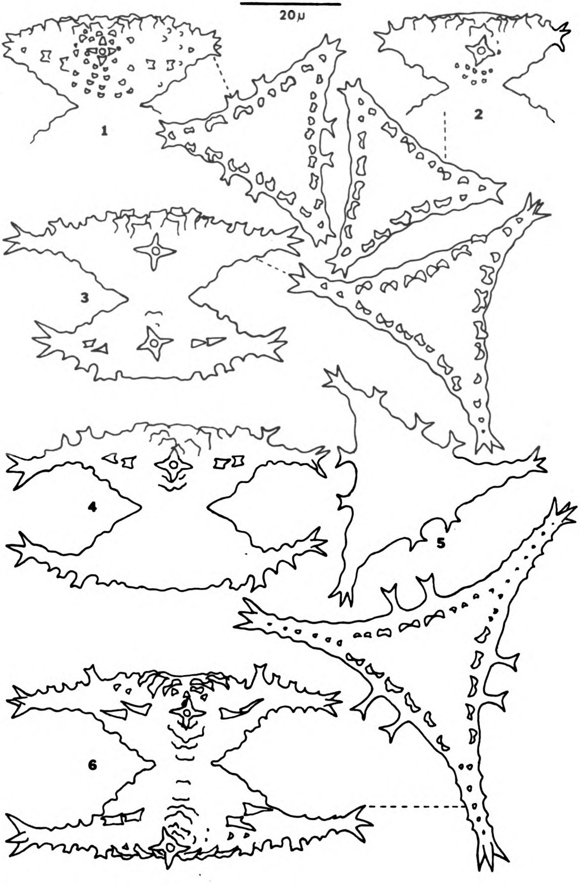


PLATE 99

STAURASTRUM

PLATE 99

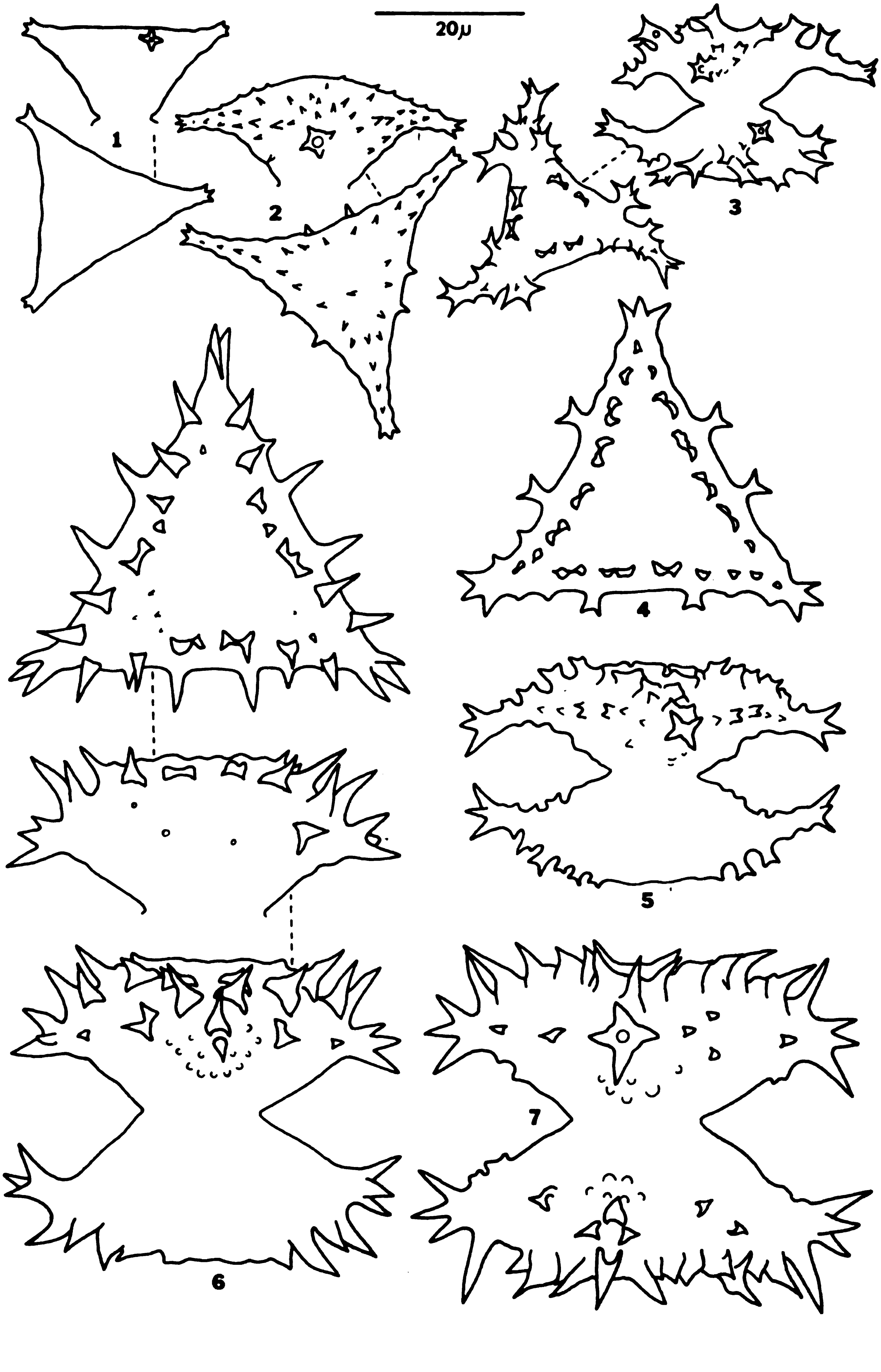


PLATE 100

STAURASTRUM

PLATE 100

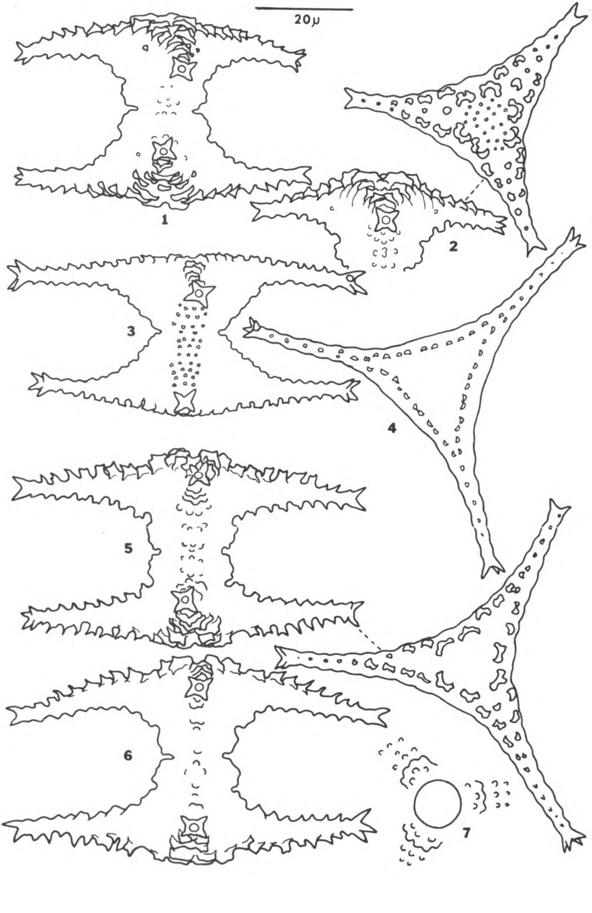


PLATE 101

STAURASTRUM

PLATE 101

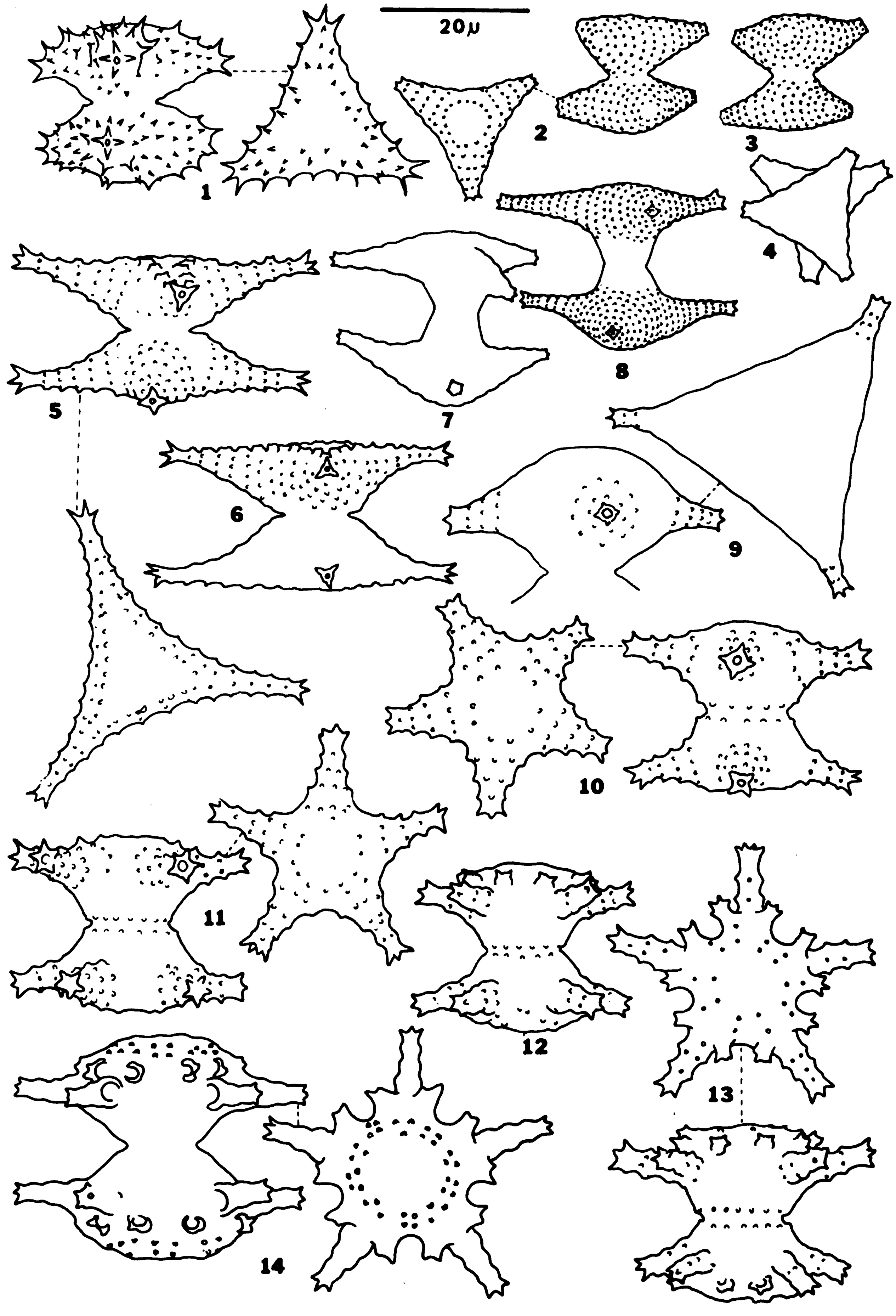


PLATE 102

STAURASTRUM

Figs.		Page
1,2,3. 4,5.	St. proboscidium	209
	1 - Mt63-16	
	2 - Mt63-181 (=St. borgeanum)	
	3 - Mt62-11 (=St. aculeatum var. ornatum)	
	4 - Mt63-185 (morpha)	
	5 - Mon4181 (=St. borgeanum)	
6,7.	St. sexcostatum var. sexcostatum	320
	6 - 6Mon38	
	7 - Mt63-419	
8.	St. sexcostatum var. productum	320
	8 - Mt63-447	
9.	St. sexcostatum fa.................................	321
	9 - Mt63-154	

PLATE 102

20μ

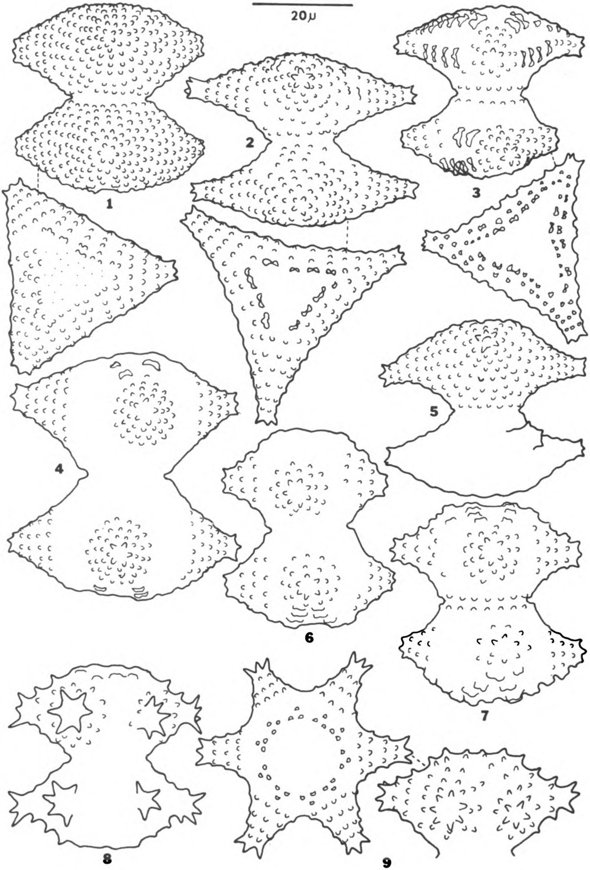


PLATE 103

STAURASTRUM

Figs. | | Page

1,2,3. *St. boreale* 243
3 - (Top view)
1,2,3 - Mt63-188

4,5,6, 7,8,9, 10,11. *St. gracile* var. *gracile* 272
4,6,8,9,10 - Mt63-499
11 - Mt63-499
5 - Mt63-391
7 - Mt63-218
8 - (dichotypical specimen?)
(*St. gracile* and *St. cingulum*)
10 - (portion showing decoration on lateral wall between processes)
11 - (top view)

