PLANKTON DIATOMS OF THE "TOKO-MARU" VOYAGE (BRAZIL COAST)

F. C. Müller-Melchers *

The Japanese fisheries research vessel, that visited the coast of Brazil collected besides other materials a set of plankton gatherings that were deposited in the Instituto Oceanográfico at São Paulo.

Mr. J. de Paiva Carvalho had the kindness to place a number of these gatherings of plankton at my disposal to be analysed according to their contents in diatoms. My very best thanks to Mr. J. de Paiva Carvalho for his kindness.

The gatherings consist of two groups: 4 samples from the south and the rest, 14 samples from around the mouth of the Amazonas River, below and above the equator. The two groups are very distinct from one and another, the 4 samples from the South have a very marked tendency to the Rio Grandense — Uruguayan marine province. The discoid forms of Actinocyclus and Coscinodiscus prevail in this material. These 4 samples from the south, to a certain extent are similar to the Uruguayan coast. This had already been noted in bottom samples from Rio Grande do Sul (Barra). A large amount of Actinocyclus specimens were found. At first it seemed that these specimens might belong to Actinocyclus tortuusus Mann. After further investigation I decided on a new species proposing the name of Actinocyclus brasiliensis. A fair number of Actinocyclus octosinarius Ehbg., as well as Actinocyclus platensis MM. were found. The same diatoms were found in bottom samples taken by Mr. Plinio Soares Moreira from aboard the corvette "Solimões" (Brazilian navy). It seems that this marine province reaches from Uruguay (39 ° - 28 ° South latitude) along the Brazilian coast. The Coscinodiscus forms are mostly the same as from the Uruguayan and Argentine coast. Coscinodiscus oculus iridis Ehbg., was found as the most frequent. There are small differences in areolation and form of the rosette that may have been produced by colder waters in the south. Coscinodiscus Ehrlich Grunow

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* This paper was prepared under auspices of the Conselho Nacional de Pesquisas at Rio de Janeiro, which made possible the study of this material. I am greatly indebted to this Institution for letting me study at the Instituto Oceanográfico de São Paulo, my very best thanks.
frequent at Cananéia (Estado de São Paulo) 25° lat., S 48°52' W and described by me as *Coscinodiscus heteroporus* Ehbg., in Las Diatomeas del Plancton Marino de las costas del Brasil on page 110, was found only twice, being brackish, it must have been washed out to sea by currents. I have given a detailed description of this diatom in this paper... The group of *Actinoptychus* is represented by three forms. Further investigation will show if types of *Actinoptychus seminarius* (mualbanus) Ehbg. that have been found and show certain differences in areulation belong to other or new species. The *Chaetoceros* group is relatively poor in these gatherings, or it may be that the samples at my disposal were rather exiguous. *Chaetoceros obtusus* Ehbg. was found as new for the South American Coast. In *Chaetoceros pseudoexcenticus* Mangin, resting spores were found. Illustrations of these are not known to me and given in this paper. They are smooth like *Chaetoceros curvisetus* Cleve.

The Amazonas material is poor in forms and consists chiefly of *Coscinodiscus concinnus* W. Smith in great quantities, *Coscinodiscus centricus triidis* Ehbg., in less. They are accompanied by *Nitzschia pungens* var. *atlantica* Cleve, which I believe is found for the first time on the South American Coast. Cqpp, West Coast of U. S. A., found this diatom at Lower and Southern California, and describes it as neritic temperate form. Gaarder only describes *Nitzschia delicatissima* Cleve with which *Nitzschia pungens* var. *atlantica* Cleve sometimes has been confused.

In "Toko-Maru" materials there is no doubt in my definition it shows well the striation that is difficult or not visible in *N. delicatissima*, also this latter is more slender. The other frequent diatom in the equatorial material is *Dolghinu Brightwellii* Grunow that is found, nearly always with resting spores.

São Paulo — April/May 1957.
Atlantida, Uruguay, January 1958.

