

MARINE, MAINLY BENTHIC, DIATOMS OF THE WEST COAST OF THE ISLAND LA PALMA (CANARY ISLANDS)

by

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RESUMEN

Se presenta una lista de 183 taxones de diatomeas marinas de la isla de La Palma, obtenida como resultado del estudio de siete muestras de sedimentos y fragmentos de algas depositadas en cubetas en las que fueron separadas las muestras de algas marinas. La mayoría de las diatomeas de estas muestras son epífitas de algas bentónicas. También fueron recolectadas algunas especies planctónicas. Se realizan comentarios de algunos de los taxones más interesantes así como fotografías de frústulas.

ABSTRACT

A list of 183 different taxa of marine diatoms from La Palma is the result of a study on seven samples of sediment and algal fragments left over in reservoirs in which samples of marine algae had been sorted out. Most diatoms in these samples are epiphytes of seaweeds. Some planctonic specimens may have been caught as well. Annotations on several of the most interesting taxa as well as photographs of cleaned frustules of these organisms have been added.

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INTRODUCTION

From 1976, the biogeographically oriented marine research, initiated by the Rijksmuseum van Natuurlijke Historie (National Museum of Natural History), Leiden, has been directed mainly on the south-eastern part of the North Atlantic Ocean ("Macaronesia") (Fig. 1). The Rijksherbarium (National Herbarium), Leiden, and the Geologisch Instituut (Geological Institute), Groningen, participate in this long-term programme, which is called the CANCAP-project. Samples from which diatoms could be isolated have been collected by the second author during the CANCAP-IV expedition. For more details about the CANCAP-project you are referred to papers by WEISSCHER, PRUD'HOMME VAN REINE and DUINEVELD (in press) and by WEISSCHER (1982). Comparable samples have been collected by the second author during CANCAP-V (1981 - Azores) and CANCAP-VI (1982 - Cape Verde Islands). The authors are not aware of any publication dealing exclusively with marine benthic diatoms of islands of Macaronesia.

MATERIALS AND METHODS

Marine algae were collected in the period of June 29th and July 6th, 1980 along the W. coast of La Palma. Most collections have been made by W.F. Prud'homme van Reine in the littoral zone or in shallow water by free diving or by SCUBA-diving. One collection (3810) is from deeper water where sunken buoys of old disused fish-traps have been scraped off to obtain filamentous algae. Collected marine algae were kept in refrigerated plastic reservoirs (temperature c. + 4° C). After a day or occasionally two days most seaweeds in these samples could be provisionally identified and separately preserved. Sediment and algal frag-

ments in the reservoirs were concentrated by repeatedly decanting the seawater and subsequent allowing of the sediment and algal debris to settle. Finally the deposit is preserved in ethanol 70%.

Samples have been taken from the following stations (Fig. 2).

Sample 3563. Station 4.D10. S.W. coast of La Palma, Punta del Hombre, 28°30'N, 17°53'W, free diving, 1-4 m, 29-5-1980.

Sample 3641. Station 4.D11. S.W. coast of La Palma, Puerto de Naos, 28°35'N, 17°55'W, Scuba diving, 7-10 m, 31-5-1980.

Sample 3660. Same station, midlittoral, 31-5-1980.

Sample 3696. Station 4.D12. W. coast of La Palma, Punta del Moro, 28°38'N, 17°56'W, Scuba diving, 12-14 m, 2-6-1980.

Sample 3778. Station 4.D13. W. coast of La Palma, Puerto de Naos, 28°36'N, 17°55'W, lower littoral, 3-6-1980.

Sample 3810. Station 4.152. S.W. of La Palma, 28°38'N, 17°59'W, depth 120-180 m, old traps with lines and buoys. Depth of buoys unknown, 3-6-1980.

Sample 3882. Station 4.D14. W. coast of La Palma, Tijarafe, 28°42'N, 17°58'W, free diving, 1-4 m, 4-6-1980.

Preparation of slides.

Removal of the grosser elements of animal and vegetable detritus by straining through a small-mesh sieve is normally followed by treatment with H_2O_2 and $KMnO_4$ (see Van der Werff & Huls). If complete removal of clay fragments is considered necessary treatment with boiling H_2SO_4 and oxidising with KNO_3 is resorted to. Subsequently the cleaned frustules are washed carefully with distilled water in a centrifuge and after that they are embedded in Naphrax (Refr. index 1.62).

For microscopic examination the senior author used a Nikon Labophot microscope, equipped with an Olympus OM-1 camera.