PLATE 103

20µ

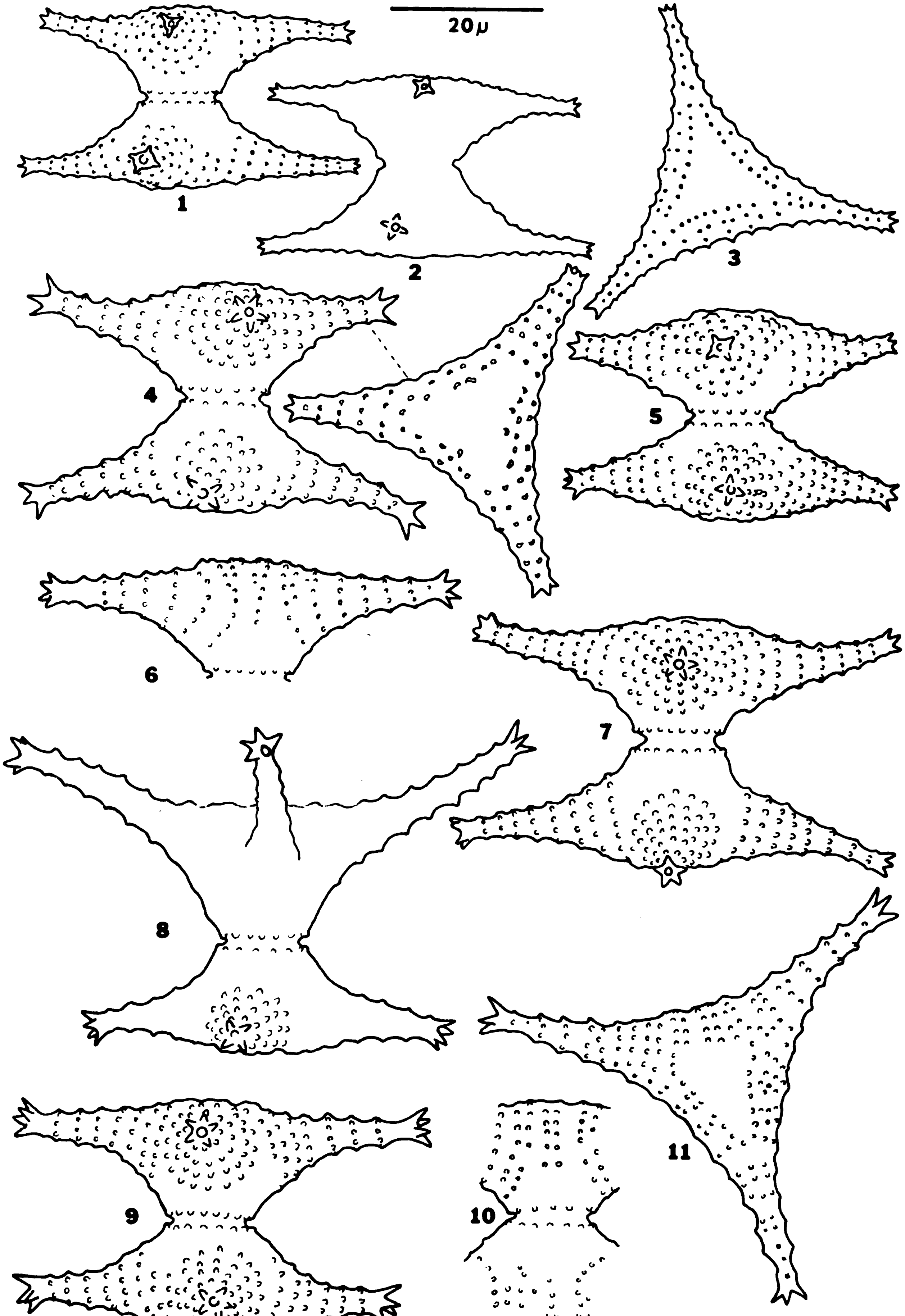


PLATE 104

STAURASTRUM

PLATE 104

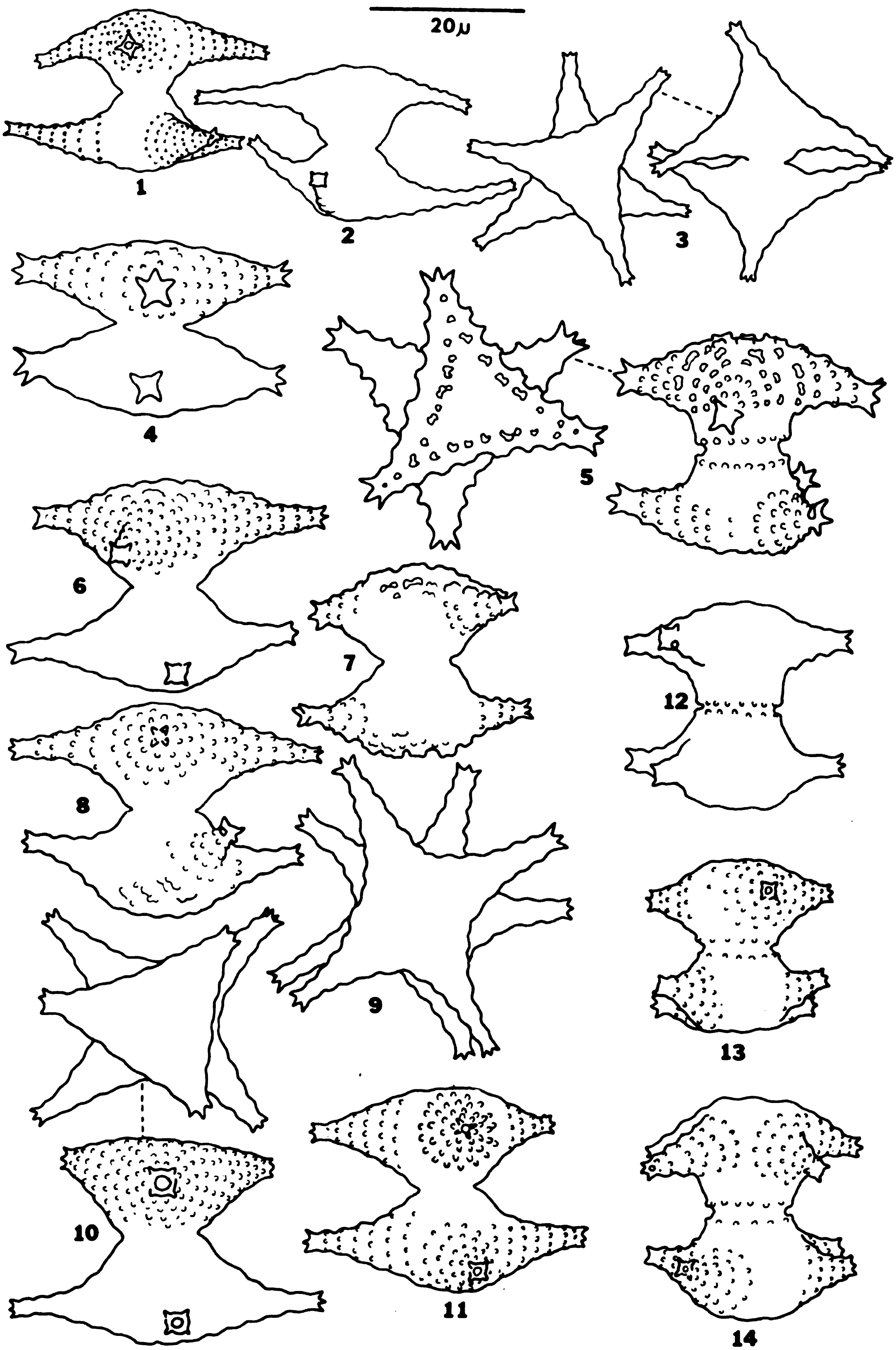


PLATE 105

STAURASTRUM

Figs.		Page
1,2,3.	*St. cingulum* var. *cingulum*	248
	1- Mt63-340	
	2- Mt63-197	
	3- Mt63-127	
4.	*St. thunmarkii*	327
	4- Mt63-334	