STATIONS OF "TOKO-MARU" — 1957 — ALONG THE BRAZILIAN COAST.

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<td>11-4-57</td>
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Actinocyclus brasiliensis n. sp. (Plate I, fig. 1a-1b)

0.086 - 0.090 mm

Surface flat to the border, where it descends gently. Colour dark brown, purplish. Central space semicircular bearing a few closely packed granules. Markings granular 10 in 0.01 mm. A few hyaline interspaces give a sunburst effect. The rays of granules are flexuose towards the border. Border striae indiscernible. Pselldonodule very small, 0.002 mm (2) indistinct (obsolete).

N. Ingram Hendey suggests (in litt.) that the specimens might be identified as Actinocyclus tortuosus Mann. (Austral. Antarctic Exped. p. 21, pl. 1, fig. 9 and plate 2, fig. 1. H has as great resemblance but the hyaline interspace in A. tortuosus are of a very much greater number and more tortuous; the same applies to the granular rays. So the above name is given "ad interim".

Stat.: 193 RR - 196 R - 212, 213.

Actinocyclus octanarius Ehrenberg, 1838. (Plate II, fig. 5).

1861 Actinocyclus Ehrenbergii Ralfs ex Pritchard.

Dr. N. Ingram Hendey in Discovery Rep., XVI, p. 259 has reinstated the name of Actinocyclus octanarius as type.

The iridescent colours will be very light sky blue others of dark purple. The latter seem to belong to the type moniliformis. Hatrarg (p. 185) describes this as a separate species, but I believe it should be drawn together with A. octanarius as it is very closely identical. Eventually a variety.

Stat.: 212 and 213 - not common.
Actinoecylus plateus Müller-Melchers, 1954.

This species seems to belong to southern Brazil, Uruguay and Argentina. It was not found around the mouth of the Amazonas River.
STAT.: 193, 212 and 213.

Actinoptychus arenatus Ehrenberg, 1854. (Plate I, fig. 2, 3)

Microogr., 33, f. XIII, f. 17.

Schmidt Atlas, table 1, fig. 9; table 20, fig. 4.
Brockmann, Chr. Meits. Quarterly Heliandis, p. 54.

Very rare. This species is distinguished by 6 spines, one in each sector, else very much like A. arenatus Ehrenberg. The areole are smaller and more crowded.
STAT.: 212.

Actinoptychus campanulifer A. Schmidt, 1875.

One only specimen was found. Well known further to the north, on the coast of Estado de São Paulo.
STAT.: 193.

Actinoptychus turgidus T. & Brun? (Plate I, fig. 4)

The following description is made from one specimen only, this was so delicate that most of the areolation could not be seen. A type very closely related to this was found around Cananéia at "Costa do Cardoso". I give the description as follows: 0.125 mm 0, of a very pale yellow colour; six sectors, about all of the same height. Each sector slightly curved. Hexagon hyaline space in the middle indistinct. Spines one or two could be made out. Granulation partly parallel or disorderly, 2/8 in 0.01 mm wide about flat.

It might belong to Actinoptychus turgidus. The specimens from “Costa do Cardoso” seem to be related to this one. A. N. Atlas, 173, fig. 2.
STAT.: 193.

Asteromphalus Hookeri Ehrenberg 1864. (Plate III, fig. 9)

Microgr., vol. XXXV, A 21, fig. 2.
Rattray, Rev. Conch., 9,656 (1888).
Koester, Valdivia Antarktischen, p. 90, fig. VIII, fig. 9. (1905)
Mann, Albatross, p. 275 (1907).

A rare species on the Brazilian coast, Oceanico, pelagic?
STAT.: 212.

Bacteriastrum delicatulum Cleve, 1897.

Rather rare.
STAT.: 196 and 212.
Bacteriasterum hyalinum Lauder, 1864.

Not common, some specimen showed resting spores.  
Stat.: 193, 196 and 212.

