

ACTA BOTANICA FENNICA 66
EDIDIT
SOCIETAS PRO FAUNA ET FLORA FENNICA

DESMIDS FROM UGANDA AND LAKE VICTORIA

COLLECTED BY DR. EDNA M. LIND

BY

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AND

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WITH ONE MAP AND TWELVE PLATES

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Foreword

The two senior authors of this paper were during the post-war period much engaged in the study of desmids from tropical and subtropical habitats. As a result of this common interest they, together with Dr. G. A. PROWSE, in 1958 published a comprehensive treatise on Sudanese Desmids, based on collections made by Dr. JULIAN RZÓSKA. Already earlier Dr. GRÖNBLAD had received from Dr. EDNA M. LIND some desmid samples from Uganda and Lake Victoria, dealt with in the present paper. Other tasks and illness, however, postponed the completion of the study of this material. As in the study of the collection from Sudan, GRÖNBLAD made the first investigation and then sent the material with his drawings and annotations to SCOTT, who made his suggestions for the identification of some difficult desmids and added some more identifications and his notes to the manuscript. The material was then sent back to GRÖNBLAD who intended to prepare the final manuscript. Due to his severe illness he unfortunately was unable to do so, but 7 ½ plates were prepared and inked. ROLF GRÖNBLAD died 20 April 1962.

On the request of SCOTT the whole material of annotations and original drawings then was sent to him, but SCOTT, being ill himself, and having to take care of his crippled wife, was unable to finish the manuscript. He had to give up his work on desmids and, in January 1963, he entrusted the third author, CROASDALE, with the completion of the present work.¹ ARTHUR M. SCOTT died 18 August 1963.

¹ Aided by a grant (G 18551) from the National Science Foundation.

About $\frac{1}{4}$ of the total determinations and $4\frac{1}{2}$ plates have been added by the third author. In the cases where the CROASDALE identifications differ from those of SCOTT and/or GRÖNBLAD the various opinions have been noted, the authors being indicated by »RG», »Scott», and »HC». The last mentioned author holds herself responsible for all opinions, not followed by (RG) or (Scott). This rather unusual method was used as the third author has felt that it would be of value for the still enlarging field of tropical desmid study to know the opinions of the two senior authors.

The last author is honored by having been entrusted with this paper, and hopes she has succeeded in maintaining the high standard of the first two. She would like to express for all the sincere gratitude to Dr. EDNA M. LIND for making these fine collections available and for furnishing the ecological data, to Phil. lic. TOINI TIKKANEN for inking plates 1—8, to Dr. ALEXANDER LUTHER for retrieving the manuscript after Dr. GRÖNBLAD's death, and to Dr. HANS LUTHER for presenting the paper and arranging for its publication.

Hannah Croasdale

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Notes on the localities

by Dr E. M. LIND

Nr. 1. Lake Bunyoni

S. W. Uganda in Kigezi. A lake formed in a valley which was dammed by volcanic lava. Collection is from squeezings of *Ceratophyllum demersum* and *Potamogeton pectinatus* taken from a canoe about half way down the east shore. The lake has a reed swamp dominated by *Phragmites* with *Nymphaea coerulea* and *Potamogeton pectinatus* common.

Note: In the open water of this lake I noted a lot of *Closterium aciculare* var. *subpronum*. In a paper on the W. Irish Lakes with W. H. PEARSALL we noticed that this desmid was most common in the more calcareous lakes. L. Bunyoni has an alkalinity and conductivity between two and three times that of L. Victoria.

Nr. 2. Brick-pit near Kampala

About 4 miles from Kampala on Masaka road, on N. side. A steep-sided pit about 18 inches deep where clay had been removed for brick-making. Collection was squeezings from *Utricularia* sp. Pool is surrounded by *Typha* and Cyperaceae and grasses which are rapidly encroaching on it.

Nr. 3. Dam near Mbarara — Katenga Dam

Nine miles from Mbarara, N. of the road to Bushenyi. Overgrown with *Pistia Stratiotes*, *Azolla* sp. and *Nymphaea coerulea*. Also *Potamogeton* sp., *Ottelia ulvaeifolia*, *Utricularia* sp. Surrounded by *Typha australis* and *Leersia hexandra* which are encroaching.

Nr. 4. Dam near Soroti

Mile 13 on Moroto Road. Sample taken from shore. Very little open water. *Leersia hexandra* advancing. *Nymphaea coerulea* (a), *Ceratophyllum demersum* (a). *Ottelia ulvaeifolia*, *Utricularia* sp., *Polygonum* spp. Surrounded by grass swamp with Cyperaceae.

Nr. 5. Dam near Soroti (Wera)

Near Wera on Wera-Amuria Road, not far from it. Not as overgrown as No. 4. *Utricularia* (aa), *Ceratophyllum* (a), *Nymphaea coerulea* (a). Surrounded by grass swamp with Cyperaceae.

Nr. 6. Lake Victoria

Sample is a mixture of two collections:

IV/52. Taken at mid-day from boat in Murchison Bay off Kisubi.

8/8/50. Collected by G. FISH at 11.30 pm off Bukakata. (This was included because of all L. Victoria samples it was richest in desmids.)

Desmid flora of the samples

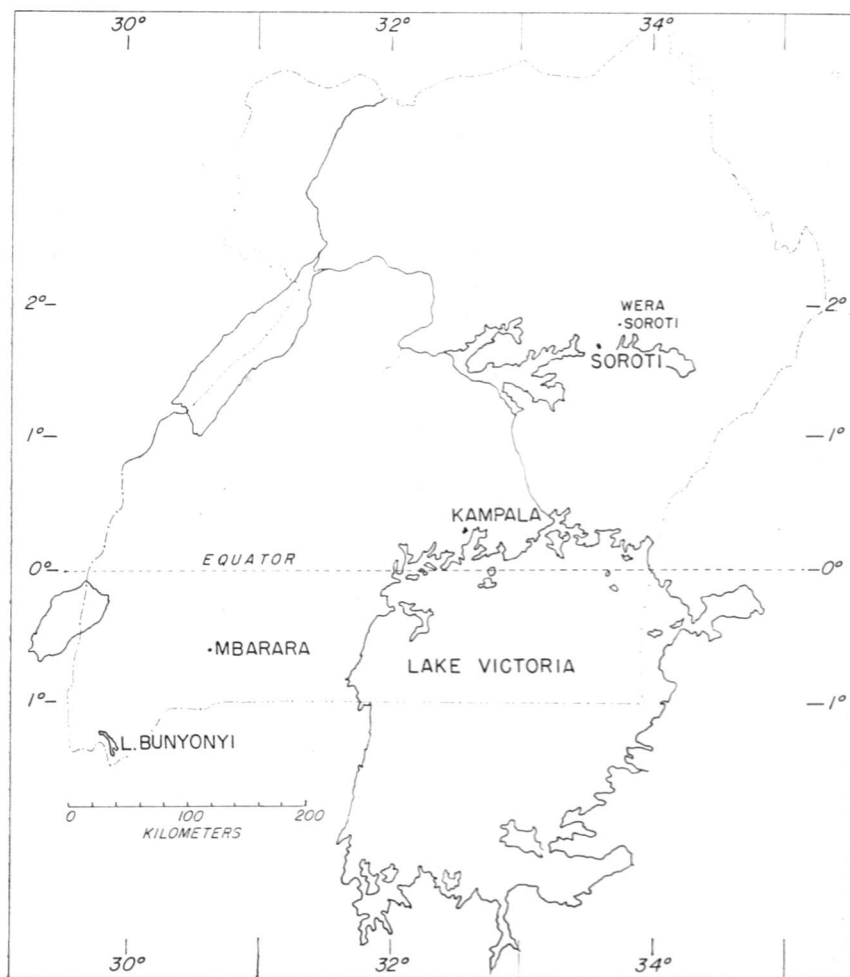
A figure for a taxon is noted only when it originated from the sample in question.

Nr. 1 — Lake Bunyoni

Euastrum oculatum Börges., f. Fig. 20—22.

Cosmarium bireme Nordst., f. Fig. 264—265. — *C. paradoxum* Turn. Fig. 102—103. — *C. Regnesi* Reinsch. — *C. subtumidum* Nordst. var. *circulare* Borge Fig. 65—66. — *C. subtumidum* Nordst. var. *subtumidum* f. *minus* Borge Fig. 86—87. — *C. tenue* Arch. var. *tenue* f. *tumidum* Grönbl. n. f. Fig. 84—85.

Staurostrum coarctatum Bréb. var. *subcurtum* Nordst. Fig. 122—124. — *S. gracile* Ralfs var. *coronulatum* Boldt Fig. 153—154. — *S. hexacerum* (Ehrenb.) Wittr., f. — *S. inflexum* Bréb.



Nr. 2 — Brick pit near Kampala

Penium sp.

Closterium cornu Ehrenb. — *C. diana* Ehrenb. — *C. gracile* Bréb. var. *elongatum* W. & W. — *C. parvulum* Näg. var. *angustum* W. & W. Fig. 3. — *C. venus* Kütz., f. Fig. 208.

Pleurotaenium baculoides (Roy & Biss.) Playf. Fig. 7.

Euastrum elegans (Bréb.) Kütz. var. *elegans* f. — *E. Luetkemuelleri* Duc. — *E. Luetkemuelleri* Duc., f. Fig. 211—213. — *E. sphyroides* Nordst., f. Fig. 31, 214—216.

Micrasterias ambadiensis (Grönb. & Scott) Thomass. f. *latiloba* (Grönb. & Scott) Thomass. Fig. 40. — *M. pinnatifida* (Kütz.) Ralfs, f. Fig. 222. — *M. radians* Turn. Fig. 38—39. — *M. zeylanica* Fritsch, f. Fig. 41.

Cosmarium Blyttii Wille. — *C. cucurbita* Bréb. var. *attenuatum* G. W. West. — *C. cucurbita* Bréb. var. *cucurbita* f. *rotundata* Krieg. Fig. 45. — *C. cylindrocystiforme* W. & W. Fig. 232. — *C. gonioide* W. & W. — *C. kilimanense* Schmidle. — *C. lomnicense* Lütke. — *C. moniliforme* (Turp.) Ralfs var. *subpyriforme* Grönb. n. var. Fig. 48. — *C. novae-sembiae* Wille. — *C. Nymannianum* Grun., f. Fig. 248. — *C. pseudoconnatum* Nordst. Fig. 251—252. — *C. pseudoretusum* Duc. var. *africanum* (Fritsch) Krieg. & Gerl. Fig. 237—238. — *C. pyramidatum* Bréb., f. Fig. 256. — *C. retusum* (Perty) Rab. Fig. 90. — *C. ?staurastroides* Eichl. & Gutw. — *C. stigosum* (Nordst.) Krieg. Fig. 231. — *C. striolatum* (Näg.) Arch. var. *Nordstedtii* (Möb.) Krieg. Fig. 104—106, 268. — *C. subauriculatum* W. & W. Fig. 54—55.

Staurastrum apiculatum Bréb. — *S. diptilum* Nordst. — *S. monticulosum* Bréb. var. *bifarium* Nordst.? — *S. orbiculare* Ralfs var. *depressum* Roy & Biss.

Nr. 3 — Dam near Mbarara

Pleurotaenium trabecula (Ehr.) Näg. var. *elongatum* Cedergr., f.

Euastrum elegans (Bréb.) Kütz. var. *elegans* f. Fig. 210. — *E. elegans* (Bréb.) Kütz. var. *compactum* (Wolle) Krieg. Fig. 25—26.

Micrasterias ambadiensis (Grönb. & Scott) Thomass. f. *latiloba* (Grönb. & Scott) Thomass. Fig. 220. — *M. crux-melitensis* (Ehr.) Hass. f. *minor* Turn. Fig. 36. — *M. pinnatifida* (Kütz.) Ralfs.

Cosmarium connatum Bréb. — *C. connatum* Bréb. var. *africanum* Fritsch & Rich Fig. 257—258. — *C. contractum* Kirchn. var. *contractum* f. Fig. 234. — *C. contractum* Kirchn. var. *ellipsoideum* (Elfv.) W. & W. — *C. ?depressum* (Näg.) Lund. var. *depressum* Fig. 113. — *C. granatum* Bréb. var. *pyramidale* Schmidle Fig. 76—78. — *C. ?Hammeri* Reinsch var. *Hammeri* f. — *C. kilimanense* Schmidle, f. — *C. Lundellii* Delp. var. *corruptum* (Turn.) W. & W., f. Fig. 230. — *C. Lundellii* Delp. var. *ellipticum* W. & W. f. Fig. 228—229. — *C. malinvernianum* (Rac.) Schmidle Fig. 100—101. — *C. medioscrobiculatum* W. & W., f. Fig. 61—62. — *C. pseudonitidulum* Nordst. — *C. subtumidum* Nordst. var. *subtumidum* f. *maius* Croasd. n. f. Fig. 242—244. — *C. tenue* Arch. var. *tenue*. — *C. tenue* Arch. var. *tenue* f. *tumidum* Grönb. n. f. — *C. trachypleurum* Lund. Fig. 239—241. — *C. wembaerense* Schmidle Fig. 259.

Arthrodesmus convergens Ehr. var. *convergens* Fig. 112. — *A. convergens* Ehr. var. *curtus* Turn. f. *maior* Croasd. n. f. — *A. convergens* Ehr. var. *curtus* Turn. f. *obtusispinosus* Croasd. n. f.

Staurastrum cyclacanthum W. & W., f. Fig. 197—198. — *S. floriferum* W. & W. — *S. leptocladum* Nordst. var. *cornutum* Wille Fig. 158. — *S. margaritaceum* (Ehr.) Menegh. — *S. orbiculare* Ralfs. — *S. orbiculare* Ralfs var. *hibernicum* W. & W. & Carter. — *S. tohopekaligense* Wolle var. *robustum* Scott & Presc. Fig. 144—145.

Nr. 4 — Dam near Soroti

Closterium abruptum W. West var. *africanum* Fritsch & Rich f. *angustum* Grönbl. n. f. Fig. 2. — *C. acutum* Bréb. — *C. acutum* Bréb. var. *latius* Grönbl., f. Fig. 1. — *C. cornu* Ehrenb. — *C. diana* Ehrenb. — *C. gracile* Bréb. — *C. subulatum* (Kütz.) Bréb. — *C. turgidum* Ehrenb. var. *Borgei* Deflandre Fig. 4. — *C. venus* Kütz. — *C. venus* Kütz., f. Fig. 207.

Pleurotaenium Ehrenbergii (Bréb.) DeBary, f. — *P. trabecula* (Ehr.) Näg. var. *elongatum* Cedergr., f. — *P. trabecula* (Ehr.) Näg. var. *rectum* (Delp.) W. & W.

Euastrum divaricatum Lund., f. Fig. 27. — *E. elegans* (Bréb.) Kütz. var. *elegans* f. — *E. evolutum* (Nordst.) W. & W., f. — *E. ?oculatum* Börges. — *E. praemorsum* (Nordst.) Schmidle var. *simplicius* Grönbl. & Scott Fig. 19. — *E. pseudoboldtii* Grönbl. f. Fig. 23 — 24. — *E. spinulosum* Delp. var. *Lindae* Grönbl. & Scott Fig. 32. — *E. subcrassum* Fritsch, f. Fig. 29—30. — *E. truncatiforme* G. S. West Fig. 28.

Micrasterias crux-melitensis (Ehr.) Hass. f. *minor* Turn. Fig. 35. — *M. decemdentata* (Näg.) Arch. Fig. 219. — *M. decemdentata* (Näg.) Arch., f. Fig. 33. — *M. pinnatifida* (Kütz.) Ralfs, f. — *M. radians* Turn. Fig. 37. — *M. tropica* Nordst. var. *ambadiensis* Grönbl. & Scott Fig. 43. — *M. tropica* Nordst. var. *elegans* W. & W. — *M. zeylanica* Fritsch Fig. 34. — *M. zeylanica* Fritsch, f. Fig. 42.

Cosmarium bicardium Reinsch Fig. 80—81. — *C. bimamillatum* Krieg., f. 67—68. — *C. ?Blythii* Wille. — *C. capense* DeToni var. *Nyassae* Schmidle. — *C. connatum* Bréb. Fig. 51—52. — *C. cucurbita* Bréb. var. *attenuatum* G. W. West Fig. 46. — *C. decachondrum* Roy & Biss., f. Fig. 94—95. — *C. diploporum* (Lund.) Lütke. Fig. 49. — *C. Hammeri* Reinsch var. *Hammeri*. — *C. Hammeri* Reinsch var. *Schmidlei* Grönbl. & Scott Fig. 79. — *C. hexagonum* Nordst. Fig. 69. — *C. isthmium* West. — *C. kilimanense* Schmidle, f. Fig. 96—97. — *C. lanceolatum* (Turn.) Lütke. f. *turgidum* Grönbl. n. f. Fig. 44. — *C. lobatum* Börges. — *C. malinvernianum* (Rac.) Schmidle. — *C. moniliforme* (Turp.) Ralfs var. *moniliforme*. — *C. pachydermum* Lund. var. *aethiopicum* W. & W. — *C. permaculatum* Grönbl. & Scott Fig. 59—60. — *C. phaseolus* Bréb. var. *subbireme* Rac. Fig. 245—247. — *C. protuberans* Lund., f. Fig. 253—255. — *C. pseudonitidulum* Nordst. — *C. pseudonitidulum* Nordst. var. *angustissimum* Grönbl. n. var. Fig. 63—64. — *C. pygmaeum* Arch., f. Fig. 74—75. — *C. quadratum* (Gay) DeToni var. *applanatum* Insam & Krieg. Fig. 82—83. — *C. quadratum* Lund., f. Fig. 98—99. — *C. Regnellii* Wille var. *Regnellii* f. Fig. 260. — *C. Regnellii* Wille var. *chondrophorum* Skuja f. *minus* Grönbl. n. f. Fig. 88—89. — *C. retusi-forme* (Wille) Gutw. ?var. — *C. sinostegos* Schaarschm. var. *granulatum* Croas. n. var. Fig. 70—73. — *C. ?subdanicum* West Fig. 261. — *C. tenue* Arch. var. *minus* Presc. & Scott. — *C. tithophorum* Nordst. var. *depressum* W. & W., f. Fig. 92—93. — *C. trilobulatum* Reinsch var. *bioculatum* Krieg. Fig. 91. — *C. tyrolicum* (Nordst.) Krieg. & Gerl. var. *Beanlandii* (W. & W.) Krieg. & Gerl. — *C. zonatum* Lund. var. *javanicum* (Gutw.) Krieg., f. Fig. 267.

Arthrodesmus convergens Ehrenb. var. *convergens* Fig. 111. — *A. convergens* Ehrenb. var. *curtus* Turn. f. *maior* Croas. n. f. Fig. 131. — *A. convergens* Ehrenb. var. *curtus* Turn. f. *obtusispinosus* Croas. n. f. Fig. 114. — *A. mucronulatus* Nordst. f. *depauperatus* Grönbl. n. f. Fig. 109. — *A. subulatus* Kütz. var. *americanus* (Turn.) W. & W.

Staurastrum cerastes Lund., f. Fig. 137—138. — *S. clepsydra* Nordst. var. *obtusum* Nordst., f. Fig. 272—273. — *S. coarctatum* Bréb. var. *subcurtum* Nordst. — *S. cuspidatum* Bréb., f. — *S. dejectum* Bréb. var. *subglabrum* Grönbl. f. *maius* Bourr. — *S. Dickiei* Ralfs var. *maximum* W. & W. Fig. 277—278. — *S. disputatum* W. & W. — *S. fuellerbornei* Schmidle, f. Fig. 139. — *S. furcatum* (Ehr.) Bréb. Fig. 147. — *S. inconspicuum* Nordst. — *S. iotatum* Wolle. — *S. leptodermum* Lund. var. *Ikapoe* (Schmidle) W. & W., f. Fig. 119.

— *S. orbiculare* Ralfs. — *S. orbiculare* Ralfs var. *denticulatum* Nordst. Fig. 116—118. — *S. orbiculare* Ralfs var. *Ralfsii* W. & W. Fig. 115. — *S. paradoxum* Meyen var. *parvum* West. — *S. pinnatum* Turn. var. *subpinnatum* (Schmidle) W. & W., f. Fig. 150—151. — *S. pinnatum* Turn. var. *subpinnatum* (Schmidle) W. & W., f. *bullatum* Grönb. n. f. Fig. 148—149. — *S. pseudotetracerum* (Nordst.) W. & W. Fig. 155—157. — *S. quadricornutum* Roy & Biss Fig. 146. — *S. tetracerum* Ralfs. — *S. Westianum* (W. & W.) Thomass. — *S. zonatum* Börges.

Sphaerosoma excavatum Ralfs.

Spondylosium planum (Wolle) W. & W. f. *unipapillatum* Croasd. n. f. Fig. 152.

Nr. 5 — Dam 2 (Wera) near Soroti

Closterium diane Ehrenb. — *C. diane* Ehrenb., f. Fig. 206. — *C. diane* Ehrenb., f. Fig. 205. — *C. Kuetzingii* Bréb. — *C. setaceum* Ehrenb.

