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"Dedicated to the memory of Dr. J. Frenguelli (1958 †)

PLANKTON DIATOMS OF THE SOUTHERN ATLANTIC ARGENTINA AND URUGUAY COAST

by

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The following investigation of plankton diatoms is due to gatherings taken by Prof. E. Balech of Necochea during the "Primera Operación Merluza por el buque oceanográfico "Madryn", comandet by Capitán Gorrochetegui and organized by the Departamento Oceanográfico del Ministerio de Marina de la República Argentina. My very best thanks for giving me the opportunity to study this area where as far as I know no plankton diatom studies have been made up to now. The quadrangle comprising the sea between the argentine east coast and the uruguayan south coast about 54º W to 60º W and 34º S to 40º S.

The first investigation of argentine coastal diatom plankton was published by A. Marques da Cunha and Olivera da Fonseca in 1917 at the Instituto Oswaldo Cruz, Río de Janeiro, J. Frenguelli published the first extensive paper in 1928 "Diatomeas del Océano Atlántico" than in 1930 "Diatomeas de la Costa Atlántica de Miramar". Results of gatherings taken by the "Meteor Expedition" described by Hentschel (1932) could not be taken in to consideration as the publication is not available in this country. J. Frenguelli in "Diatomeas del Río de la Plata" page 214 sumarises 5 stations situated in the estuary of the Río de la Plata, enumerating the few diatoms given for these investigated in this paper. In 1937 N.I. Hendey "The Plankton Diatoms of the Southern Seas" was published (Discovery Reports XVI). This in part touches the argentine southern coast as well. Following we have J. Frenguelli "Diatomeas de la Bahía de San Blás" 1938: "Diatomeas de Rada Tilly" 1949; "Diatomeas del Golfo de San Matías" 1939; "Diatomeas del Río de la Plata" 1941. Müller Melchers

in 1951 published "Actinoptychus Frenguelli" (Golfo de San Jorge) with a list of Diatoms found together with this species. Cleve "South Atlantic" 1900 lies to far off from the argentine coast to be of interest to this investigation. All these latter investigations were mostly based on costal gatherings.

As far as litterature is available to me there is nothing published from this region. This quadrangle is bordered by the coasts of Argentina and Uruguay, influenced by the Brazil warm current and by the Malvinas cold current (Falkland Islands Current). Balech, 1940, has given an accountt of these currents and this influence on faunistic life. The same applies to phytoplankton.

The present investigation shows by "indicator species" how far several plankton diatoms have been displaced from their original regions. For instance the Malvinas current coming up from the south displaces Rhizosolenia curvata, that is known from about Cape Horn (Hart. 1937). This diatom was first found at 41º29'S - 56º52'W and later as far north as 36º36'S - 54º51'W, on the fringe of the oceanic branch of the Brazil current or even in the same. Rhizosolenia curvata, a tipical subantarctic diatom, was acompanied by other antarctic diatoms as in this case Corethron "hystrix phase" and Fragilariopsis antarctica.

On the other hand in the temperate waters of the Brazil current, on the coastal side as well in oceanic waters. Chaetoceros coarctatus, a tipical warm water oceanic diatom was found, common on the brazilian coast. This diatom was inhabited by Vorticella oceanica in living state. Balech located this diatom at 36º22'5"S- 53º04'W. This same diatom has been found on various ocassions at Atlántida during the winter months of June, July and August. During the summer in January and February, showing that at certain periods of the year influxes of the Brazil current reach down to the uruguayan coast.

Other diatoms of temperate water habit as Stephanopyxis Palmeriana were found at Punta del Este and Atlántida in coastal plankton gatherings. During the expedition "Madryn". Coscinodiscus Hustedtii was found at 30º36'S - 54º51'W. This diatom first found at Atlántida during January 1954 and in the same year investigating brazilian plankton at Mar de Trepandé (Cananeia). I was not quite sure if this diatom could be counted as oceanic species, by a mere coincidence revising an old slide from Thum of Leipzig: I located the same is the Golf of Bengal, in tropical waters. This diatom has been displaced by the Brazil current as far South as 37º26'S - 55º

31'W. It was found in frequent numbers and can be determinated as of warm seas, tropical.