Biddulphia aurita (Lygbye) Brébisson et Godey, 1838.

Brébisson et Godey, Cons. sur. les Eaux, p. 590, fig. 5-7.
Brébisson, M. Rare, Explo., vol. 11, n° 2 (1831).
Biddulphia aurita var. minima — 0.02 mm.
A very small variety of this species was found in only a few specimens.
Size of our specimens 0.0174 mm width.
Stat.: 115 and 131.

Biddulphia chinensis Gréville, 1806.

Quite a large amount was found at station 212 and 213. It might be an other endemic centre like the one on the Argentine coast in front of Samborombóo.
Width — 0.188 to 0.202 mm.
Stat.: 193, 212F and 213A.

Biddulphia ineris Ehrenberg, 1843.

Marine brackish form. Rio Grande do Sul, Cananéia (M.M.)
Stat.: 193 and 212.

Biddulphia mobilienoi Bayley, 1845.

Together with Biddulphia chinensis but in much smaller amount. Not rare.
Stat.: 193, 196, 212 and 213.

Biddulphia regia (Schultze Ostenfeld, 1908.
Stat.: 125, 131, 139 and 145.

Biddulphia rhombus Wm. Smith, 1851.
Stat.: 212 and 213.

Chaetoceros affinis Lauder, 1864.
Stat.: 212 and 213F.

Chaetoceros coarctatus Lauder, 1864.
Stat.: 193 and 212F.
Chaetoceros compressus Lauder, 1854.
STAT.: 193Fr.

Chaetoceros curvisetus Cleve, 1889.
STAT.: 213 Fr. (rare).

Chaetoceros didymus Ehrenberg, 1846.
STAT.: 163 R.

Chaetoceros lorenzianus Grunow, 1863 (Plate IV, fig. 13).
Marine and brackish. Several resting spores of this species were found.
STAT.: 193.

Chaetoceros Okamurai Ikari, 1928 (Plate VI, fig. 21)
Botan. Magazine Tokyo, vol. XLII, p. 248, fig. 2.
Chain straight, not twisted. Cells in front view broad, quadrangular with rounded angles, sometimes elongated. Valve convex and elevated to two low cones, leaving a shallow depression. Foramina rhomboidal. Setae start direct from these cones and each then coalesces with the other. Seta long and straight adorned with spines. Terminal setae not found. LOCALITY: seas of Japan, Ikari. Warm water type!

The material found was in fragmentary state. Cells of 0.030 width, 0.44 high, with rhomboid foramina. Heavy setae, but these were all broken not one was found in entire length. Most of the specimens were found two cells together.

Not found to the South of Brazil. New for Brazil and South America.
STAT.: 115, 131, 159, and 161 Fr.

Chaetoceros peruvianus Brightwell, 1856.
STAT.: 193.

Chaetoceros pseudocurvisetus Mangin, 1910 (Plate III, fig. 11)
Tropical, sub tropical, notile.
Fairly common. Known from Canada surroundings.
In one chain resting spores were found. I believe that this is the first time that this has been noted in this species. Cupp (1943) does not mention resting spores.
STAT.: 212.

Chaetoceros rostratus Lauder, 1864.
STAT.: 212 and 213.
*Corethron pelagicus* Brun., 1891 (Plate V, fig. 22).


Hustedt, Kieselalgen, p. 547, fig. 312 A, B. (1930).


"The chief difference between this and the other phases are considerable, shortening of connective zone and increased diameter of cell" (Hendey).

The material was mostly in bad state and fragmentary. I give several measurements from Uruguayan material that are coincident with Brazilian specimens:

- 0.062 height x 0.063 mm 
- 0.063 " x 0.060 mm 
- 0.060 " x 0.065 mm 
- 0.060 " x 0.050 mm 
- 0.100 " x 0.092 mm 
- 0.151 " x 0.090 mm 

My citation in *Las Diatomeas del Plancton Marino de las costas del Brasil* (1955) p. 167, should be changed to *Corethron pelagicus* Brun.