RESULTS

Results are summarized in table I, containing references to literature, the names of taxa, and frequency in the different samples. A code is used for relative quantities in each sample: cc = abundant, c = common, + = frequent, r = rare and rr = very rare. The collecting and cleaning method employed made differentiation of the assembled samples in strictly planctonic and strictly benthic diatoms impossible.

ANNOTATIONS

Annotations are only given for specimens not commonly recorded in literature. In some cases nomenclature is discussed. After each name are given the number of the figure in the present paper, a reference to another published figure, an annotation of its frequency in the samples, and usually length (l.) and breadth (b.) of the figured valve.

Achnanthes fimbriata (Grunow) Ross — fig. 3; FOGED 1975, p. 8, pl. 11, f. 7. (as *A. manifera* Brun).

Rare: only in samples 3696 and 3882.

l: 33 μ m; b: 11 μ m; c. 12 striae in 10 μ m.

Actinocyclus subtilis (Gregory) Ralfs — fig. 4; HUSTEDT 1927-1966, part I, p. 535, f. 304.

Quite frequent in most samples.

Diameter: 60 μ m.

Amphora binodis Gregory — fig. 5; PERAGALLO 1897-1908, p. 227, pl. 50, f. 34, 35.

Rare, common only in sample 3660.

Table 1.

lit. ref.	CANCAP - IV	3563	3641	3660	3778	3696	3810	3882
H 2	Achnanthes brevipes Agardh							
H 2	A. brevipes Agardh var. angustata (Greville) Cleve		rr	r	+	rr	+	+
H 2	A. danica (Flögel) Grunow					rr	rr	rr
F	A. fimbriata (Grunow) Ross		rr	rr	c	r	cc	
H 2	A. longipes Agardh							
H 1	Actinocyclus ehrenbergii Ralfs			c	+	r	rr	r
H 1	A. ehrenbergii Ralfs var. crassa (W. Smith) Hustedt		rr	rr	r	rr	r	r
H 1	A. ehrenbergii Ralfs var. Ralfsii (W. Smith) Hustedt		rr	r	r			
H 1	A. subtilis (Gregory) Ralfs		r	c	+	r	+	c
Cl+P	Amphiprora gigantea Grunow var. sulcata (O. 'Meara) Cleve		rr					
P	Amphora angusta Gregory		r		rr			r
P	A. bacillaris Gregory		rr					
P	A. binodis Gregory		r	+	r	rr	rr	
P	A. coffeaeformis (Agardh) Kützinger		r	r	+	r		r
P	A. crassa Gregory		rr					
N	A. crassa Gregory var. campechiana Grunow		rr			rr		r
P	A. decussata Grunow		r					
P	A. dubia Gregory		rr					
B	A. exigua Gregory		r/+	+	rr	rr		
He	A. hyalina Kützinger		rr			rr		
P	A. limbata Cleve					rr		
P	A. obtusa Gregory							
P	A. obtusa Gregory var. oceanica (Castracane) Cleve		rr					
He	A. ocellata Donkin		rr					
P	A. proteus Gregory		rr	r				
P	A. terroris Ehrenberg		+/c	+	rr	r		r
P	A. turgida Gregory		r	r	r	+	r	
H 2	Asterionella notata (Grunow) Grunow						r	
P	Auricula intermedia (Lewis) Cleve		rr					
He	Bacillaria paxillifer (O.F. Müller) Hendey		r		r			

lit. ref.	CANCAP - IV	3563	3641	3660	3778	3696	3810	3882
H 1	Bidduphia aurita (Lyngbye) de Brébisson et Godey		rr		r	r	r	
H 1	B. pulchella Gray		r			rr		
H 1	B. titiana (Grunow) Grunow							
He	Caloneis liber (W. Smith) Cleve		rr	rr	rr		rr	c
He	C. linearis (Grunow) Boyer		rr					
H 4	C. schumanniana (Grunow) Cleve var. biconstricta (Grunow) Reichelt		rr					
He	Campyloneis fastuosus Ehrenberg						r	
P	C. innominatus Ross et Abdin		r			rr		
Cle	C. ralfsii W. Smith		r					r
He	Campyloneis grevillei (W. Smith) Grunow		rr		rr			
H 2	Climacospheia moniligera Ehrenberg	cc	+	r	+	+	r	c
H 2	Cocconeis britannica Naegeli		r				rr	
H 2	C. costata Gregory							
H 2	C. dirupta Gregory var. flexella (Janisch et Rabenhorst) Grunow			r				
H 2	C. heteroidea Hantsch			+	r			
H 2	C. molesta Kützing	rr	c	r	r	c	r	+
H 2	C. molesta Kützing var. crucifera Grunow	r	cc	r	+	cc	+	c
H 2	C. pellucida Grunow ex. Hantsch		+	r	+			r
H 5	C. peltoides Husteds		+		+		rr	
H 2	C. pseudo-marginata Gregory		rr	r			rr	
H 2	C. scutellum Ehrenberg	+	+	cc	c	c	+	c
H 2	C. scutellum Ehrenberg var. stauroneiformis Rabenhorst		r	r	r			r
H 2	Coscinodiscus crenulatus Grunow						rr	
H 1	C. radiatus Ehrenberg						rr	
Le	C. subtilis Ehrenberg						rr	
H 2	Diploneis bombus Ehrenberg		rr					
H 2	D. chersonensis (Grunow) Cleve		r	rr				
H 2	D. coffaeiformis (A. Schmidt) Cleve		rr	rr				
H 2	D. crabo (Ehrenberg) Ehrenberg		r	rr			rr	r