After having investigated the gatherings from the "Madryn" expedition, the author had the possibility to study the brasilian South Atlantic plankton flora at the Instituto Oceanográfico of São Paulo, Brazil. A few plankton gatherings and bottom samples, taken from aboard the corvette "Solimoes" at about 32°S near the coast, show that a tipical brazilian diatom flora is found on the Río Grande do Sul coast. This was confirmed by a bottom sample given to me by Mr. J. Soriano (1953) the latter showing a tipical collection of brazilian marine diatoms. A few of these are enumerated further down, these are not known from the uruguayan coast. The sample was taken a few miles off shore in front of the mouth of the Río Grande do Sul at a place known as "Barra do Río Grande".

The diatoms found are "Campylodiscus Daemelianus, Trachyneis antillarum, Terpsinoe americana, Terpsinoe musica, Nitzschia circumsuta, Biddulphia laevis, Actinoptychus splendens," This last diatom is well known on the argentine coast but not on the uruguayan. It seems that the Río Grande coast represents a barrier between Brazil and the southern South Atlantic (from about 32°S).

J. J. Parodiz, indicates something like thuis on page 208 of his "Transgresiones oceánicas" 1942: "desde los 32°S, fauna de transición. Elementos Sud brasileños costeros y magallánicos en profundidad". Rev. Geogr. Americ. Vol. XVIII 1942 Buenos Aires.

Part II.

As I had a small number of other samples from the argentine coast, received some years ago from Prof. E. Balech, these have been described in the second part of this paper. These samples beeing taken during other months of the year, differ to a certain extent from those taken from aboard of the "Madryn".

Part III.

To give an idea of uruguayan marine plankton from offshore gatherings I give an account on the samples taken by Dr. F. de Buen on the uruguayan southwest coast. These are not taken so far south as "Madryn" gatherings, but they give a good idea of uruguayan winter plankton. The stations are influenced partly by the Brazil current.

The oceanographic data are to be found in F. de Buen, "La Ocea nografía frente a las costas del Uruguay" 1951.