Pleurotaenium cylindricum (Turn.) W. & W. var. *Stuhlmannii* (Hieron.) Krieg. Fig. 16. — *P. eugeneum* (Turn.) W. & W. var. *undulatum* (Borge) Krieg. Fig. 203. — *P. gloriosum* (Turn.) W. & W. Fig. 10—11. — *P. minutum* (Ralfs) Delp. — *P. minutum* (Ralfs) Delp. var. *elongatum* (W. & W.) Cedergr. Fig. 5—6. — *P. subcoronulatum* (Turn.) W. & W., f. Fig. 17—18. — *P. subcoronulatum* (Turn.) W. & W. var. *africanum* Schmidle Fig. 12—15. — *P. trabecula* (Ehrenb.) Näg. var. *elongatum* Cedergr. Fig. 204. — *P. trabecula* (Ehrenb.) Näg. var. *elongatum* Cedergr., f. Fig. 8—9. — *P. verrucosum* (Bail.) Lund.

Euastrum elegans (Bréb.) Kütz. var. *elegans* f. Fig. 209. — *E. substellatum* Nordst., f. Fig. 217—218.

Micrasterias crux-melitensis (Ehr.) Hass. f. *minor* Turn. — *M. radians* Turn. — *M. tropica* Nordst. var. *ambadiensis* Grönb. & Scott. — *M. tropica* Nordst. var. *elegans* W. & W. Fig. 221.

Cosmarium contractum Kirchn. var. *minutum* (Delp.) W. & W. — *C. Hammeri* Reinsch var. *Schmidlei* Grönb. & Scott. — *C. lobatum* Börges. var. *ellipticum* Fritsch & Rich, f. Fig. 53. — *C. lobatum* Börges. var. *minus* (Smith) Grönb. Fig. 236. — *C. maximum* (Börges.) W. & W. var. *latum* Scott n. var Fig. 224—226. — *C. moniliforme* (Turp.) Ralfs var. *moniliforme* Fig. 47. — *S. moniliforme* (Turp.) Ralfs var. *punctatum* Lagerh., f. Fig. 249—250. — *C. nordax* Turn. Fig. 227. — *C. obtusatum* Schmidle. — *C. ordinatum* W. & W. — *C. Scottii* Croasd. n. sp. Fig. 56—58. — *C. Scottii* Croasd. f. *minus* n. f. Fig. 235. — *C. vogesiaceum* Lemaire var. *quadrigranulatum* (Gutw.) Laporte Fig. 262—263. — *C. zonatum* Lund. var. *angustum* Grönb. & Scott Fig. 50.

Xanthidium antilopaeum (Bréb.) Kütz. var. *hebridarum* W. & W. Fig. 269. — *X. subtrilobum* W. & W. var. *africanum* (Schmidle) Grönb. & Scott. Fig. 107. — *X. subtrilobum* W. & W. var. *inornatum* Skuja.

Arthrodesmus convergens Ehrenb. var. *convergens* Fig. 110. — *A. convergens* Ehrenb. var. *curtus* Turn. f. *maior* Croasd. n. f. — *A. convergens* Ehrenb. var. *curtus* Turn. f. *obtusispinosus* Croasd. n. f. — *A. curvatus* Turn. Fig. 281—282. — *A. maximus* Borge Fig. 130. — *A. mucronulatus* Nordst. f. *depauperatus* Grönb. n. f. Fig. 108. — *A. subulatus* Kütz. var. *americanus* (Turn.) W. & W. Fig. 129.

Staurostrum apiculatum Bréb. — *S. cerastes* Lund., f. — *S. connatum* (Lund.) Roy & Biss., f. Fig. 284—285. — *S. corniculatum* Lund. var. *spinigerum* W. West, f. Fig. 274. — *S. dejectum* Bréb. var. *dejectum* f. *angustatum* Teil. Fig. 283. — *S. dejectum* Bréb. var. *subglabrum* Grönb. f. *maius* Bourr. Fig. 102—121. — *S. Dickiei* Ralfs var. *Dickiei* Fig. 275—276. — *S. Dickiei* Ralfs var. *Dickiei* f. Fig. 134, 279—280. — *S. Dickiei* Ralfs var. *Dickiei* f. *longispinum* Fritsch & Rich morpho Fig. 135—136. — *S. Fuellerbornei* Schmidle f. *reductum* Grönb. n. f. Fig. 140—141. — *S. furcatum* (Ehrenb.) Bréb. — *S. gladiusum* Turn. f. *cur-*

vispinum Grönbl. n. f. Fig. 127—128. — *S. laceratum* Turn. var. *Bourrellyi* Scott n. v. Fig. 193—194. — *S. leptocladum* Nordst. var. *cornutum* Wille. — *S. leptodermum* Lund. var. *Ikapoa* (Schmidle) W. & W. Fig. 290—291. — *S. mucronatum* Ralfs f. *crassum* Grönbl. n. f. Fig. 132—133. — *S. polymorphum* Bréb. var. *divergens* Nygaard Fig. 191—192. — *S. quadricornutum* Roy & Biss. — *S. Sebaldi* Reinsch var. *gracile* Messik., f? Fig. 201—202. — *S. Sebaldi* Reinsch var. *ornatum* Nordst. — *S. senarium* (Ehrenb.) Ralfs var. *simplex* Hirano, f. Fig. 142—143. — *S. setigerum* Cleve var. *setigerum* f. Fig. 292—293. — *S. subcornutum* DeToni var. *parvum* Grönbl. & Scott. — *S. subcylacanthum* Scott n. sp. Fig. 199—200. — *S. tetracerum* Ralfs. — *S. Wildemanii* Gutw. var. *Wildemanii* Fig. 288—289. — *S. Wildemanii* Gutw. var. *maius* (W. & W.) Scott & Presc. Fig. 125—126.

Nr. 6 — Lake Victoria

Closterium aciculare T. West var. *subpronum* W. West & G. S. West Fig. 159—160.

Cosmarium contractum Kirchn. var. *ellipsoideum* (Elfv.) W. & W. Fig. 162. — *C. contractum* Kirchn. var. *minutum* (Delp.) W. & W. — *C. depressum* (Näg.) Lund. var. *depressum* f. Fig. 233. — *C. depressum* (Näg.) Lund. var. *achondrum* (Boldt) W. & W., f. Fig. 161, 223. — *C. moniliforme* (Turp.) Ralfs var. *panduriforme* Heimerl Fig. 163.

Staurostrum anatinum Cooke & Wills var. *subglabrum* G. S. West, f. Fig. 178—181. — *S. coarctatum* Bréb. var. *subcurtum* Nordst. f. *maius* Grönbl. n. f. Fig. 164—165. — *S. corniculatum* Lund. var. *spinigerum* W. West f. *latum* Grönbl. n. f. Fig. 166—167. — *S. cuspidatum* Bréb. Fig. 286—287. — *S. dejectum* Bréb. var. *dejectum* Fig. 168—169. — *S. excavatum* W. & W., f. Fig. 182. — *S. leptocladum* Nordst. var. *africanum* G. S. West Fig. 188—190. — *S. limneticum* Schmidle var. *limneticum* Fig. 174—175. — *S. limneticum* Schmidle var. *limneticum* f. *victoriense* Croasd. n. f. Fig. 176—177. — *S. limneticum* Schmidle var. *Groenbladii* Croasd. n. var. Fig. 172—173. — *S. Lindae* Grönbl. n. sp. Fig. 186—187. — *S. muticum* Bréb., f. Fig. 270—271. — *S. planctonicum* Teil. var. *bulbosum* (West) Thomass. Fig. 195—196. — *S. setigerum* Cleve var. *nyansae* Schmidle Fig. 170—171. — *S. tohopikaligense* Wolle var. *nonanum* (Turn.) Schmidle Fig. 184—185. — *S. sp.* Fig. 183.

Taxonomical Part

Literature quotations for taxa are given when the taxon is not present in either WESTS' Monograph or Rabenhorst's Kryptogamenflora (KRIEGER, 1937).

All dimensions are given in microns (μ)

Abbreviations:

<i>c</i>	= circa	<i>lat.</i>	= width of cell
<i>cpap</i>	= with papilla	<i>long</i>	= length of cell
<i>cpr</i>	= with processes	<i>spap</i>	= without papilla
<i>crass</i>	= thickness	<i>spr</i>	= without processes
<i>csp</i>	= with spines	<i>ssp</i>	= without spines
<i>ist</i>	= width of isthmus	$^{\circ}$	= degrees of arc

Penium sp. Nr. 2.

Closterium abruptum West var. *africanum* Fritsch & Rich f. *angustum* Grönbl. n. f. Nr. 4. — Fig. 2.

Forma multo minor tenuiorque quam varietas. Long. 72, lat. 5.5 (13 x).

Wall smooth, 3 pyrenoids per semicell. Much smaller than the variety and relatively more slender, but resembles it particularly in the straight middle portion and abruptly incurved ends. Compare also *Cl. cornu* which it resembles more closely in size, although not in shape.

Closterium aciculare T. West var. *subpronum* W. West & G. S. West. Cells straight, moderately curved or angularly bent, with well-marked distinction between cylindrical middle portion and uniformly slender ends. Long. 395–430, lat. 4–4.6 (86–107 $\times$), apex 1.8–2.0. Nr. 6. — Fig. 159–160.

KRIEGER (1937, p. 265) absorbs this variety into the type variety, but the distinction between middle and terminal portions, as pointed out by WEST & WEST (1904, p. 176), is very striking and seems sufficiently different to warrant the rank of variety.

Closterium acutum Bréb. Nr. 4.

Closterium acutum Bréb. var. *latius* Grönb. forma. A smaller form with the apices more blunt. Long. 70, lat. 5.5 (12.7 $\times$). Nr. 4. — Fig. 1.

Closterium cornu Ehrenb. »Cum zygospore» (RG). Nr. 2, 4.

Closterium diana Ehrenb. Nr. 2, 4, 5.

Closterium diana Ehrenb. forma. A slender form, approaching var. *pseudodiana* (Roy) Krieg., about 9 or 10 pyrenoids per semicell; wall smooth and colorless. Long. 291, lat. max. 20 (14.5 $\times$), lat. apic. 5, 110°. Nr. 5 — Fig. 206.

Closterium diana Ehrenb. forma. Wall smooth, apex typical of *Cl. diana*, but cell is more slender and much less curved than the type. Long. 309, lat. max. 23 (13.4 $\times$), lat. apic. c. 6, 53°. Nr. 5. Fig. 205.

Closterium gracile Bréb. Nr. 4.

Closterium gracile Bréb. var. *elongatum* W. & W. Nr. 2.

Closterium Kuetzingii Bréb. Wall striate, about 12 striae visible at center of cell; 8 pyrenoids per semicell. Long. 552, lat. max. 15 (37 $\times$), lat. apic. 4. Nr. 5.

Closterium parvulum Näg. var. *angustum* W & W. A smaller and less curved form. Long. 74, lat. 4 (18 $\times$), 115°. Nr. 2. — Fig. 3.

Closterium setaceum Ehrenb. Striae not visible; 3 pyrenoids per semicell. Long. 435, lat. max. 12 (36 $\times$), lat. apic. 3. Nr. 5.

Closterium subulatum (Kütz.) Bréb. Nr. 4.

Closterium turgidum Ehrenb. var. *Borgei* Deflandre. Wall finely striate. Long. 1094. Nr. 4. — Fig. 4.

Closterium venus Kütz. Nr. 4.

Closterium venus Kütz. forma. RG left figures of 3 plants which he called *Cl. incurvum* Bréb. (*Cl. venus* var. *incurvum* (Bréb.) Krieger). They are relatively short as in *Cl. incurvum*, but differ in lesser curvature (*Cl. venus* = 150–160°, *Cl. incurvum* = c. 180°), and in the general shape: RG's plants have the uniform curvature of *Cl. venus*. *Cl. incurvum* tapers abruptly to very sharp ends from a broad thickened middle portion. Nr. 2, 4. — Fig. 207–208.

Pleurotaenium baculoides (Roy & Biss.) Playf. Long. 426, lat. max. bas. 23 (18.5 ×). Nr. 2. — Fig. 7.

Pleurotaenium cylindricum (Turn.) W. & W. var. *Stuhlmannii* (Hieron.) Krieg. Wall densely and finely porose; 13 visible polar nodules. Long. 1368, lat. bas. 61 (22.4 ×). Nr. 5. — Fig. 16.

Pleurotaenium Ehrenbergii (Bréb.) DeBary forma. »Fa. majus!» (RG). Nr. 4.

Pleurotaenium eugeneum (Turn.) W. & W. var. *undulatum* (Borge) Krieg. Semicells cylindrical, with very little taper, undulations faint and irregular, wall smooth; about 12 small polar nodules visible. Long. 1054, lat. bas. 49 (21.5 ×), lat. apic. 40. Nr. 5. — Fig. 203.

Pleurotaenium gloriosum (Turn.) W. & W. Semicell with 3 very faint undulations above basal inflation, no girdle, 14 visible polar nodules; chloroplast bands fragmented into many small units, each with one pyrenoid. Long. 1040, lat. bas. 48, lat. apic. 42, ist. 44. Nr. 5. — Fig. 10–11.

Pleurotaenium minutum (Ralfs) Delp. »Only one seen» (Scott). Long. 150, lat. bas. 12 (12.5 ×), lat. apic. 10. Nr. 5.

Pleurotaenium minutum (Ralfs) Delp. var. *elongatum* (W. & W.) Cedergr. Long. 221, lat. bas. 9 (24.6 ×), lat. apic. 5.3. Nr. 5. — Fig. 5–6.

Pleurotaenium subcoronulatum (Turn.) W. & W. forma ad var. *detum* W. & W. acced. A large form. Long. 760, lat. bas. 53 (14.3 ×), lat. apic. 51, 16 visible polar nodules. Nr. 5. — Fig. 17–18.

RC. called this *Pl. Wallichianum* (Turn.) Krieg., but HC believes it more closely resembles *Pl. subcoronulatum* because of the expanded apex, while

the irregular indentations below approach var. *detum*. FRITSCH & RICH (1924, p. 329) found, in Natal, »all transitions between type and var. *detum*».

Pleurotaenium subcoronulatum (Turn.) W. & W. var. *africanum* Schmidle Two forms were seen, both longer than type; a) Margins of semicell very faintly and irregularly undulate, no girdle, 10 visible polar nodules. Long. 564, lat. bas. 27 ($21 \times$), lat. apic. 23, ist. 24. Nr. 5. — Fig. 12–13.

b) Apex of semicell less expanded, 12 visible polar nodules. Long. 638, lat. bas. 30 ($21.3 \times$). Nr. 5. — Fig. 14–15.

Pleurotaenium trabecula (Ehrenb.) Näg. var. *elongatum* Cedergr, Wall smooth, apex truncate with rounded angles, 3 basal crenations; chloroplast bands broken up into small units, each with one pyrenoid. Long. 610, lat. bas. 32 ($19 \times$), lat. apic. 24μ . Nr. 5. — Fig. 204.

Pleurotaenium trabecula (Ehrenb.) Näg. var. *elongatum* Cedergr. forma. Wall smooth, apex truncate with rounded angles, basal inflation prominent, with two smaller inflations above it. Somewhat longer than the maximum length given for the variety, but too slender to be var. *maximum* (Reinsch) Roll, as RG suggested. Nr. 3, 4, 5. — Fig. 8–9.

Pleurotaenium trabecula (Ehrenb.) Näg. var. *rectum* (Delp.) W. & W. Long. 247, lat. max. bas. 18.4 ($13.4 \times$), lat. apic. 14. Nr. 4.

Pleurotaenium verrucosum (Bail.) Lund. Nr. 5.

Pl. sp. Nr. 5.

Euastrum divaricatum Lund. forma. A relatively short form, approaching var. *subdivaricatum* (W. & W.) Krieg. in its ornamentation. Long. 39, lat. csp. 39. Nr. 4 — Fig. 27.

Euastrum elegans (Bréb.) Kütz. var. *elegans* forma. Nr. 2, 4.

Euastrum elegans (Bréb.) Kütz. var. *elegans* forma. A small form approaching var. *madagascariense* West & West (1895, p. 52, VI: 18) in its open apical notch and ornamentation reduced to 3 central granules. Long. 27, lat. 18 ($1.5 \times$), ist. 4.5. Nr. 5 — Fig. 209.

Euastrum elegans (Bréb.) Kütz. var. *elegans* forma. A rounded form with open apical notch and reduced ornamentation, approaching var. *compactum* (Wolle) Krieg. Long. 32, lat. 22 ($1.5 \times$). Nr. 3. — Fig. 210.

Euastrum elegans (Bréb.) Kütz. var. *compactum* (Wolle) Krieg. forma. Ornamentation reduced. Long. 27–29, lat. 19–20, crass. 13, ist. 4–6. Nr. 3. — Fig. 25–26.

Euastrum evolutum (Nordst.) W. & W. forma. Nr. 4.

Euastrum Luetskemuelleri Duc. Nr. 2.

Euastrum Luetskemuelleri Duc. forma. A large form with sides concave, not expanding at apex, ocellus high as in var. *carniolicum* (Lüttk.) Krieg. Long. 37, lat. 23 ($1.6 \times$), crass. 18, ist. 8. Nr. 2. — Fig. 211–213.

?*Euastrum oculatum* Börges. Nr. 4.

Euastrum oculatum Börges. forma. A form with a relatively short polar lobe, resembling *E. evolutum* (Nordst.) W. & W. Long. 42–48, lat. 28–31, crass. 17–18, ist. 8–9. Nr. 1. — Fig. 20–22.

Euastrum praemorsum (Nordst.) Schmidle var. *simplicius* Grönbl. & Scott in GRÖNBLAD, PROWSE & SCOTT (1958, p. 15, Fig. 69, 73). Long. 69, lat. 37, ($1.6 \times$), ist. 10. Nr. 4. — Fig. 19.

Euastrum pseudoboldtii Grönbl. forma. This form has a deeper apical notch, lacks the paired granules above the isthmus, is much smaller, and has the surface and marginal granules more pronounced than in the type. Long. 15, lat. 10 ($1.5 \times$), crass. 7, ist. 5. Nr. 4. — Fig. 23–24.

Euastrum sphyroides Nordst. forma. Differs in its larger size and open sinus. Long. 54, lat. 41, ($1.3 \times$), ist. 14. Nr. 2. — Fig. 31.

RG said »Cf. var. *lata* Schmidle (1899, p. 43, III: 3) and *E. hypnochondrioides* W. & W.«. It seems, however, closest to a form from the French Sudan illustrated by BOURRELLY (1957, p. 1063, II: 16).

Euastrum sphyroides Nordst. forma. This form resembles var. *intermedium* Lüttk. in its proportions ($1.1 \times$), and var. *Hieronymusii* (Schmidle) Krieg. in its marginal ornamentation consisting of short spines rather than teeth, but also approaches *E. ceylanicum* (W. & W.) Krieg. in its size and vertical view, with a suggestion of marginal verrucae on the lateral lobes. It differs from all of them in having the interior series of intramarginal teeth bicuspid, and in having an open sinus. Long. 47, lat. csp. 42, crass. 22, ist. 12. Nr. 2. — Fig. 31, 214–216.

Euastrum spinulosum Delp. var. *Lindae* Grönbl. & Scott in GRÖNBLAD, PROWSE & SCOTT (1958, p. 17, Fig. 84–88). Two plants were illustrated: a) Long. 108, lat. 103, ist. 21. Nr. 4. — Fig. 32 a.

b) (Side view only): Long. 99, crass. 49. Nr. 4 — Fig. 32 b.

Euastrum subcrassum Fritsch in FRITSCH & RICH (1937, p. 176, Fig. 8 D, F) forma. A form approaching var. *elaboratum* Grönbl. in GRÖNBLAD, PROWSE & SCOTT (1958, p. 17, VI: 77 a, 80–82). It has a large central ocellus and the

two ocelli within the polar lobe, but lacks all other facial ornamentation except for the basal nodules. Cf. *E. sympageum* W. & W., *E. truncatiforme* G. S. West and *E. truncatum* Josh. var. *trifolium* (Cohn.) Krieg. Long. 57, lat. 32 ($1.8 \times$), ist. 9. Nr. 4 — Fig. 29–30.

Euastrum substellatum Nordst. forma. Differs from type in larger size and in the bases of the basal lobes which are horizontal for more than half their length from the isthmus, resulting in a closed sinus, and then are abruptly upwardly directed. This closely resembles *E. spicatum* Turn., which KRIEGER (1937, p. 629) includes in *E. substellatum*. Long. 62, lat. csp. 58, crass. 24, ist. 13. Nr. 5. — Fig. 217–218.

Euastrum truncatiforme G. S. West. The Uganda plant differs in distribution of intramarginal granules. In WEST's plant there is one within each lateral lobule and none within the polar lobe, in ours there is one within each corner of the polar lobe and only one for each lateral lobe. Long. 46, lat. 36 ($1.3 \times$), ist. 10. Nr. 4. — Fig. 28.

Micrasterias ambadiensis (Grönbl. & Scott) Thomasson f. *latiloba* (Grönbl. & Scott) Thomasson (1960 a, p. 22, 4: 9) (*M. radians* var. *ambadiensis* f. *latiloba* Grönbl. in GRÖNBLAD, PROWSE & SCOTT (1958, p. 21. Photo 362). Long. 138–147, lat. 118–126, ist. 21–23. Nr. 2, 3. — Fig. 40, 220.

Micrasterias crux-melitensis (Ehrenb.) Hass. f. *minor* Turn. Cells 83–110, lat. 76–101, ist. 15–30. Nr. 3, 4, 5. — Fig. 35–36.

Micrasterias decemdentata (Näg.) Arch. Long. 46, lat. 46, ist. 11. Nr. 4. — Fig. 219.