lit. ref.	CANCAP - IV	3563	3641	3660	3778	3696	3810	3882
H 2	Diploneis fusca (Gregory) Cleve		rr					
H 2	D. litoralis (Donkin) Cleve		rr			r	r	
H 2	D. papula (A. Schmidt) Cleve			rr				
H 2	D. smithii (de Brebisson) Cleve		r		rr			
H 1	Endictya oceanica Ehrenberg		rr					
H 4	Epithemia sores Kützing							
H 2	Grammatophora gibberula Kützing		rr			rr	r	
H 1	G. angulosa Ehrenberg							
H 2	G. oceanica (Ehrenberg) Grunow		rr					
P	G. oceanica (Ehrenberg) Grunow var. adriatica (Grunow) H. et M. Peragallo		rr		rr			
H 2	G. oceanica (Ehrenberg) Grunow var. macilenta (W. Smith) Grunow				rr	rr		
H 2	G. serpentina (Ralfs) Ehrenberg				rr	rr		
H 2	G. undulata Ehrenberg		r		rr	r	+	c
Heu	G. undulata Ehrenberg cf. var. gallopagensis Grunow		rr		r		rr	
H 1	Hyalodiscus subtilis Bailey	rr		r				
P	H. ambiguus (Grunow) Tempère et Peragallo		rr					
H 1	Isthmia enervis Ehrenberg		rr			rr		rr
H 2	Licmophora abbreviata Agardh						r	
H 2	L. ehrenbergii (Kützing) Grunow		rr					
H 2	L. flabellata (Carm.) Agardh		rr			rr		
H 2	L. gracilis (Ehrenberg) Grunow		rr		c		c	c
H 2	L. gracilis (Ehrenberg) Grunow var. anglica (Kützing) H. et M. Peragallo		+	+				
H 2	L. grandis (Kützing) Grunow			c	r	c	c	+
H 2	L. juergensii Agardh		r			r		
H 2	L. paradoxa (Lyngbye) Agardh		rr					
H 2	Licmospheia grunowii Mereschkowsky		rr					
H 2	Mastogloia apiculata W. Smith		r					
H 2	M. asperuloides Hustedt		rr			r	rr	c

lit. ref.	CANCAP - IV	3563	3641	3660	3778	3696	3810	3882
He	Navicula ramosissima (Agardh) Cleve	rr	rr			r		+
H 4	N. rostellata Kützinger		rr					
H 3	N. versicolor Grunow		rr			rr		
F	N. zostereti Grunow							
He	N. angularis W. Smith					r		
H 4	N. bilobata W. Smith					rr		
H 4	N. closterium (Ehrenberg) W. Smith		rr					
H 4	N. coarctata Grunow		+			r	r	rr
Ch	N. distantoides Hustedt		r		r			+
F	N. fluminensis Grunow		rr					
P	N. insignis Gregory		rr					
P	N. lorenziana Grunow var. densestriata (H. et M.							
P	N. Peragallo) Hustedt		rr				rr	
P	N. marginulata Grunow var. didyma Grunow					rr		
A.S.A.	N. mediterranea Hustedt		r					
Cl	N. panduriformis Gregory		r			r	r	
Cl	N. sicula (Castracane) Hustedt var. migrans (Cleve)							
	Hassle							
H 4	N. sigma (Kützinger) W. Smith		rr				r	
LB	N. valdestriata Hustedt & Aleem						rr	
Ch	N. vidovichii Grunow		rr					
He	Okenia inflexa (de Brébisson in Kützinger) Eulenstein			r/+	rr			
H 2	Opephora gemmata (Grunow) Hustedt		rr		r			
H 2	O. marina (Gregory) Petit				rr			
H 4	Pinnularia borealis Ehrenberg		rr					
P	P. clavculus Gregory		rr					
P	Pleurosigma decorum W. Smith		rr					rr
Cle	P. formosum W. Smith		rr					rr
P	P. nicobaricum (Grunow) Grunow		rr	r	rr			
P	P. rigidum W. Smith			rr				
He	P. strigosum W. Smith		rr	rr				rr