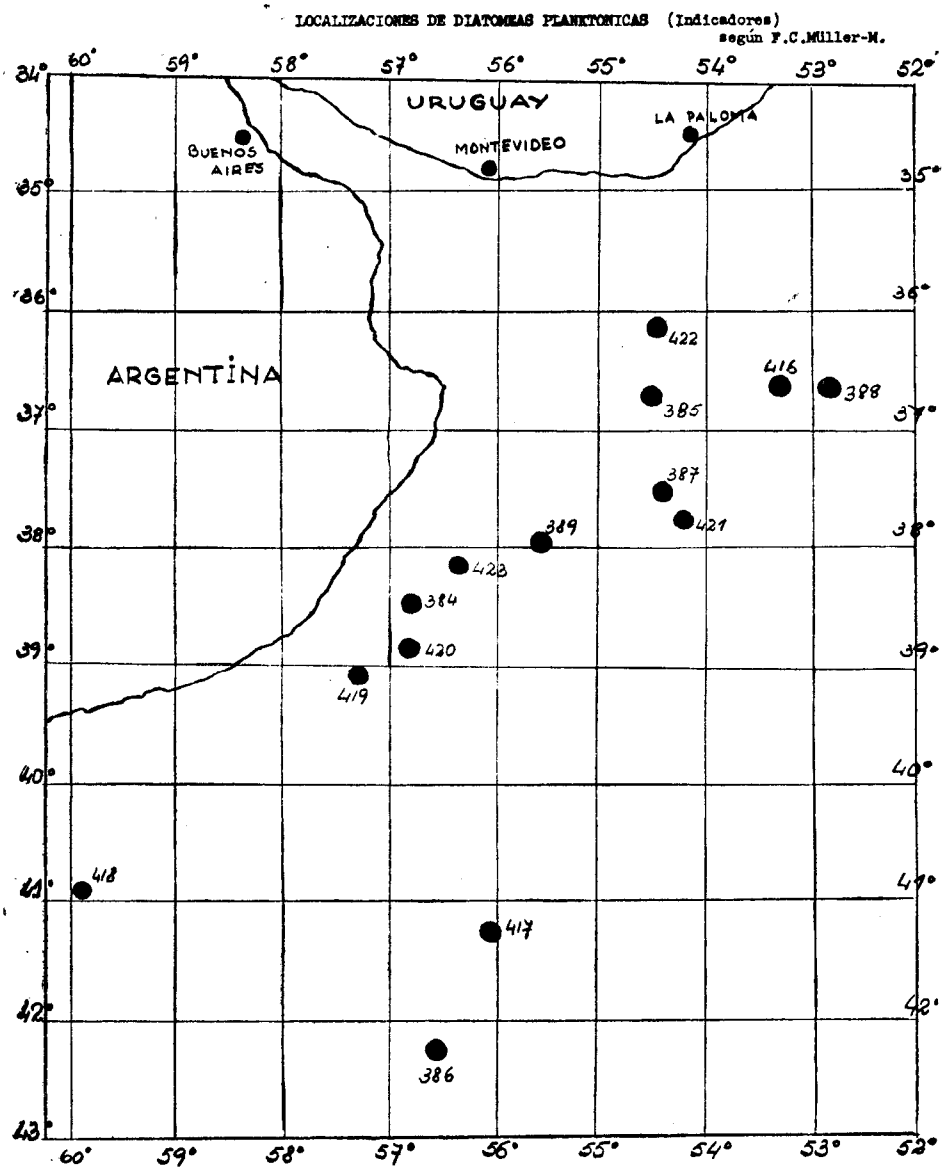
This plankton shows two completely different comunities i comparision to the open Atlantic. It is in part Rhizosolenia plankto and part disco plankton (Actinocyclus and Coscinodiscus). Th results of these plankton gatherings were made a few years ago, bu not published in de Buen: Oceanografía, they are given at the en of this paper. The gatherings were taken during May 1951 from th cutter "PALOMA" and are quite different to those taken in Jul from the trawler "ANTARES" the first are Rhizosolenia plankton Rh. alata and Rh. calcar avis predominant. The second taken in Jul from the "ANTARES" is a disco plankton, with a few other diatom well known in coastal uruguayan gatherings. The first is tipica oceanic plankton taken about 30 miles from shore to the south an the second a disco plankton that may be influenced by the las remnants of the Río de la Plata? Disco plankton like this is ofte taken during late autumn and winter at Atlántida. Various specie of diatoms of temperate water are found in both gatherings.

I would like to call the attention to the following two case regarding cold water species in plankton on the Brazil coast.

Chaetoceros similis, a fragment of this pelagic diatom was found at 36º03'S - 54º46'W. This diatom is only known from the North Atlantic - it is not known from the South Atlantic. During my stay at the Instituto Oceanográfico at São Paulo this diatom was found in a plankton gathering from the harbour of Salinopolis, just below the equator. In this gathering the specimens were well developped and not at all fragmentary.

A similar case happened mith well defined specimen-of Chaetoce ros furcellatus found at Santos, Río Baguacu, Río Batatal, Mar de Cubatao (Brazil). How far south or north can diatoms be displaced and how long will they survive in different temperature? These are two cases known to me recently, similar cases will have to be taken into consideration.

After having written this paper, Dr. Hugo J. Ferrando made a study on quantities of Merluza (Merluccius hubbsi) being cought in the cold water of the Malvinas current off the uruguayan coast. It is a very interesting paper and to a certain extent shows the fishing in a plankton area of cold water. I believe that future studies will show the usefulness of plankton Indicator Diatoms.