Micrasterias decemdentata (Näg.) Arch. forma. Differs from type in having lateral lobes once more divided. Differs from *M. abrupta* W. & W. in its convex polar lobes terminating in one spine. Differs from *M. truncata* (Corda) Bréb. in its open incision between side lobes and polar lobes. Long. 53, lat. 52. Nr. 4. — Fig. 33.

Micrasterias pinnatifida (Kütz.) Ralfs. Nr. 3.

Micrasterias pinnatifida (Kütz.) Ralfs forma. Differs in having extremities of polar lobe ending in single spine, and in having lateral lobes broad and then abruptly tapered near extremity. Long. 57–73, lat. 57–80, ist. 11–13. Nr. 2, 4. — Fig. 222.

Micrasterias radians Turn. Fig. 37 shows a typical form, fig. 38, in its stout lobes and relatively long spines, resembles a forma in GRÖNBLAD, PROWSE & SCOTT (1958, p. 21, XI: 120—123). Long. 96—160, lat. 87—159, ist. 19—27. Nr. 2, 4, 5. Fig. 37—39.

Micrasterias tropica Nordst. var. *ambadiensis* Grönbl. & Scott in GRÖNBLAD, PROWSE & SCOTT (1958, p. 22, IX: 108—109, X: 116—118). Long. 104—124, lat. 99—106, ist. 17—19. Nr. 4, 5. — Fig. 43.

Micrasterias tropica Nordst. var. *elegans* West & West (1897, p. 86, 366: 2). Long. 102—111, lat. 100—108, ist. 17—20, lat. pol. lob. 46—60. Nr. 4, 5. — Fig. 221.

Micrasterias zeylanica Fritsch. Long. 40, lat. 46, ist. 11. Nr. 4. — Fig. 34.

Micrasterias zeylanica Fritsch forma. Lateral lobes atypical. Long. c. 46, lat. 50—62, crass. c. 28. Nr. 2, 4. — Fig. 41—42.

Cosmarium bicardia Reinsch. Wall smooth. Long. 17, lat. 15, crass. c. 10, ist. c. 5. Nr. 4. — Fig. 80—81.

For discussion of retention of this name as distinct from *C. clepsydra* Nordst. see GRÖNBLAD (1960, p. 35).

Cosmarium bimamillatum Krieger (1932, p. 171, 13: 3) forma ad f. *minor* Rich (1935, p. 133, Fig. 11 B—D) acced. Differs from type and RICH's form in the slightly projected apex and in the absence of central ornamentation. Long. 20—23, lat. 17—20, crass. c. 13, ist. c. 7. Nr. 4. — Fig. 67—68.

RG suggested that this might be a form of *C. dichondrum* West & West (1895, p. 65, 7; 12) [and these two species are so similar that perhaps they should be combined (HC)], but HC believes that RG's plant is closer to *C. bimamillatum* in its paired apical nodules in lateral view, in the general cell shape and supraisthmial row of granules in face view.

C. bireme Nordst. forma. Differs in having semicells broader and less angular, and with less prominent projection in vertical view. Long. 15, lat. 15, crass. 9.2, ist. c. 7. Nr. 1. — Fig. 264—265.

Cosmarium Blyttii Wille. Nr. 2, ?4.

Cosmarium capense DeToni (1889, p. 969) var. *Nyassae* Schmidle (1902, p. 70, II: 1). Nr. 4. — Fig. 51—52.

Cosmarium connatum Bréb. Two pyrenoids. Long. 60—62, lat. 44—45, crass. to 40, ist. 30—32. Nr. 3, 4. — Fig. 51—52.

Cosmarium connatum Bréb. var. *africanum* Fritsch & Rich (1937, p. 183, fig. 12 J—K). Semicells with supraisthmial row of scrobiculations? («granules» in FRITSCH & RICH, (l. c.). Long. 68—70, lat. 50—52, crass. 42, ist. 34—35. Nr. 3. — Fig. 257—258.

The Uganda plant closely resembles a form from the French Sudan shown by BOURRELLY (1957, p. 1068, 7: 56) (Scott).

Cosmarium contractum Kirchn. var. *contractum* forma. Isthmus less open than in type; pyrenoid one; wall smooth. Long. 27, lat. 21, crass. 15, isth. 5. Nr. 3. — Fig. 234.

This seems closest to a form figured with zygospore from Burma by SKUJA (1949, p. 120, 30: 14—15).

Cosmarium contractum Kirchn. var. *ellipsoideum* (Elfv.) W. & W. Semicells ellipsoid, isthmus relatively broad. OKADA (1934, p. 164, 27: 8) figures a very similar form from the N. Kurile Is. Long. 39, lat. 30, ist. 12. Nr. 3, 6. Fig. 162.

Cosmarium contractum Kirchn. var. *minutum* (Delp.) W. & W. Long. 22—24, lat. 17—18, crass. c. 11—12, isth. 6—7. Nr. 5, 6.

Cosmarium cucurbita Bréb. var. *cucurbita* f. *rotundata* Krieger (1932, p. 174, 8: 13). Chloroplast axial. Long. 30, lat. 17—18 ($1.7 \times$). Nr. 2. — Fig. 45.

RG suggested this might be a new var. of *C. curtum*, but it seems fundamentally closer to *C. cucurbita*, being relatively shorter and much less tapered.

Cosmarium cucurbita Bréb. var. *attenuatum* G. S. West. Semicells slightly tapered to rounded apex; wall punctate; chloroplast axial. Long. 30—32, lat. 17—17.5. Nr. 2, 4. — Fig. 46.

RG suggested *C. curtum* (Bréb.) Ralfs for the plant, but with its shorter cells and more rounded apex it seems closer to *C. Cucurbita*.

Cosmarium cylindrocystiforme West & West (1912, p. 85) (*Cylindrocystis pyramidatum* West & West (1902, p. 134, 18: 1—2). Wall markings not visible; in vertical view circular. Long. 34, lat. 22 ($1.5 \times$), ist. 21. Nr. 2. — Fig. 232.

Scott called the plant *C. cucurbita* f. *rotundata* Krieger, which, however is $1\frac{3}{4} \times$ as long as broad, with less tapered apices. It seems very similar to the plant figured as *C. subglobosum* Nordst. f. by KRIEGER (1932, p. 187, 8: 12) and also by VAN OYE (1943, p. 31, V: 6—7).

Cosmarium decachondrum Roy & Biss. (1886, p. 196, 268: 15) forma. Semicells depressed semicircular, with large granules around the margin and two

granules below the apex; vertical view showing central tumor. Long. 25.5, lat. 28, ist. 7. Nr. 4. — Fig. 94—95.

Cf. *C. pseudotaxichondrum* Nordst. var. *ambadiense* (Grönbl. & Scott) Bourrelly (1961, p. 345, 21: 4). RG also suggested that it might be a new var. of *C. taxichondrum* Lund.

Cosmarium ?depressum (Näg.) Lund. var. *depressum*. Long. 44—46, lat. 40—41, ist. 10—11. Nr. 3. — Fig. 113.

RG also suggested for this *Arthrodesmus convergens* Ehrenb. f. *inermis* (Jacobs.) Schmidle (1899, p. 47, 3: 10) or f. *minor* Grönblad (1945, p. 23, 8: 166), but because of its closed linear sinus it seems closer to *C. depressum*.

Cosmarium depressum (Näg.) Lund. var. *depressum* forma. A form with more rounded apex and sinus that opens rather soon, thus approaching var. *elevatum* Borge (1918, p. 34, 3: 6). BORGE's variety, however, has a scrobiculate wall, and RG shows the Uganda form as smooth. Long. 39, lat. 39, ist. 12. Nr. 6. — Fig. 233.

Cosmarium depressum (Näg.) Lund. var. *achondrum* (Boldt) W. & W. forma. Differs in more widely open sinus and in occasional presence of two pyrenoids per semicell. Long. 46, lat. 46, ist. 15. Nr. 6. — Fig. 161, 223.

GRÖNBLAD (1960, p. 37, Fig. 40—41) figures a plant from Italy with two pyrenoids, tentatively identifying it as *C. depressum* v. *achondrum*. The Italian plant is very different, however, being 1 1/2 times as long as broad, and therefore perhaps does not belong to this species.

Cosmarium diplosporum (Lund.) Lütkem. Sides of semicell nearly cylindrical, narrowing toward rounded apex, whose wall lacks internal thickening. Long. 60—64, lat. 29—33. Nr. 4. — Fig. 49.

Cosmarium gonioides W. & W. Nr. 2.

Cosmarium granatum Bréb. var. *pyramidale* Schmidle (1898, p. 34, II: 17). Sides concave; wall punctate, sometimes more coarsely so at apex; in lateral view with sides very slightly broader at base. Cf. *C. raneegungense* Turn. (1892, p. 65, X: 13) which is very similar, but relatively broader. Long. 32—41, lat. 20—26, crass. c. 13, ist. 7—8. Nr. 3. — Fig. 76—78.

Cosmarium Hammeri Reinsch var. *Hammeri*. Nr. 4.

Cosmarium ?Hammeri Reinsch var. *Hammeri* forma. Nr. 3.

Cosmarium Hammeri Reinsch var. *Schmidlei* Grönbl. & Scott in GRÖNBLAD, PROUSE & SCOTT (1958, p. 27, 13: 163—165). Wall fairly thick; two pyrenoids. Long. 38—40, lat. 33—34, ist. 10—11. Nr. 4, 5. — Fig. 79.

Cosmarium hexagonum Nordstedt (1870, p. 208, 3: 18) ?forma. Semicells obversely semicircular, with convex apex, within which are several irregular rows of granules, including a larger median one. Only face view seen. Long. 28, lat. 21, ist. 6. Nr. 4. — Fig. 69.

This is only half the size of the type and differs also in its wide open sinus. It approaches in outline a figure of this size from Brazil, illustrated by GRÖNBLAD (1945, p. 19, 6: 116 (not 117). RG suggested that it might be a new species, but HC is hesitant to describe it without knowledge of the other views.

Cosmarium isthmium West Nr. 4.

Cosmarium kilimanense Schmidle (1898, p. 40, II: 28) forma. Differs in larger size, lack of central ornamentation (in RG's figure), in less retuse apex, and in presence of marginal granules. Cf. also *C. ungerianum* (Näg.) DeBary var. *nodosum* Lütkenmüller (1910, p. 496). Long. 30—33, lat. 30—32, crass. 18—19, ist. 9—10. Nr. 2, 3, 4. — Fig. 96—97.

Cosmarium lanceolatum (Turn.) Lütkenmüller (105, p. 337) f. *turgidum* Grönb. n. f. Nr. 4. — Fig. 44.

Semicellulae apicem obtusior, et inflationem parvam supra isthmum habentes; membrana levis, sine scrobiculatione. Long. 118, lat. 33.

Semicells less sharply tapered, with slight swelling above isthmus, apex smooth, without scrobiculation. Probably the same plant illustrated as *C. elongatum* Rac. in GRÖNBLAD, PROWSE & SCOTT (1958, p. 26, fig. 130).

Cosmarium lobatum Börgesen (1890, p. 947, 4: 38). One pyrenoid. Long. 76, lat. cpap. 53, spap. 49 ($1.5 \times$). Nr. 4.

Cosmarium lobatum Börges. var. *ellipticum* Fritsch & Rich (1937, p. 188, Fig. 14 L—N) forma. Differs in having two pyrenoids and a smooth wall. Long. 55—63, lat. cpap. 48—55, spap. 43—50 (1.25 — $1.28 \times$), crass. 31—36, ist. 18—19. Nr. 5. — Fig. 53.

Cosmarium lobatum Börges. var. *minus* (G. M. Smith) Grönb. (1945, p. 19, VI: 124). Semicells more depressed, with flattened apex. Long. 30, lat. cpap. 29, spap. 27 ($1.1 \times$), crass. 17, ist. 9. Nr. 5. — Fig. 236.

Cosmarium lomnicense Lütkenmüller (1910, p. 489, II: 21—24). Nr. 2.

Cosmarium Lundellii Delp. var. *corruptum* (Turn.) W. & W. forma. Smaller than the variety, with wide open sinus; wall evenly and conspicuously scrobiculate. The Uganda plant approaches f. *minor* Gutwinski (1895, p. 88, 3: 19)

but is less compressed. Cf. also Jao's form (1949, p. 53, 2: 20), but wall not thickened at angles. Long. 45, lat. 36, ist. 12. Nr. 3. — Fig. 230.

Cosmarium Lundellii Delp. var. *ellipticum* W. & W. forma. Sinus slightly open; wall punctate? Long. 50–56, lat. 39–42 ($1\frac{1}{3} \times$), crass. 27–32, ist. 12–13. Nr. 3. — Fig. 228–229.

This is very similar to the plant figured under this name from Arnhem Land by SCOTT & PRESCOTT (1958, p. 47, 12: 21–22). It differs from the WESTS' plant in its more open sinus, broader apex, and broader ventral view.

Cosmarium malinvernianum (Rac.) Schmidle Long. 41–42, lat. 34–36, crass. 26, ist. 8–12. Nr. 3, 4. — Fig. 100–101.

This is very similar to the plant recorded by SCOTT as *C. trachypleurum* Lund. from the same station, but SCOTT's figure (Fig. 239–241) shows fewer, stouter marginal and intramarginal spines, with a smooth area between the latter and the central ornamentation.

Cosmarium mansangense West & West (1907, p. 209, 14: 15). Granules in 10 horizontal and 10 vertical series, 22 around margin of semicell; two pyrenoids. Long. 60, lat. 27, ist. 19. Nr. ? — Fig. 266, drawn by Scott without annotation of the sample number.

Cosmarium maximum (Börger.) West & West (1897, p. 114) var. *latum* Scott n. var. Nr. 5. — Fig. 224–226.

Cellulae minores quam in specie, a facie visae satis angulariter circulares; semicellulae a vertice visae anguste ellipsoideae, a latere visae circulares; semicellulae spinas parvas in angulis inferioribus habentes; proprietates membranae non diagnoscenda; pyrenoidea ut videtur duo. Long. 89, lat. csp. 93, ssp. 90, crass. 48, ist. 24.

Cells smaller than in the species, in face view rather angularly circular; semicells in vertical view narrowly ellipsoid, in lateral view circular; semicells with small spines on lower angles; wall character not discernible; presumably two pyrenoids.

Cosmarium medioscrobiculatum West & West (1902, p. 169, 21: 1) forma. Semicells with widely opening sinus, with thick wall and with group of coarser scrobiculae in upper central part; two pyrenoids. Differs in its larger size, less depressed cells and higher position of large scrobiculae. In vertical view the lateral angles are somewhat projecting. Long. 55–58, lat. 46, crass. c. 32, ist. 23–28. Nr. 3. — Fig. 61–62.

RG called this var. *egranulatum* Gutw., which KRIEGER & GERLOFF (1962, p. 37) include under the type variety Cf. *C. perforatum* Lund. var. *Skujae* Grönbl. forma in SKUJA (1949, p. 133, 27: 11), from which it differs in its smaller

size, more widely open sinus, and laterally projecting angles, also in the higher position in the semicell of the group of large scrobiculae. From *C. perforatum* var. *crassangulatum* Insam & Krieger (1936, p. 105, IV: 6) it differs in its smaller size and higher basal angles.

Cosmarium moniliforme (Turp.) Ralfs var. *moniliforme*. Wall smooth. Long. 37—42, lat. 21—25, crass. 21—25, ist. 7.5—9. Nr. 5. — Fig. 47.

Cosmarium moniliforme (Turp.) Ralfs var. *panduriforme* Heimerl. Sinus deeper and apex less rounded than is typical for the variety. Long. 33, lat. 17.5, ist. 12.5. Nr. 6. — Fig. 163.

Cosmarium moniliforme (Turp.) Ralfs. var. *punctatum* Lagerh. forma. Semicells nearly circular with flat sides, coarsely punctate at least at apex; chloroplast axial with radiating bands. Differs in shallower sinus and flat sides. «Only one seen» (Scott). Long. 26, lat. 13, ist. 6. Nr. 5. — Fig. 249—250.

SCOTT called this *C. trachypolum* West & West (1897 a, p. 166, 8: 14—15), pointing out that the apical ornamentation was porose, not granular. But *C. trachypolum* shows merely a notch at the isthmus, whereas the Uganda plant, with a distinct sinus, seems to resemble more closely *C. moniliforme* var. *punctatum*, especially as depicted by RICH (1932 a, p. 246, Fig. 2 D—E) and by WEST & WEST (1895, p. 70, IX: 30—31).

Cosmarium moniliforme (Turp.) Ralfs var. *subpyriforme* Grönbl. n. var. Nr. 2. — Fig. 48.

Forma minima, semicellulis rotundatis, parte latissima, autem, supramedia ut in *C. subpyriformi* Lagerh. Incisura isthmi abrupta ut in *C. pyriformi* Nordst., saepe, autem, per flexum semicellularum ad isthmum celata. Semicellulae a vertice non visae, probabiliter, autem, circulares. Long. 15—16, lat. 8—9, ist. 4.

A very small form, with the semicell rounded but with its broadest part above the middle, as in *C. subpyriforme* Lagerheim (1887, p. 197, fig.). Cells with notch at isthmus as in *C. pyriforme* Nordstedt (1870, p. 214, fig.), but this is often obscured by a twisting of the semicells at the isthmus. Vertical view not seen but presumably circular.

Cosmarium mordax Turn. (1892, p. 50, 7: 29, 9: 7). «Wall apparently smooth; only one seen.» (Scott). Long. 31, lat. 36, ist. 10. Nr. 5. — Fig. 227.

SCOTT labelled this drawing «ad *C. pseudotaxichondrum* Nordst. «markings not visible» (NORDSTEDT 1877, p. 20, II: 5). But SCOTT's plant, with its bluntly angular basal angles, seems almost identical with TURNER's plant, which shows no surface markings.

Cosmarium novae-semlicae Wille. Nr. 2.

Cosmarium Nymannianum Grun. forma. Differs in having cells relatively narrow, with apparently smooth wall. Other views not seen. Long. 39, lat. 23 ($1.7 \times$), ist. 7. Nr. 2. — Fig. 248.

Cosmarium obtusatum Schmidle. Nr. 5.

Cosmarium ordinatum W. & W. Nr. 5.

Cosmarium pachydermum Lund. var. *aethiopicum* W. & W. Nr. 4.

Cosmarium paradoxum Turner (1892, p. 64, IX: 22). Two plants were seen: a) Long. 99, lat. 78, ist. 36 (not figured), and b) Long. 89, lat. 69, ist. 29. Nr. 1. — Fig. 102–103.

Cosmarium permaculatum Grönbl. & Scott in GRÖNBLAD, PROWSE & SCOTT (1958, p. 29, 17: 252–254). Differs in the scrobiculae which are triangular and arranged in a hexagonal pattern. Long. 64, lat. 44, crass. c. 33, ist. 16. Nr. 4. — Fig. 59–60.

Cosmarium phaseolus Bréb. Sinus opening rather widely from the interior; wall smooth. Long. 32, lat. 28, crass. 15, ist. 8. Nr. 5.

Cosmarium phaseolus Bréb. var. *subbireme* Raciborski (1889, p. 83, V: 4). Wall coarsely punctate. Long. 18, lat. 18, crass. max. 13, ist. c. 6. Nr. 4. — Fig. 245–247.

Cosmarium protuberans Lund. forma. Differs only in smaller size. SCHMIDLE (1894, p. 58, 7: 22) describes a var. *minor*, but his is quite different, with more rounded semicells and small smooth central papilla. Nr. 4. — Fig. 253–255.

Cosmarium pseudoconnatum Nordst. Apex rounded, isthmus shallow; wall smooth?; chloroplast 4, each with one pyrenoid. Long. 62–63, lat. 37–45 (1.4 – $1.5 \times$), ist. to 41. Nr. 2. — Fig. 251–252.

Cosmarium pseudonitidulum Nordst. Wall coarsely punctate; two pyrenoids. Long. 48, lat. 35–37, ist. 10–12. Nr. 3, 4.

Cosmarium pseudonitidulum Nordst. var. *angustissimum* Grönbl. n. var. Nr. 4. — Fig. 63–64.

Varietas a specie differens quod maior, atque quod semicellulae latera fere recta et apicem rectum angustumque habent, ita forma ad *C. Hammeri* accedentes; semicellulae a vertice visae ellipticae sine protuberatione mediana; membrana grosse scrobiculata; pyrenoidea duo. Long. 53, lat. 41, crass. 26, ist. c. 12.

Semicells with nearly straight sides and apex, approaching in shape *C. Hammeri*; vertical view elliptic without median protuberance; wall scrobiculate; pyrenoids two.

Cosmarium pseudoretusum Duc. var. *africanum* (Fritsch) Krieger & Gerloff (1962, p. 97, XX: 19) (*C. Hammeri* Reinsch var. *africanum* Fritsch) Apex truncate; wall smooth?. Long. 32, lat. 25, crass. c. 16, ist. 10. Nr. 2. — Fig. 237—238.

Cosmarium pygmaeum Arch. forma. Differs in linear but open sinus, and in rounded semicells. Long. 8.5, lat. 8, crass. 5, ist. 3.8. Nr. 4. — Fig. 74—75.

Cosmarium pyramidatum Bréb. forma. Cells relatively long; semicells broadest at the very base, with apex and basal angles rounded and with sides nearly straight, wall porose. In lateral view sides rounded. Long. 63, lat. 36 ($1\frac{3}{4} \times$), crass. 27, ist. 14. Nr. 2. — Fig. 256.