Stat.: 193 and 212 F.

*Coccolithus asteromphalus* Ehrenberg, 1844.

Stat.: 212 and 213.

*Coccolithus commutatus* Grunow, 1881.

Brackish marine indicator.

Stat.: 113, 125, 133, 140, 141, 143 and 212.

*Coccolithus concinnus* Wm. Smith, 1856.

Very common and sometimes predominant in the Amazonas region.

Cells about 0.172 upper cell 0.0344 high.

- 0.025 upper girdle 0.0559 high.
- 0.0516 lower cell 0.0516 high.
- 0.1419 about as high as diameter.

Valves all with closed middle centes. The open center has not been found on the South America coast.

Stat.: 113, 125, 133, 140, 141, 145 A, and 161.

*Coccolithus divisus* Grunow, 1878.

Stat.: 106 S.

*Coccolithus excentricus* Ehrenberg, 1839.

Stat.: 106, 212 and 213 (about 0.090 mm ).
- 118 -

Coccosinodiscus gigas var. praetextus (Janisch) Hustedt, 1928.
Stat.: 212 and 213.

Warm water indicator.
Stat.: 125, 131, 140 and 213.

Coccosinodiscus Jovianus Ostenfeld, 1915, var. aculeata Meister, 1932 (Plate II, fig. 6).
Meister Asien.
Length of spines about 0.0012 mm to 0.0014 mm. About 0.172 g the spines are the only difference to the species.
On the Uruguayan coast in Coccosinodiscus communis something like this variety is found but in this case the spines are more like apiculi.
Stat.: 131, 139.

Coccosinodiscus Kurzii Grunow ex Schmidt, 1888.
Schmidt Atlas, plate 113, fig. 17, Elephant Point — Bengal, 1888.
Lohman, Phor. Diatomea Kretzschmar's Hilke, Prof. Paper 1909, plate 20, fig. 1; plate 21, fig. 2, 1908.
Both without rosette and closed centre.
Together with Heicozidiscus ovalis Lohman and other marine brackish forms.
Lohman, Deep Sea Coros, Prof. Paper 1913, p. 71, 13, fig. 5, 1913.
Core n. 223 29°25′ N 20°37′ W
223 30°13′ N 29°06′ W
228 06°13′ S 18°12′ W

I am not of Kolbe's opinion to unite Cos. Kurzii with Cos. obscures they have both quite different areolation.
Hendey — in littoris — Plankton Sierra Leone, West Africa.
With closed centre.
As very little is known of this diatom and as this represents one of the most frequent Coccosinodiscus at Cananéia, Estado de São Paulo, Brazil, I have examined more closely the various data at hand.
A. Schmidt Atlas, pl. 113, f. 17. Perforated border of small cells. Band of about 3 to 4 circles of larger areola diminishing later to to centre. Ring of small areola at the centre with small hyaline space of about 0.02 mm.
Coccosinodiscus Kurzii Grunow, from Cananéia, Brazil (Plate II, fig. 8):
about 0.084 to 0.165 mm, border of festooned smaller areola, like garlands (festoons of a curtain) 6 in 0.01 mm. Then follows a band of larger areola, 4 in 0.01 mm and after this the large areola about 3 to 4 circlets of 2 1/2 in 0.01 mm to diminish to 3 in 0.01 mm till they reach the ring of small areola 4 in 0.01 mm having a hyaline centre space that measures about 0.003 to 0.004 mm and that in smaller specimens some times does not exist. Before the inserted rays small poroids are found (immersion!).

The Sierra Leone (Africa) built of the valves is very like those from Brazil and the drawings in A. S. A., p. 113, f. 17, only the small hyaline space in the middle is missing. But I do not imagine that this should alter the type, as in very small Brazil specimens it is very small.