Plankton Gatherings From "Madryn"

PLANKTON GATHERINGS FROM "MADRYN"

Nr. MM	St. Nr. Balech	Position Lat.	Long.	Date	Hour	Temp.
384	fondo	38º23'S	57º08'W	29/V/54		
385	7,	36º51'S	54º48'W	6/VI/54	16.30	12º30
386	50,	41º29'S	56º52'W	12/VI/54	14.00	6º20
387	V25	37º35'S	56º32'W	2/VI/54	15.45	
388	V10	36º36'S	54º51'W	2/VI/54		13ºS
389	55	37º54'S	56º30'W			
416	V50	36º30'S	53º37'W	27/V/54	5.15	14º
417	32	40º25'S	56º17'W	10/VI/54	19.00	
418	37/VI	40º16'S	59º01'W	30/V/54	3.45	
419	V80	38º45'S	57º28'W	29/V/54	21.00	12ºS
420	V15	38º23'S	57º08'W	29/V/54	16.30	13º
421	V36	37º26'S	55º31'W	2/VI/54	21.45	12º4S
422		36º03'S	54º46'W	8/VI/54	12.00	12º6S
423		37º54'S	56º30'W	8/VI/54	19.00	

The letter behind the numbers mean:
P predominant. A abundant. F frequent.
S scarce. R rare. RR very rare.

1 **Actinocyclus atlanticus** n. sp. Plate I. fig. 1

Discoid, valves convex, with concentric undulation slightly impressed at the middle. Border broad, finely striated in quincunx, about 17|20 beadings in 0,01 mm. Border spinulae at 12 to 14 micron apart. Centre very small with closely packed granules, generaly two together. Moniliform striae in radiate fasciculae 8,5 beads in 0.01 mm.. Marginal ocellus round sometimes indistinct. Ocellus next to a spinula about 0,0017 mm. diameter.

Diameter 0,110 - 0,123 mm.

Locality 421-423, also found on the uruguayan and brazilian coast; generaly in isolated specimens.

2 **Actinocyclus australis** Grunow. 1880
In van Heurck "Synopsis", pl. 125 f. 7-8, 1880-1885.

1890 Rattray, p. 153
1928 Frenguelli, p. 524, pl. XIV, f. 14-15
1930 " , p. 298, pl. V, f. 15.

Locality 421, also found on the uruguayan and brazilian coast.

3 **Actinocyclus crassus** v. Heurck. 1881
Synopsis Diat. Belge, p. 215, Lam. 124, f. 6-8

1938 Frenguelli, p. 327.

Locality 384-421; uruguayan and brazilian coast in plankton MM.

4 **Actinocyclus octanarius** Ehrenberg. 1838
Infusionsthier, p. 172, pl. 21, f. 7

1861 Actinocyclus Ehreubergii Ralfs ex Pritchard
1890 Rattray, p. 171 (Actinocyclus Ehrenbergii)
1937 Hendey Plankton Diat. of S. Seas, reinstates the original name given by Ehrenberg, Discovery Rep., Vol. XVI, p. 259-260-262.

Locality 388-421; uruguayan and brazilian coast, MM. 62º59'S - 57º28'W (Subantarctic).

5 **Actinocyclus platensis** Müller Melchers. 1953
New and little known Diat., p. 4, lam. 3, f. 1-3

1928 Frenguelli under Actinoc. Barklyi, p. 523, pl. XIV, 1-5

Marine and neritic species on the argentine and uruguayan coast.

Coast of Brazil (Río Grande do Sul, Salinopolis) MM; coast of Africa (Freetown, Sierra Leone) Hendey.

Locality 389-421; not common.

6 **Actinoptychus Frenguellii** Müller Melchers. 1951. Plate I, fig. 6
Physis, Vol. XX, Nº 58

Marine and coastal. Gulf of San Jorge, 46º59'S - 61º10'W gatherings received from Prof. E. Balech .Puerto Deseado, MM.