PLATE 105

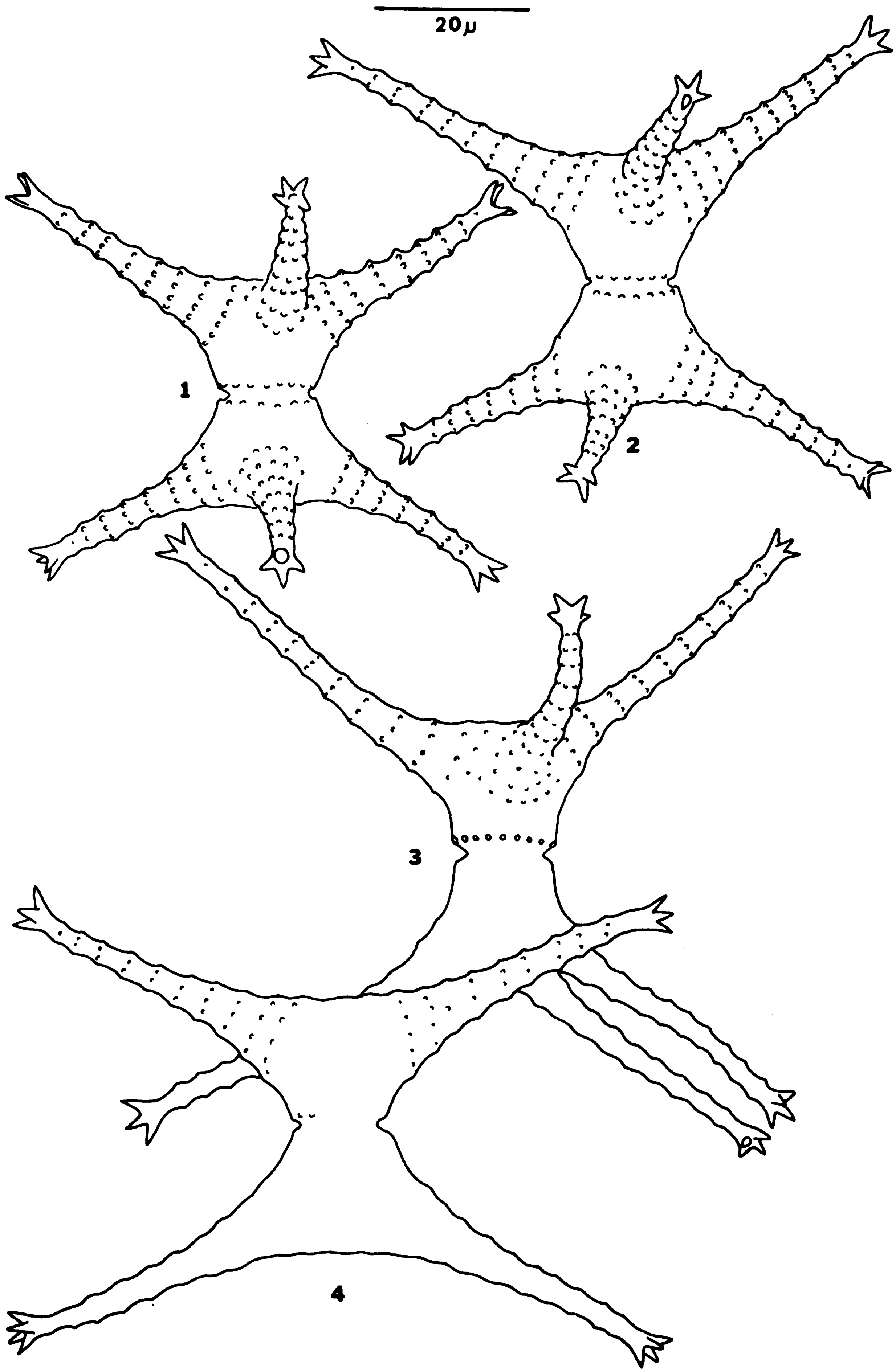


PLATE 106

STAURASTRUM

PLATE 106

20μ

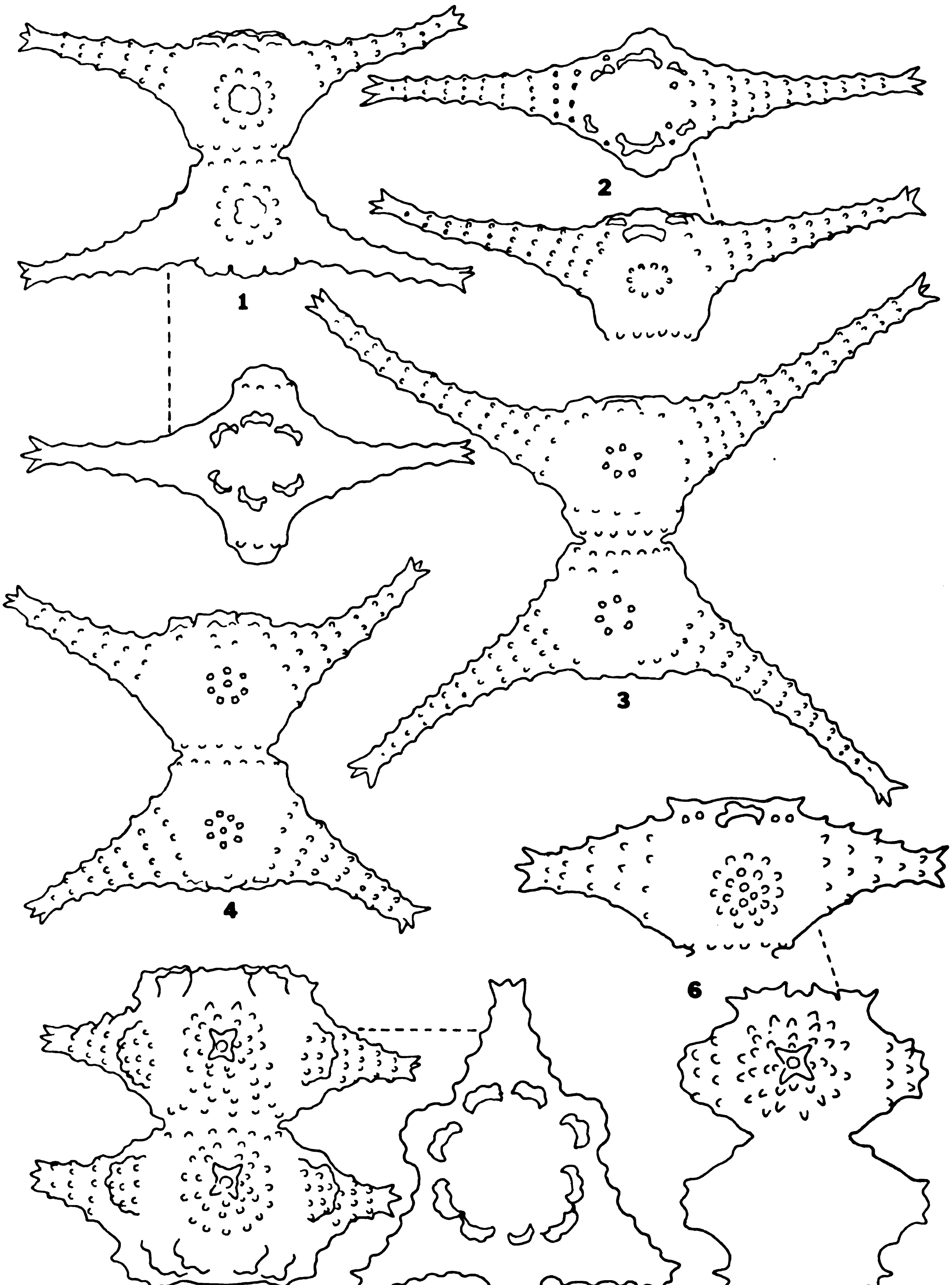


PLATE 107

STAURASTRUM

PLATE 107

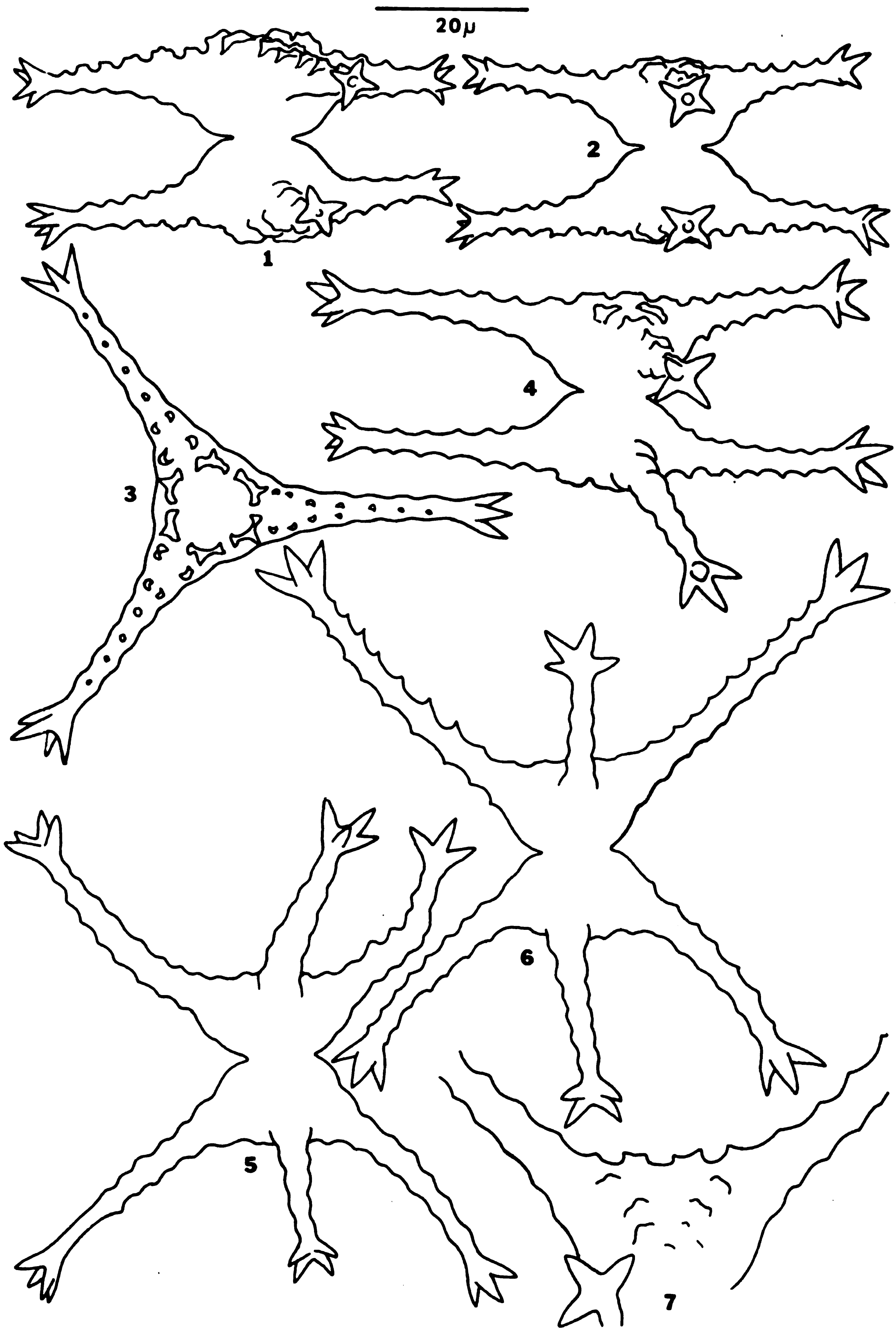


PLATE 108

STAURASTRUM

Figs. Page

1,2. *St. pinque* 303
1 - Mt64-99
2 - Mt63-90

3,4. *St. paradoxum* var. *paradoxum* 307
3 - Mt64-99
4 - Mt63-297

5. *St. pinque* var. *tridentata* 303
