

SHELF OFF ALAGOAS AND SERGIPE (NORTHEASTERN BRAZIL) 5 STATION LIST AND NOTES ON BENTHIC BIONOMY

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SYNOPSIS

A dredging stations list, with sedimentological and faciological data, together with the correspondent location and facies maps, is given as a result of a survey of a fraction of the northeastern Brazilian continental shelf. The analysis of these samples follow the general scheme adopted for similar researches conducted by the Laboratório de Ciências do Mar.

Reference is made to previous literature about this area. Some items, needing complementary information, are discussed: faciological zonation, muddy bottoms (with special attention to the Rio São Francisco mouth), biogenous substrata, continental slope fauna, as well as relict terrigenous sediment present in some places near the shelf edge.

INTRODUCTION

Several previous publications are devoted to the results of the survey of the continental shelf off Alagoas and Sergipe States, conducted aboard the trawler, Akaroa in 1965: Cavalcanti et al., 1967; Eskinazi-Leça, 1970; Luna, 1970; Mabesoone & Tinoco, 1967; Sudene, 1969. The study of the benthic bionomy of this shelf is already begun in a special paper, (Kempf, 1970a). References to the Akaroa bottom sampling stations are also given in Kempf, 1970b and in press.

The principal objective of the present contribution to the Akaroa results series is the divulgation of the dredging stations list, as a basis for further systematical and ecological researches on the biological material. The list includes also some stations

of other boats which operated in the same area: Canopus (*) and R/V Calypso (Forest, 1966). Few stations of the Navy R/V Almte Saldanha, without references to biological material, are not considered here (see Kempf, in press). As it seems unnecessary to return to the results already published (op. cit.), only some items, needing complementary information or comparison with data from other northern and northeastern Brazilian areas, are discussed. Concerning the São Francisco River mouth, a synthesis is performed between the results of the present survey and those of a consequent shrimp fishing experiment (Barros & Jonsson, 1967; Coutinho, 1970).

PRESENTATION OF THE RESULTS

The data regarding the dredging stations, including succinct sedimentological analysis (granulometry of the main fractions and carbonate content of the total sediment) and facies indications, are presented in tabular form. (Tab. 2). The bottom descriptions primarily given in the fishery report are reconsidered here in terms of the scheme adopted for similar researches conducted by the Laboratório de Ciências do Mar. The criteria thus used for the characterization of the sedimentary facies are summarized in Tab. 1 and in the legend of Tab. 3 whereas the interrelations existing between them are shown on Tab. 2.

The referred publications and a recent note by Mabesoone et al. (in press) may be consulted for further information on the methodology as well as on the benthic bionomy. In respect of the last item, the given population lists can be considered as valid for the entire area studied.

GENERAL REMARKS

Zonation. — The principal types of substrata appear in a clear vertical zonation (in a seaward direction: Littoral quartz sand ± mud, Calcareous algae, Organogenic material), parallel to the general alignment of the shore, as function, at one and the same time, of the proximity of terrigenous influence, light pe-

(*) The results of the cruises, another SUDENE (Superintendência do Desenvolvimento do Nordeste) fishery survey, are not discussed as a whole, but scattered in several publications. These samplings (115 stations, 45-80 m depth) are limited to the lower part of the shelf and in the vicinity of its edge, and cover a wide geographical range, between the States of Ceará and Sergipe, including the oceanic banks off Ceará and Rio Grande do Norte. Consequently, their data are joined to more complete studies covering the entire shelf of given areas KEMPF, 1970a and in press; KEMPF et al. 1970a and 1970b.

netration and hydrodynamism. This evidence is supported by uniform hydrological and physiographical conditions along a straight and open coast. The sedimentary sequence is only interrupted at the São Francisco River, because of a predominant terrigenous influence, and to a lesser degree at the Japaratuba River canyon. The sequence is also partially disturbed in its upper horizon in front of the more important coastal streams.

Mud. — Its extent considered in terms of the width of the shelf, the São Francisco area appears as the largest muddy bottom of northeastern Brazil. Thus, its population is richer and more diversified than that of the coastal muddy patches, so that several animals have to be added to the published faunal list of the later: Polychaeta of the genera *Diopatra*, *Telepsavus*, *Owenia* and *Sternaspis*, and the Mollusca *Natica cayenensis* Ré-cluz, *Pitar aresta* Dall & Simpson, *P. palmeri* Fischer & Testud, *Tellina trinitatis* Tomlin and *Mulinia kempfi* Cauquoin. Even so, the variety is by far smaller than it is on the vast amazonian muddy bottoms. In the case of the Mollusca for instance, besides the several species previously listed, the family Nuculidae, so common in that region, is completely lacking off the São Francisco, with the exception of the widely distributed *Nuculana acuta* (Conrad) (*Nucula* spp., *Nuculana concentrica* (Say), *Yoldia* spp. and *Y. perprotracta* Dall (Kempf & Matthews, 1968) could thus be included to the faunal characteristics of the northwestern Brazil).

Even apart from the São Francisco and Japaratuba sectors, the percentage of terrigenous mud present over the whole area, including certain areas of the calcareous algae bottom, is more elevated that which is observed in the detailed investigation of the vicinity of Recife (on Figs. 2 and 3, only occurrences $\geq 20\%$ are charted; for complementary details see station list). This fact is easily explained by a very reduced continental influence in the latter case.

Biogenous material. — Substrata composed of biogenous fragments cover a greater part of the studied area: the (1) calcareous algae and (2) organogenic material facies and (3) the local reef and biodetritic sub-facies of the littoral sandy belt.