lit. ref.	CANCAP - IV	3563	3641	3660	3778	3696	3810	3882
H 2	Podocystis adriatica Kützing		C		Yr	C	Y	Y
H 1	Podosira montagnei Kützing		Y	+	+	Y	Y	C
H 1	Pyxidicula mediterranea Grunow		Y			Y	Yr	Y
H 2	Rhabdonema adriaticum Kützing		Y		Y	Yr	Y	
P	Rhoicosigma compactum (Greville) Peragallo					Yr		
P	R. oceanicum Peragallo			Yr				
H 2	Rhoicosphenia curvata (Kützing) Grunow		Yr					
H 4	Rhopalodia gibberula (Ehrenberg) O. Müller		Yr					
H 1	Stephanopyxis turris (Greville et Arnott) Ralfs						Yr	
H 2	Striatella delicatula (Kützing) Grunow				Yr			
H 2	S. unipunctata (Lyngbye) Agardh		Y	Y		Y	CC	
P	Surirella armoricana Peragallo et Peragallo		Y			Yr	Yr	
He	S. fastuosa Ehrenberg		Y			Yr	Yr	
P	S. hybrida Grunow		Yr			Yr		
H 2	Synedra crystallina (Agardh) Kützing		Y					
H 2	S. formosa Hantsch		+	+	Y	Y		Y
H 2	S. fulgens (Greville) W. Smith var. mediterranea Grunow		Y			Yr	Y	
H 2	S. gaillonii (Bory) Ehrenberg				Y			
H 2	S. hennedyana Grunow		Y	Yr			Yr	
H 2	S. investiens W. Smith		Y			Y	Y	
H 2	S. laevigata Grunow		Y/+			Y	+	+
H 2	S. laevigata Grunow var. hyalina Grunow		+	Y	+		C	+
H 2	S. tabulata (Agardh) Kützing		Y		Yr	Yr	Yr	
H 2	S. undulata Bailey		Y		Yr			
He	Trachyneis aspera (Ehrenberg) Cleve		Y	Y		Y	Y	Y
He	T. aspera (Ehrenberg) Cleve var. elliptica Hendy		Yr					
H 1	Triceratium alternans Bailey							Yr
H 1	T. antedeluvinum (Ehrenberg) Grunow		Y	Yr	Y	Y		C
H 1	T. balearicum Cleve et Grunow				Yr			
H 1	T. formosum Brightwell		Yr			Yr	Y	

lit. ref.	CANCAP - IV	3563	3641	3660	3778	3696	3810	3882
H 1	Triceratium formosum Brightwell fo. quadrangularis (Greville) Hustedt							
H 1	T. pentacrinus (Ehrenberg) Wallich					rr		rr
H 1	T. pentacrinus (Ehrenberg) Wallich fo. quadrata Hustedt		rr	rr	rr			
He	Tropidoneis lepidoptera (Gregory) Cleve		r					

- l: 20 μm ; b: 9 μm .
- Amphora crassa* Gregory var. *campechiana* Grunow — fig. 6; NAVARRO 1982, p. 322, f. 18.
- Rare, only in sample 3641.
- l: 68 μm ; b: 13 μm .
- Amphora obtusa* Gregory — fig. 7; PERAGALLO 1897-1908, p. 216, pl. 48, f. 9.
- Rare. The difference with var. *oceanica* (Castracane) Cleve is rather obscure.
- l: 61 μm ; b: 13 μm .
- Bacillaria paxillifer* (O.F. Müller) Hendey; HENDEY 1964, p. 274, pl. 21, f. 5 (not p. 74 as given in VANLANDINGHAM); VAN LAN-DINGHAM p. 409 gives *B. paradoxa* Gmelin in Linnaeus 1788 as the correct name, while O.F. MÜLLER in 1786 already published the name *Vibrio paxillifer*.
- Campylodiscus ralfsii* W. Smith — fig. 8; CLEVE-EULER 1951-1954, part 3:3, p. 127, f. 1576.
- Diameter c. 32 μm .
- Campyloneis grevillei* (W. Smith) Grunow — fig. 9; HENDY 1964, p. 184, pl. 27, f. 9-11.
- Very rare and found only in samples 3641 and 3778.
- l: 65 μm ; b: 43 μm .
- Coscinodiscus crenulatus* Grunow — fig. 10; HUSTEDT 1927-1966, part I, p. 411, f. 219.
- This remarkable species was only once found in sample 3810.
- Diameter 22 μm .
- Coscinodiscus subtilis* Ehrenberg — fig. 11; LEBOUR 1930, p. 48, f. 25a.
- Very rare and only in sample 3810.
- Diameter 72 μm .