5 - Mt63-90

6,7. *St. smithii* fac. *triradiatum* 321
6 - Mt63-97
7 - Mt63-218

PLATE 108

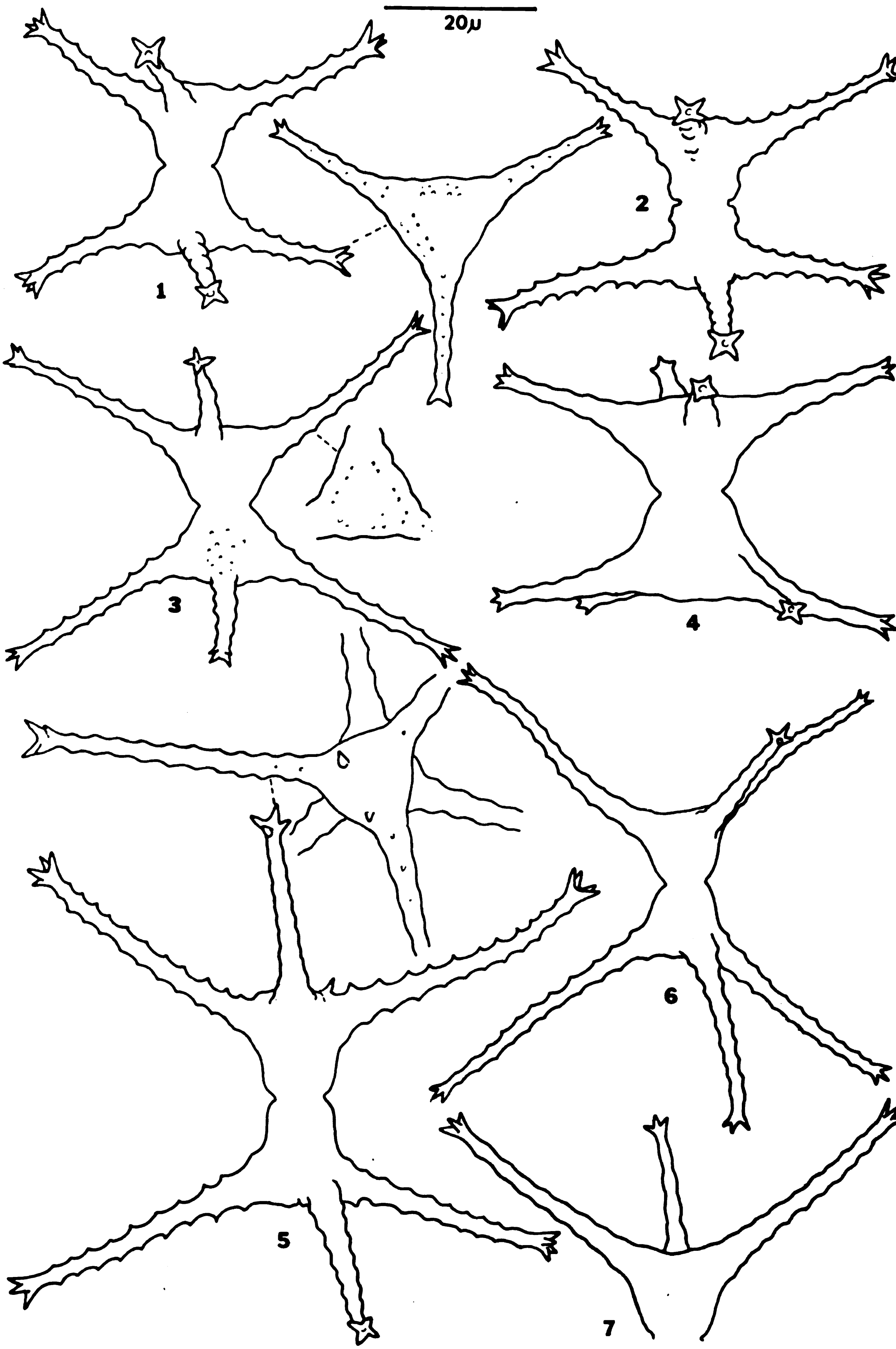


PLATE 109

STAURASTRUM

Figs.		Page
1,3.	<u>St</u>. <u>chaetoceras</u> f. <u>triradiata</u> .... 1 - Mt64-111 3 - Mt64-61	248
2,4.	<u>St</u>. <u>chaetoceras</u> .... 2,4 - Mt64-21	247
5.	<u>St</u>. <u>chaetoceras</u> fa. .... 5 - Mt64-70	248