Cosmarium quadratum (Gay) DeToni var. *applanatum* Insam & Krieger (1936, p. 107, III: 17). Angles much rounded; sinus linear, closed. Long. 10, lat. 8—9, crass. 6, ist. c. 4. Nr. 4. — Fig. 82—83.

Cosmarium quadrum Lund. Nr. 4.

Cosmarium quadrum Lund. forma. Semicells subrectangular, sides slightly diverging to the rounded upper angles, apex flat to slightly concave. Granules of one size, in decussating oblique series, presence of punctae between them doubtful. Semicells in vertical view elliptic; two pyrenoids. Long. 44—46, lat. 46—48, crass. 27, ist. 16—17. Nr. 4. — Fig. 98—99.

The taxonomy of this group is difficult. RG suggested that this plant might be *C. pseudobroomei* Wolle, which, however, is normally smaller, with fewer granules; he also referred to *C. quadrum* var. *sublatum* (Nordst.) W. & W. f. *dilatatum* Scott & Grönl. (1957, p. 22, VI: 5) which, however, is larger, relatively longer, and is porose between the vertically arranged granules.

Cosmarium Regnellii Wille var. *Regnellii* forma. Differs in the cells being longer than broad, with lateral angles less projected. Long. 13—15, lat. 10—14, crass. c. 7, ist. c. 4—5. Nr. 4. — Fig. 260.

Cosmarium Regnellii Wille var. *chondrophorum* Skuja (1949, p. 139, 29: 5) f. *minus* Grönl. n. f. Nr. 4. — Fig. 88—89.

Forma a specie differens quod anguli minus eminent atque quod semicellula papillam mediam habet; a variete *chondrophoro* differens quod apex planus aut vix retusus, atque quod cellula probabiliter minor. Long. 12—17, lat. 12—14, crass. cpap. 8—9, ist. 4—5.

Differs from the species in the less projecting lateral angles and in the presence of a central papilla. Differs from SKUJA's variety in the flat (not retuse) apex and presumably smaller size.

This new form would seem to include the plants of this variety depicted in GRÖNBLAD, PROWSE & SCOTT (1958, p. 32, 14: 174—175) and SCOTT & PRESCOTT (1961, p. 68, 32: 14). But because of the central papilla and the less pronounced lateral angles perhaps all these plants might better be placed under *C. polygonum* (Näg.) Arch. (HC).

Cosmarium Regnesi Reinsch. »Only one seen» (Scott). Long. 8, lat. 8, crass. c. 5, ist. 4.5. Nr. 1.

Cosmarium retusifforme (Wille) Gutw. ?var. Nr. 4.

Cosmarium retusum (Perty) Rab. Typical in size and shape but with fewer granules. Long. 32, lat. 24, ist. 8—9. Nr. 2. — Fig. 90.

Cosmarium Scottii Croasd. n. sp. Nr. 5 — Fig. 56—58.

Semicellulae transverse oblongo-ellipticae, a latere visae circulares, a vertice visae late ellipticae sine protuberatione mediana; membrana satis crassa, subiliter scrobiculata; pyrenoidea duo. Long. 60, lat. 45 ($1.3 \times$), ist. 18.

Semicells transversely oblong-elliptical, in side view circular, in vertical view broadly elliptical without median protuberance; wall fairly thick and finely scrobiculate; two pyrenoids.

Figured by SCOTT without a name, with the comment »many seen», it was doubtfully assigned by RG to *C. contractum* var. *ellipsoideum*, from which, however, it differs in its larger size, relatively greater length with more convex apex, less open sinus, scrobiculate wall and two pyrenoids. Other plants that might be assigned here are *C. contractum* var. *ellipsoideum*? in GRÖNBLAD, PROWSE & SCOTT (1958, p. 25) and ?*C. depressum* var. *achondrum* (Boldt) W. & W. in GRÖNBLAD (1960, p. 37, fig. 40—41, photo 28).

C. Scottii Croasd. f. *minus* Croasd. n. f. Nr. 5. — Fig. 235.

Forma multo minor, membrana relative crassa et arcte porosa; pyrenoidea duo. Long. 38, lat. 30, crass. c. 21, ist. 11.

Wall relatively thick and closely porose; two pyrenoids. Differs only in smaller size and in having pores instead of scrobizulae.

Cosmarium sinostegos Schaarschm. var. *granulatum* Croasd. n. var. Nr. 4. — Fig. 70—73.

Varietas a typo differens quod anguli laterales rotundati, omni duas granulas minutas ferente, necnon quod papilla centralis brevis obtusa, deorsum versa. Long. 8—9, lat. 8.5—10, crass. 4.5—5, ist. 3—3.5.

Cells somewhat resembling var. *obtusius* Gutw. but with lower basal angles rounded, and each bearing two minute granules. In lateral view central papilla blunt and somewhat downwardly projecting.

Compare *C. Doidgei* Fritsch & Rich (1937, p. 185, XII: G—1) and also *C. spyridion* West & West (1895, p. 64, 8: 26 (RG)).

Cosmarium ?staurastroides Eichl. & Gutw. Nr. 2.

Cosmarium stigmatosum (Nordst.) Krieger (1932, p. 186, X: 19) forma. Differs from NORDSTEDT's figure in its narrower isthmus, widely opening sinus, and in its apparent absence of granules mixed with the punctae; two pyrenoids. SCOTT, who observed it, said: »Wall seems to be porose but pattern not visible.» Nr. 2. — Fig. 231.

Cosmarium striolatum (Näg.) Arch. var. *Nordstedtii* (Möb.) Krieger (1932, p. 186, XII: 2) forma. A small form with semicells nearly semicircular; large granules regularly arranged in oblique decussating series, with punctae between them. Long. 76—78, lat. 45—48, ist. 34—37; also a larger form not illustrated: long. 88—89, lat. 51—54, crass. 45—48, ist. 41—42. Nr. 2. — Fig. 104—106, 268.

Cosmarium subauriculatum West & West (1895, p. 55, VI: 31) Spines more acute and sometimes curved. Long. 46—55, lat. csp. 48—51, ssp. 41—48, crass. 30.5—33, ist. 24.6—34.5. Nr. 2. — Fig. 54—55.

Cf. var. *bogoriense* (Bern.) Bourrelly (1957, p. 1076, X: 89) which has sharp spines as ours but differs in its distinctly scrobiculate wall.

Cosmarium ?subdanicum W. West. Cells similar in outline to species, but smaller, and with 4 subapical granules. Long. 15, lat. 12, ist. c. 5. Nr. 4. — Fig. 261.

IRÉNÉ-MARIE (1951, p. 118, II: 25) shows one nearly so small from Quebec, and DICK (1930, p. 133, 8: 1—2) shows one with similar subapical granules.

Cosmarium subtumidum Nordst. var. *subtumidum* f. *maius* Croasd. n. f. Nr. 3. — Fig. 242—244.

Forma differens quod cellulae maiores atque semicellulae satis ellipticae. Long. 45—46, lat. 40, crass. 24—26, ist. 11—12.

Semicells in face view somewhat elliptic, but with flattened apex, in side view circular, in end view broadly elliptic; wall smooth or very delicately punctate.

Cosmarium subtumidum Nordst. var. *subtumidum* f. *minus* Borge (1913, p. 18, I: 11). Long. 25, lat. 24, crass. 13, ist. 7. Nr. 1. — Fig. 86—87.

Cosmarium subtumidum Nordst. var. *circulare* Borge (1903, p. 97, III: 22) Long. 23—29, lat. 21—28, crass. to 15, ist. 7—9. Nr. 1. — Fig. 65—66.

SCOTT and RG both figured this plant; SCOTT's without a name, RG's as *C. nitidulum* De Not fa. The plant differs from both *C. subtumidum* and *C. nitidulum* in its more rounded apex, but in its more tumid vertical view it seems closer to *C. subtumidum*.

Cosmarium tenue Arch. var. *tenue* Wall smooth. Long. 14, lat. 12, crass. 9, ist. 3. Nr. 3.

Cosmarium tenue Arch. var. f. *tenue tumidum* Grönbl. n. f. Nr. 1,3 — Fig. 84—85..

Semicellulae late ellipticae, sinu clauso; membrana levis aut interdum sparse punctata; semicellulae a vertice visae paululum tumidae, protuberatione mediana minima. Long. 12.5—13, lat. 12—13, crass. 6.7—7.2, ist. 4—5.

Semicells broadly elliptic, with closed sinus; wall smooth or widely punctate; semicells in vertical view slightly tumid with very slight median protuberance.

Cosmarium tenue Arch. var. *minus* Prescott & Scott (1942, p. 15, I: 20). Wall very finely and inconspicuously punctate. Long. 9.2, lat. 7, ist. 3.5 Nr. 4.

Cosmarium tithophorum Nordst. var. *depressum* West & West (1902, p. 164, XX: 29) forma. Cells smaller with flattened apex, sinus sharper at interior, median protuberance reduced. Long. 21—24, lat. 23—27, crass. 13—14, ist. 5—7. Nr. 4. — Fig. 92—93.

Cf. *C. Doidgei* Fritsch & Rich (1937, p. 185, Fig. 12 G—I) which, however, has an elevated apex and more pronounced median protuberance. Cf. also *C. pileatum* Borge (1918, p. 29, 8: 1) which, however, is less depressed, is broader in vertical view and has less pronounced protuberance.

Cosmarium trachypleurum Lund. Long. 44—48, lat. csp. 38—40, ssp. 36, crass. 25—27, ist. 12—13. Nr. 3. — Fig. 239—241.

The Uganda plant approaches var. *spinosum* West & West (1895, p. 66, 8: 17) in its stouter spines, but is closer to the type in its central ornamentation and vertical view. Cf. var. *spinosum* of NYGAARD (1932, p. 142, fig. 43) and *C. malinverianum* (Rac.) Schmidle (fig. 100—101 in this paper).

Cosmarium trilobulatum Reinsch var. *bioculatum* Krieg. in KRIEGER & GERLOFF (1962, p. 99). Long. 19, lat. 15, ist. 5.5. Nr. 4. — Fig. 91.

Cosmarium tyrolicum (Nordst.) Krieg. & Gerloff var. *Beanlandii* (W. & W.) Krieger & Gerloff (1962, p. 48). Nr. 4.

Cosmarium vogesiacum Lemaire var. *quadrigranulatum* (Gutw.) Laporte (1931, p. 113) (*C. polonicum* Rac. var. *quadrigranulatum* Gutw.) forma ad formam KRIEGER & BOURRELLY (1956, p. 162, X: 98) acced. Cells smaller and with reduced granulation. Long. 19, lat. 18, crass. c. 13, ist. 7. Nr. 5. — Fig. 262—263.

SCOTT suggested that the plant might be *C. geminatum* Lund., but this has elliptical semicells with wide open sinus.

Cosmarium wembaerense Schmidle (1899, p. 32, II: 8). Semicells more angular than *C. laeve* Rab., smaller and relatively longer than *C. sexangulare* Lund. Long. 26, lat. 19 (1.37 ×), ist. 6. Nr. 3. — Fig. 259.

Cosmarium zonatum Lund. var. *angustum* Grönb. & Scott in GRÖNBLAD, PROWSE & SCOTT (1958, p. 35, 13: 151). Cells elongate, tapering toward the apex with retuse sides; in vertical view broadly elliptical. Long. 58, lat. 24, crass. 21, ist. 9. Nr. 5. — Fig. 50.

Cosmarium zonatum Lund. var. *javanicum* (Gutw.) Krieger (1932, p. 190, X: 2) forma. The Uganda plant is larger than the species or var. *javanicum*. It differs from the species in its flattened apex, but differs from the variety in its circular vertical view. Long. 60, lat. 28, ist. c. 15. Nr. 4. — Fig. 267.

Cf. *C. zonatum* in SCOTT & PRESCOTT (1961, p. 73, 28: 5).

Xanthidium antilopaeum (Bréb.) Kütz. var. *hebridarum* W. & W. Lateral spines arising above middle of semicell, and not quite paired; apical spines slightly diverging, in one semicell single and larger than the lateral spines, in the other paired and smaller than the lateral ones. Vertical view not seen. Cf. *X. pseudobengalicum* Grönb. (1921, p. 50, IV: 32—33), from which it differs in its smaller size and more closely paired spines. Long. csp. 63, ssp. 43, lat. csp. 70, ssp. 42, ist. 21. Nr. 5. — Fig. 269.

Xanthidium subtrilobum West & West (1887, p. 88, 368: 14) var. *africanum* (Schmidle) Grönb. & Scott in GRÖNBLAD, PROWSE & SCOTT (1958, p. 37, 19: 268—269). Long. csp. 106, lat. csp. 99, ist. 21, with prominent central protuberance. Nr. 5. — Fig. 107.

Xanthidium subtrilobum W. & W. var. *inornatum* Skuja (1949, p. 151, 33: 14). Central protuberance not prominent and lacking any ornamentation. Long. csp. 86, ssp. 60, lat. csp. 75, ssp. 54, crass. 26, ist. 18. Nr. 5.

Arthrodesmus convergens Ehrenb. var. *convergens*. Long. 32—47, lat. csp. 57—78, ssp. 32—40, ist. 10—15, spines 5—20 (relatively long). Nr. 3, 4, 5. — Fig. 110—112.

Arthrodesmus convergens Ehrenb. var. *curtus* Turner (1892, p. 134, XI: 32) f. *maior* Croasd. n. f. Nr. 3, 4, 5. — Fig. 131.

Cellulae paululo maiores quam var. *curtus*, spinae longiores, sinus arctius clausus.

Cells a little larger than TURNER's variety, with longer spines and more tightly closed sinus. Long. 48—61, lat. csp. 55—90, ssp. 50—55, crass. 25, ist. 15—16, spines 6—20.

RG suggested for this plant the name *A. maximus* Borge var. *africanus* n. var., but BERGE (1925, p. 37, IV: 18) characterizes his species on two characters: long straight spines and two pyrenoids. RG's plant lacks both these features and also has a more linear sinus, so it seems more appropriate to consider it a variety of *A. convergens* var. *curtus*, which was the name suggested by SCOTT for a rather similar plant.

Arthrodesmus convergens Ehrenb. var. *curtus* Turn. f. *obtusispinosus* Croasd. n. f. Nr. 3, 4, 5. — Fig. 114.

Forma a varietate differens solummodo ut spinae obtusae sunt. Long. 53—69, lat. csp. 69—97, ssp. 50—63, ist. 16—20.

RG made this a form of his proposed variety *A. maximus* var. *africanus*, but for the reasons stated above HC feels it belongs to *A. convergens* var. *curtus*.

Arthrodesmus curvatus Turner (1892, p. 135, XI: 33, XII: 2). Long. 44, lat. csp. 79, ssp. 40, crass. 27, ist. 14. Nr. 5. — Fig. 281—282.

Arthrodesmus maximus Borge (1925, p. 37, IV: 18). Spines horizontal, long and stout. Long. 53, lat. csp. 99, ssp. 47, ist. 13, spines 24—27. Nr. 5. — Fig. 130.

RG suggested that this might be var. *latus* Scott & Grönblad (1957, p. 26, X: 14—15) which, however, is a relatively longer form, with diverging spines.

Arthrodesmus mucronulatus Nordstedt (1870, p. 232, IV: 58) f. *depau-peratus* Grönbl. n. f. Nr. 4, 5. — Fig. 108—109.

Forma a specie differens ut margo dorsalis leviter convexus est, indicio spinarum accentium nullo. Long. 32—38, lat. csp. 45—57, ssp. 27—37, ist. 8—12, spines 4—5.

Differs in smoothly convex dorsal margin with no indication of accessory spines. Cf. *A. hiatus* Turn. f. *maior* Turner (1892, p. 134, XI: 40, XII: 1) from which it differs in less widely open sinus and stouter spines.

Arthrodesmus subulatus Kütz. var. *americanus* (Turn.) W. & W. Long.

27—37, lat. csp. 44—69, ssp. 27—33, ist. 8.5—11, spines 7—20. Nr. 4, 5. — Fig. 129.

Staurastrum anatinum Cooke & Wills var. *subglabrum* G. W. West (1907, p. 129, VI: 8) formae. Processes long, horizontal or sometimes eventually incurving, granular, terminating in 3—4 spines. Body of semicell wholly smooth but in face view irregularly elevated as if with depressed verrucae, in vertical view sides slightly swollen. Long. 35—41, lat. cpr. 96—103, ist. 9—10. Nr. 6. — Fig. 178—181.

RG suggested calling this plant var. *glabrum* var. nov., but it seems well to avoid this name since there is already a forma *glabrum* Brook (1959, p. 596). *S. anatinum* is a rather confusing species and it is better perhaps not to add to it a new variety based only on these two drawings of not wholly similar plants.

Staurastrum apiculatum Bréb. Nr. 2, 5.

Staurastrum cerastes Lund. forma. Differing in the shape of the body of the semicell, cup-shaped, flat at the apex and smooth above the widely open sinus; differing also in the end view which shows the processes more sharply defined from the body. Long. 49—51, lat. cpr. 48—54 (diag. 66—76), spr. 24—27, ist. 12—14. Nr. 4, 5. — Fig. 137—138.

Cf. also *S. Sebaldi* Reinsch which, however, typically has larger and relatively shorter cells and shows groups of granules below the less strongly converging processes.

Staurastrum clepsydra Nordst. var. *obtusum* Nordst. forma of RICH (1932, p. 173, Fig. 10 A—D). Differs only in broader isthmus and more obtuse angles. Nr. 4. — Fig. 272—273.

Staurastrum coarctatum Bréb. var. *subcurtum* Nordst. Cells quite variable especially in relative breadth of isthmus. RG noted a dichotypical cell: 2+3-radiate. Long. 22—24, lat. 16.5—21, ist. 7—10. Nr. 1, 4. — Fig. 122—124.

Staurastrum coarctatum Bréb. var. *subcurtum* Nordst. f. *maius* Grönl. n. f. Nr. 6. — Fig. 164—165.

Cellulae maiores quam var. *subcurtum*, apice convexiore, a vertice visae quadrangulares. Long. 35, lat. 30, ist. 12, 4-gona.

Larger than the type with more convex apex.

Staurastrum connatum (Lund.) Roy & Biss. forma. Differs in its slightly swollen angles and in its spines which appear to be twisted in vertical view. Long. csp. 32, ssp. 23, lat. csp. 30, ssp. 25, ist. 6. Nr. 5. — Fig. 284—285.

Staurastrum corniculatum Lund. var. *spinigerum* W. West forma. Long. csp. 46, ssp. 36, lat. csp. 39, ssp. 29, ist. 22. Nr. 5. — Fig. 274.

In its much larger size and slightly swollen angles this approaches var. *americanum* Scott & Grönblad (1957, p. 34, 28: 7–10).

Staurastrum corniculatum Lund. var. *spinigerum* W. West f. *latum* Grönbl. n. f. Nr. 6. — Fig. 166–167.

Forma lata, isthmo lato, semicellula a vertice visa triangularis, lateribus convexis, angulis mamillatis. Long. 35, lat. csp. 39, ist. 19.

A broad form with broad sinus. THOMASSON (1960, p. 242) with good reason (HC) calls this variety; *Staurodesmus leptodermus* var. *corniculatus* (Lund.) Thomass.

Staurastrum cuspidatum Bréb. Long. 28, lat. csp. 48, spines to 16, slightly converging. Nr. 6. — Fig. 286–287.

Staurastrum cuspidatum Bréb. forma. Nr. 4.

Staurastrum cyclacanthum W. & W. forma. A form in its body shape approaching var. *depressum* Scott & Grönblad (1957, p. 35, 18: 15–16), but differing in larger size, presence of spines on body below processes, and tricuspid verrucae in apical crown. Long. 26, lat. csp. 42, ist. 10. Nr. 3. — Fig. 197–198.

Staurastrum dejectum Bréb. var. *dejectum* Long. csp. 27, lat. csp. 27, ist. 6.5 Nr. 6. — Fig. 168–169.

Staurastrum dejectum Bréb. var. *dejectum* f. *angustatum* Teiling (1954, p. 129). Differs from the species in its rather sharp sinus. Long. 28, lat. csp. 29, ssp. 26, ist. 9. Nr. 5. — Fig. 283.

Scott called this *S. apiculatum* Bréb. which, however, as pointed out by TEILING, has small erect spines arising from the dorsal surface some distance from the rounded angles.

Staurastrum dejectum Bréb. var. *subglabrum* Grönbl. f. *maius* Bourrelly (1957, p. 1082, 12: 110). Differs only in sides being less concave in ventral view and spines being slightly shorter. Long. 33–37, lat. csp. 49–57, ssp. 34–36, ist. 13–14, spines 10–12. Nr. 4, 5. — Fig. 120–121.

RG suggested calling this plant *S. Dickiei* Ralfs var. *africanum* n. var. but the above determination of Scott seems more appropriate.

Staurastrum Dickiei Ralfs var. *Dickiei*. Cells relatively long, dorsal and ventral margins strongly and equally convex, spines convergent, short. Long. 30–32, lat. csp. 33, ssp. 27, ist. 10, spines 4. Nr. 5. — Fig. 275–276.

The Uganda plants most closely resemble *f. longispina* Fritsch & Rich (1937, p. 205, Fig. 21 C) but differ in broader isthmus, smaller size and shorter spines. Cf. also var. *maximum* West in BORGÉ (1909, p. 10, I: 7) which, however, is much larger.