Diploneis coffaeiformis (A. Schmidt) Cleve — fig. 12; HUSTEDT 1927-1966, part II, p. 611, f. 1025.

Rare in sample 3882 and very rare in sample 3641 and 3660.

1: 38 μ m; b: 25 μ m.

Diploneis smithii (de Brébisson) Cleve — figs. 13; HUSTEDT 1927-1966, part II, p. 647, f. 1051.

Rare.

1: 36 μ m; b: 25 μ m.

Grammatophora undulata Ehrenberg cf. var. *gallopagensis* Grunow — fig. 14; VAN HEURCK 1885, pl. 53 bis, f. 20.

It is with great hesitation that we record this variety of *G. undulata*, having no detailed description to rely on. As can be seen from the photograph the median part of the frustule is less constricted than pictured in the drawing by VAN HEURCK. VAN HEURCK indicated this taxon may be a new species. To be more sure about that, however, more frustules than the single one we had must be studied.

1: 45 μ m; b: 4.5-8 μ m.

Mastogloia erythraea Grunow — fig. 15; HUSTEDT 1927-1966, part II, p. 524, f. 959 c.

Commonly only in sample 3882.

1: 31 μ m; b: 11.5 μ m.

Mastogloia pulchella Cleve — fig. 16; HUSTEDT 1927-1966, part II, p. 535, f. 969.

Rare.

1: 43 μ m; b: 16 μ m.

Mastogloia quinquecostata Grunow — fig. 17; HUSTEDT 1927-1977, part II, p. 556, f. 989.

Frequently found in sample 3882.

1: 47 μ m; b: 16.5 μ m.

Mastogloia rostrata (Wallich) Hustedt — fig. 18; HUSTEDT 1927-1966, part II, pl. 572, f. 1007.

Very rare, only found in sample 3641.

HUSTEDT described this diatom as a pelagic species from the Indian Ocean.

l: 70 μ m; b: 11 μ m.

Mastogloia testudinea Voigt — fig. 19; VOIGT 1942, p. 18, f. 26.

Found only in sample 3641.

l: 55 μ m; b: 25 μ m.

Navicula applicita HUSTEDT — fig. 20; HUSTEDT 1927-1966, part III, p. 386; f. 1473.

The rows of punctae running parallel to the outline of the central areas can be quite clearly seen.

In a resembling species, *N. rudiformis*, the rows of punctae are not parallel to the outline. In other respects the two species are rather similar.

l: 39 μ m; b: 26 μ m.

Navicula finnmarchica (Cleve at Grunow) Cleve — fig. 21;

HENDEY 1964, p. 198, pl. 30, f. 5.

Very rare and only found in sample 3641 and 3696.

l: 33 μ m; b: 10.5 μ m.

Navicula hamulifera Grunow — fig. 22; HUSTEDT 1927-1966, part III, p. 312, f. 1430.

The hook-shaped nodules can be clearly seen. HUSTEDT mentioned breadth of 12 μ m; our specimens are somewhat smaller.

Navicula praetexta Ehrenberg — fig. 23; HUSTEDT 1927-1966, part III, p. 411, f. 1488.

Very rare.

l: 52 μm , b: 32 μm .

Navicula versicolor Grunow — fig. 24; HUSTEDT 1927-1966, part III, p. 524, f. 567.

Found only once in sample 3641.

l: 44 μm ; b: 20.5 μm .

Nitzschia fluminensis Grunow — fig. 25; FOGED 1975, p. 46, pl. 29, f. 17.

We are not convinced of the correctness of this identification. The length of the frustules is much smaller than indicated elsewhere, on the other hand the number of striae and keelpunctae corresponds with the number given in other publications.

l: 58 μm ; b: 7 μm ; 6 keelpunctae and 16 striae in 10 μm .

Okedenia inflexa (de Brébisson in Kützing) Eulenstein — fig. 26; HENDEY 1964, p. 270, pl. 37, f. 16, 17.