PLATE 109

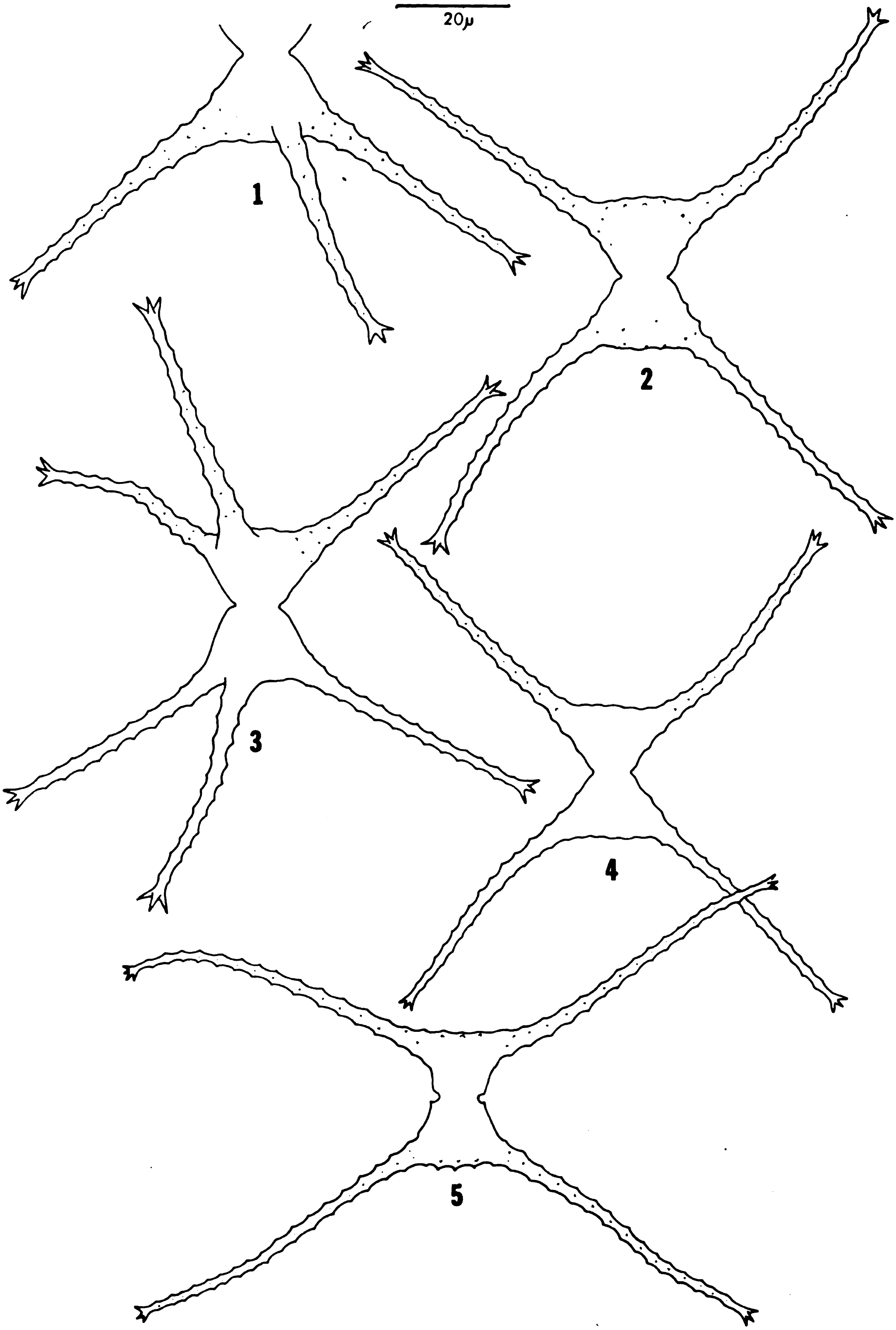
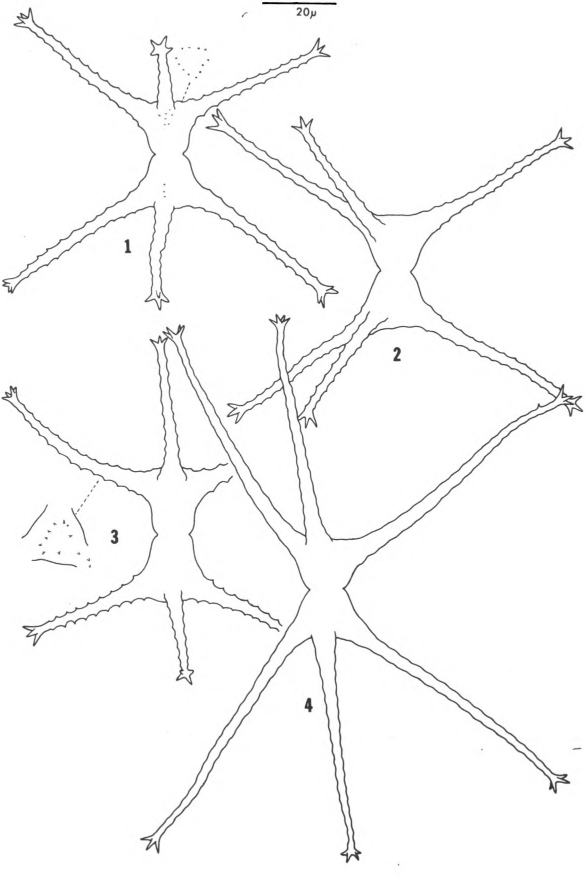


PLATE 110

STAURASTRUM

PLATE 110



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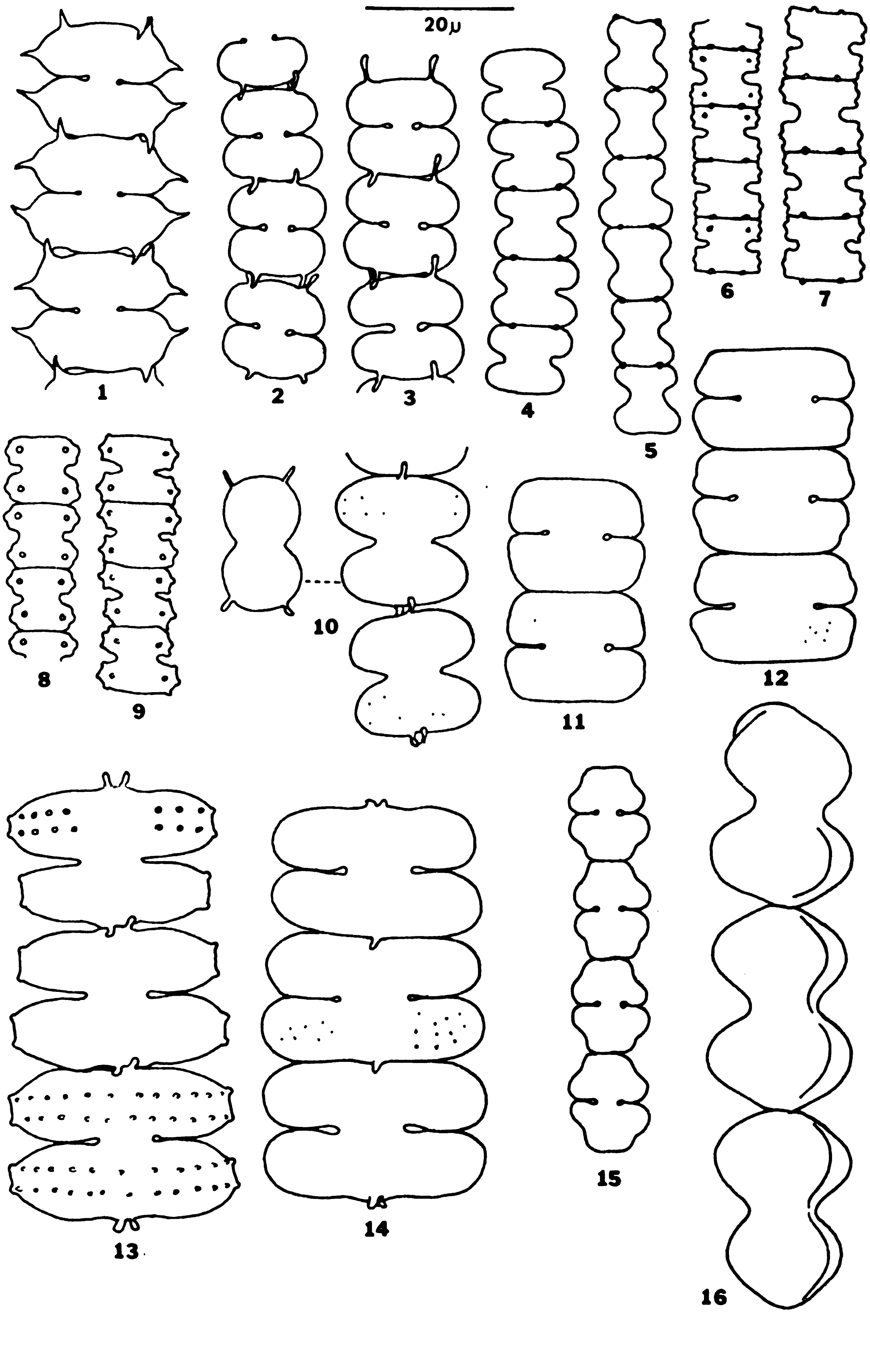