(1) The calcareous algal bottom is the most typical and, by its extent, characterizes the tropical Brazilian shelf. Contrary to other biogenous deposits built up by transported or slowly accumulated fragments, it represents an "active" bottom with its uppermost layer alive and constructive. Notably *Halimeda* articles, which normally contribute a certain amount to this

substratum and are able to constitute a particular subfacies, show a high concentration in the northern part of the area studied.

Closer observation of its biological components allows the subdivision of the calcareous algal bottom into two different horizons, directly related to the present light penetration conditions prevailing over the shelf: an upper horizon (or infra-littoral zone of the bionomists) and a lower one (or circa-littoral one). The latter often presents a certain amount of yellowish algal sand and gravel, as well as Melobesiae with impoverished crust-forming capacity, and may be interpreted as partly relict.

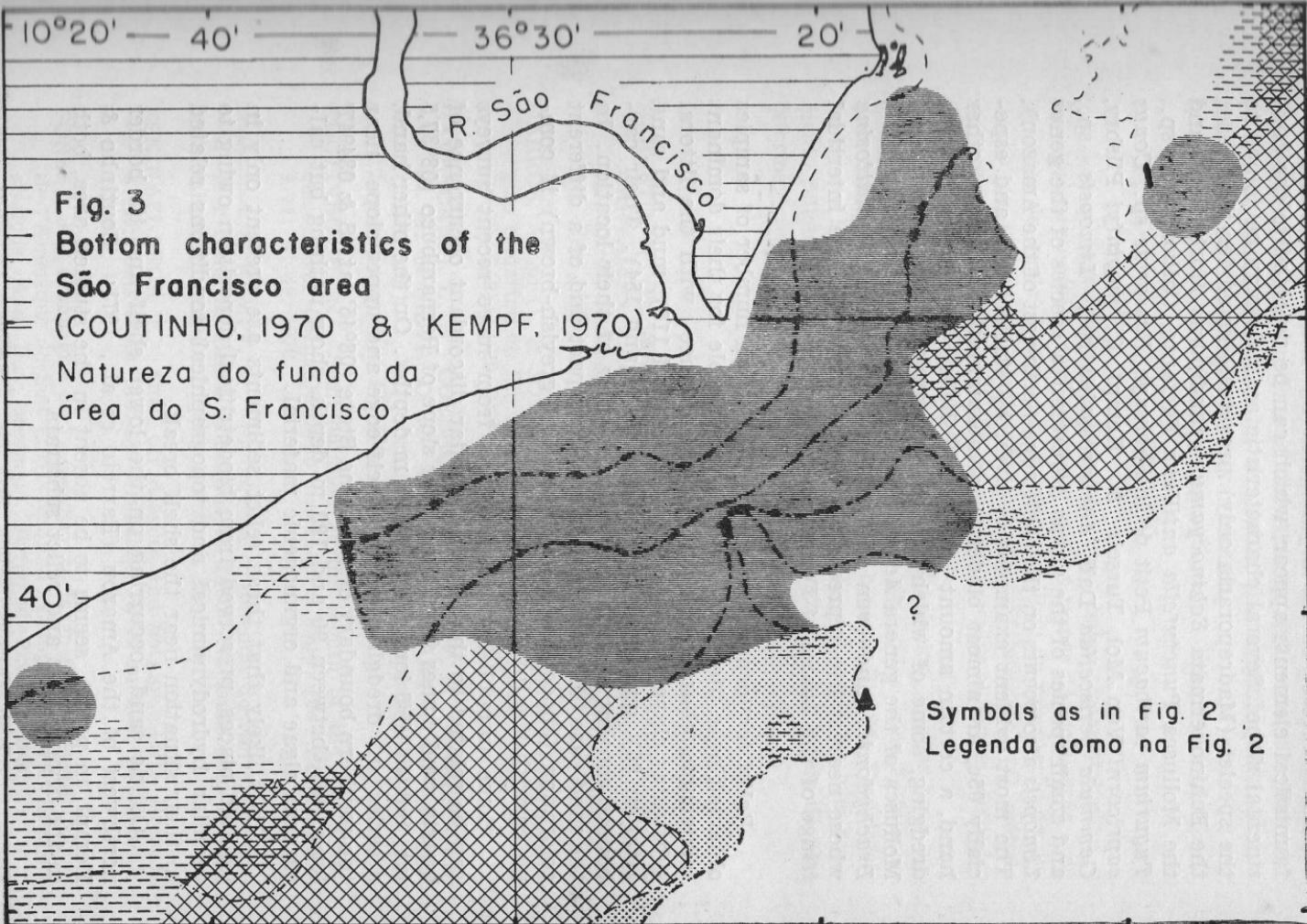
(2) The organogenic material facies is also well represented, but covers a small area because of its location. The conjunction of a shallow shelf break and an elevated light penetration favours algal life and reduces the shelf-edge bidetritic bottom to a narrow belt along the upper slope. Only the unusual conditions at the São Francisco allow it to cover a somewhat greater surface and to reach a shallower depth, in direct connection with the terrigenous facies.

The composition of this substratum suggests a low accumulation rate and a partial relict origin, more pronounced than in the former case: detritus of prevailing animal origin, with contribution of a certain amount of planktonic material and mud, and, in many cases, addition of Melobesiae fragments which may be provenient from an older calcareous algal level.