Contrary to VAN LANDINGHAM, p. 3162, we accept the genus *Okedenia* as separate from *Amphora*. HENDEY 1964, p. 64 gives the correct differentiation: the *Okedenia* raphe lies in the middle of the valve, the *Amphora* raphe, however, close to the ventral margin.

l: 80 μm ; b: 7 μm .

Podocystis adriatica Kützing — fig. 27; HUSTEDT 1927-1966, part II, p. 131, f. 652.

Frequent in most samples.

l: 53 μm .

Surirella hybrida Grunow — fig. 28; PERAGALLO 1897-1908, p. 252, pl. 64, f. 1.

Very rare and only found in sample 3641 and 3696.

l: 130 μm ; b: 75 μm .

Trachyneis aspera (Ehrenberg) Cleve — fig. 29; HENDEY 1964,
p. 236, pl. 29, f. 13.

Found in most samples.

l: 75 μ m; b: 16 μ m.

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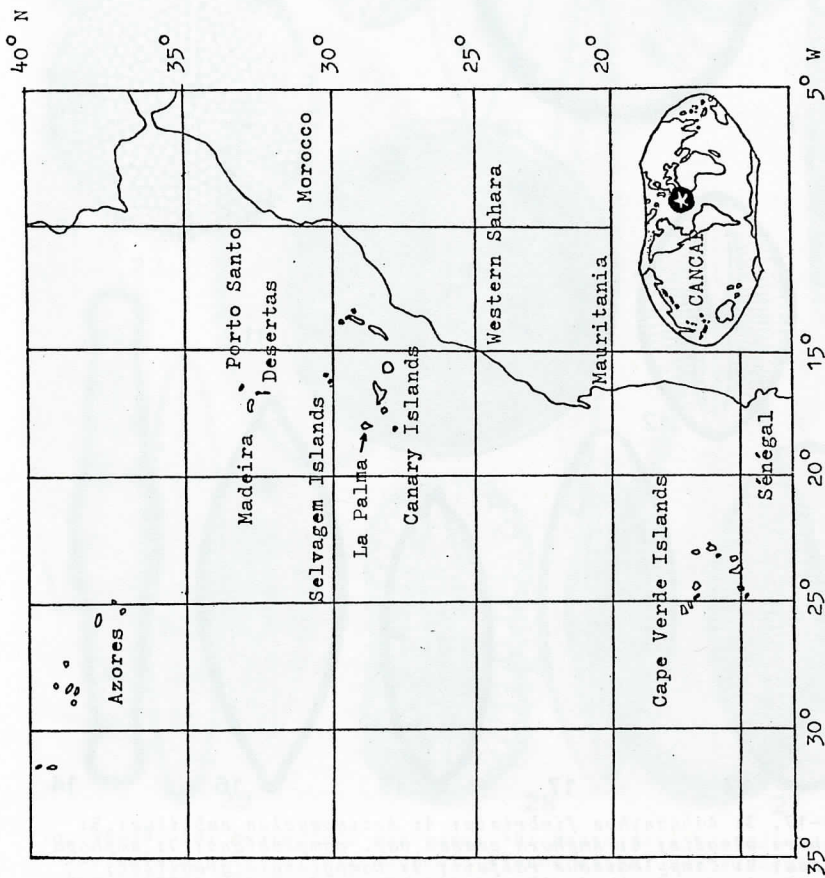