PLATE 112

SPONDYLOSIUM, HYALOTHECA

BAMBUSINA

PLATE 112

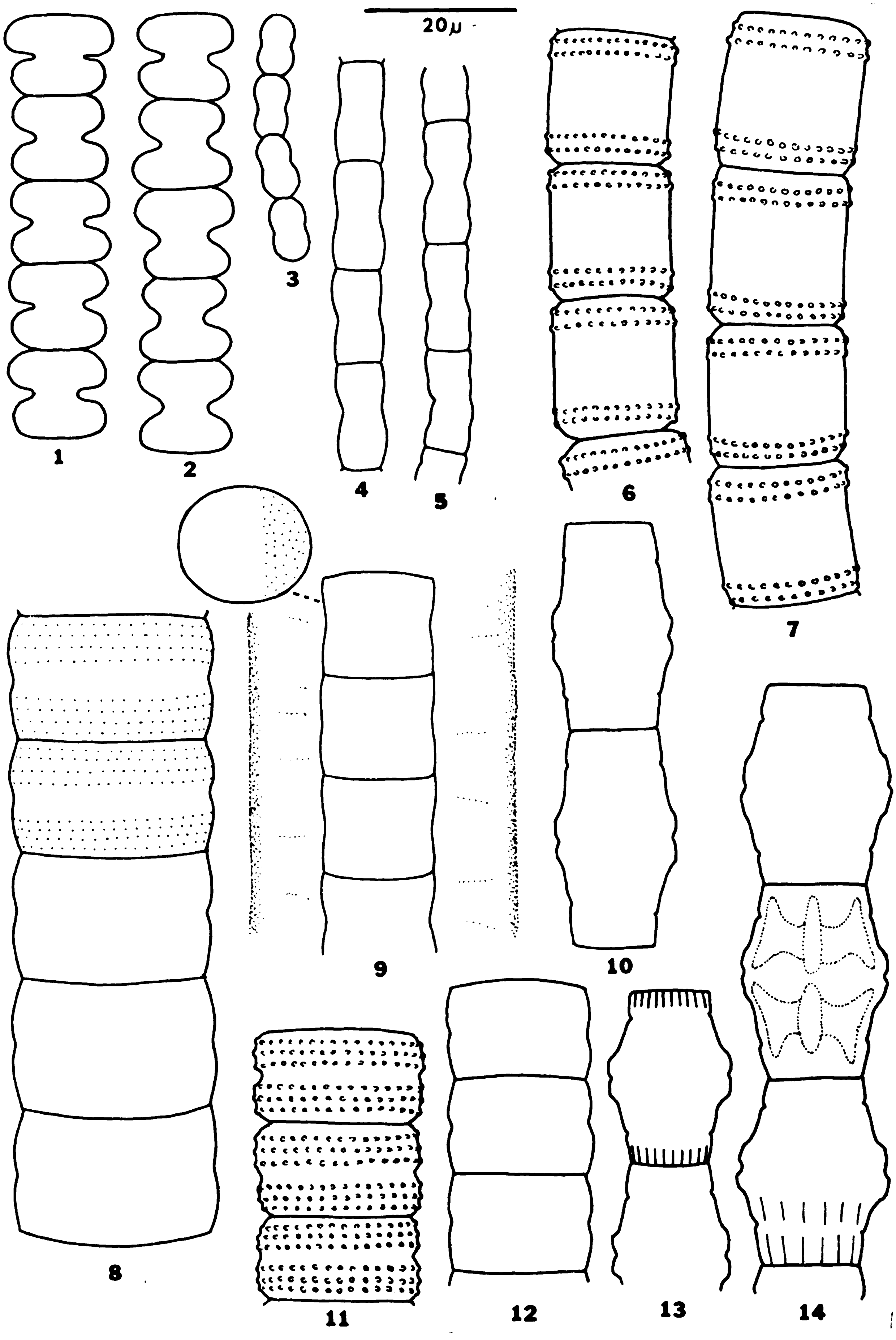

PLATE 113

DESMIDIUM

PLATE 113

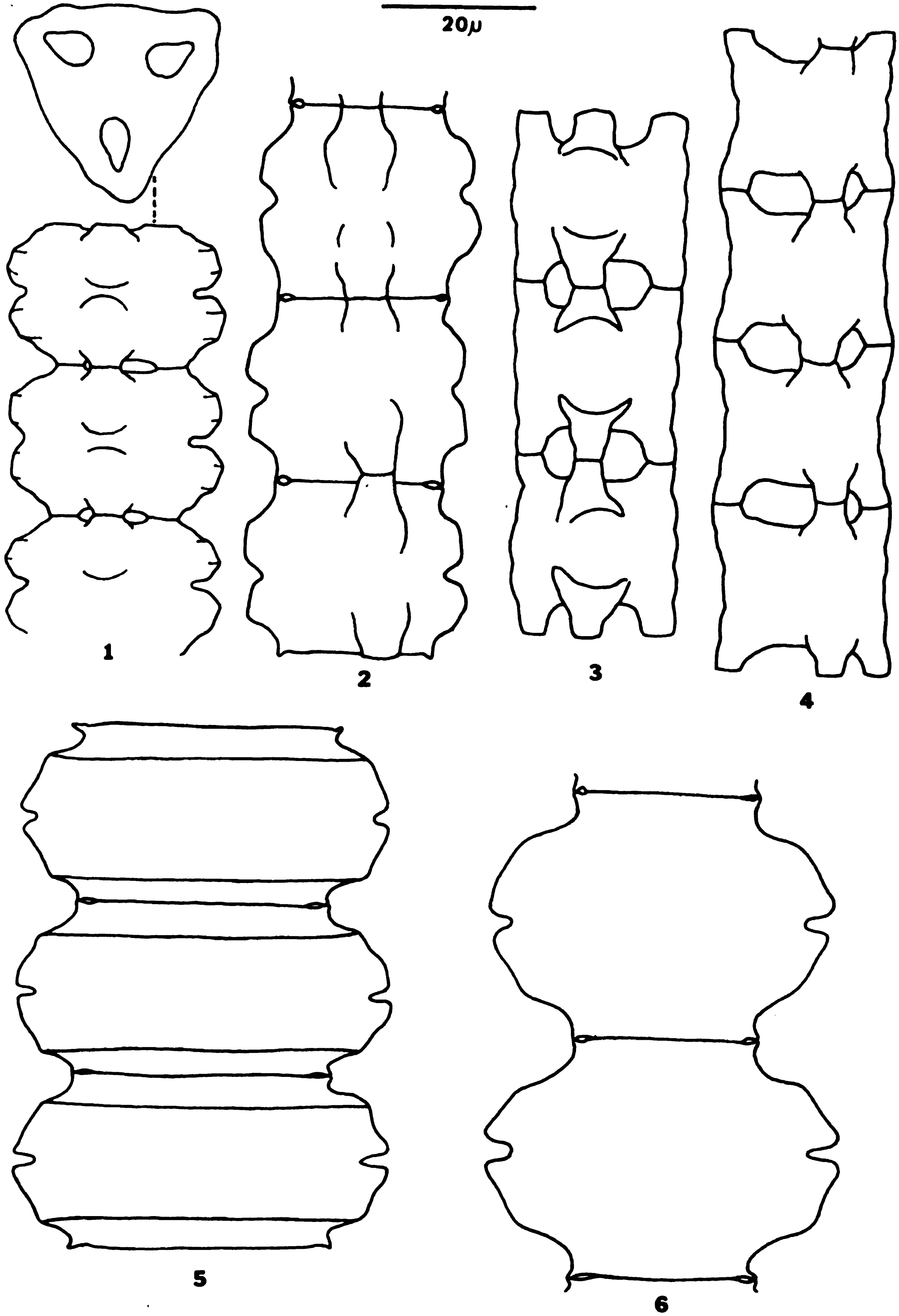

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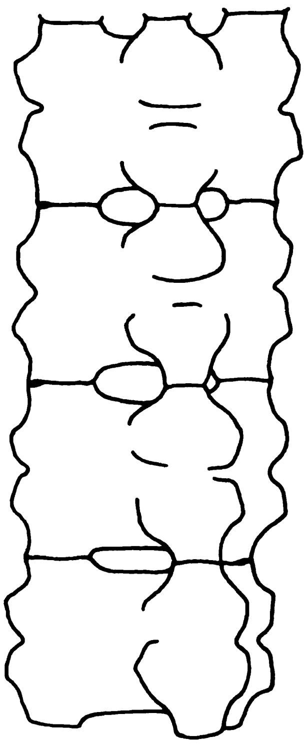
PLATE 114

20μ



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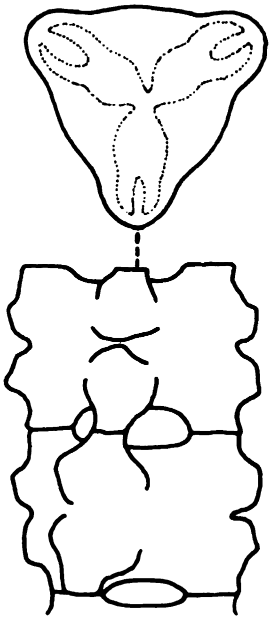

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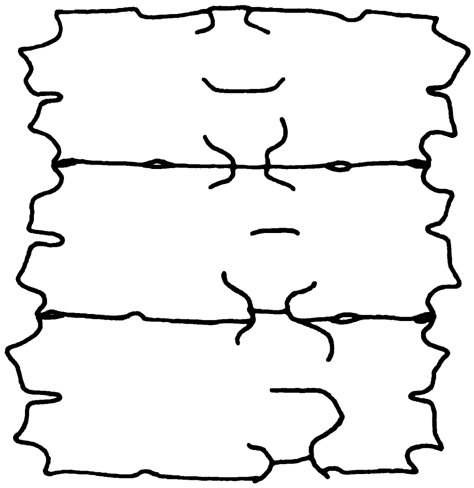

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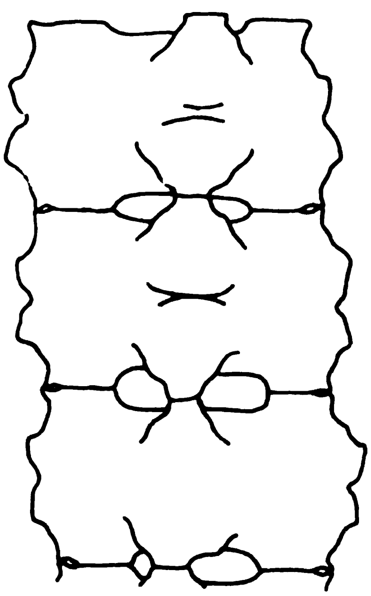

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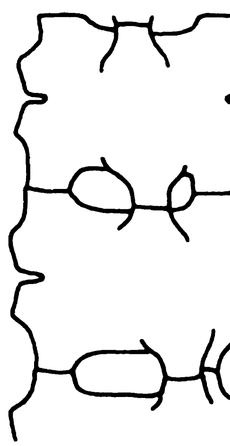

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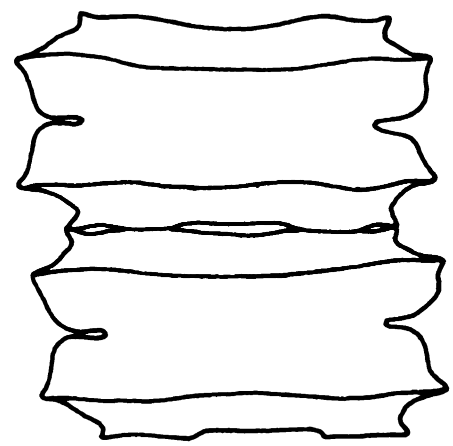

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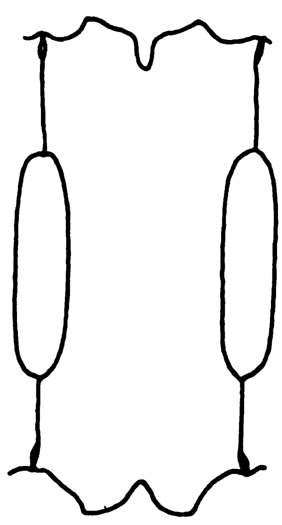

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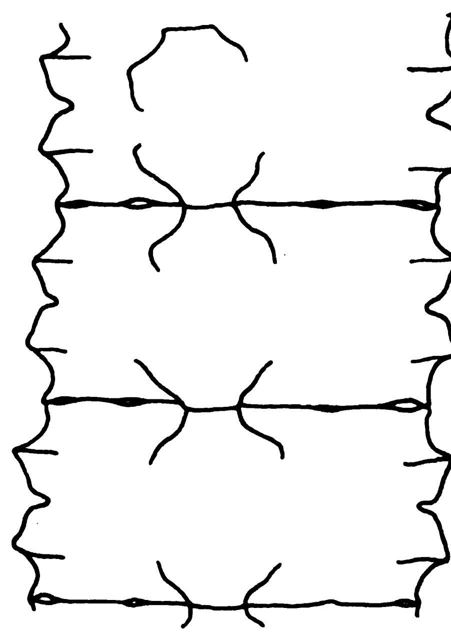

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APPENDICES

APPENDIX I

Explanation of Ciphers used to Describe the Geology

Kb - Bearpaw shale.
Dark-gray and brownish clay shale; thick units of non-fissile bentonitic shale; calcareous and ferruginous concretions throughout; contains some thick bentonite beds.