(3) Bioretitus of varied composition are normally associated to the littoral quartz sand. The simplest and most frequent case is demonstrated by a sand very rich in Melobesiae, dead and fragmented as well as alive, present in a continuous belt along the inner margin of the calcareous algal substratum and considered as a transition. This transition is easily differentiated between the littoral quartz sand and the calcareous algal bottoms by the relative proportions of quartz and carbonate present in the sediment.

The reef sand, a part of the nearshore reefs, is found only at one station (98, near the reef of Peba). As coralline and algal constructions are present along a good portion of the coast of Alagoas, this substratum is certainly more frequent, although not reached by the present investigations.

A third case, of restricted importance, comparable with hydrodynamic accumulation of "shell" sand, is shown by a bioretitic sand of exclusive animal origin: molluscs, bryozans, foraminifers... (stations 77 and 142 and, to a lesser degree, the mud-covered st. 76).



Continental slope. — In certain deep located stations, provisionally referred to the organogenic material facies, some new faunistic elements appear, which can be reported to the continental slope. Several characteristic animals may be joined to the species (Madreporaria only) previously listed for that case: the Echinodermata *Echinocyamus grandiporus* Mortensen and the Mollusca *Puncturella antillana* Farfante, *Calliostoma* sp., *Tugurium caribaeum* Petit de la Saussaye, *Nassarius* sp., *Conus capricorni* Van Mol, Tursch & Kempf, *C. mcgintyi* Pilsbry, *Gemmula periscelida* Dall, *Ancistrosyrinx* sp., *Limopsis* sp., and small species of the genus *Amusium* (a species of the genus *Limopsis* also occurs on the shelf edge northwest of the Amazon). The most evident examples is given by stations 05b and especially 05c, an almost biotritritical accumulation. On the other hand, a certain amount of dead shells, brought up by this dredging, some of which are well preserved, belong to littoral Mollusca of the genera *Acmaea*, *Fissurella*, *Hemitoma*, *Littorina*, *Brachydontes*, and even the genera *Nerita* and *Nodilittorina* whose nearest live representatives are located in the intertidal fringe of the Island of Fernando de Noronha.

Relict terrigenous sediments. — A small number of samples obtained near the shelf edge are remarkable for their dominant terrigenous characteristics, in discordance with the littoral substrata: clayey mud (stations 80, 81 and 110), mud and sand (station 86), quartz sand (stations 65, 94 and 154). Their carbonate content is abnormally low in view of their location. In the mud case, the sediment is more compact and of a different coloration (chocolate-brown instead of greyish-brown) if compared with the inshore stations.

Some unpublished observations from more recent surveys can be related to this data. A similar discordant occurrence of quartz sand comes from the upper slope of Pernambuco ($08^{\circ}37'5$ lat. S & $034^{\circ}45'0$ long. W, 240-305 m depth). On the other hand, a series of dredgings on the shelf edge and upper slope near the southern boundary of the same State ($08^{\circ}45'$ lat. S & $034^{\circ}47'$ long. W), between 90 and 180 m depth, show nothing but calcareous algae and organogenic material.

It is likely that these relict sediments are present only in isolated places, preserved from biotritritical deposition owing to peculiar hydrodynamical and topographical conditions related to their situation near the shelf break.

Oolitic sand, occurring on the lower shelf and its border northwest of the Amazon (Barreto et al., 1971; Coutinho & Kempf, in press), seems to be absent in the studied area, both in the organogenic and relict substrata.

Acknowledgments. — I am grateful to the geologists. J. M. Mabesoone for his analysis of the Akaroa sediment samples and P. N. Coutinho for making available the original data of his study on the São Francisco River mouth.

RESUMO

A lista de estações de dragagem, com dados sedimentológicos e faciológicos sumários, conjuntamente com os mapas de localização e de natureza de fundo, é apresentada como resultado da prospecção de um trecho da plataforma continental do nordeste brasileiro. O método empregado é o mesmo utilizado para levantamentos similares efetuados pelo Laboratório de Ciências do Mar.

A literatura já existente sobre a área é referida. Alguns itens necessitando de informação complementar são discutidos: zonação faciológica, fundos de lama (especialmente os da boca do Rio São Francisco), substratos biogênicos, fauna do talude continental, como também sedimento relíquia presente em certos pontos próximos à margem da plataforma.

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TABLE 1

BOTTOM CHARACTERISTICS

MABESOONE &
TINOCO, 1967

COUTINHO, 1970

LITTORAL (= TERRIGENOUS)

Mud.....} terrigenous component>60%

Qz Sand.....bi det. variable,<40%} terrigenous component>60%

(reef).....} bi detritic component>60%,
(bi det. mat.)} not from free living calc. algae (local)

Terrigenous
Mud
São Francisco

Terrigenous sand
Bi detritic sand
Silty clay
Very silty clay

CALCAREOUS ALGAE

bi detritic component>60%, predominantly free living calc. algae
constructive substratum
(*Halimeda* variable, s/facies if dominant)

Algal

Algal

ORGANOGENIC MATERIAL (= SHELF EDGE BIODETRITIC)

bi detritic component>60%, varied origin, in great part animal,
calc. algae frag. present or not,
living algae absent,
planktonic contribution

mud present>20%

Organogenic
material

RELICT (terrigenous)

terrigenous component>60%, in discordant position (local)

Mud,(nor con-
nected with
littoral)