Fig. 1. Map of the area covered by the CANCAP-expeditions

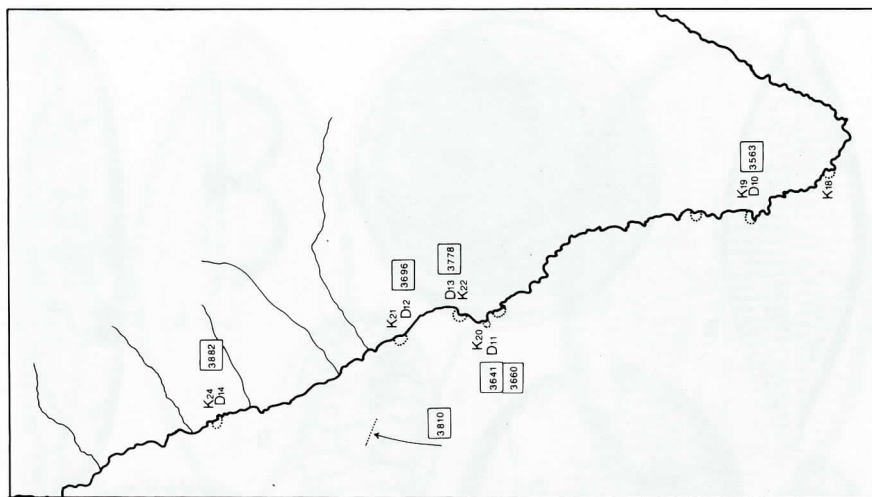


Fig. 2. Map of La Palma with sample numbers

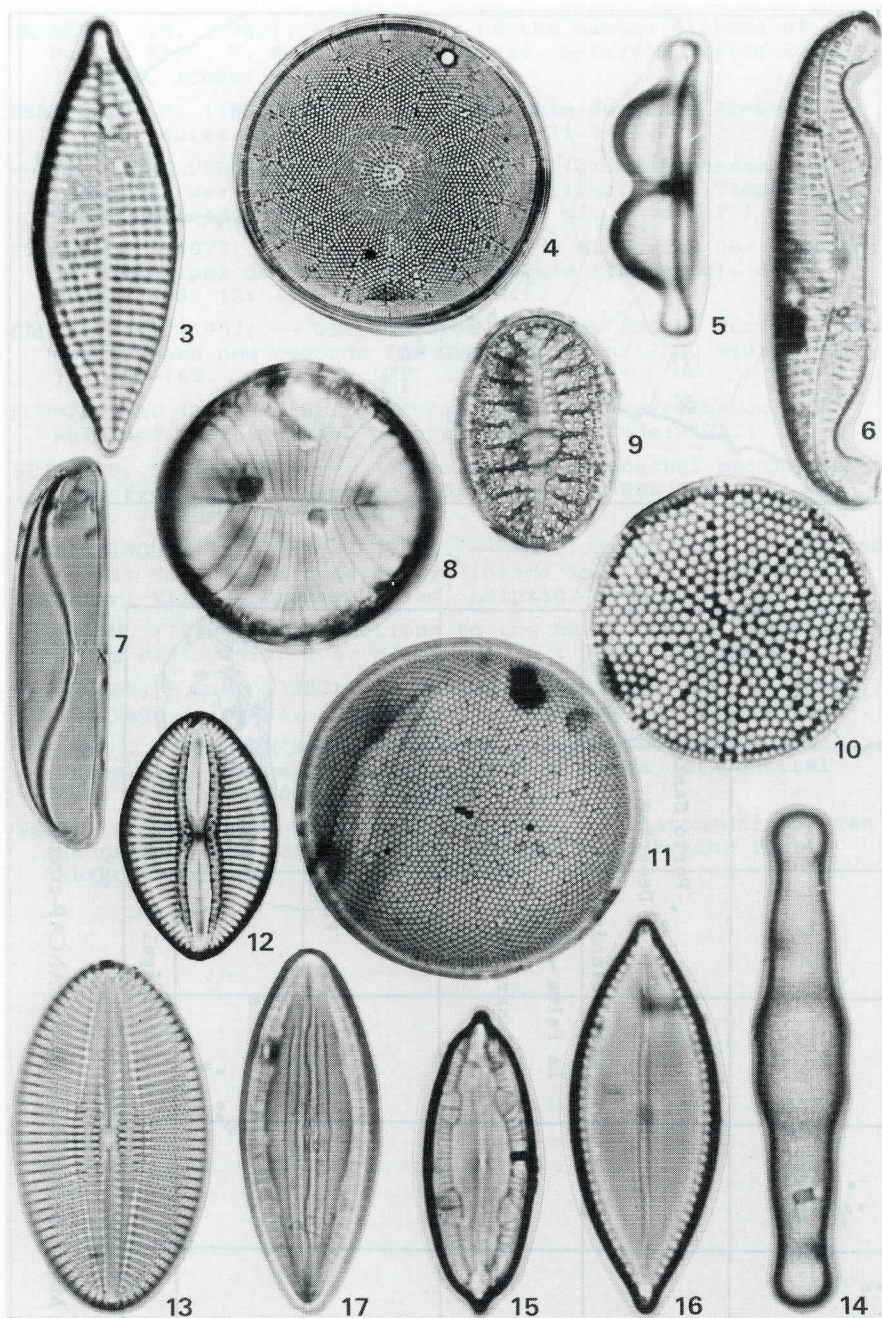


Fig. 3-17. 3: *Achnanthes fimbriata*; 4: *Actinocyclus subtilis*; 5: *Amphora binodis*; 6: *Amphora crassa* var. *campechiana*; 7: *Amphora obtusa*; 8: *Campylodiscus ralfsii*; 9: *Campyloneis grevillei*; 10: *Coscinodiscus crenulatus*; 11: *Coscinodiscus subtilis*; 12: *Diploneis coffaeiformis*; 13: *Diploneis smithii*; 14: *Grammatophora undulata* cf. var. *gallopagensis*; 15: *Mastogloia erythraea*; 16: *Mastogloia pulchella*; 17: *Mastogloia quinquecostata*.