Diameter 0,0467 - 0,123 mm.

Locallty 423; very rare.

7 **Actinoptychus senarius** Ehrenberg. 1843
Berlin. K. Akad. Wiss. Phy. Abh., 1841, p. 400 pl. 1, f. 27.

Actinoptychus undulatus, Kuetzing 1844, p. 132
" " **Ralfs ex Pritchard**

Actinoptychus senarius Ehr. reinstated by N. I. Hendey in South. Seas, Discovery Rep., 1937, p. 271
Locality 384-421; scarce, small specimens
South Atlantic (48º to 50ºS - 62º to 65ºW) Hendey.

Uruguayan and brazilian coast. Marine and brackish water.

8 **Actinoptychus splendens** (Shadb.) Ralfs. 1861 Plate I, fig. 5
Pritchard Infus., p. 840

Frenguelli 1930, p. 302

Loaality 384-386. In bottom sample 384 frequent, else searce. Not. known from the uruguayan coast, only found fossil. Not scarce from Brazil (Coast of Río Grande do Sul, MM).
Diameter 0,100 mm..

9 **Actinoptychus vulgaris** Schumann. 1867
Preuss. Diatom., p. 64.

1928 Frenguelli, p. 521
1930 " p. 301

Locality 384 bottom sample.
Marine from argentine, uruguayan and brazilian cost.
Diameter 0,048 to 0,106 mm.

10 **Bacteriastrum hyalinum** Lauder
variety "**princeps**" (Castracane) Ikari. 1927

Bot. Mag. Tokyo, Vol. 41, Nº 486, p. 423, f. 3

1886 Castracane "Challenger", p. 84, pl. 14, f. 5; pl. 29, f. 3
1928 Frenguelli as Bacter. varians, p. 543

Marine species in scarce numbers, mostly fragmentary.

Locality 388-421. Known on the uruguayan and brazilian coast.

11 **Bidddulphia chinensis** Greville, 1866, Plate II, fig. 7
Descr. New and Rare Diatoms, XIX, p. 81, f. 16

1928 Frenguelli, p. 515
1952 Müller Melchers, Bidd. chinensis

1954 Müller Melchers, New and little known Diatoms, p. 10
1955 " " Symposium UNESCO, São Paulo, Diat. Plank. as Indicators

The large quantities of this diatom found induce me to believe that Biddulphia chinensis is endemic in front of the "Ensenada de Somborombon", Prov. of Buenos Aires coast (Argentina) from where it spreads to the south along the argentine coast and less to the north along the uruguayan coast. During several years (1943-45) it was abundant at Atlántida and predominant during the summer (Jan., Febr.) from where it disappeared suddenly and in all the following years has not returned in such large quantities to the uruguayan coast.

In the material Nr. 385 some specimens show spines with teratological phenomena. This material was collected in the waters influenced by the cold Malvinas current and on the fringe of the warm Brazil courent. This may have caused termic changes or change in salinity concentration (see Müller Melchers, Bidd. chinensis, 1952, p. 11). It also called the attention to the strange difference in lenght and width of spines. This was noted in nearly all gatherings that specimens of lesser width had long, a quite straight and sharply pointed spines. The two short processes were also ot so heavy built, and much more slender. This was noted as well in plankton taken in the harbour of Quequen and in coastal gathering from Necochea. At present I can not explain what might be the cause of these lightly built specimens. The other broad specimens or even of the same width were much more heavily built, processes as well as spines, the latter bent as known in normal specimens.

Marine, coastal and oceanic.
Locatlity 385, 386, 387, 388, 389, 417S, 419, 420A, 421, 423.
Known as far south as Puerto Deseado (47º40'S - 67º40'W); Uruguay and Brazil as far north as 7º01'S - 37º47'W.