Staurostrum Dickiei Ralfs var. *Dickiei* forma. A very small form. Long. 20–24, lat. csp. 21–25, ssp. 18–22, ist. 8, spines 2–3. Nr. 5. — Fig. 279–280.

Such extremely small forms have been reported previously only from arctic regions by BORGÉ (1913, p. 27, II: 26) and others. Cf. *Staurodesmus glabrus* fac. *glabrus* Thomasson (1959, p. 75, 21: 18) from the Argentine.

Staurostrum Dickiei Ralfs var. *Dickiei f. longispina* Fritsch & Rich (1937, p. 205, Fig. 21 C) morpha. Cells relatively longer and semicells more rounded. Long. 35, lat. csp. 48, ssp. 27, ist. 12, spines to 12. Nr. 5 — Fig. 135–136.

Staurostrum Dickiei Ralfs var. *maximum* West & West (1895, p. 72, 8: 19). Long. 39, lat. csp. 48, ssp. 40, ist. 12, spines 5. Nr. 4. — Fig. 277–278.

This differs from WESTS' original figure which is smaller and has horizontal recurved spines. However, most authors depict converging spines, and the Uganda form is very similar to one figured from Venezuela by DEFLANDRE (1928, p. 236, Fig. 161–162).

Staurostrum diptilum Nordstedt (1870, p. 227, IV: 56). Nr. 2.

Staurostrum disputatum W. & W. Long. 24, lat. 22, ist. 9. Nr. 4.

Staurostrum excavatum West & West (1909, p. 71, VI: 19–20) forma. Cell with semicells twisted 90° at axis; processes long, with c. 20 undulations, terminating in two spines. Long. c. 14, lat. cpr. 55, ist. 4. Nr. 6. — Fig. 182.

With its long processes this form resembles var. *planctonicum* Krieger (1932, p. 198, XV: 17), but differs in less depressed cells with more definite apical excavation. Cf. also *S. excavatum* var. *minimum* Bern. as portrayed by NYGAARD (1926, p. 213, V: 47–49) and by THOMASSON (1955 a, p. 220, III: 4) both of which show a 90° twist but differ in smaller size, shorter processes and less definite excavation.

Staurostrum floriferum West & West (1896, p. 267, 18: 1). Nr. 3.

Staurostrum Fuellebornei Schmidle (1902, p. 74, II: 10) forma. A large form with five processes having two circles of granules and ending in two rather long spines; apex having a circle of 10 tridentate verrucae and sometimes showing punctae in center. Long. cpr. c. 50, spr. c. 42, lat. cpr. 60–74, ist. c. 19. Nr. 4. — Fig. 139.

Stauroastrum Fuellebornei Schmidle f. *reductum* Grönbl. n. f. Nr. 5. — Fig. 140—141.

Forma reducta, 5-gona, omnino sine ornatu supra-isthmiali; processus breves, singulum circulum granulorum habentes; apex coronam 10 verrucarum simplicium praebens. Long. cpr. 39—41, spr. 34—39, lat. cpr. 57—63, ist. 20—23.

A reduced 5-angular form, totally lacking any supraisthmial ornamentation; processes short with single circle of granules; apex crowned with 10 simple verrucae. SCHMIDLE (1902, p. 74) commented on «a small form lacking the supraisthmial protuberances» which might well refer to this variety. RG noted that *S. Fuellebornei* might perhaps be united with *S. Eichleri* Racib in EICHLER & RACIBORSKI (1893, p. 123, III: 25) which has a more elaborate supraisthmial ornamentation.

Stauroastrum furcatum (Ehr.) Bréb. Cells tri-gona, very large; accessory processes rather long and very near the angles. Long. cpr. 49—57, spr. 37—43, lat. cpr. 46—53, lat. spr. 32—37, ist. 18—19, access. proc. csp. to 8. Nr. 4, 5. — Fig. 147.

GRÖNBLAD (1960, p. 17) suggested that the name *S. furcatum* be given up in favor of *S. Renardii* Reinsch (1867, p. 127, 23: A—I), but in a note on his figure for this paper he indicated a preference for *S. furcatum*. (SCOTT suggested the name *S. contectum* Turn. (1892, p. 111, XV: 20) var. *evolutum* n. var. for this form).

Stauroastrum gladiusum Turn. f. *curvispinum* Grönbl. n. f. Nr. 5. — Fig. 127—128.

Cellulae magnae; spinae longae, aliquantulum curvatae. Long. csp. 58, ssp. 44, lat. csp. 60, ssp. 37, ist. 15, spines to 15.

Cells large, spines long and somewhat curved. Cf. *S. setigerum* forma in this paper, from which it differs in having the spines at the angles no stouter than the other spines, and in having the semicells somewhat more rounded. It still seems possible, however, that these are the same species.

Stauroastrum gracile Ralfs var. *coronulatum* Boldt (1885, p. 116, V: 28). Cell with cup-shaped body and very slightly diverging processes; apical verrucae very low; processes ending in two teeth. Long. cpr. 25—27, spr. 23, lat. cpr. 40—43, spr. 12—13, ist. 7. Nr. 1. — Fig. 153—154.

Because of confusion and overloading the species *S. gracile* has become nearly meaningless, yet, temporarily at least, it seem the best designation for this Uganda form. RG's note on his drawing (Fig. 153—154) said «cf. *S. gracile* var. *nanum*». SCOTT figured an essentially similar form under the name of

S. gracile var. *coronulatum*. This name seems better, and SCOTT's figure closely resembles a plant so named by HIRANO (1959, p. 362, 44: 24).

Staurastrum hexacerum (Ehr.) Wittr. forma? Nr. 1.

Staurastrum inconspicuum Nordst. Nr. 4.

Staurastrum inflexum Bréb. Nr. 1.

Staurastrum iotantum Wolle. Nr. 4.

Staurastrum laceratum Turner (1892, p. 126, XV: 11) var. *Bourrellyi* Scott. n. var. (= *S. galeatum* Turn. in BOURRELLY (1957, p. 1083, 16: 142). Nr. 5. — Fig. 193—194.

Varietas differens quod paululum minor, differens necnon quod processus semicellularum non alternati in solummodo duas spinas terminantes; denticulationes solummodo in latere dorsali. Long. 40—41, lat. cpr. 53—60, ist. 8—9.

The species is characterized by the large turret-like 3-spined verrucae on the dorsal surface of the semicell at the base of each process. Scott's variety differs in its slightly smaller size, in the processes of the semicells not alternating, in the processes terminating in two spines, and in the denticulations being limited to the dorsal side of the processes. (Fig. 194 is a *reconstruction* from a rear view).

Staurastrum leptocladum Nordst. var. *africanum* G. S. West (1907, p. 129, VI: 12). Semicells with smooth, convex apex; above isthmus a little or not at all swollen, with small granules as in the upper semicell of the African form figured by Schmidle (1899, p. 51, III: 30). Long. 34—39, lat. cpr. 106—124, ist. 6.5—7.5, crass. c. 15. Nr. 6. — Fig. 188—190.

Staurastrum leptocladum Nordstedt (1870, p. 228, IV: 57) var. *cornutum* Wille (1884, p. 19, I: 39). Single series of rounded granules above isthmus. Long. 41—42, lat. cpr. 83—87, lat. at base 12—13, ist. 8—9. Nr. 3, 5. — Fig. 158.

Staurastrum leptodermum Lund. var. *Ikapoae* (Schmidle) West & West (1907, p. 213, XVI: 8). This plant with its broad isthmus and short spines very closely resembles the original *S. Ikapoae* Schmidle (1902, p. 74, II: 11), differing only in the wall depicted without comment by SCOTT as smooth. Long. csp. 52, ssp. 39, lat. 33, ist. 23. Nr. 5. — Fig. 290—291.

Staurastrum leptodermum Lund. var. *Ikapoae* (Schmidle) W. & W. forma. Angles swollen, spines erect, wall smooth. Differs in its much larger size, stouter spines and smooth wall. Long. csp. 85, ssp. 48, lat. 48, ist. 23. Nr. 4. — Fig. 119.

Staurastrum limneticum Schmidle (1899, p. 52, IV: 5) var. *limneticum*. Processes 6, irregularly denticulate on both surfaces, as shown in a plant, also from Lake Victoria, by THOMASSON (1955, p. 268, Fig. 22); terminal spines rather stout. Long. spr. 40, lat. cpr. 101, ist. 13. Nr. 6. — Fig. 174—175.

Staurastium limneticum Schmidle var. *limneticum* f. *victoriense* Croasd. n. f. Nr. 6. — Fig. 176—177.

Forma processus 8—9 circulis denticulationum undulatos, in 4 spinas desinentes, habens; apex semicellulae duobus granulis intramarginalibus radialiter ordinatis inter processus ornatus. Long. 37, lat. cpr. 72—80, ist. 10.

Processes undulate with 8—9 circles of denticulations, terminating in 4 spines; apex of semicell ornamented between the processes with two intramarginal granules, arranged along a radius. (RG called this »*S. limneticum* var.»).

Staurastrum limneticum Schmidle var. *Gronbladii* Croasd. n. var. Nr. 6. — Fig. 172—173.

Varietas a typo differens quod processus fere horizontales, in 4 spinas desinentes, et granulis in superficie dorsali necnon ventrali paediti; differens necnon ornatu apicali e duabus verrucis non altis (vel granulis binis?) inter processus constante. Long. 46, lat. cpr. 96, ist. 15.

A variety differing from the type in having the processes nearly horizontal, terminating in 4 spines, with granules on the dorsal as well as the ventral surface; it differs also in the apical ornamentation which consists of two low verrucae (or paired granules?) between the processes.

This most closely resembles *S. limneticum* var. *Nygaardii* Krieger (1932, p. 202, 16: 10) but differs in the more abundant but low apical ornamentation and different curvature and termination of the processes. (RG called this »*S. limneticum* var.»).

Staurastrum Lindae Grönbl. n. sp. Nr. 6. — Fig. 186—187.

Cellulae biradiatae depressae, processibus longioribus tenuioribusque; semicellulae ad isthmum tortae. Corpus totum semicellulae leve, margine dorsali quasi tam convexo quam ventrali, a vertice visum late fusiforme. Processus c. 15 undulationes acutas vel dentationes parvas praebentes, in 2—3 spinas minimas desinentes. Long. 15, lat. cpr. 80, spr. c. 18, ist. 5.

Cells biradiate, depressed, with relatively long slender processes, semicells twisted at the isthmus. Body of semicell wholly smooth, dorsal margin nearly as convex as ventral, in ventral view broadly fusiform. Processes with c. 15 sharp undulations or small dentations, terminating in 2—3 very small spines.

Except for the strikingly convex apex the species most closely resembles *S. excavatum* var. *planctonicum* Krieger (1932, p. 198, XV: 17). Cf. also *S. sp. aff. americanum* var. *longiradiatum* Smith in THOMASSON (1955, p. 266, Fig. 21) which, however, has longer cells and relatively shorter processes with only

c. 6 undulations. Named in Honor of Dr. EDNA M. LIND, to whom the authors are indebted for these fine collections.

Staurastrum margaritaceum (Ehrenb.) Menegh. Nr. 3.

Staurastrum monticulosum Bréb. var. *bifarium* Nordst. ? Nr. 2.

Staurastrum mucronatum Ralfs f. *crassum* Grönb. n. f. Nr. 5. — Fig. 132—133.

Forma differens quod semicellulae crassiores, necnon sinus latius apertus; latera semicellulae a vertice visa, convexa, indentationem medianam, autem, habentia. Long. 21, lat. csp. 37, ssp. 30, ist. 13.

Differs in thicker semicells and more widely open sinus; in vertical view sides slightly concave, angles rounded.

Staurastrum muticum Bréb. forma. Differs in rather large size, and in having the ventral margin of the semicell somewhat more convex than the dorsal. Long. 38, lat. 35, ist. 12. Nr. 6. — Fig. 270—271.

THOMASSON (1960, p. 242, Fig. 11—12) shows a similar but even larger form from New Zealand.

Staurastrum orbiculare Ralfs. Wall smooth. Long. 35, lat. 32, ist. 9—10. Nr. 3—4.

Staurastrum orbiculare Ralfs var. *denticulatum* Nordstedt (1870, p. 224, IV: 42). Cells nearly circular, angles thickened, variable, with or without two warts. Long. 38—41, lat. 37, ist. 11. Nr. 4. — Fig. 116—118.

Staurastrum orbiculare Ralfs var. *depressum* Roy & Biss. Nr. 2.

Staurastrum orbiculare Ralfs var. *hibernicum* West & West (1912, p. 156, 124: 5—9). Nr. 3.

Staurastrum orbiculare Ralfs var. *Ralfsii* W. & W. Long. 28, lat. 24, ist. 9. Nr. 4. — Fig. 115.

Staurastrum paradoxum Meyen var. *parvum* West. Nr. 4.

Staurastrum pinnatum Turner (1892, p. 115, 13: 27) var. *subpinnatum* (Schmidle) West & West (1902, p. 82, 21: 33) forma. Differs in having the granules of the apical crown elaborated to tricuspid verrucae as long as the verrucae at the origin of the processes. Cells 4-rayed. Long. 30, lat. cpr. 37, spr. 13, ist. 10. Nr. 4. — Fig. 150—151.

Staurastrum pinnatum Turn. var. *subpinnatum* (Schmidle) W. & W. f. *bulatum* Grönb. n. f. Nr. 4. — Fig. 148—149.

Forma parva, 5-gona; basi semicellulae manifeste inflata, uno dente parvo infra omnem processum ornata. Long. 30, lat. cpr. 37, spr. 12, ist. 7.

A small 5-angled form with semicells having a markedly swollen base which is ornamented with one small tooth under each process.

Staurastrum planctonicum Teiling var. *bulbosum* (West) Thomasson (1960, p. 230) [= *S. planctonicum* var. *bullosum* Teiling (1946, p. 77, Fig. 31), and *S. planctonicum* var. *bullatum* Teiling (1947, p. 232)]. Nr. 6. — Fig. 195—196.

Staurastrum polymorphum Bréb. var. *divergens* Nygaard (1949, p. 103, Fig. 54). The Uganda form is small, but closely resembles Fig. 54 f—g of NYGAARD with its strongly diverging processes, and the few small spines on the convex apex and above the isthmus. Long. 18, lat. cpr. 16 (diag. 20), spr. 9, ist. 5. Nr. 5. — Fig. 191—192.

Staurastrum pseudotetracerum (Nordst.) W. & W. Processes slender, slightly diverging, terminating in 4 small teeth; sinus wide-angled. Long. cpr. 18, spr. 10, lat. cpr. 23, spr. c. 8, ist. 6. Nr. 4. — Fig. 155—157.

Cf. also *S. iotantum* Wolle which differs in having a notch at the isthmus and no teeth terminating the processes.

Staurastrum quadricornutum Roy & Biss. Long. cpr. 34—37, spr. 22—24, lat. cpr. 28—33, spr. 22—24, ist. 13. Nr. 4, 5. Fig. 146.

Staurastrum Sebaldi Reinsch var. *gracile* Messikommer (1927, p. 347, II: 19) forma? A small form differing in smaller size, presence of only two verrucae between the processes in end view, and of a single sub-process granule below, and of 4 spines terminating each process. Long. 25, lat. cpr. 38, ist. 7. Nr. 5. — Fig. 201—202.

This is very small to be a *S. Sebaldi*, but conforms closely in body shape, ornamentation below the processes, the 4 widely divergent spines terminating the processes, and in vertical view the verrucae close to the margin. SCOTT suggested for this the name *S. crenulatum* (Näg.) Delp., but *S. crenulatum* has a fundamentally fusiform cell body and horizontal processes, whereas the Uganda form has a cup-shaped body and converging processes.

Staurastrum Sebaldi Reinsch var. *ornatum* Nordst. Nr. 5.

Staurastrum senarium (Ehrenb.) Ralfs var. *simplex* Hirano (1948, p. 68, Fig. 7) forma. Differs in its smaller size, in having shorter marginal spines in the lower whorl and in the bifid apices of the processes being more widely

spreading. Long. cpr. 24—36, spr. 19—24, lat. cpr. 25—35, spr. 16—27, ist. 7—12. Nr. 5. — Fig. 142—143.

This plant might perhaps be as well classified under *S. furcatum* (Ehr.) Bréb. forma of RICH (1932, p. 175, Fig. 11 A—C), but indicates its relationship to *S. senarium* by the occasional presence of a bifid rather than a simple spine in the second series. RG also suggested as a name *S. forficulatum* Lund. forma, and Scott suggested *S. forficulatum* var. *minus* (Fritsch & Rich) Grönl. & Scott in GRÖNBLAD, PROWSE & SCOTT (1958, p. 40, Fig. 319—320). But *S. forficulatum*, as shown by its author and emphasized in WESTS' Monograph, does not have smooth processes. (GRÖNBLAD, 1960 p. 46, suggested that the name *S. senarium* be rejected in favor of *S. Hantschii* Reinsch).

Staurastrum setigerum Cleve var. *setigerum* forma. Spines at angles only slightly stouter than spines between angles which are relatively stout and long, and very slightly curved. Long. csp. 51, ssp. 40, lat. csp. 55, ssp. 34, ist. 12, spines to 12. Nr. 5. — Fig. 292—293.

This form seems to approach var. *subvillosum* Grönl. (1945, p. 30, 13: 269). Cf. also *S. gladiusum* var. *curvispinum* Grönl. in this paper.

Staurastrum setigerum Cleve var. *nyansae* Schmidle (1899, p. 53, IV: 8). Long. ssp. 53—57, lat. ssp. 48, csp. 87, ist. 12—16. Nr. 6. — Fig. 170—171.

Staurastrum subcornutum DeToni (1889, p. 1144) var. *parvum* Grönl. & Scott in GRÖNBLAD, PROWSE & SCOTT (1958, p. 43, Fig. 283—284). Long. 39, lat. csp. 57, ssp. 31, ist. 11. Nr. 5.

Staurastrum subcyclacanthum Scott n. sp. Nr. 5. — Fig. 199—200.

Cellula *S. cyclacantho* similis, differens, autem quod corpus semicellulae ab isthmo late expansum, ornatu, nisi verruca infra omnem processum, nullo. Semicellula a vertice visa sine verrucis marginalibus ad originem processus, tria paria, autem, verrucarum intramarginalium dorsaliter in processu extensa. Sex verrucae apicales 4-cuspidatae coronam compactam formantes. Long. 40, lat. cpr. 60, ist. 13.

Cells resembling *S. cyclacanthum* but differing in the body of the semicell which expands widely from the isthmus with no ornamentation except for a verruca below each process. Also in vertical view it lacks the marginal verrucae at origin of process, but instead shows 3 pairs of intramarginal verrucae extending dorsally on the process. Six apical 4-cuspid verrucae form a compact crown.

Cf. *S. peristephes* Scott & Prescott (1961, p. 100, 59: 5) from which it differs in having 3 terminal spines on processes, a different type of verrucae in apical crown, and in lack of supraisthmial ornamentation.

Staurastrum tetracerum Ralfs. Nr. 4, 5.

Staurastrum tohopekaligense Wolle var. *nonanum* (Turn.) Schmidle (1899, p. 52) (incl. *S. tohopekaligense* var. *quadrangulare* West & West (1895, p. 80, IX: 9). Cells in vertical view quadrangular with slightly convex sides; processes 3 at each angle, about as long as body of semicell, terminating in 3, sometimes two, rather long diverging spines. Long. cpr. 85, lat. cpr. 85, ist. 20. Nr. 6. — Fig. 184—185.

Staurastrum tohopekaligense Wolle var. *robustum* Scott & Prescott (1961, p. 114, 48: 1). Long. cpr. 64—67, spr. 38—39, lat. cpr. 62—66, spr. 30—33, ist. 18—20. Nr. 3. — Fig. 144—145.

Staurastrum Westianum (W. & W.) Thomasson (1960, p. 32 (= *Cosmarium Regnesi* var. *productum* W. & W.). Nr. 4.

Staurastrum Wildemanii Gutw. var. *Wildemanii*, cf. SCOTT & PRESCOTT (1956, p. 352, Fig. 1—6). Long. csp. 61—85, ssp. 48—53, lat. csp. 68—90, ssp. 42—48, ist. 19—21, spines to 20. Nr. 5. — Fig. 288—289.

Smaller than the dimensions given by GUTWINSKI (1902, p. 605, 40: 61) with less depressed cells and shorter spines, but very similar to *S. subtrifolcatum* W. & W. f. *bidens* Schmidle (1902, p. 73, II: 9) which SCOTT & PRESCOTT (l. c.) place as a synonym. Scott suggested that the plant might be var. *rotundatum* Grönbl. & Scott in GRÖNBLAD, PROWSE & SCOTT (1958, p. 43, Fig. 277—278) or *S. longispinum* (Bail.) Arch. forma as figured by BOURRELLY (1957, p. 1086, 14: 122).

Staurastrum Wildemanii var. *maius* (W. & W.) Scott & Prescott (1956, p. 353, Fig. 8—12). Long. csp. 68—80, ssp. 48—58, lat. csp. 75—87, ssp. 48—53, ist. 21—22, spines to 20. Nr. 5. — Fig. 125—126.

Staurastrum zonatum Börgesen (1890, p. 951, V: 48). Nr. 4.

Staurastrum sp. Processes granular, ending in 3 spines and with a large inflation at the base. Face view not seen. Lat. cpr. 97. Nr. 6. — Fig. 183.