Kbf - Belle Fourche shale.
Dark blue-gray siliceous shale with many calcareous and ferruginous concretions and intercalated thin layers of bentonite.

Kc - Colorado shale.
Dark gray shale and siltstone many concretions and sandy units. Includes equivalents of Fall River, Skull Creek, Newcastle, Mowry, Belle of Fourche, Greenhorn, Carlile, and Niobrara formation, and locally Telegraph Creek formation. In the less well known areas beds of other ages may have been included.

Kcl - Clagget formation.
Chiefly dark-gray shale with iron-stained concretions; locally sandstone present; numerous bentonite beds near base.

Khc - Hell Creek formation.
Somber-gray sandstone and greenish shaly clay and mudstone containing dinosaur bones; a few thin lignite and subbituminous coal beds.

Ki - Idaho batholith and associate masses.
Faintly gneiss quartz monzonite, granodiorite and similar rocks. The extreme eastern part of Idaho batholith extends into Ravalli county. This and nearby masses of similar rocks are shown as associate with the Idaho batholith and designated Ki. Future studies may show that some granitoid masses farther east also allied to the Idaho batholith or that a few of the masses now grouped with that batholith are younger. Precise dating is impossible at present.

Kib - Border zone of Idaho batholith and associated masses.
Granite gneiss and a sedimentary rocks, mainly of Belt age, impregnated with granitic material. Because of lack of information they are not distinquished around some of the smaller granitic masses that have such border zones.

Descriptive notes were taken from the "Geology Map of Montana" compiled by Ross, Andrews, and Witkind. Prepared in cooperation with the Montana Bureau of Mines and Geology 1955, reprinted 1958.

Kjr - Judith River formation.
Light-colored sandstone at top; lower third somber-gray siltstone and sandy shale; greenish-gray and some lignite beds includes the Parkman sandstone member of south-central Montana.

Kk - Kootenai formation and associated rocks.
Conglomerate, sandstone, shale, and mudstone; purplish and green beds are common; mainly the Kootenai; in southern Montana includes strata that have been mapped as Cloverly formation. Includes Second Cat Creek and Third Cat Creek sands of drillers in central part; and CutBank sand of drillers in western part. As here mapped, may locally include thin units of Jurassic age.

Kl - Lennep sandstone.
Mainly dark-brown andesitic sandstone with intercalated shale; locally contains thin coal beds.

Km - Montana group, undifferentiated.
Mainly sandstone and shale, soft and in part poorly consolidated: some coal; shown undivided only in areas where detailed data are lacking and in these areas some rocks not of Montana age may have been included. In particular, rocks designated Km in southwestern Montana may include some Tertiary strata.

Ktc - Telegraph Creek formation.
Buff mainly soft, fissile sandy shale with subordinate amounts of concretionary sandstone.

Ktm - Two Medicine formation.
Greenish-gray clay with local nodular limestone and crossbedded sandstone; locally coal in lower part. Rock equivalent to Judith River formation, Claggett formation; and upper part of Eagle sandstone are included in this unit.

Ku - Cretaceous, undifferentiated.
Used in only a few areas such as Disturbed Belt east of Glacier National Park, where subdivision is difficult.

Mu - Mississippian, undifferentiated.
Sandstone, shale and limestone in part dolomitic, with chert nodules, some quartzite; include Big Snowy group in central part of the state, Madison group in central and southwestern parts; and Hannan and Brazer limestone in the northwestern part; may include small amounts of Pennsylvanian rocks in areas where stratigraphic studies are incomplete.

pCga- Grinnell argillite.
Reddish purple and green argillite, and some quartzite; generally contains some feldspar and carbonates.

pCap- Appekunny argillite.
Gray quartzitic and quartzite.

pCg - Greyson shale.
Dark-gray to dark-brown argillaceous and sandy rock; weathers brown or red; grades into the Spokane above and the Newland below. Distinquished only in the general vicinity of Helena.

pCgs- Pre-Belt gneiss, schist, and related rocks.
Comprises all the rocks older than the Belt series except the stillwater complex. These include the Cherry Creek group, consisting of interlaminate gneiss, schist, marble and quartzite; and the Pony series of Tansley and others consisting of gneiss, schist, of both sedimentary and igneous origin. Recent work has resulted in the distinction of small masses of granitic and injected rocks now regarded as resulting from intrusion in Cretaceous or Tertiary time. Other such masses may have escaped recognition.

pCm - Missoula group.
Chiefly red, marron, or purple argillite, sandy or quartzitic argillite, and generally impure quartzite and limestone. The larger limestone masses are similar to the Siyeh limestone of the Piegan group. The Missoula group includes numerous named formation, most of which cannot be traced with confidence far from their type localities. Among these are Marsh shale in Helena region, the stripped Peak and Libby formations in northwestern Montana, five near Missoula, and others in and south of Glacier Park.

pCn - Newland limestone.
Dark bluish-gray argillaceous, dolomitic limestone with some argillite, locally schistose; segregation structures not conspicuous. In central and western Montana, the Newland and Wallace formations have been treated as essentially synonymous terms by some authors.

pCp - Prichard formation.
Dark-gray generally argillaceous rocks, locally sandy or quartzitic; locally metamorphosed to schist.

pCpi- Piegan group.
Most of the Piegan group is subdivided into formations that are in part equivalent to each other. Where correlations are relatively doubtful the group designation is retained. Carbonate- bearing rocks predominate in the group, but the proportions and character of the impurities in thses rocks and the relations to the non-carbonate-bearing rocks vary from place to place.

pCr - Ravalli group.
A diverse assemblage with numerous subdivisions, only a few of which have been recognized over a large enough area to be distinquished here. Near Idaho the rocks are light colored and siliceous, ranging from pure white quartzite to silicious shale, mostly in subdued tones of gray, green, purple and red. Near Missoula the rocks are dark-gray quartzitic argillite. In and near Glacier National Park, the Greinnell, Appekunny, and Altyn formation are distinquished.

pCs - Spokane shale.
Red or red purple shale with numerous green beds locally and some quartzite; grades into the Empire above and the Greyson below and

in some areas as mapped probably includes all or part of the Empire and Greyson shales. The name has been used over a wide area in Montana but in a strict sense can be used safely only in the general vicinity of Helena.

pCw - Wallace formation.
A heterogeneous unit that includes dark-gray argillite, areanaceous and argillaceous limestone, in part dolonitic, and gray limy quartzite, shale and sandstone in large areas. The arqillaceous and sandy or quartzitic rocks are commonly slightly calcareous. The dominantly carbonate-rich rocks contain "molar tooth" or segregation structures. Commonly characterized by thin laminae. Locally red rocks near the top may represent a transition into the Missoula group.

Qal - Alluvium
Mainly valley fill consisting of silt, sand and gravel; includes some terrace deposits and glacial drift of Pleistoncene age in someareas; locally includes hot spring tufa. The older part of the alluvium, where present, is probably Pliocene age.

Qg - Glacial drift.
Morainal and outwash plain deposits of mountain glaciers; mainly ill-sorted and poorly rounded boulders, cobbles, pebbles, and sand; may include alluvium in places.

Qgl - Glacial lake deposits.
Mainly silt; believe to have been deposited in lakes formed behind temporary dams of ice or morainal deposits.

QTt - Terrace deposits.
Gravel, sand, and silt of terrace remnants.

Tfu - Fort Union formation.
Clay shale, siltstone and sandstone; local lenses of impure limestone and numerous lignitic beds.

TKb - Boulder batholith and broadly related rocks.
Mainly quartz monzonite, but includes diorite, aplite, and other rocks. The distinctions between rock masses relative to the Boulder batholith and those mapped as of other ages are locally arbitrary and tentative.

TKl - Livingston formation
Water-laid volcanic material, mainly andesitic in composition includes agglomerate, conglomerate, sandstone, and shale. The name is here used only for the rock originally named, mainly near and north of Livingston. These rocks include age equivalents of various Cretaceous and Paleocene units.

Ts - Tertiary sedimentary rocks, undifferentiated.
Classic deposits in western Montana, mostly in valleys and in most places not divided into formation; mostly poorly consolidated gravel, sand, silt and clay; includes some tuffaceous material and

locally lenses of lignite and bentonite; a little hot spring tufa; and in areas not yet mapped in detail, lava may be included. These rocks were in part laid down in lakes but a larger part was formed in streams and alluvial fans. These rocks are Tertiary in age and as now mapped may even include some beds of Cretaceous age. Some late Tertiary terrace deposits may be included.

Tv - Tertiary volcanic rocks.
Flows and associate pyroclastic deposits, with subordinate amounts of intercalated sedimentary beds and lignite. The volcanic materials is mostly latite; quartz latite, and andesite but includes some shyolite and basalt. The distinction between Tertiary and pre-Tertiary volcanic rocks was not made in some of the reports used in the compilation. Hence, in the less well-known areas some pre-Tertiary volcanic rocks may be included.