12 **Biddulphia mobiliensis** Bailey. 1845
Americ. Journ. Sc., Vol. 48, p. 336, pl. 4, f. 24

1928 Frenguelli, p. 514
1937 Hendey, p. 276

Neritic and oceanic species in scarce numbers together with Bidd. chinensis. Never in large amounts. Warm water species.
Locality 420RR-422F. — Coast of Uruguay and Brazil.

13 **Chaetoceros affinis** Lauder. 1864
Trans. Micr. Soc. N. S., Vol. XII, p. 68

1939 Frenguelli, p. 223
1949 Müller Melchers, p. 162.

Locality 387. — Uruguay and Brazil. worm water.

14 **Chaetoceros atlanticus** Cleve. 1873 Plate III fig. 14
Kgl. Sv. Vet. Akad. Hdlg. Bih., Vol. 1, Nº 13, p. 11, pl. 2, f. 8

1915 Mangin, p. 28
1937 Hendey, p. 290
1943 Frenguelli, p. 456
1954 Manguin, p. 15

Locality 386.

Oceanic species. South Georgia and South Africa, Hendey.

15 **Chaetoceros coarctatum** Lauder. 1864
Trans. Micr. Soc., Vol. XII, p. 79, pl. 8, f. 8

1907 Karsten Valdivia, p. 120, pl. XVI, f. 6
1937 Hendey, p. 293, pl. VII, f. 7-8.
1949 Müller Melchers, p. 164, f. 6

I did not find this species personally in the gatherings at hand. It was comunicated to me by Prof. E. Balech who found Ch. coarctatum at 36º22' 05"S — 53º04'W that is to say in the outside —oceanic— branch of the Brazil current. The specimens were invaded by Vorticella oceanica Zach.. On the uruguayan coast, specially at Punta del Este I have found repeatedly Ch. coarctatum during the winter months May, July, August. The water was always of high salinity. It has been found in January at Atlántida together with Rhizosolenia imbricata v. Shrubsolei, also a warm, or temperate species. Known from the Brazil coast and in large quantities from around Cuba, Müller Melchers.

16 **Chaotoceros oriophilus** Castracane. 1886 Plate III 15
Challenger, p. 85

1905 Karsten, p. 118, pl. 15, f. 8
1915 Mangin, p. 34, f. 13-14
1937 Hendey, p. 295, pl. XIII, f. 7

1943 Frenguelli, p. 248, pl. IV, f. 5-8
1954 Manguin, p. 16

Tipical antarctic species sometimes confounded with Ch. convolutus. The drawing by Frenguelli gives a good idea of this species. The seta start from the sides of the valves and not in a curve on top as in Ch. peruvianus. The seta are large and long, provided with spines. In the gatherings studied few specimens were found. In this case we have an indicator species brought from the south antarctic to 37°35'S 56°33'W (Nr 387) by the cold Malvinas current.
Locality 386-387.
Diameter 0.031 mm.; awns 0.004 mm.

17 **Chaetoceros curvisetus** Cleve. 1889
Vid. Udb. Kanonbaad. H. Togt., p. 55

1928 Frenguelli, p. 546
1949 Müller Melchers, p. 162
Locality 387, 388, 389, 417S, 421, 423.
Neritic species planktonic. Argentine, uruguayan and brazilian coast.

18 **Chaetoceros decipiens** Cleve. 1873
Sv. Vet. Ak. Hdl. Bih., Vol. 1, p. 11

1928 Frenguelli, p. 553
1937 Hendey, p. 298
1949 Müller Melchers, p. 162

Locality 385, 387, 422.

Oceanic species of temperate and cold temperate water. Found at times in winter plankton. Argentine, uruguayan and brazilian coast, MM. Perú current (Hendey).

19 **Chaetoceros didymus** Ehrenberg. 1846
Ber. Berlin, Akad., p. 75

1928 Frenguelli, p. 547
1937 Hendey, p. 301
1949 Müller Melchers, p. 162

Locality 417.

Neritic species of temperate and warm water. In this case found on the fringe of the Brazil current meeting with the Malvinas current.
Perú Current and round South Africa (Hendey).