RG portrayed merely the vertical view, with the comment «only one seen». He suggested doubtfully a relationship with *S. volans* West & West (1895, p. 79, IX: 10—11), and also suggested calling it *S. inflatiusculum* n. sp. It seems unwise, however, to describe a new species from only a vertical view of one specimen.

Sphaerosoma excavatum Ralfs. A relatively narrow form with shallow sinus, very similar to the plant figured by BOURRELLY (1957, p. 1092, 17: 156). Nr. 4.

Spondylosium planum (Wolle) W. & W. f. *unipapillatum* Croasd. n. f. Nr. 4. Fig. 152.

Forma a specie typica differens quod sinus latius apertus, et quod margo lateralis semicellulae unicam papillam fert. Long. 12, lat. 14.5, ist. 7.

A form differing from the type in its more widely open sinus and in the presence of a single papilla on the lateral margin of the semicell.

Apical connecting processes apparently lacking, otherwise this plant might well be classified with *Sphaerosoma granulatum* Roy & Biss. or *Sph. excavatum* Ralfs var. of WEST & WEST (1896, p. 231, XII: 9) or *Sph. indicum* Turner (1892, p. 141, 18: 2). Cf. also *Spondylosium Mungulporeanum* Turner (l. c., p. 46, 18: 14), which, in TURNER's figure gives the appearance of having a single lateral nodule, but his description says «sides acute». TURNER's plant also is smaller with deeper, narrower sinus.

Literature

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Explanation of Plates I—XII

PLATE I

- Fig. 1. *Closterium acutum* Bréb. var. *latius* Grönbl. f. $\times 775$.
 2. » *abruptum* W. West var. *africanum* Fritsch & Rich f. *angustum* Grönbl. n. f. $\times 775$.
 3. » *parvulum* Näg. var. *angustum* W. & W. $\times 445$.
 4. » *turgidum* Ehr. var. *Borgei* Deflandre $\times 265$.
 5—6. *Pleurotaenium minutum* (Ralfs) Delp. var. *elongatum* (W. & W.) Cedergr. f. 5 $\times 445$, 6 $\times 730$.
 7. » *baculoides* (Roy & Biss.) Playf. $\times 265$.
 8—9. » *trabecula* (Ehr.) Näg. var. *elongatum* Cedergr. f. 8 $\times 205$, 9 $\times 265$.
 10—11. » *gloriosum* (Turn.) W. & W. 10 $\times 205$, 11 $\times 605$.
 12—15. » *subcoronulatum* (Turn.) W. & W. var. *africanum* Schmidle 12 $\times 308$, 13 $\times 805$, 14 $\times 215$, 15 $\times 445$.
 16. » *cylindricum* (Turn.) W. & W. var. *Stuhlmannii* (Hieron.) Krieg. $\times 265$.

PLATE II

- Fig. 17—18. *Pleurotaenium subcoronulatum* (Turn.) W. & W. f. 17 $\times 265$, 18 $\times 445$.
 19. *Euastrum praemorsum* (Nordst.) Schmidle var. *simplicius* Grönbl. & Scott $\times 445$.
 20—22. » *oculatum* Börges. f. 20 $\times 775$, 21—22 $\times 805$.
 23—24. » *pseudoboldtii* Grönbl. f. $\times 775$.
 25—26. » *elegans* (Bréb.) Kütz. var. *compactum* (Wolle) Krieg. f. $\times 775$.
 27. » *divaricatum* Lund. f. $\times 890$.
 28. » *truncatifforme* G. S. West $\times 890$.
 29—30. » *subcrassum* Fritsch f. $\times 445$.
 31. » *sphyroides* Nordst. f. $\times 890$.
 32. » *spinulosum* Delp. var. *Lindae* Grönbl. & Scott a $\times 445$, b $\times 530$.
 33. *Micrasterias decemdentata* (Näg.) Arch. f. $\times 445$.
 34. » *zeylanica* Fritsch $\times 775$.
 35—36. » *crux-melitensis* (Ehr.) Hass. f. *minor* Turn. $\times 445$.

PLATE III

- Fig. 37—39. *Micrasterias radians* Turn. 37—38 $\times 445$, 39 $\times 265$.
 40. » *ambadiensis* (Grönbl. & Scott) Thomass. f. *latiloba* (Grönbl. & Scott), Thomass. $\times 445$.
 41—42. » *zeylanica* Fritsch f. $\times 445$.
 43. » *tropica* Nordst. var. *ambadiensis* Grönbl. & Scott $\times 445$.

- Fig. 44. *Cosmarium lanceolatum* (Turn.) Lüttk. f. *turgidum* Grönbl. n. f. $\times 775$.
 45. » *cucurbita* Bréb. var. *cucurbita* f. *rotundatum* Krieg. $\times 775$.
 46. » » var. *attenuatum* G. S. West $\times 730$.
 47. » *moniliforme* (Turp.) Ralfs var. *moniliforme* $\times 890$.
 48. » » var. *subpyriforme* Grönbl. n. var. $\times 1214$.
 49. » *diplosporium* (Lund.) Lüttk. $\times 775$.
 50. » *zonatum* Lund. var. *angustum* Grönbl. & Scott $\times 800$.
 51—52. » *connatum* Bréb. $\times 445$.
 53. » *lobatum* Börges. var. *ellipticum* Fritsch & Rich $\times 445$.
 54—55. » *subauriculatum* W. & W. $\times 775$.

PLATE IV

- Fig. 56—58. *Cosmarium Scottii* Croasd. n. sp. $\times 800$.
 59—60. » *permaculatum* Grönbl. & Scott $\times 445$.
 61—62. » *medioscrobiculatum* W. & W. f. 61 $\times 445$, 62 $\times 775$.
 63—64. » *pseudonitidulum* Nordst. var. *angustissimum* Grönbl. n. var. $\times 775$.
 65—66. » *subtimum* Nordst. var. *circulare* Borge $\times 445$.
 67—68. » *bimamillatum* Krieg. f. $\times 775$.
 69. » *hexagonum* Nordst. ?f. $\times 730$.
 70—73. » *sinostegos* Schaarschm. var. *granulatum* Croasd. n. f. $\times 1240$.
 74—75. » *pygmaeum* Arch. f. $\times 1214$.
 76—78. » *granatum* Bréb. var. *pyramidale* Schmidle $\times 775$.
 79. » *Schmidlei* Grönbl. & Scott $\times 730$.
 80—81. » *bicardia* Reinsch $\times 775$.
 82—83. » *quadratulum* (Gay) DeToni var. *applanatum* Insam & Krieg. $\times 1214$.
 84—85. » *tenue* Arch. var. *tenue* f. *tumidum* Grönbl. n. f. $\times 775$.
 86—87. » *subtimum* Nordst. var. *subtimum* f. *minus* Borge $\times 775$.
 88—89. » *Regnellii* Wille var. *chondrophorum* Skuja f. *minus* Grönbl. n. f. $\times 1214$.
 90. » *retusum* (Perty) Rab. $\times 1214$.
 91. » *trilobulatum* Reinsch var. *bioculatum* Krieg. $\times 730$.
 92—93. » *tithophorum* Nordst. var. *depressum* W. & W. 92 $\times 730$, 93 $\times 775$.

PLATE V

- Fig. 94—95. *Cosmarium decachondrum* Roy & Biss f. 94 $\times 730$, 95 $\times 590$.
 96—97. » *kilimanense* Schmidle f. 96 $\times 445$, 97 $\times 390$.
 98—99. » *quadratum* Lund. f. $\times 775$.
 100—101. » *malinvernianum* (Rac.) Schmidle $\times 775$.
 102—103. » *paradoxum* Turn. $\times 445$.
 104—106. » *striolatum* (Näg.) Kirchn. var. *Nordstedtii* (Möb.) Krieg. f. 104, 106 $\times 445$, 105 $\times 775$.
 107. *Xanthidium subtrilobum* W. & W. var. *africanum* (Schmidle) Grönbl. & Scott $\times 445$.
 108—109. *Arthrodesmus mucronulatus* Nordst. f. *depauperatus* Grönbl. n. f. 108 $\times 445$, 109 $\times 775$.
 110—112. » *convergens* Ehr. var. *convergens* $\times 445$.
 113. *Cosmarium depressum* (Näg.) Lund. var. *depressum* $\times 445$.
 114. *Arthrodesmus convergens* Ehr. var. *curtus* Turn. f. *obtusispinosus* Croasd. n. f. $\times 445$.
 115. *Staurastrum orbiculare* Ralfs var. *Ralfsii* W. & W. $\times 445$.
 116—118. » » var. *denticulatum* Nordst. $\times 445$.
 119. » *leptodermum* var. *Ikapoae* (Schmidle) W. & W. f. $\times 445$.
 120—121. » *dejectum* Bréb. var. *subglabrum* Grönbl. f. *maius* Bourr. $\times 775$.
 122—124. » *coarctatum* Bréb. var. *subcurtum* Nordst. $\times 445$.

PLATE VI

- Fig. 125—126. *Staurastrum Wildemanii* Gutw. var. *maius* (W. & W.) Scott & Presc. $\times 445$.
 127—128. » *gladiosum* Turn. f. *curvispinum* Grönbl. n. f. $\times 445$.
 129. *Arthrodesmus subulatus* Kütz. var. *americanus* (Turn.) W. & W. $\times 775$.
 130. » *maximus* Borge $\times 445$.
 131. » *convergens* Ehr. var. *curtus* Turn. f. *maior* Croasd. n. f. $\times 445$.

- Fig. 132—133. *Staurastrum mucronatum* Ralfs f. *crassum* Grönbl. n. f. $\times 445$.
 134. » *Dickiei* Ralfs var. *Dickiei* f. $\times 730$.
 135—136. » » var. *Dickiei* f. *longispina* Fritsch & Rich $\times 775$.
 137—138. » *cerastes* Lund. f. $\times 775$.
 139. » *Fuellerbornei* Schmidle f. $\times 775$.
 140—141. » » f. *reductum* Grönbl. n. f. $\times 445$.
 142—143. » *senarium* (Ehr.) Ralfs var. *simplex* Hirano $\times 730$.
 144—145. » *tohopekaligense* Wolle var. *robustum* Scott & Presc. $\times 445$.
 146. » *quadricornutum* Roy & Biss. $\times 445$.
 147. » *furcatum* (Ehr.) Bréb. $\times 445$.
 148—149. » *pinnatum* Turn. var. *subpinnatum* (Schmidle) W. & W. f. *bullatum* Grönbl. n. f. $148 \times 775, 149 \times 730$.
 150—151. » » var. *subpinnatum* f. $\times 775$.

PLATE VII

- Fig. 152. *Spondylosium planum* (Wolle) W. & W. f. *unipapillatum* Croasd. n. f. $\times 1460$.
 153—154. *Staurastrum gracile* Ralfs var. *coronulatum* Boldt $\times 775$.
 155—157. » *pseudotetracerum* (Nordst.) W. & W. $\times 775$.
 158. » *leptocladum* Nordst. var. *cornutum* Wille $\times 445$.
 159—160. *Closterium aciculare* T. West var. *subpronum* W. & W. $\times 265$.
 161. *Cosmarium depressum* (Näg.) Lund. var. *achondrum* (Boldt) W. & W. f. $\times 445$.
 162. » *contractum* Kirchn. var. *ellipsoideum* (Elf.) W. & W. $\times 445$.
 163. » *moniliforme* (Turp.) Ralfs var. *panduriforme* Heimerl $\times 445$.
 164—165. *Staurastrum coarctatum* Bréb. var. *subcurtum* Nordst. f. *maius* Grönbl. n. f. $\times 445$.
 166—167. » *corniculatum* Lund. var. *spinigerum* W. West f. *latum* Grönbl. n. f. $\times 445$.
 168—169. » *dejectum* Bréb. var. *dejectum* $\times 890$.
 170—171. » *setigerum* Cleve var. *nyansae* Schmidle $\times 445$.
 172—173. » *limneticum* Schmidle var. *Groenbladii* Croasd. n. var. $\times 445$.
 174—175. » » var. *limneticum* $\times 445$.
 176—177. » » var. *limneticum* f. *victoriense* Croasd. n. f. $\times 445$.
 178—179. » *anatinum* Cooke & Wills var. *subglabrum* G. S. West. f. $\times 445$.

PLATE VIII

- Fig. 180—181. *Staurastrum anatinum* Cooke & Wills var. *subglabrum* G. S. West f. $\times 445$.
 182. » *excavatum* W. & W. f. $\times 775$.
 183. » sp. $\times 445$.
 184—185. » *tohopekaligense* Wolle var. *nonanum* (Turn.) Schmidle $\times 445$.
 186—187. » *Lindae* Grönbl. n. sp. $\times 445$.
 188—190. » *leptocladum* Nordst. var. *africanum* G. S. West $\times 445$.
 191—192. » *polymorphum* Bréb. var. *divergens* Nygaard $\times 1090$.
 193—194. » *laceratum* Turn. var. *Bourrellyi* Scott n. var. $\times 800$.
 195—196. » *planctonicum* Teil. var. *bulbosum* (W. West) Thomass. $\times 588$.
 197—198. » *cyclacanthum* W. & W. f. $\times 800$.
 199—200. » *subcylacanthum* Scott n. sp. $\times 800$.
 201—202. » *Sebaldi* Reinsch var. *gracile* Messik. $\times 800$.

PLATE IX

- Fig. 203. *Pleurotaenium eugeneum* (Turn.) W. & W. var. *undulatum* (Borge) Krieg. $\times 205$.
 204. » *trabecula* (Ehr.) Næg. var. *elongatum* Cedergr. $\times 205$.
 205—206. *Closterium diana* Ehr. formae $\times 225$.
 207—208. » *venus* Kütz. formae $\times 800$.
 209—210. *Euastrum elegans* (Bréb.) Kütz. var. *elegans* formae $\times 800$.
 211—213. » *Luethemuelleri* Duc. f. $\times 800$.
 214—216. » *sphyrroides* Nordst. f. $\times 800$.
 217—218. » *substellatum* Nordst. f. $\times 800$.

- Fig. 219. *Micrasterias decedentata*. (Näg.) Arch. $\times 605$.
 220. » *ambadiensis* (Grönl. & Scott) Thomass. f. *latiloba* (Grönl. & Scott) Thomass. $\times 605$.

PLATE X

- Fig. 221. *Micrasterias tropica* Nordst. var. *elegans* W. & W. $\times 605$.
 222. » *pinnatifida* (Kütz.) Ralfs f. $\times 800$.
 223. *Cosmarium depressum* (Näg.) Lund. var. *achondrum* (Boldt) W. & W. f. $\times 445$.
 224—226. » *maximum* (Borges) W. & W. var. *latum* Scott n. var. $\times 605$.
 227. » *mordex* Turn. $\times 800$.
 228—229. » *Lundellii* Delp. var. *ellipticum* W. & W. f. $\times 800$.
 230. » var. *corruptum* f. $\times 775$.
 231. » *stigmatosum* (Nordst.) Kreig. $\times 800$.
 232. » *cylindrocystiforme* W. & W. $\times 800$.
 233. » *depressum* (Näg.) Lund. var. *depressum* f. $\times 445$.
 234. » *contractum* Kirchn. var. *contractum* f. $\times 800$.
 235. » *Scottii* Croasd. f. *minus* Croasd. n. f. $\times 800$.
 236. » *lobatum* Börges. var. *minus* (Smith) Grönl. $\times 800$.

PLATE XI

- Fig. 237—238. *Cosmarium pseudoretusum* Duc. var. *africanum* (Fritsch) Krieg. & Gerloff $\times 800$.
 239—241. » *trachypleurum* Lund. $\times 800$.
 242—244. » *subtimum* Nordst. var. *subtimum* f. *maius* Croasd. n. f. $\times 800$.
 245—247. » *phaseolus* Bréb. var. *subbireme* Rac. $\times 1090$.
 248. » *Nymannianum* Grun. f. $\times 445$.
 249—250. » *moniliforme* (Turp.) Ralfs var. *punctatum* Lag. f. $\times 800$.
 251—252. » *pseudocannatum* Nordst. $\times 445$.
 253—255. » *protuberans* Lund. f. $\times 1090$.
 256. » *pyramidatum* Bréb. f. $\times 1090$.
 257—258. » *connatum* Bréb. var. *africanum* Fritsch & Rich $\times 605$.
 259. » *wembaerense* Schmidle $\times 800$.
 260. » *Regnellii* Wille var. *Regnellii* f. $\times 800$.
 261. » *subdanicum* W. West $\times 775$.
 262—263. » *vogesiaceum* Lemaire var. *quadrigranulatum* (Gutw.) Laporte $\times 1090$.
 264—265. » *bireme* Nordst. f. $\times 800$.
 266. » *mansangense* W. & W. $\times 800$.
 267. » *zonatum* Lund. var. *javanicum* (Gutw.) Krieg. f. $\times 445$.
 268. » *striolatum* (Näg.) Arch. var. *Nordstedtii* (Möb.) Krieg. f. — detail of wall structure.
 269. *Xanthidium antilopaeum* (Bréb.) Kutz. var. *hebridarum* W. & W. $\times 800$.

PLATE XII

- Fig. 270—271. *Staurastrum muticum* Bréb. f. $\times 445$.
 272—273. » *clepsydra* Nordst. var. *obtusum* Nordst. f. Rich $\times 445$.
 274. » *corniculatum* Lund. f. *spinigerum* West f. $\times 445$.
 275—276. » *Dickiei* Ralfs var. *Dickiei* $\times 775$.
 277—278. » var. *maximum* W. & W. $\times 775$.
 279—280. » var. *Dickiei* f. $\times 800$.
 281—282. *Arthrodesmus curvatus* Turn. $\times 575$.
 283. *Staurastrum dejectum* Bréb. var. *dejectum* f. *angustatum* Teil. $\times 800$.
 284—285. » *connatum* (Lund.) Roy & Biss. $\times 800$.
 286—287. » *cuspidatum* Bréb. $\times 600$.
 288—289. » *Wildemanii* Gutw. var. *Wildemanii* $\times 800$.
 290—291. » *leptodermum* Lund. var. *Ikapoae* (Schmidle) W. & W. $\times 800$.
 292—293. » *setigerum* Cleve var. *setigerum* f. $\times 800$.