TABLE 2

BOTTOM INTERRELATIONS

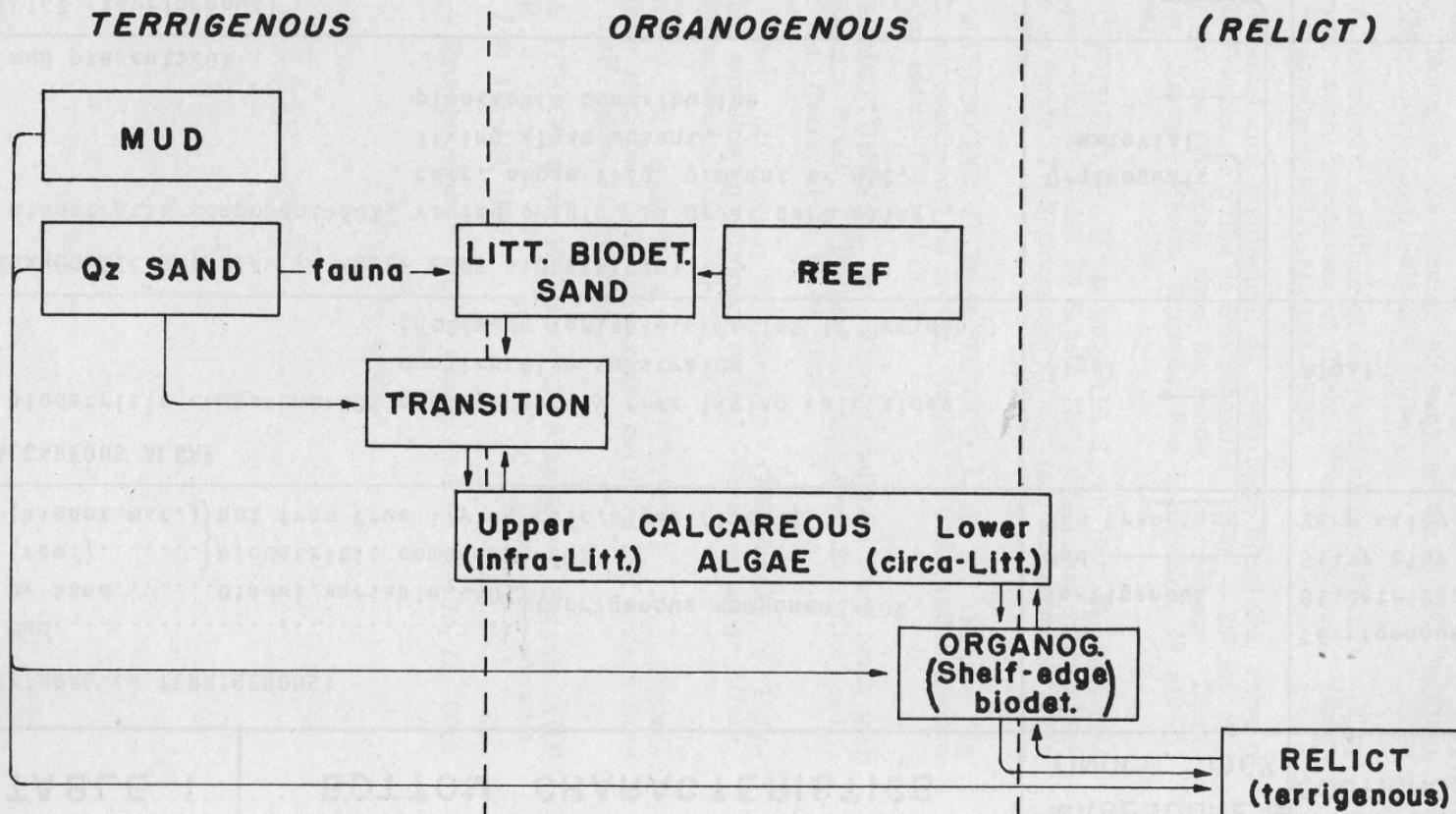


TABLE 3

Position

Depth
(m)% Coarse
2 mm 53 μ % Fine
2 μ %CO₃
(total
sed.)

Bottom char.

Station	Date	Lat. S	Long. W							(total sed.)	Granul.	Facies
						2 mm	53 μ	2 μ				
AKAROA												
01	10.09.65	08°56'2	035°07'7	21	0,0	42,6	18,2	39,2	10	M&S	Lm&s	
02	"	08°56'2	035°02'7	32	48,9	36,4	2,3	12,4	81	(M)G&S	CA	
03	"	08°56'2	034°57'7	36	75,1	24,9	0,0		99	SG	CAh	
04	"	08°56'2	034°52'7	44	92,5		7,5		-	S,G	CA	
05	"	09°01'0	034°51'2	46	-	-	-	-	-	S,G	CA	
05a	"	"	"	54	24,0	67,0	9,0		84	GS	CAh	
05b	"	"	"	560	-	-	-	-	-	-	-	O
05c	"	"	"	370	98,6	1,4	0,0		100	G	O	
06	"	09°01'2	034°56'3	40	-	-	-	-	-	-	G	CA
07	"	09°01'5	035°01'3	36	65,2	23,0	11,8		87	(M)SG	CAh	
08	"	09°01'7	035°06'5	36	52,9	22,3	2,8	22,0	73	SMG	CAh	
09	"	09°02'0	035°11'7	20	18,7	65,4	3,1	12,8	73	(G)(M)S	CA	
10	"	09°06'7	035°13'6	19	36,0		64,0		-	SM	Lm	
11	"	09°06'9	035°08'7	36	60,7	30,8	8,5		94	SG	CAh	
12	09.09.65	09°07'1	035°03'7	36	-	-	-	-	-	(M)S,G	CA	
13	"	09°07'2	034°58'7	42	72,5	17,2	10,3		91	(M)(S)G	CAh	
14	"	09°07'3	034°53'7	72	53,6	28,9	3,6	13,9	83	(M)SG	CA	
15	"	09°11'1	034°57'0	52	72,4	27,6	0,0		99	SG	CA	
16	"	09°11'1	035°02'0	41	67,6	32,4	0,0		99	SG	CA	