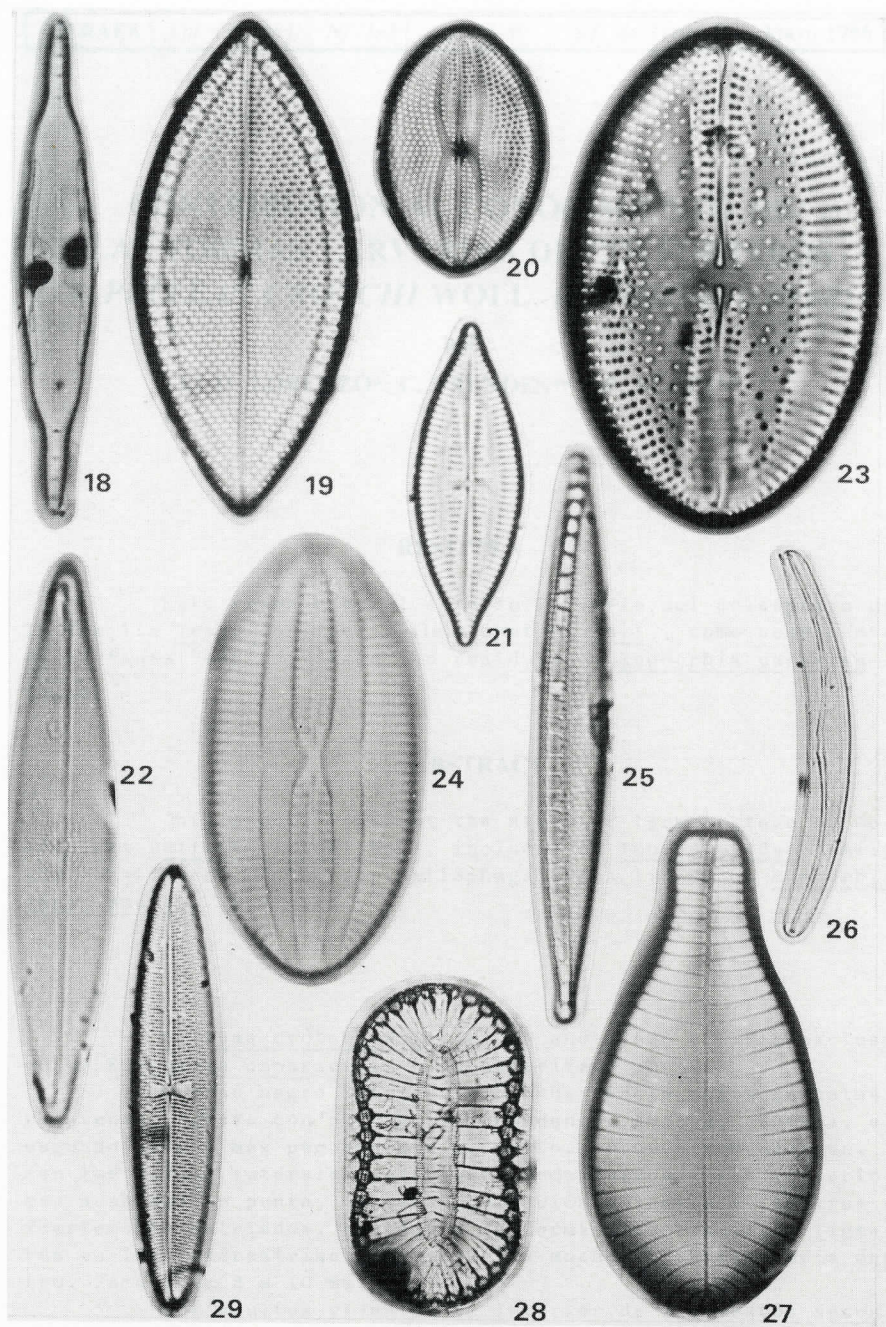


Fig. 18-29. 18: *Mastogloia rostrata*; 19: *Mastogloia testudinea*; 20: *Navicula applicita*; 21: *Navicula finnmarchica*; 22: *Navicula hamulifera*; 23: *Navicula praetexta*; 24: *Navicula versicolor*; 25: *Nitzschia fluminensis*; 26: *Okedenia inflexa*; 27: *Podocystis adriatica*; 28: *Surirella hybrida*; 29: *Trachyneis aspera*.