STAT.: 213. Only very few specimens were found. It seems that Coscinodiscus Korschelt prefers warm brackish water. At Cananéia it was found in brackish to marine surroundings, it will support very low salinity. It was found out at sea in front of the Ilha da Boa Vista.

Coscinodiscus obscurus A. Schmidt, 1878.

0.058 — 0.079 mm, about 3 1/2 areola in 0.01 mm with small hyaline centre and poroids.

STAT.: 193 R.

Coscinodiscus oculus iridis Ehrenberg, 1839.

Frequent in most stations, found along most of the South Atlantic coast.

STAT.: 115, 137, 145, 161, 197, 212 and 213.

Coscinodiscus pacificus Grunow, 1884.

STAT.: 212 and 213.

Coscinodiscus perforatus Ehrenberg, 1844.

STAT.: 212 and 213.

Coscinodiscus punctiger (Castr.) Müller-Melchers, 1953.

STAT.: 196, 212 and 213. Scarce and rare.

Coscinodiscus radiatus Ehrenberg, 1839.

STAT.: 115, 145, 161, 193, 212 and 213.

Coscinodiscus Rothii (Ehr.) Grunow, 1878.

STAT.: 212 and 213. Rare.

Coscinodiscus Vidovichii Müller-Melchers, 1953.

STAT.: 212 R.
Cyclotella striata var. ambigua Grunow, 1882.
Frønegrill, Sam Bla, p. 331, 1928.
Brackish water indicator — 0.024 mm 5, 11 stria in 0.01 mm.
Stat.: 331.

Cyclotella Meneghiniana Kützing, 1844.
Brackish water indicator.
Stat.: 133 RR.

Ditylum Brightvelli Grunow, 1881.
In the gatherings from the Amazonas mouth region the specimens were mostly provided with resting spores. These were found also loosely floating in the plankton. One specimen with 4 corners was found, at station 196.
Stat.: 113, 131, 139 R, 140, 159 (many spores), 161, 166 and 213.

Eupodiatus antiquus Cox., 1889. (Plate IV, fig. 12)
One only found — 0.129 mm 5.
Stat.: 103.

Hemidiscus microdiscus Gréville, 1865.
Stat.: 115 and 213.

Hemidiscus membranaceus Cleve, 1873.
Stat.: 100.

Hemidiscus ovalis Lohman, 1938.
Müller — Aden. Coscinodiscus phaeomuricus, plate XII, fig. 80, 87, 1928.

Hyalodiscus laevis Ehrenberg, 1845.
Stat.: 136 RR.

Lauderia borealis Gran., 1900.
Stat.: 113, 133 and 106.

Lithodesmium undulatus Ehrenberg, 1840.
Stat.: 213.

Nitzschia concretata Grunow var. oceanica Frønegrill, 1928.
Oceano Atlántico, p. 312, lam. l, fig. 33.
Stat.: 196.
**Nitzschia pungens var. atlantica** Cleve, 1897 (Plate VI, fig. 18, 19).


Valves linear lanceolate, acute. United in stiff chains by the overlapping tips of the cells (Cupp, 1943).

Length 0.071 – 0.162 mm long x 0.0023 – 0.0048 broad Keal puncta obsolete, of the same number as the striae: 11 to 16 (usually 13/14). Closely related to *Nitzschia seriata* but cells are more pointed, valves narrower and mostly with greater overlapping of cells endings. Striae visible in water, not visible in *N. delicata*. Stat.: 115, 131, 140, 150 and 161.

**Nitzschia seriata** Cleve, 1883.

Stat.: 193 and 212.

**Pleurosigma affinis** Grunow, 1880.

Stat.: 193 and 212 8.

**Pleurosigma brasiliense**, n. sp.

0.37 to 0.50 x 0.062

Valve lanceolate, elongated with sharply acute ends. Median line central, slightly sigmoid, the ends are turned in contrary directions. Axial area small, nodule oblong. Structure transverse and oblique lines, seen with utmost difficulty. Oblique lines crossing at about 60°. Both striaations 30 to 32 lines in 0.01 mm (counted by photography). Same structure in the middle part as in the endings.