17	09.09.65	09°11'1	035°07'0	32	63,2	22,3	4,5	10,0	85	(M)SG	CA
18	"	09°11'1	035°12'0	32	22,6	57,5	3,2	16,7	66	(M)GS	CA
19	"	09°11'1	035°17'0	19	95,5		4,5		66	S,G	CA
20	"	09°15'7	035°19'2	22	21,2	78,8	0,0		61	GS	CA
21	"	09°15'7	035°14'2	35	39,1	35,6	5,9	19,4	71	MG&S	CAh
22	"	09°15'7	035°09'2	31	85,2	14,8	0,0		100	(S)G	CAh
23	"	09°15'7	035°04'2	41	44,2	40,9	3,5	11,4	83	(M)G&S	CAh
24	"	09°15'7	034°59'2	49	83,5		16,5		-	S,G	CA
25	"	09°20'6	035°00'7	53	7,2	80,3	12,5		85	(M)S	CA
26	"	09°20'6	035°05'7	45	56,6	15,4	6,8	21,2	77	(S)MG	CAh
27	"	09°20'6	035°10'7	36	82,5	17,5	0,0		99	(S)G	CAh
28	"	09°20'6	035°15'7	27	95,0		5,0		-	S,G	CA
29	08.09.65	09°20'6	035°20'7	20	27,8	72,2	0,0		67	GS	CA
30	"	09°24'2	035°24'3	20	42,9	57,1	0,0		95	S&G	CA
31	"	09°24'2	035°19'2	27	-	-	-	-	-	G	CA
32	"	09°24'2	035°14'2	27	-	-	-	-	-	G	CA
33	"	09°24'2	035°09'2	36	63,1	16,7	3,7	16,5	80	(S)MG	CAh
34	"	09°24'2	035°04'2	44	39,9	37,8	5,3	17,0	74	MG&S	CAh
35	"	09°27'8	035°07'7	32	-	-	-	-	-	G	CA
36	"	09°27'8	035°12'7	35	-	-	-	-	-	G	CA
37	"	09°27'8	035°17'7	31	-	-	-	-	-	G	CA
38	"	09°27'8	035°22'7	27	30,1	67,9	2,0		97	GS	CA
39	"	09°27'8	035°27'7	17	39,6	60,4	0,0		31	GS	Ls
40	"	09°32'1	035°30'6	16	99,9	0,1	0,0		100	G	CA

Station	Date	Position		Depth (m)	% Coarse		% Fine	%CO ₃ (total sed.)	Bottom char.		
		Lat. S	Long. W		2 mm	53 μ	2 μ		Granul.	Facies	
41	08.09.65	09°32'1"	035°25'6"	26	79,9		20,1	-	MS, G	CA	
42	"	09°32'1"	035°20'6"	31	81,2		18,8	-	(M)S, G	CA	
43	"	09°32'1"	035°15'6"	36	98,4		1,6	-	S, G	CA	
44	"	09°32'1"	035°10'6"	40	-	-	-	-	G	CA	
45	"	09°37'1"	035°10'7"	48	55,0	28,3	5,1	11,6	72	(M)SG	CA
46	"	09°37'1"	035°15'7"	36	46,1	39,5	5,4	9,0	81	(M)G&S	CA
47	07.09.65	09°37'1"	035°20'7"	35	-	-	-	-	-	CA	
48	"	09°37'1"	035°25'7"	30	53,0	46,9	0,1	76	G&S	CA	
49	"	09°37'1"	035°30'7"	23	99,7	0,3	0,0	100	G	CA	
50	"	09°37'1"	035°35'7"	18	-	-	-	-	S, G	CA	
51	"	09°41'4"	035°38'2"	20	17,2	75,4	7,4	59	(G)S	L/CA	
52	"	09°41'4"	035°33'2"	27	99,3	0,7	0,0	100	G	CA	
53	"	09°41'4"	035°28'2"	36	69,7	30,3	0,0	98	SG	CA	
54	"	09°41'4"	035°23'2"	41	68,5	31,5	0,0	97	SG	CA	
55	"	09°41'4"	035°18'2"	51	-	-	-	-	-	CA	
56	"	09°46'2"	035°19'7"	67	59,8	21,6	6,4	12,2	82	(M)SG	CA
57	"	09°46'2"	035°24'7"	45	-	-	-	-	G	CA	
58	"	09°46'2"	035°29'7"	41	31,6	61,0	7,4	87	GS	CA	
59	"	09°46'2"	035°34'7"	31	61,2	15,1	6,8	16,9	77	(S)MG	CA
60	06.09.65	09°46'2"	035°39'7"	42	0,0	6,7	29,4	63,9	3	M	Lm