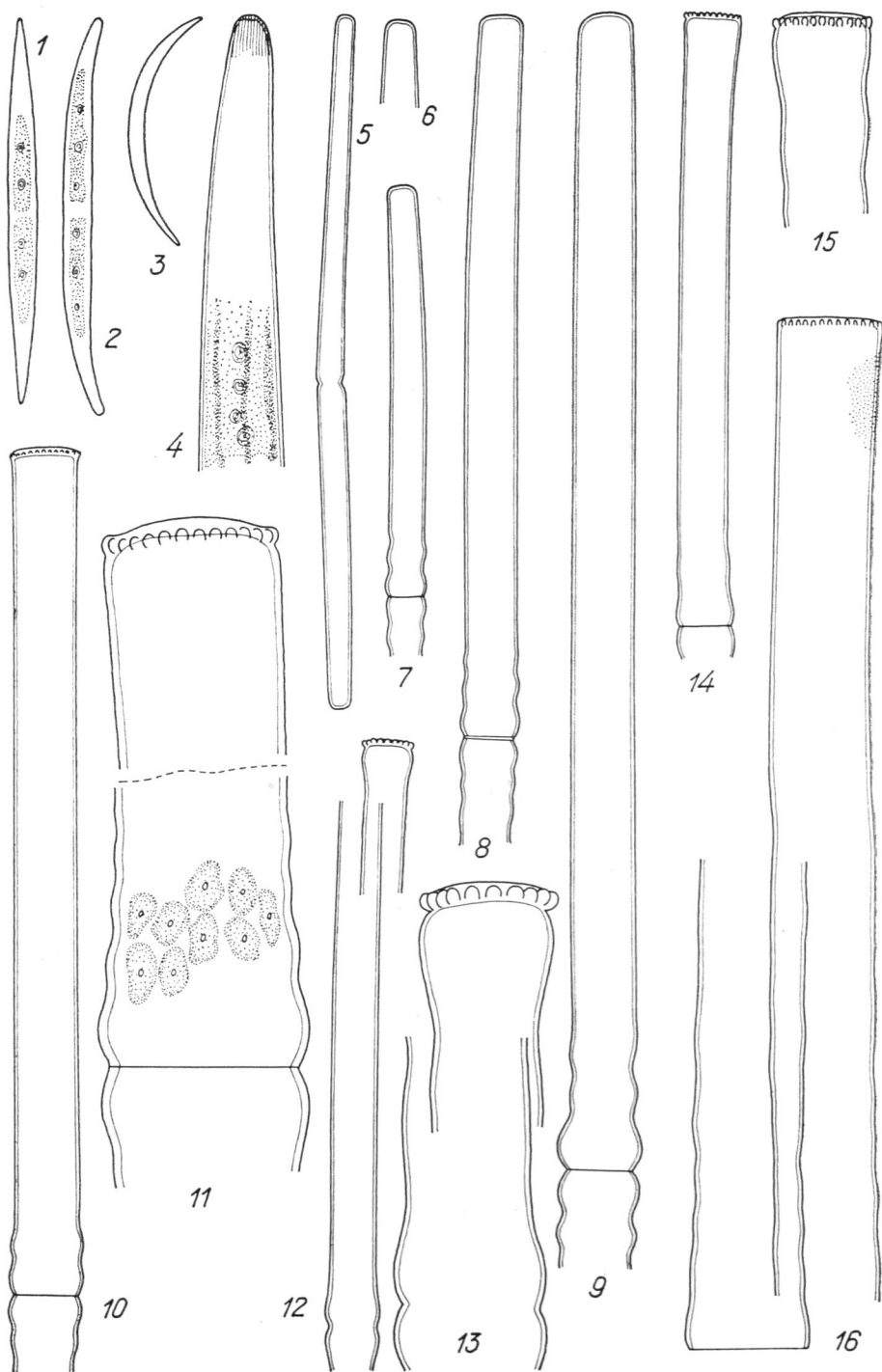
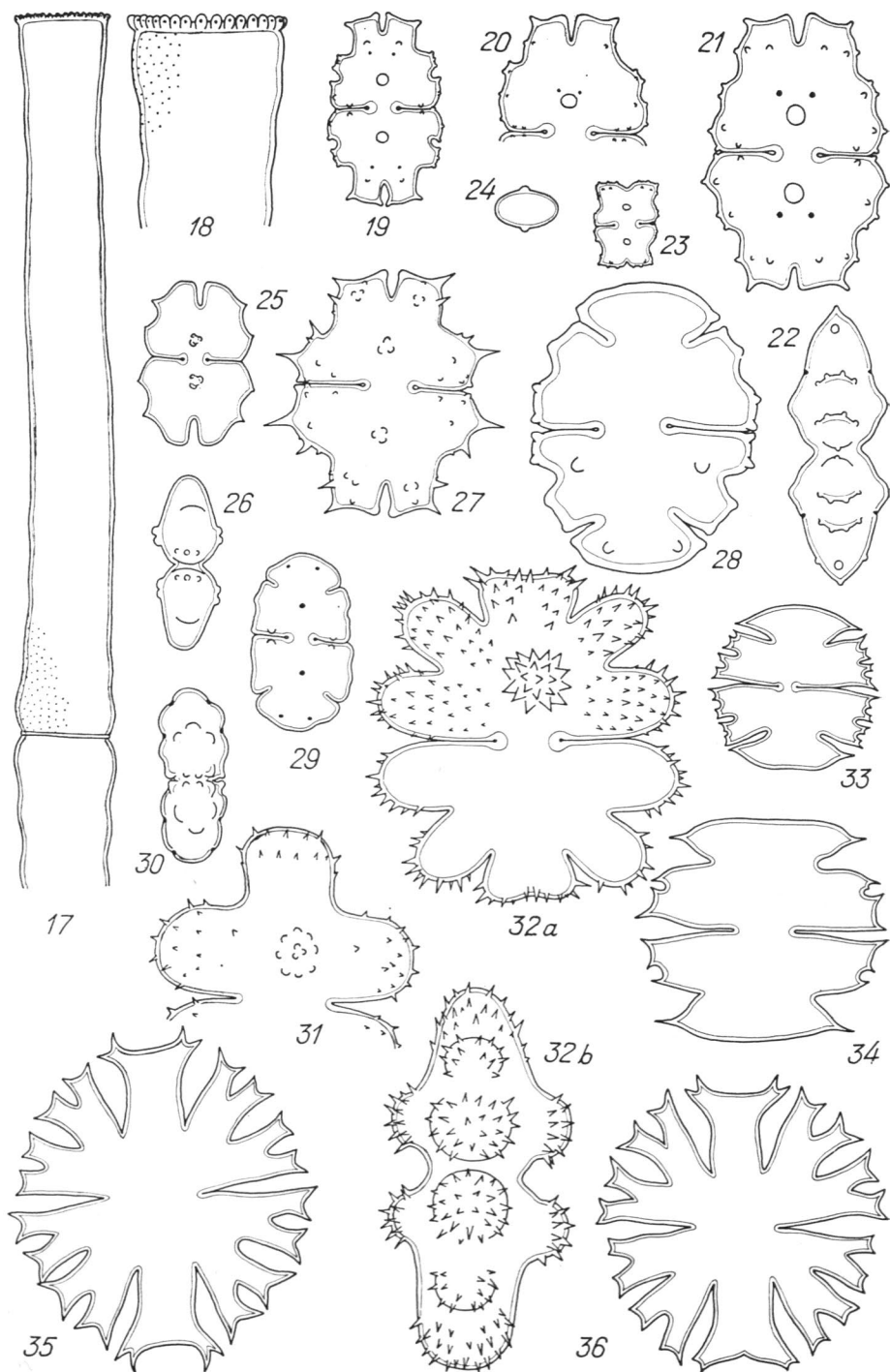


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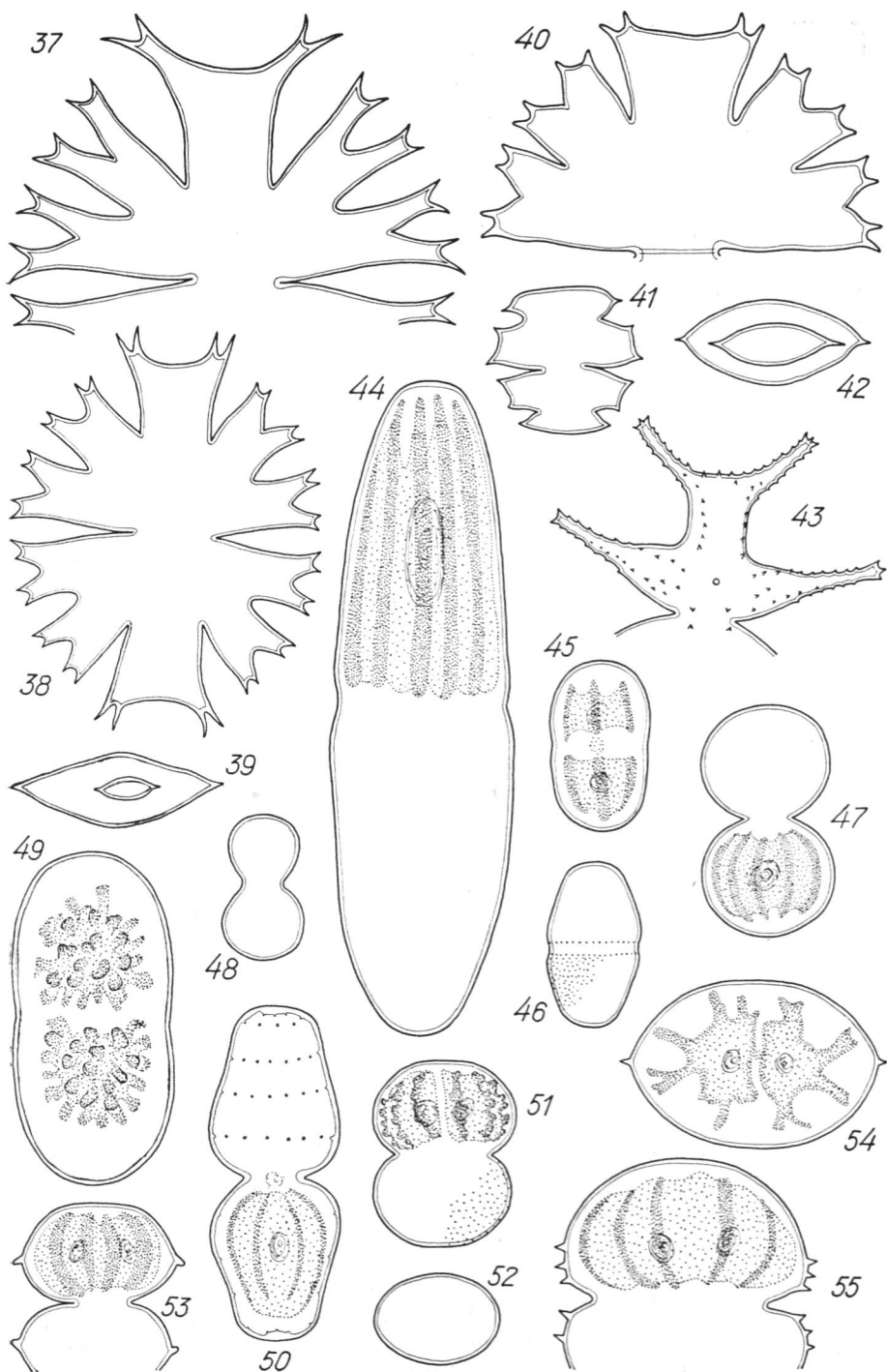
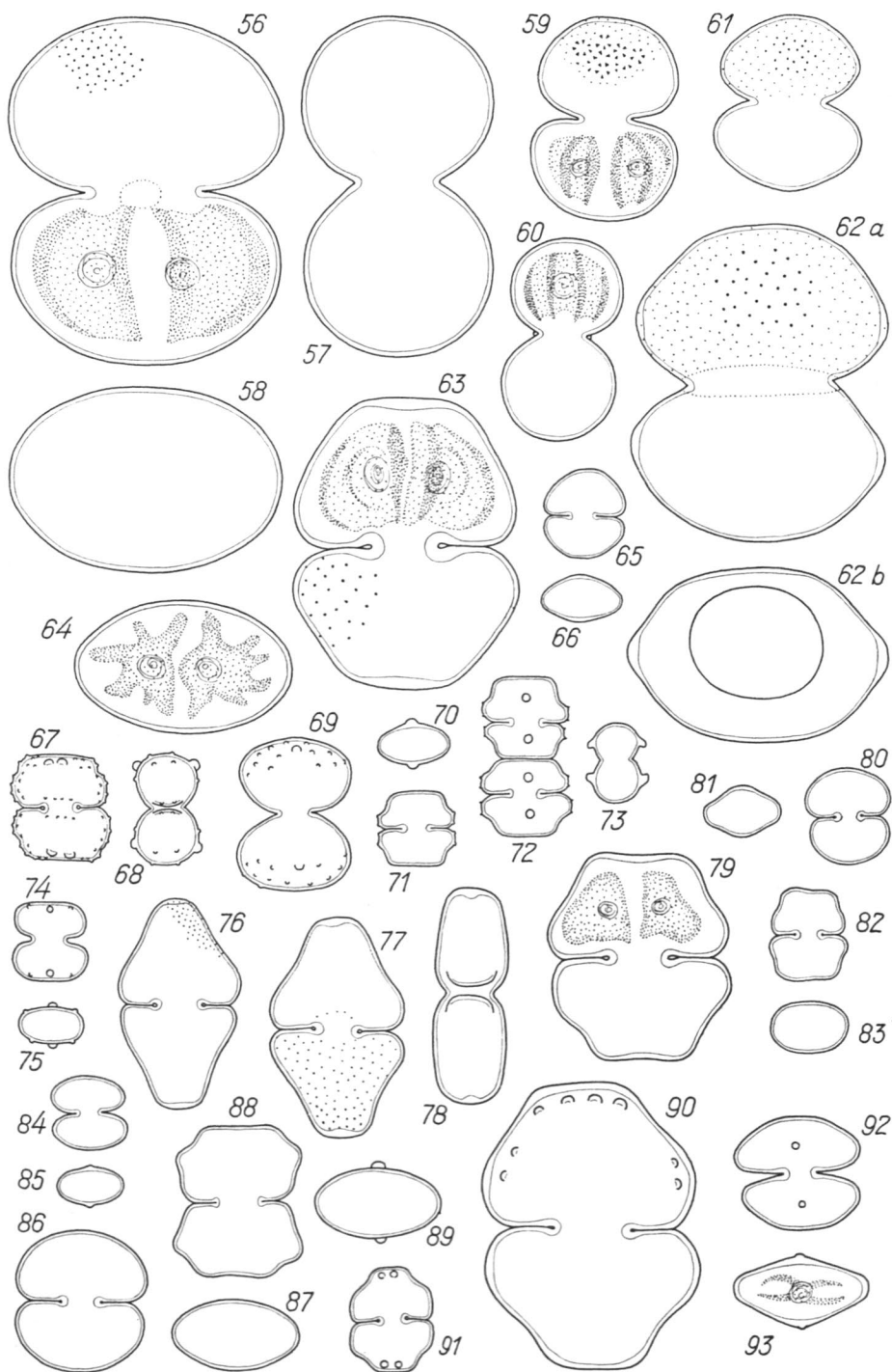


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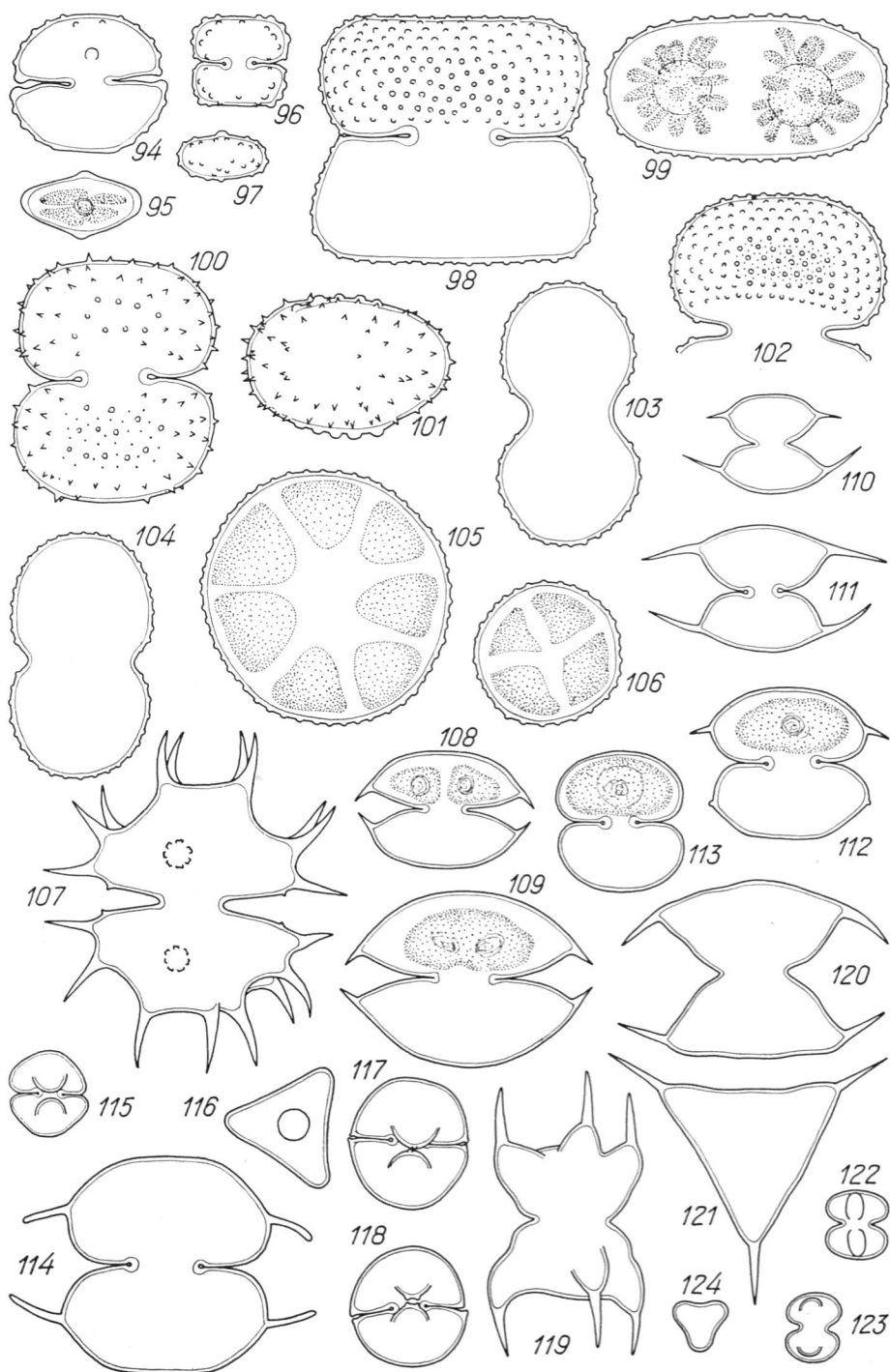
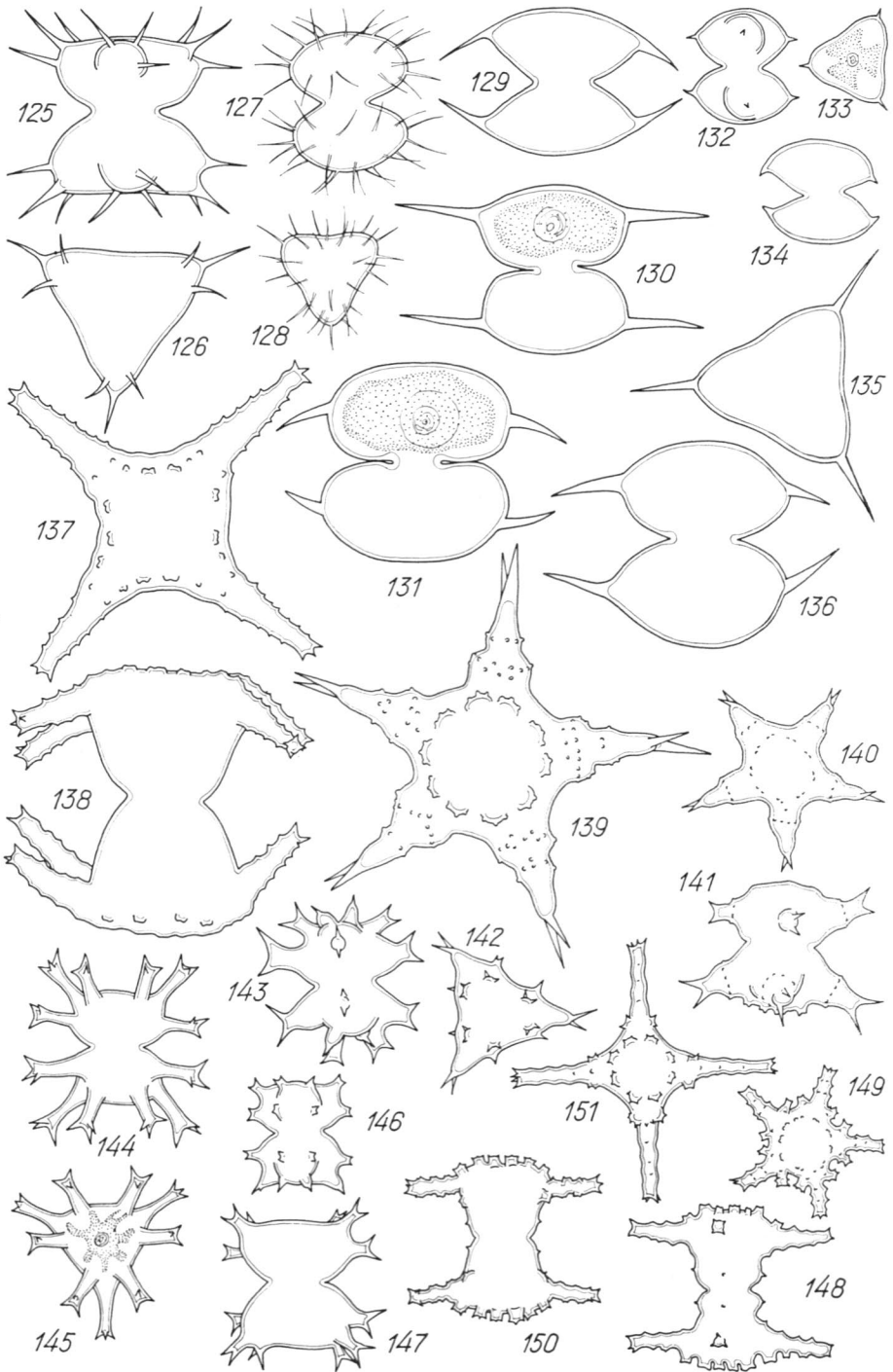