Also found at Cananéia, Ilha do Bom Abrigo, 29°07'4" S – 47°37'5" W. Andrade & Teixeira.

Atlantica (Uruguay) MM.

The nearest form is, as far as bibliography is available – *Pleurosigma affinis* Grunow, 1881. Stat.: 115, 145, and 159.

**Pleurosigma naviculaceum** Brébisson, 1854.

Stat.: 193 R.

**Rhizosolenia alata** var. gracillima Grunow, 1881.

Stat.: 113, 145, and 159.

**Rhizosolenia alata** var. indicus Ostenfeld, 1901.

Stat.: 193, 196 and 213.
Rhizosolenia Bergonii H. Peragallo, 1892.

Warm water indicator. Subtropical, tropical.

Rhizosolenia calcarea varia M. Schultze, 1858.

Oceanic, Marine.

Rhizosolenia hyalina Ostenfeld, 1901.

Kodo har og Aden bogen, p. 109-11, fig. 11, 1901.

Hirose, A. S. A., pl. 318, fig. 11:15, Japan Binnenmeer Alaska, 1920.


Allen & Cope, Java. in Rhizosolenia Cleve, p. 28, fig. 34, 1935.


Schmidt, A. S. A., pl. 319, fig. 11-13, Japan Binnenmeer, Canareia, Brazil, in oceanic waters.

Gardner found Rhizosolenia hyalina in the Central Atlantic on the border of the Sargasso Sea at the following stations:

St. 63 22.6° - 36°11' N - 43°58' W

St. 64 24.6° - 34°44' N - 47°02' W

To my knowledge this is the first mention of this diatom in the Atlantic, till then only known from southern Asia and Japan.

Very transparent. Areolation could not be seen.

Rhizosolenia imbricata var. Shrubsolii (Cleve Schröder, 1906.

Rhizosolenia robusta Norman, 1861.

Rhizosolenia setigera Brightwell, 1858, var. dags n. var. (Plate VI, fig. 20.

This new variety is well known all along the Brazilian coast, I did not insist in my paper "Las Diatomeas del plankton marino de las Costas del Brasil" but the amount of plankton gatherings that were examined during my stay at São Paulo showed that this Rhizosolenia was constant in build, showing a very heavy, daggerlike spine without the long hair ending. It is by all means a variety or type of its surroundings.

Rhizosolenia Stolterfothii H. Peragallo, 1888.


Found also at Canareia in 1957. I found some of this diatom in marine gatherings, but it seems to be scarce on the Brazilian coast, Uruguay, one single specimen was found only. Not known on the Argentine coast,

STAT.: 212.
Skeletonema costatum (Gréville) Grunow, 1866.
STAT.: 115, 131, 140, 193, 212 and 213.

Stephanopyxis Palmierionum (Gréville) Grunow, 1884.
Tropical and subtropical warm water indicator.
STAT.: 193, 212 and 213.

Surirella fastuosa Ehrenberg, 1852 (Plate IV, fig. 15)
STAT.: 196 R and 212 R.

Surirella rovata Frenguelli, 1935.
Brackish water.
STAT.: 193.

Thalassiothrix nitzschioides Grunow, 1881.
STAT.: 115 and 193.

Thalassiothrix decipiens (Grunow) Jorgensen, 1905.
STAT.: 193 and 213.

Thalassiothrix subtilis (Ostenfeld) Gran., 1881 (Plate V, fig. 16)

Oceanic temperate species. Embedded in irregular gelatinous masses.
STAT.: 149 and 145.

Thalassiothrix arctica Cleve and Grunow, 1880.

Navicula antillarum Mann, Albatross, p. 336, 1907.
Trachyneis antillarum Subrahmanyan, Madras, p. 193, 1946.