61	06.09.65	09°46'2	035°44'7	18	92,5	7,5	0,0	99	G	CA
62	"	09°50'7	035°47'2	21	69,6	22,7	7,7	92	SG	CA
63	"	09°50'7	035°42'2	27	23,8	64,3	11,9	96	(M)GS	CA
64	"	09°50'7	035°37'2	33	53,9	39,1	7,0	93	SG	CA
65	"	09°50'7	035°32'2	41	24,0	62,7	5,3 | 8,0	38	(M)GS	[Ls]
66	"	09°53'3	035°36'3	38	-	-	-	-	-	CA
67	"	09°53'3	035°41'3	34	64,3	35,7	0,0	98	SG	CA
68	"	09°53'3	035°46'3	20	37,0	55,4	7,6	93	GS	CA
69	"	09°53'3	035°51'3	14	18,6	71,5	9,9	31	(G)S	Ls
70	"	09°58'2	035°52'7	21	52,5	47,5	0,0	91	G&S	CA
71	"	09°58'2	035°47'7	34	40,0	53,4	6,6	92	S&G	CA
72	"	09°58'2	035°42'7	50	52,3	47,7	0,0	99	G&S	CA
73	05.09.65	10°02'7	035°43'0	90	36,5	42,2	3,3 | 18,0	78	MS&G	O
74	04.09.65	10°02'7	035°48'0	36	68,8	31,0	0,2	97	SG	CA
75	"	10°02'7	035°53'0	23	54,2	45,8	0,0	92	G&S	CA
76	"	10°02'7	035°58'0	21	2,1	59,5	4,4 | 34,0	65	MS	Lb
77	"	10°05'3	036°02'2	24	11,9	88,1	0,0	73	(G)S	Lb
78	"	10°05'5	035°57'2	27	31,7	59,4	8,9	77	GS	CA
79	"	10°05'7	035°52'2	27	82,2	17,8	0,0	100	(S)G	CA
80	"	10°05'8	035°47'2	290	6,2	18,2	75,6	6	M	[Lm]
81	"	10°08'3	035°51'5	75	33,7	66,3	-	SM	[Lm]	
82	"	10°08'3	035°56'5	27	25,6	74,4	0,0	91	GS	CA
83	"	10°08'3	036°01'5	20	65,9	34,1	0,0	99	SG	CA
84	"	10°11'5	036°05'4	20	10,3	89,7	0,0	11	(G)S	Ls

Station	Date	Position		Depth (m)	% Coarse		% Fine		% CO ₃ (total sed.)	Bottom char.	
		Lat. S	Long. W		2 mm	53μ	2μ	Granul.		Facies	
85	04.09.65	10°12'6	036°00'5	21	80,2	19,8	0,0	99	(S)G	CA	
86	03.09.65	10°13'6	035°55'6	41	20,7	40,5	7,3	31,5	44	GS&M	[L]/0
87	"	10°18'3	035°56'3	54	3,3	40,9	28,6	27,2	61	M&S	0
88	"	10°17'8	036°01'3	21	-	-	-	-	-	G	CA
89	"	10°17'2	036°06'3	23	18,4	81,6	0,0	19	(G)S	Ls	
90	"	10°16'7	036°11'3	13	-	-	-	-	-	-	Ls
91	"	10°19'6	036°15'3	15	-	-	-	-	-	S,G	Ls
92	"	10°20'3	036°10'4	21	10,8	86,3	2,9	10	(G)S	Ls	
93	"	10°21'2	036°05'5	27	40,5	37,3	4,2	18,0	61	MG&S	CA
94	"	10°22'2	036°00'5	49	3,9	68,2	11,8	16,1	37	MS	[Ls]
95	"	10°26'3	036°03'3	40	49,6	29,0	3,2	18,2	85	MSG	CA
96	"	10°25'5	036°08'2	23	0,1	24,4	75,5	0	M	Lm	
97	"	10°24'5	036°13'2	21	-	-	-	-	-	-	?L/CA
98	02.09.65	10°23'5	036°18'2	13	15,6	72,2	12,2	85	(M)(G)S	Lr	
99	"	10°28'2	036°20'5	11	0,2	30,3	69,5	0	M	Lm	
100	"	10°28'9	036°15'5	25	-	-	-	-	R	-	
101	"	10°29'7	036°10'5	27	6,6	93,4	0,0	82	S	CA	
102	"	10°30'2	036°05'5	90	50,9	22,3	5,0	21,8	73	SMG	CA/0
102b	"	"	"	"	36,3	52,5	11,2	88	(M)GS	CA/0	
103	"	10°35'0	036°07'0	110	36,9	28,1	12,4	22,6	64	G&M&S	CA/0

104	02.09.65	10°33'7	036°12'0	27	71,9	27,1	1,0	98	SG	CA	
105	"	10°32'5	036°17'0	40	0,1	41,4	58,5	0	M	Lm	
106	"	10°31'2	036°22'0	8	1,6	44,7	53,7	0	M	Lm	
107	10.08.65	10°34'3	036°26'0	9	0,2	40,2	59,6	0	M	Lm	
108	11.08.65	10°36'2	036°21'3	63	2,6	27,1	70,3	0	M	Lm	
109	"	10°38'0	036°16'7	73	0,1	33,3	66,6	0	M	Lm	
110	"	10°42'7	036°18'5	111	0,0	27,6	72,4	0	M	[Lm]	
111	"	10°40'8	036°23'2	54	-	-	-	-	-	-	
112	"	10°39'1	036°28'0	24	1,3	12,9	85,8	0	M	Lm	
113	10.08.65	10°37'3	036°32'7	15	-	-	-	-	M,S	L	
114	"	10°38'2	036°37'5	9	0,6	52,8	16,7	29,9	9	S&M	Ls&m
115	"	10°41'5	036°41'5	9	-	-	-	-	-	-	
116	"	10°42'1	036°36'7	16	0,9	99,1	0,0	0	S	Ls	
117	"	10°42'7	036°31'7	27	48,5	49,7	1,8	81	S&G	CA	
118	"	10°43'7	036°26'7	56	-	-	-	-	M,S	?CA/0	
119	09.08.65	10°44'5	036°21'7	54	-	-	-	-	-	?CA/0	
120	"	10°48'5	036°24'5	200	7,3	65,9	6,5	20,3	71	MS	O
121	"	10°47'7	036°29'5	34	-	-	-	-	-	CA	
122	"	10°47'1	036°34'5	24	-	-	-	-	S,G	CA	
123	"	10°46'2	036°39'5	19	25,9	53,1	7,0	14,0	72	GMS	CA
124	"	10°45'5	036°44'5	18	0,5	69,6	11,8	18,1	2	MS	Ls.
125	"	10°44'7	036°49'5	10	-	-	-	-	M,S	L	
126	"	10°48'2	036°53'2	10	-	-	-	-	M,S	L	
127	"	10°49'0	036°48'2	20	11,1	19,0	31,4	38,5	24	(G)(S)M	Lm