APPENDIX II

Explanation of Ciphers used to Describe Soils.

LIGHT COLORED SOILS OF THE ARID REGIONS

A 16. Sierozem, Lithosol, Regosol.

The extent of the desertic soils in Montana is quite small being principally confined to the extreme south central area of the state, bordering Wyoming. The topography is moderate to strongly rolling bedrock plains and the vegetation, shrub-grassland. The sparse quantity of moisture received limits the production of vegetation, and likewise usually limits leaching of soluble salts to a depth of 1-2 feet. The associated soils are zonal Sierozem and azonal Regosols and Lithosols. In Sierozem soil the B horizon is usually calcareous and moderately to strongly alkaline in reaction.

MODERATELY DARK COLORED SOILS OF THE SEMI-ARID REGIONS

B 11. Brown, Regosol

B 12. Brown, Regosol, Lithosol.

B 14. Brown, Regosol, Solonetz.

The dominant soils of this region are of the Brown Great Soil group. They are well drained soils developed under grassland or shrub vegetation. Their distribution is extensively the northern glaciated plains and scattered areas of south-central and eastern Montana. They occur on such land-forms as glacial till, outwash plains and terraces, and lacustrine terraces. Within the region, and associated with the Browns, are azonal Regosols and Lithosols and intrazonal Solonetz. Among the most extensive parent materials in this region are sandstone, shale and limestone, with appreciable soluble materials. Leaching of the soluble materials occurs only to a limited depth of from 10-30 inches. Brown soils are generally neutral to slightly alkaline in the surface horizon and usually become strongly alkaline with increasing depth.

DARK COLORED SOILS OF THE SEMI-ARID REGIONS

C 3. Chestnut, Chernozem, Solonetz.

C 4. Chestnut, Lithosol.

C 5. Chestnut, Lithosol, Alluvial.

C 8. Chestnut, Regosol.

The most extensive zonal soil in this soil region is Chestnut. Also included are Chernozem, Solonetz and azonal Lithosol, Regosol and Alluvium. The region primarily occupies smooth glacial drift plains, mountain valley slopes, foothills, inter-mountain valleys, benches and terraces. The soils have developed under a vegetation of grassland-shrub. Chestnut soils are widespread in the Great Plains, developing on smooth landscape in eastern Montana, south of the Missouri, and on smooth glacial drift plains in the northeastern and north-central parts of the state. The associated Regosols and Lithosols occur on the steeper slopes. In the montane region, Chestnut soils are found along the flanks of the mountains and in the valleys. With increases in precipitation, they grade into Chernozem and Prairie soils. The surface horizons of Chestnut soils are slightly alkaline and they typically have an accumulation of carbonates in the lower part of the B horizon.

DARK COLORED SOILS OF THE SUB-HUMID REGIONS

D 4. Chernozem, Prairie.
D 5. Chernozem, Regosol.
D 6. Chernozem, Regosol, Alluvial.

This soil region lies adjacent to forest and thus is most widely located in the intermountain valleys and foothills of western Montana, and the foothills of the Big Snowy and Judith Mountains. The principal zonal soil is Chernozem, with zonal Prairie, associated in the southwestern part of the state. Also associated are azonal lithosols, Regosols and Alluvial soils. The Chernozem soils occur in the lower, drier portions of the region, adjacent to the previously described Chestnut soils. In the higher, cooler, more moist areas, Prairie soils develop. Chernozem and Prairie soils are intermediate between soils formed in arid climates where bases and carbonates tend to accumulate in the lower portions of the soil, and those developed in humid climates where bases and carbonates are completely leached out of the soil. Chernozem soils are inclined to be neutral to slightly alkaline, while Prairie soils are slightly acid.

SOILS OF THE COOL TO COLD, SUB-HUMID AND HUMID FORESTED REGIONS

F 2. Brown Podzolic, Lithosol, Regosol.
F 7. Gray Wooded, Brown Podzolic, Rockland.
F 8. Gray Wooded, Chernozem, Lithosol.

The principal zonal soils of this region are Gray Wooded and Brown Podzolic. Zonal Chernozem and Prairie soils, previously described, are less extensive associated soils. The soils occur in the foothills and mountainous areas under forest vegetation. They are grouped with azonal and land types and the following associations: Gray Wooded, Chernozem; Brown Podzolic, Lithosol and Regosol; and Gray Wooded, Brown Podzolic and Rockland. The soil parent materials are quite variable and include, for instance, glacial till, glacial lacustrine sediments, and igneous metamorphic rocks. The Gray Wooded soils usually occupy the lowest elevations and/or the drier sites among forested soils. They may be found under open timber (ponderosa pine) or under cove of fir and larch Cox, 1957). If developed from calcareous parent material a zone of calcium carbonate is usually present in or below the B horizon.. The soils are usually neutral to mildly acid in reaction above the calcareous material (Cox, 1957). Nimlos (1963) indicates that

Brown Podzolic soils occur in the wetter forest sites where the mean annual precipitation is 25 inches or more. These soils have weakly developed profiles (Cox, 1957), and are acid in reaction. Azonal Lithosols and Regosols are extensively represented in this soil region.

SOILS OF THE COLD NON-FORESTED MOUNTAIN REGIONS

H 1. Alpine Turf, Rockland, Alpine Meadow, Alpine Bog.

These are the soils of the alpine zone occurring in the areas above timber line. They are of limited extent in western Montana, and only on the Beartooth Plateau, in southern Montana do they cover an area of any significance (Nimlos,1963). The region occupies the upper mountain slopes or peaks in areas accentuated by alpine glaciation. It is wind and low temperatures, and not available soil moisture, which are primarily responsible for the type of soil developed here. The region has associated Alpine Turf, Alpine Meadow and Alpine Bog soils. The zonal Alpine Turf, is well drained and has a thin (one to three inches) highly organic surface horizon. The profiles are medium to strongly acid. Alpine Meadow soils usually occur in areas bordering depressions and are imperfectly to poorly drained. They are transitional soils between zonal and intrazonal soils. These soils are usually strongly acid. The Alpine Bog soils are intrazonal, principally occurring in poorly drained beds and depressions.

SWELLING, CLAYEY SOILS

I 1. Grumusol.

Grumusols, which are intrazonal soil occur in Montana at elevations between 3200-4500 feet, on glacial till, and outwash plains, and upon continental sediment plains. The soil parent materials were residium from shale and mixed siliceous and subsiliceous materials in the glacial drift. These swelling and shrinking clayey soils cannot be assigned to any climatic or vegetation region. They are found most extensively along the western edge of north central and central Montana. Calcium and magnesium are constituents of the clay fraction of Grumusols and may occur as soil concretions.

SALINE AND SODIC SOILS

J 2. Solonetz, Brown

The soils of this region occur upon the minimum slopes of upland continental sediment plains and upon glacial till plains. They are, for the most part, confined to the southern sections of Phillips and Valley counties, at an elevation of from 2300-3200 feet. They are formed by the interaction of factors including dry climate, impeded soil drainage, and soluble salts and sodium in the parent materials. The parent materials are glacial drift, from mixed siliceous and subsiliceous sources and residium from shales. The dominant great soil groups present are Solonetz and Brown soils. The Solonetz are highly alkaline and comprise from 40-60 percent of the soil present, and the Brown zonal soils make up approximately 30-50 percent of the soil region.

RECENT ALLUVIAL SOILS

K. 2. Alluvial, Brown.
K. 3. Alluvial, Humic Gley.

In Montana, this soil region is principally confined to flood plains and terraces. The dominant soils are azonal alluvial and zonal Brown soils. Alluvial soils are young with weakly developed horizons and the parent materials from which these soils are developing are extremely variable. This is due to varied sources of sediments which the streams and rivers carry. The soils are frequently calcareous. They range from moderately alkaline to medium acid. The Brown soils present here have already been treated under other soil regions. Humic Gley soils have a thick, black A horizons which are high in organic matter, and overlie gleyed B or C horizons. These lower horizons may be massive and gray colored (C horizons), or they may have an increase in clay and have blocky to prismatic structure (B horizon). The gleyed horizon (gray color) is due to reduction and removal of iron. These soil are wet most of the year.

IMMATURE SOILS ON UNCONSOLIDATED UPLAND MATERIALS AND AELIAN SANDS

L. 4. Regosol, Grumosol.
L. 5. Regosol, Lithosol, Brown, Chestnut.

In viewing the soil association map on page 26 it is seen that this soil region covers wide areas of central, south-central, and southeastern Montana. The dominant soils are azonal Regosols. Associated with these are: Lithosols, Brumusol, Brown and Chestnut soils. The soils primarily occur on dissected undulating or rolling plain with sandstone and shale bedrock. They have developed under grassland vegetation. The Regosol soils are frequently calcareous and vary from mildly acid to moderately alkaline in reaction. Lithosols vary from medium acid to moderately alkaline in reaction. The remaining associated soils were previously treated.

IMMATURE SHALLOW SOILS ON CONSOLIDATED UPLAND MATERIALS MISCELLANEOUS LAND TYPES.

M. 2. Lithosols, Badlands, Regosol.
M. 8. Lithosols, Regosol, Alluvial.

The soils of this region have shallow, stony, rocky or weakly developed profiles. They occur mainly in the northeast and southeast unglaciated regions of the Great Plains. The major soils of the region are azonal Lithosols. Associated with the Lithosols are: Regosols, Badlands and Alluvial soils. Because of erosion or continual gravitational movement, Lithosols may lack discrete horizons and their profiles are generally stony. The miscellaneous land types, Badlands and Rockland, constitute areas where erosion (wind and/or water) is very active, consequently removing weathered soil material, or where gravitation movements prevent the development of soil.

INDEX TO TAXA

INDEX TO TAXA

New records for Montana are indicated with an *, North America **, and new taxa +. These designations are based upon Dr. G.W. Prescott's North American Desmid check list. Also included in the index are taxa to which comparative reference is made in the systematic section of the study, but are not necessarily being reported for the state.

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