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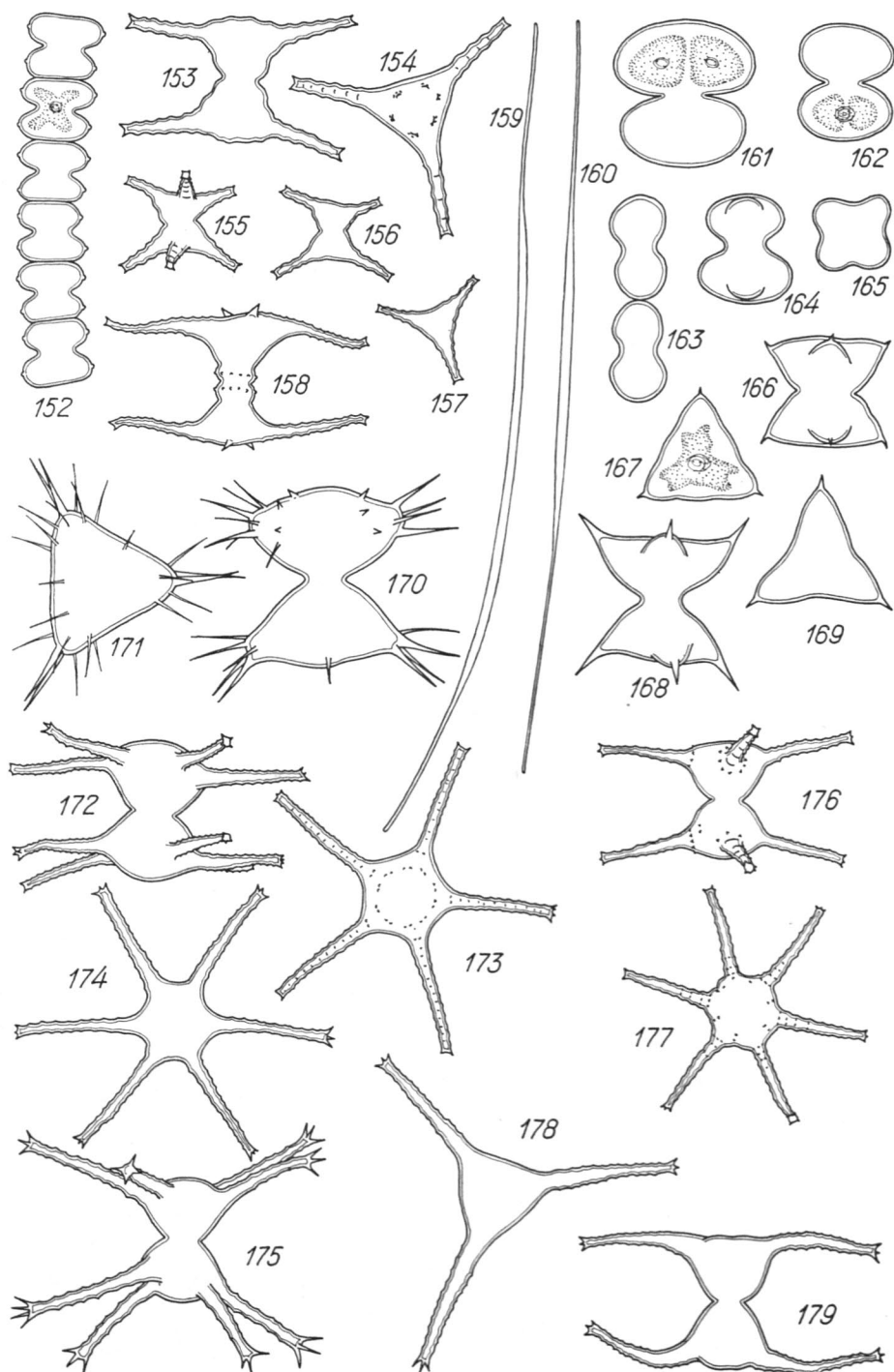
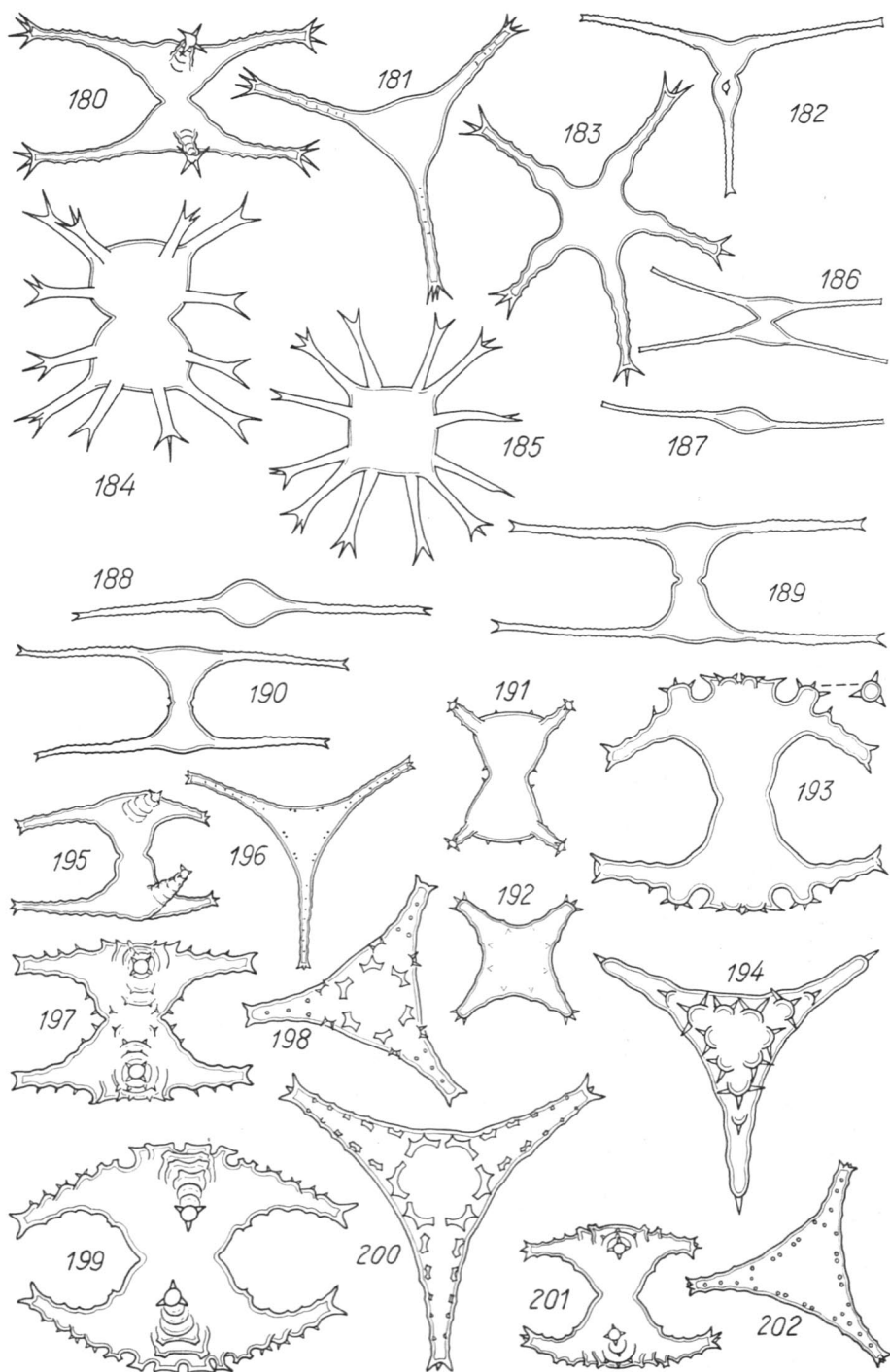


PLATE VIII



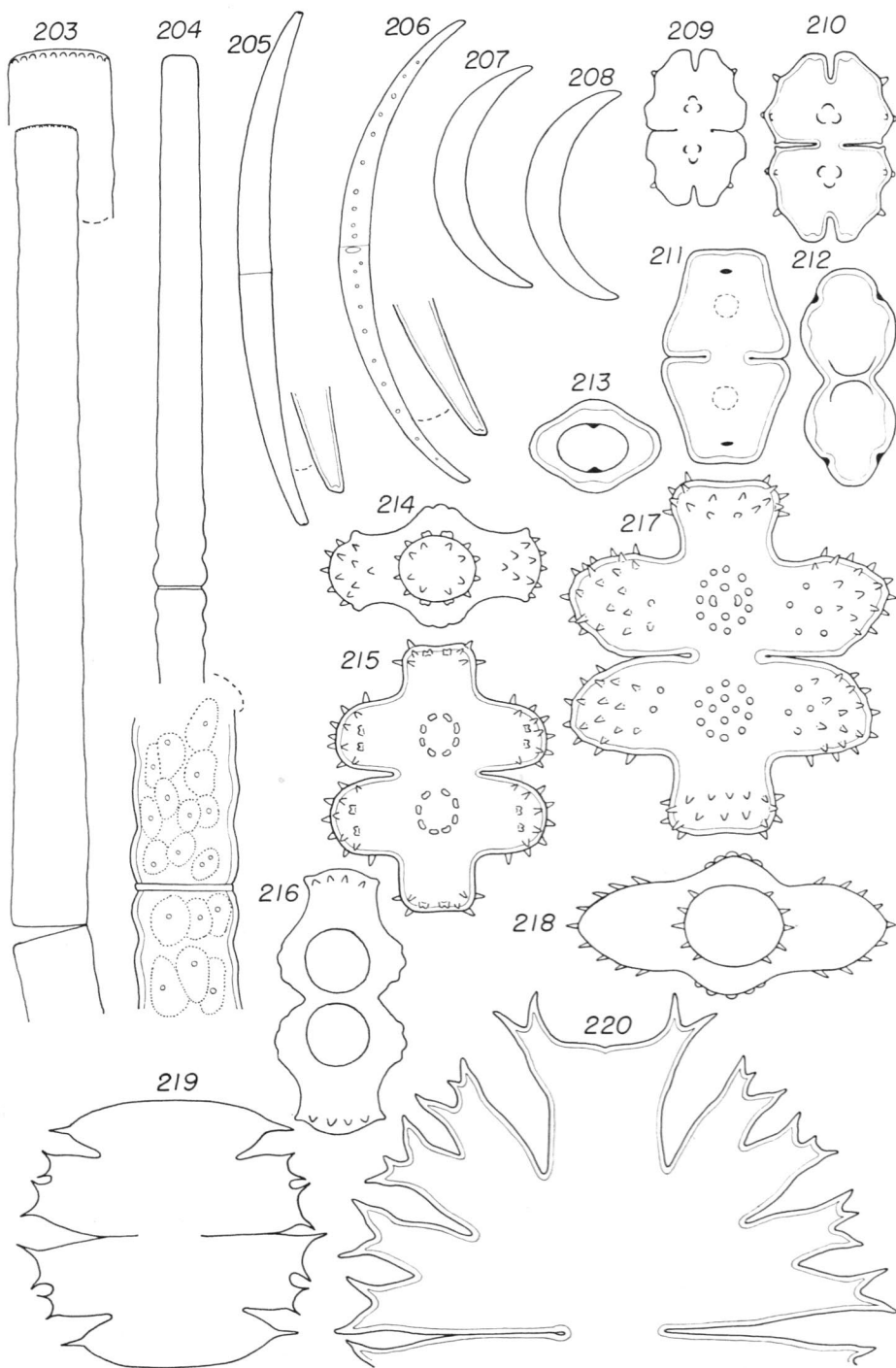
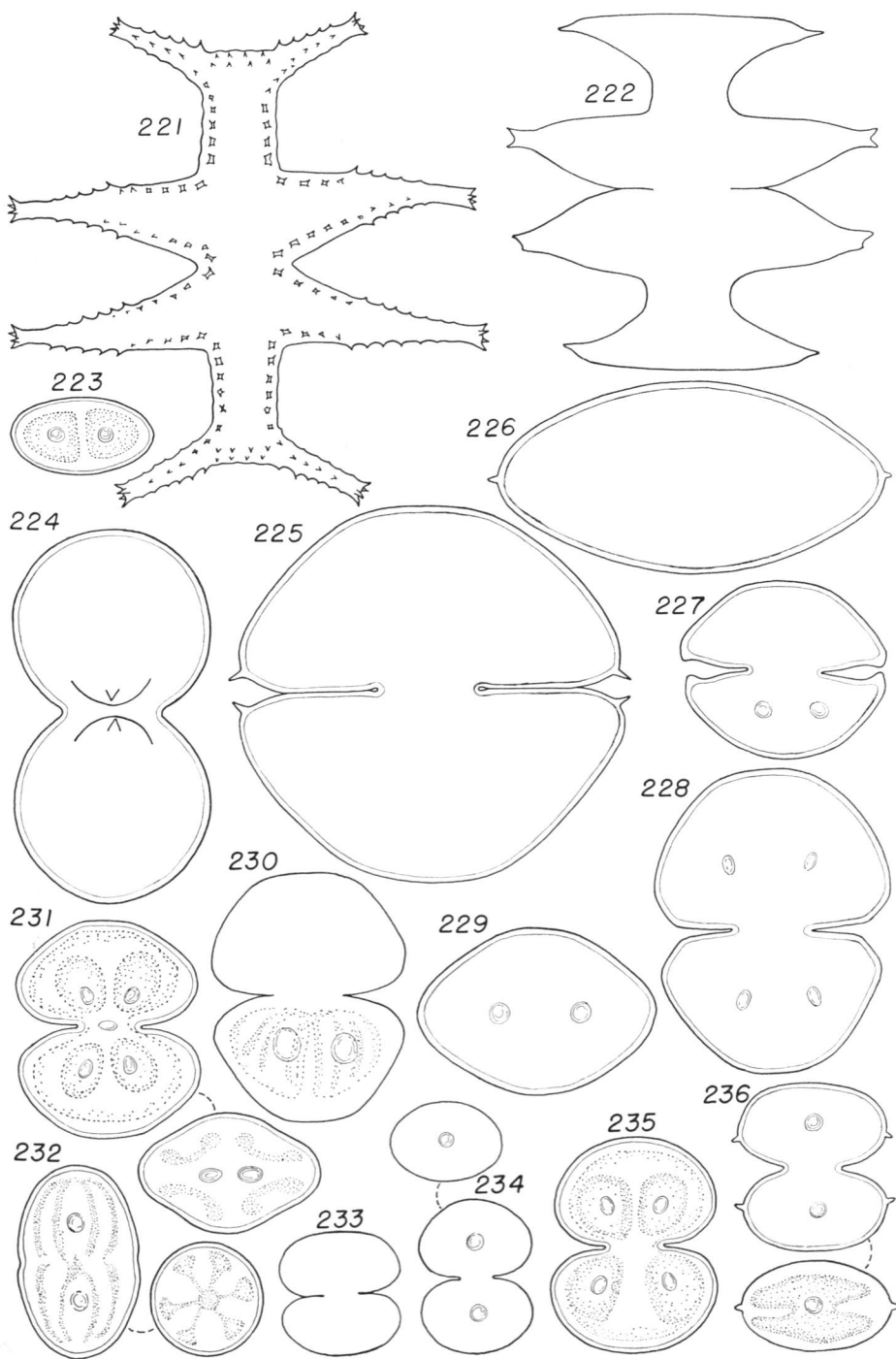


PLATE X



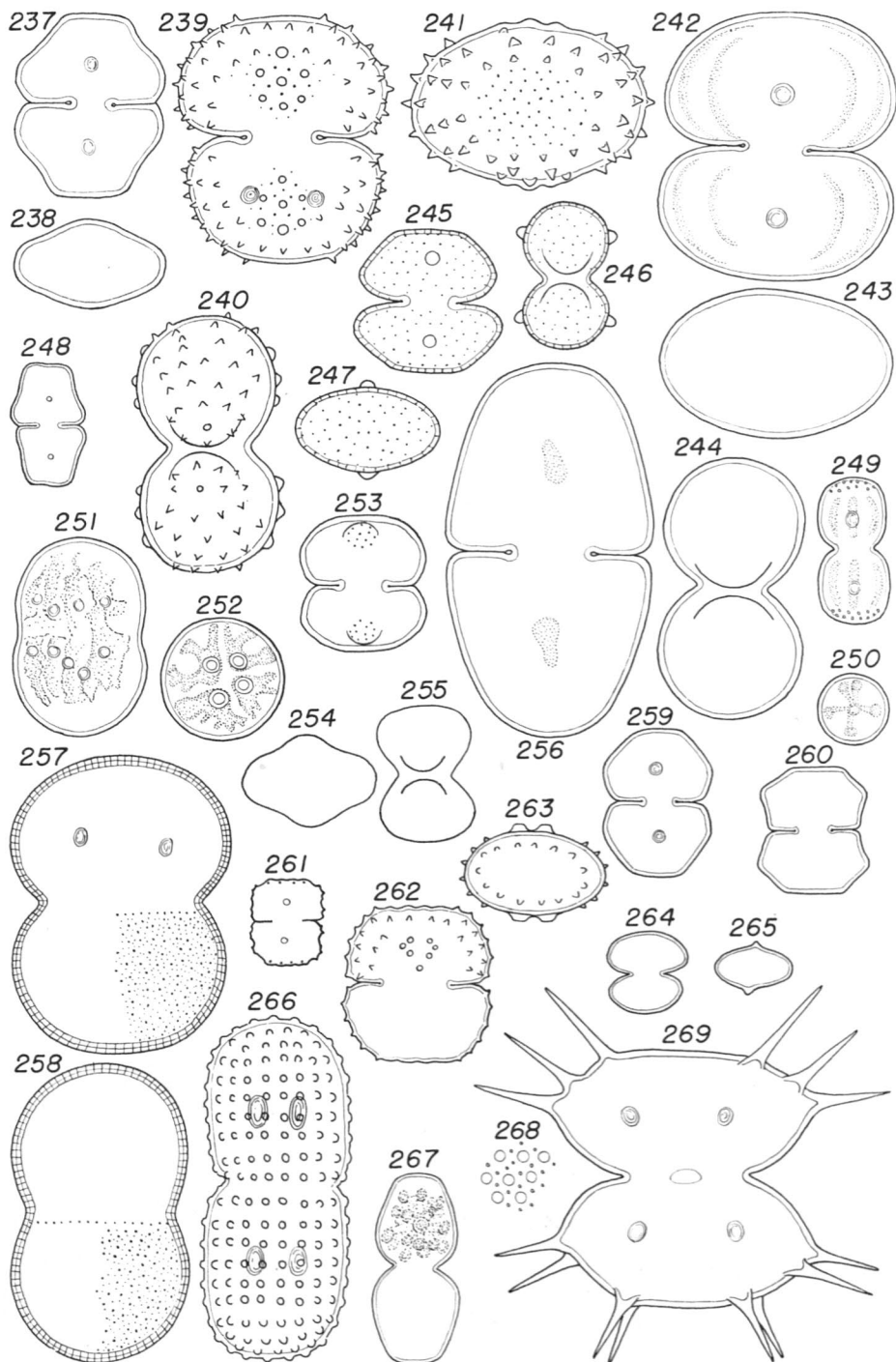
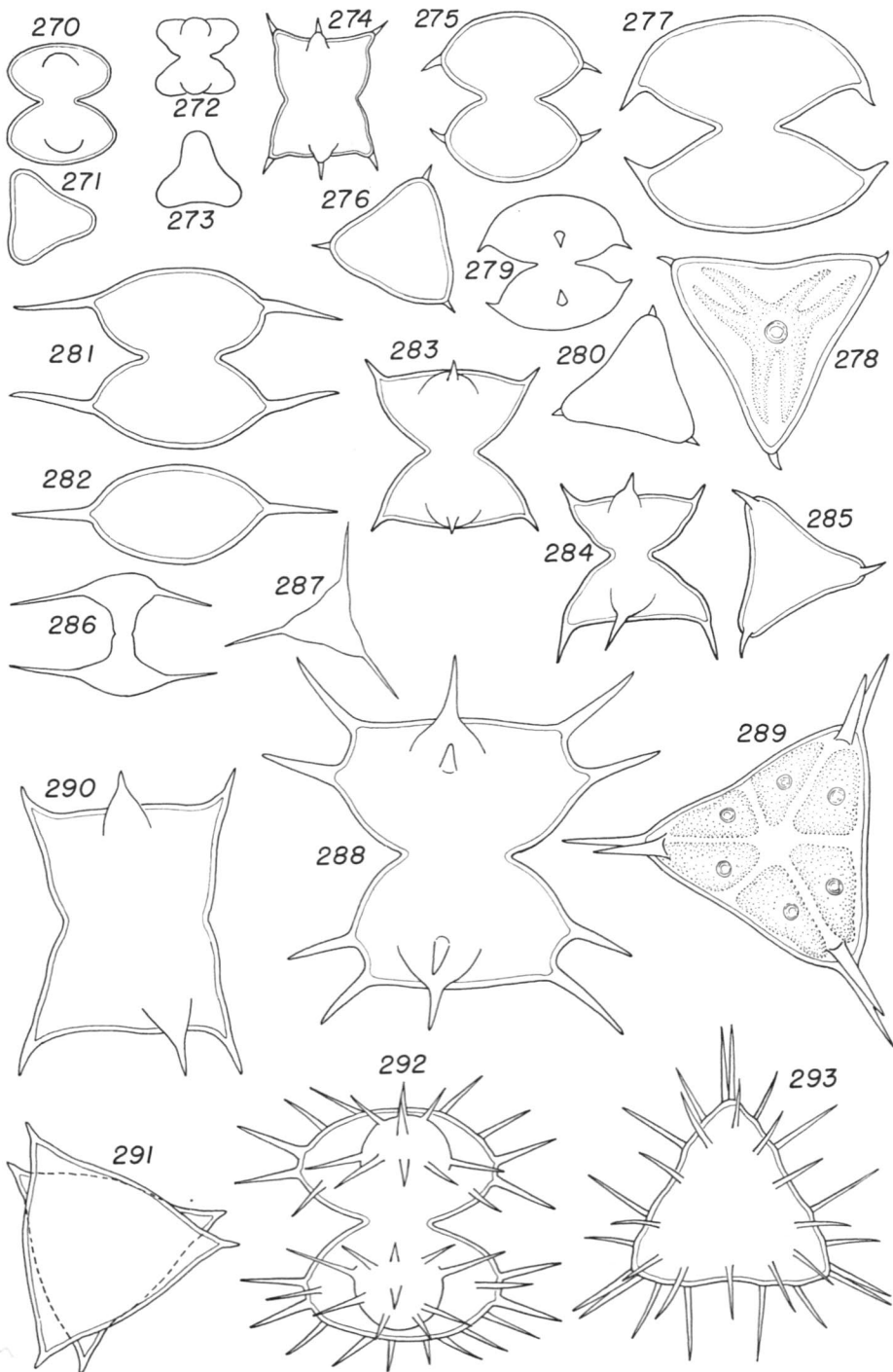


PLATE XII



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