Station	Date	Position		Depth (m)	% Coarse		% Fine		%CO ₃ (total sed.)	Bottom char.	
		Lat. S	Long. W		2 mm	53 μ	2 μ	Granul.		Facies	
128	09.08.65	10°49'7	036°43'2	27	0,3	43,5	20,1	36,1	3	M&S	Lm&s
129	"	10°50'5	036°38'2	23	-	-	-	-	-	-	-
130	08.08.65	10°51'3	036°33'2	36	41,3	51,5	7,2	92	S&G	CA	
131	"	10°55'2	036°36'5	86	50,7	27,0	5,3	17,0	79	MSG	CA/g
132	"	10°54'2	036°41'4	29	79,7	18,9	1,4	98	(S)G	CA	
133	"	10°53'5	036°46'5	36	-	-	-	-	-	-	?CA
134	"	10°52'7	036°51'3	37	-	-	-	-	-	M	Lm
135	"	10°52'0	036°56'3	10	0,0	43,9	27,2	28,9	5	M&S	Lm&s
136	"	10°56'4	036°58'5	11	-	-	-	-	-	-	-
137	"	10°56'8	036°53'6	28	7,2	32,4	60,4	0	-	M	Lm
138	"	10°57'2	036°48'7	106	1,9	51,4	46,7	1	-	M	Lm
139	"	11°02'3	036°47'7	72	7,2	58,4	10,4	24,0	68	MS	CA/0
140	07.08.65	11°02'3	036°52'7	36	10,5	86,6	2,9	95	(G)S	CA	
141	"	11°02'3	036°58'0	22	-	-	-	-	-	-	?L/CA
142	"	11°02'3	037°03'0	11	82,5	17,5	84	(M)S	Lb		
143	"	11°06'7	037°05'7	10	0,0	89,1	10,9	1	(M)S	Ls	
144	"	11°06'7	037°00'7	18	5,6	13,1	28,3	53,0	8	(S)M	Lm
145	"	11°06'7	036°55'7	30	67,3	28,3	4,4	86	SG	CA	
146	"	11°06'7	036°50'7	50	-	-	-	-	-	-	CA
147	"	11°10'8	036°53'3	96	10,9	82,8	6,3	94	(G)S	CA/0	

148	07.08.65	11°10'7	036°58'3	29	78,1	16,9	5,0	96	(S)G	CA	
149	06.08.65	11°10'3	037°03'3	27	-	-	-	-	M,S	L	
150	"	11°11'7	037°08'2	9	-	-	-	-	M,S	L	
151	"	11°15'0	037°12'2	15	0,2	20,5	28,3	51,0	9	SM	Lm
152	"	11°15'0	037°07'2	27	0,0	91,2	8,8	37	S	Ls	
153	"	11°15'0	037°02'2	37	-	-	-	-	-	CA	
154	"	11°19'7	037°04'1	47	0,5	84,2	5,4	9,9	15	(M)S	[Ls]
155	"	11°20'0	037°09'2	18	-	-	-	-	-	CA	
156	"	11°20'0	037°14'2	20	-	-	-	-	S	Ls	
160	03.12.65	10°29'3	036°19'0	15	0,1	36,0	63,9	0	M	Lm	
161	"	10°30'4	036°21'0	10	0,1	88,2	11,7	0	M	Lm	
162	"	10°31'5	036°22'8	8	0,0	36,8	50,2	13,0	1	SM	Lm
163	"	10°32'6	036°24'9	7	1,7	84,4	13,9	0	M	Lm	
164	"	10°33'7	036°27'0	8	0,6	95,5	3,9	0	M	Lm	
165	"	10°35'7	036°25'7	13	0,1	68,9	31,0	0	M	Lm	
166	"	10°34'8	036°23'8	9	0,7	85,3	14,0	0	M	Lm	
167	"	10°33'7	036°21'9	11	1,5	84,2	14,3	0	M	Lm	
168	"	10°32'8	036°19'8	18	0,1	95,5	4,4	0	M	Lm	
169	"	10°31'5	036°17'8	24	0,3	93,4	6,3	0	M	Lm	
170	"	10°33'7	036°16'5	50	0,1	90,1	9,8	0	M	Lm	
171	"	10°34'8	036°18'5	44	0,1	93,6	6,3	0	M	Lm	
172	"	10°35'7	036°20'7	33	0,1	93,3	6,6	0	M	Lm	
173	"	10°37'0	036°22'7	80	0,1	20,7	79,2	0	M	Lm	
174	"	10°37'9	036°24'7	28	0,0	29,2	70,8	0	M	Lm	