20 **Chaetoceros lorenzianus** Grunow. 1863
Verh. Zool. Bot. Ges. Wien., Vol. 13, p. 157

1937 Hendey, p. 299
1939 Frenguelli, p. 222
1949 Müller Melchers, p. 162

Locality 385, 386F, 387S.

Species of the coast of the Prov. of Buenos Aires. Tipical in winter plankton Uruguay, less in summer. Brazil (Müller Melchers). Neritic of temperate water. Perú current (Hendey).

21 **Chaetoceros peruvianus** Brightwell. 1858 Plate III fig. 16
Quart. Journ. Micr. Soc., Vol. 4, p. 107, pl. 7, f. 16-18

1937 Hendey, p. 296
1949 Müller Melchers, p. 168, f. 11-12

Locality 386RR - 387RR.

Diameter 0.0215 mm.

Oceanic. Temperate and tropical waters (Hendey). Very scarce in the South Atlantic. Not known on the argentine coast. Sometimes in small quantities at Atlántida, Uruguay. In heavy specimens at Ubatuba, Brazil coast (Müller Melchers).

22 **Chaetoceros similis** Cleve. 1896
Kgl. Sv. Vet. Akad. Hdl. Bih., Vol. 22, p. 3, Nº 5, p. 30, pl. 1, f. 1

1905 Gran Nord. Plankton, p. 87
1943 Cupp West Coast, p. 135

Neritic. Boreal species (Cupp). Neritic North europ. atlantic coast.

Coast of Scandinavia. Iceland (Gran)

Locality 422. Only a fragment of 3 cells was found, but the foramina between valves are characteristic for this species.

Diameter 0.03 mm..

Found later at Salinopolis (Brazil) 0º10'S (Müller Melchers).

23 **Cocconeis imperatrix** A. Schmidt. 1893
Schmidt Atlas, pl. 189, f. 10-15

1921 Peragallo. Pourquoi pas, pág. 52
1937 Hendey, South Seas, p. 342, pl. 10, f. 8-9. Type locality Magallanes Straits. Littoral in S. Atlantic Bransfield

Strait. East Cumberland Bay. South Georgia.
1943 Frenguelli Oreadas del Sur, p. 229, pl. 1, f. 1-2.

Locality 421. One specimen only was found.

Antaretic adyacent seas. Magallanes Straits. Islas argentinas. Peterman Peragallo. Kergulen Heiden und Kolbe.

24 **Corethron criophilum** Castracane. 1886 Plate IV. fig. 20
Challenger, p. 85, pl. 21, f. 14

1905 Karsten Valdivia, p. 101, pl. 12, f. 1-10
1937 Hendey "Hystrix Phase"; p. 328, pl. VII, f. 1-10
1943 Frenguelli Oreadas, p. 259

Tipical species of the antaretic seas found in fragments in 386 and 417 in the middle of the Malvinas cold current. Some of the fragments show the "Hystrix Phase". Resting spores were found in the same material. The species was accompanied by Fragilariopsis antaretica and Rhizosolenia curvata.

Locality 386S-417, resting spores.

25 **Coscinodiscus asteromphalus** Ehrenberg. 1844
Ber. Berl. Akad., p. 77

1890 Rattray, p. 549
1928 Frenguelli, p. 534
1937 Hendey, p. 243

The types of this species are difficult to determinate. If we take the areolation for instance this is not constant at all in the same type. Electronic photographs show secondary structure (Müller Melchers). The large central rosette is found mith and mith out structureless area. We have found very scarce numbers in the material from "Madryn" gatherings. Neritic species of high salinity only found in the Pacific. Hendey!

Locality 387R, 416R, 421R, 422R.
Diameter 0.2365 mm., Areola ½ radius 4,3 near border 5 in 0.01 mm. Border droping steeply.

ver pabellanica Grunow. 1884 Plate I fig. 3
Diat. v. Franz Josef Land Denk. Wien. Akad. p. 79