VIRGINIANS ISLANDS, St. Bartholomew, Cleve, Gulf of Mexico, Grunow.
RIO GRANDE DO SUL (BARRA), Cuba, Müller-Melchers. Lower California, Mann.
Marine brackish, bottom samples, incidently in plankton.

**STAT.**: 183.

*Triceratium fave* Ehrenberg, 1839.

**STAT.**: 193 (Brackish).

*Triceratium platypanicum* A. Schmidt, 1895 (Plate III, fig. 10).

A Schmidt Atlas, plate 82, fig. 8.

**STAT.**: 212.

**RESUMO**

Estudou-se, no presente trabalho, o material coletado ao longo da costa brasileira pelo navio "Toko-Maru".

As coletas podem ser distribuídas em dois grupos: quatro amostras provenientes do sul e as restantes 14 da circunvizinhança do desembocadura do Rio Amazonas, abaixo e acima do Equador.

Esses dois grupos são bem distintos. As quatro amostras do sul apresentam muitas semelhanças com o material das províncias riograndense e uruguaia. Nelas predominam formas discoidais de *Actinocyclus* e *Coscinodiscus*.

O autor encontrou *Chaetoceros Oikawae Ikari*, nova para a América do Sul, o mesmo acontecendo com *Nitzschia parva var. atlantica* Cleve. Em relação a *Rhizosolenia hyalina* Ostendfeld, acredita o autor ser esta a primeira vez esse díatoméa do sul da Asia é referida para o Atlântico.

Descreve o autor uma espécie nova: *Actinocyclus brasiliensis* e uma nova varianda: *Rhizosolenia setigera* Brightwell var. *daga*.

O exame das amostras permitiu concluir que o material das circunvizinhas do Amazonas é pobre em formas, consistindo principalmente de *Coscinodiscus concinns* W. Smith e, em menor quantidade, de *C. iridis* Ehrenberg. Essas duas díatoméas acham-se acompanhadas por *Nitzschia parva var. atlantica* Cleve, não raro confundida com *N. delicatissima* Cleve.

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Rattray, J.

1900. A revision of the genus Arctodiets.

Schimper, A.

Skrjabin, R. H.
PLATE I

1 a Actinoptychus brasiliensis n. sp. 0.086
   b Actinoptychus brasiliensis higher form.
2 Actinoptychus areolatus Ehrenberg 0.065
3 Actinoptychus areolatus Ehrenberg 0.062
4 Actinoptychus turgidus Tappere et Dirou 0.125
PLATE II

5. Actinocyclus arenarius Ehrenberg 0.156 28
6. Coscinodiscus Jussieuves var. arborescens Meister
7. Coscinodiscus Kurzii Grunow ex A. Schmidt Atlas
8. Coscinodiscus Kurzii 0.125 28 from "Toko" Maru
PLATE III

9 Asteromphalus Hookeri Ehrenberg 0.0015 c
10 Triceratium patagonicum A. Schmidt 0.150 one side.
11 Chaetoceros pseudocurvisetus Mangin 0.018 c with resting spores.
PLATE IV

12 Eupodius antiquus Cox 0.002 @
13 Chaetoceros baumgartenii Grunow resting spores.
14 Suctella recta Forssell 0.10 x 0.085
15 Suctella fracta Ehrenberg 0.043 x 0.085
PLATE V

16 Thalassiosira spinifera Ostenfeld 0.024 G
17 Trachysira costillana Cloe 0.125 x 0.029
PLATE VI

18 Nitzschia pungens var. atlantica Cleve
19 Nitzschia pungens var. atlantica Cleve
20 Rhizosolenia setigera n. var. dapa
21 Chaetoceros okawaei Kari
22 Corethra pelsagiwa Heun
23 Phaeocystis brasiliensis n. sp
24 Terminal part.
25 Central part
Stations of "Toko-Muru" — 1957 — along the Brazilian coast.