Station	Date	Position		Depth (m)	% Coarse		% Fine		%CO ₃ (total sed.)	Bottom char.	
		Lat. S	Long. W		2 mm	53μ	2μ	Granul.		Facies	
175	03.12.65	10°40'1"	036°23'6"	50	0,1		38,1	61,8	0	M	Lm
176	"	10°38'9"	036°21'7"	360	0,2		22,1	77,7	0	M	Lm
177	04.12.65	10°37'9"	036°19'5"	108	1,4		20,6	78,0	0	M	Lm
178	"	10°37'0"	036°17'2"	76	0,2		16,4	83,4	0	M	Lm
179	"	10°35'7"	036°15'2"	64	0,1		24,3	75,6	0	M	Lm
180	"	10°37'1"	036°14'0"	75	1,3	57,8	11,6	29,3	56	S&M	L/0
181	"	10°38'1"	036°16'0"	130	1,1	15,1	23,2	60,6	16	(S)M	Lm
182	"	10°40'0"	036°18'2"	?	56,4	33,1		10,5	95	MSG	CA/0
183	"	10°41'0"	036°20'4"	100	7,6	48,7	14,8	28,9	57	S&M	L/0
184	"	10°42'0"	036°22'5"	75	42,2	56,0		1,8	99	S&G	CA/0
185	"	10°44'0"	036°21'3"	540	1,6	70,7	14,3	13,4	78	MS	O
186	"	10°43'0"	036°19'7"	135	9,8	71,9	5,3	13,0	73	(M)S	O
190a	"	10°38'1"	036°12'4"	85-117	28,8	31,0	13,2	27,0	95	M&S&G	CA/0
<u>CANOPUS.</u>											
118	15.03.66	08°56'0"	034°52'0"	51	17,1	65,4		17,5	-	(M)(G)S	CAh
119	"	09°01'0"	034°51'0"	72	-	-	-	-	-	S,G	CA/0
120	"	09°07'0"	034°53'0"	51	57,9	42,1		0,0	-	G&S	CAh
121	"	09°11'0"	034°57'0"	40	65,9	34,1		0,0	-	SG	CAh
122	"	09°15'0"	034°59'0"	51	58,7	31,6		9,7	-	SG	CAh

123	16.03.66	09°20'0	035°00'0	49	36,2	63,8	0,0	-	GS	CA
124	"	09°24'0	035°04'0	45	65,4	34,6	0,0	-	SG	CAh
125	"	09°27'0	035°07'0	36	62,9	23,6	13,5	-	(M)SG	CAh
126	"	09°32'0	035°10'0	40	11,7	85,2	3,1	-	(G)S	CA
127	17.03.66	09°37'0	035°10'0	38	-	-	-	-	-	-
128	"	09°41'0	035°18'0	42	-	-	-	-	S,G	CA
129	"	09°46'0	035°19'0	44	-	-	-	-	G	CA
130	"	09°50'0	035°32'0	45	-	-	-	-	G	CA
131	"	09°53'0	035°36'0	44	-	-	-	-	G	CA
132	18.03.66	10°05'0	035°47'0	49	44,0	56,0	0,0	-	S&G	CA
133	"	10°18'0	035°56'0	51	58,6	41,4	0,0	-	G&S	CA/0
134	"	10°26'0	036°03'0	51	48,8	49,2	2,0	-	S&G	CA/0
135	19.03.66	10°38'0	036°16'0	51	0,5	99,5	-	-	M	Lm
136	"	11°02'0	036°48'0	60	47,2	43,9	8,9	-	G&S	CA/0
137	20.03.66	11°19'0	037°05'0	27	77,8	22,2	0,0	-	SG	CA

CALYPSO.

31	22.11.61	09°40'0	035°18'0	54447	"calcareous algae"	-	CA
33	"	09°45'0	035°35'0	32	"sand"	-	CA
40	23.11.61	10°54'0	036°45'0	34	"muddy sand, shells & fragm."	-	?L/CA
41	"	10°51'0	036°49'0	48	"mud"	-	Lm
42	"	10°53'0	036°50'0	48-57	"mud"	-	Lm
43	"	11°01'0	036°55'0	39	"mud"	-	Lm

LEGEND

Grain size

M.....Mud	(>60%), muddy.....	Lama (>60%), c/ lama
S.....Sand	(>60%), sandy.....	Areia (>60%), arenoso
G.....Gravel	(>60%), gravelly.....	Cascalho (>60%), cascalhoso
R.....Rock	.....	Rocha
().....minor component	10-20%.....	componento menor 10-20%
&.....2 components>40% or 3 comp.>30%	.....	2 componentos>40% ou 3 comp.>30%
,.....proportions unknown.....	.....	proporções desconhecidas

LEGENDA

Granulometria

<u>Facies</u>		<u>Facies</u>
L.....Littoral	.....	Litorânea
Lm.....mud	{ terrigenous comp.>60%)	lama } (comp.terrígeno>60%)
Ls.....qz sand		
Lr.....reef	{ organogenous comp.>60%)	recife } (comp.organógeno>60%)
Lb.....bioret.		
CA.....Calcareous Algae	{ organogeous)	Algas Calc. } (comp.organógeno>60%)
O.....Organogenic Material		
/.....transition (components 40-60%)	.....	transição (componentes 40-60%)
[L].....relict sediment, shelf edge	(terrigenous component>60%)	..... sed. relictiva, bordo de plataforma (comp.terrígeno>60%)