DEPARTMENT OF EARTH SCIENCES, THE UNIVERSITY OF LEEDS

INTERNAL REPORTS

OCEANOGRAPHY

R.R.S. SHACKLETON

Report of Cruise 2/76 in the S.E. Pacific

April-May, 1976.

H. ELDERFIELD

R.R.S. SHACKLETON

Report on Cruise 2/76

S.E. Pacific Ocean

APRIL 30 - MAY 25, 1976.

UNIVERSITY OF LEEDS, DEPARTMENT OF EARTH SCIENCES

UNIVERSITY OF EDINBURGH, GRANT INSTITUTE OF GEOLOGY

UNIVERSITY OF LIVERPOOL, DEPARTMENT OF OCEANOGRAPHY

IMPERIAL COLLEGE LONDON, APPLIED GEOCHEMISTRY RESEARCH GROUP

CONTENTS

DATES

Departed Callao, Peru	14.00 hrs	30 April, 1976.
Arrived first station. SH 1571	23.18 hrs	2 May, 1976
Completed last station, SH 1608	20.54 hrs	24 May, 1976
Arrived Balboa, Panama	11.00 hrs	25 May, 1976

All times are local time = G.M.T. - 5 hrs.

SCIENTIFIC PERSONNEL

From the Department of Earth Sciences, Leeds University.

DR. H. ELDERFIELD — Senior Scientist
MR. S. WAKEFIELD
MR. S. MIDDLETON

From the Grant Institute of Geology, Edinburgh University

DR. N.B. PRICE
MR. T. PEDERSEN
MR. S. MALCOLM

From the Department of Oceanography, Liverpool University

MS. A. HEPWORTH
DR. S. ASTON (on assignment from Lancaster University)
MR. N. MORLEY

From the Applied Geochemistry Research Group, Imperial College London

MR. B. THOMPSON

From the Institute of Oceanographic Sciences, Barry.

MR. P. MASON

STATION NO.	POSITION		DEPTH (M)	OPERATIONS
SH 1571	11°27.7'S	85°52.2'W ✓	4443	GC (LDI) H (5)
SH 1572	11°10.2'S	89°59.3'W ✓	3947	GC (LUDO 1572)
SH 1573	10°40.4'S	93°55.8'W ✓	3700	GC (LUDO 1573) H (surface)
SH 1574	10°40.4'S	97°00.1'W ✓	3945	GC (LUDO 1574)
SH 1575	10°25.1'S	99°00.0'W ✓	4249	GC (F)
SH 1576	10°09.4'S	101°84.1'W ✓	4265	GC (LUDO 1576)
SH 1577	9°59.2'S	101°31.0'W ✓	4330	GC (IC-SH 1577)
SH 1578	10°00.1'S	101°48.9'W ✓	4540	GC (IC-SH 1578)
SH 1579	9°30.3'S	101°30.0'W ✓	4440	GC (LUDO 1579)
SH 1580	9°12.7'S	101°30.5IW ✓	4330	GC (LUDO 1580)
SH 1581	8°34.8'S	101°31.1'W ✓	4280	GC (LUDO 1581)
SH 1582	8°39.5'S	101°28.6'W ✓	4150	GC (F) GC (LD2)
SH 1583	8°22.3'S	101°27.4'W ✓	4015	GC (LUDO 1583)
SH 1584	8°12.1'S	101°24.4'W ✓	4175	GC (LUDO 1584)
SH 1585	7°51.9'S	101°20.1'W ✓	4310	GC (LUDO 1585)
SH 1586	9°03.8'S	102°48.4'W ✓	4385	GC (LD 3)
SH 1587	9°26.7'S	103°18.3'W ✓	5293	GC (LD4) H (5)
SH 1588	7°50.5'S	105°29.8'W ✓	3660	GC (LD5) H (5) P
SH 1589	6°59.9'S	107°00.8'W ✓	3155	GC (LD6) GC (LD7)
SH 1590	6°09.5'S	106°54.8'W ✓	3007	GC (F) H (5)
SH 1591	4°25.3'S	106°48.0'W ✓	3139	GC (LD8) H (5) P
SH 1592	1°17.7'S	94°37.4'W ✓	3422	GC (F) GC (P1)
SH 1593	1°21.1'S	93°47.5'W ✓	3400	GC (F) GC (F)
SH 1594	1°24.5'S	92°58.9'W ✓	3510	GC (P2)
SH 1595	1°32.7'S	92°12.0'W ✓	3190	GC (P3)
SH 1596	0°55.1'S	87°51.5'W ✓	1540	GC (P4) GC (P5)
SH 1597	0°35.9'N	86°09.9'W ✓	2735	GC (LD9)
SH 1598	0°48.4'N	86°13.0'W ✓	2500	H (4) P
SH 1599	0°52.3'N	86°07.7'W ✓	2712	GC (P6)
SH 1600	2°30.2'N	84°04.0'W ✓	3085	GC (P7)
SH 1601	4°36.3'N	82°00.6'W ✓	4093	GC (P8) H (4)
SH 1602	5°15.7'N	79°44.5'W ✓	3075	GC (P9) H (4) P
SH 1603	6°27.5'N	78°25.8'W ✓	4007	GC (P10)
SH 1604	6°48.3'N	78°35.3'W ✓	3847	GC (P11)
SH 1605	7°08.6'N	78°43.9'W ✓	3491	GC (P12)
SH 1606	7°17.8'N	78°48.1'W ✓	3000	GC (F)
SH 1607	7°31.3'N	78°54.5'W ✓	1803	GC (P13)
SH 1608	7°37.5'N	78°37.6'W ✓	132	GC (P14)

GC = Gravity Core (core number in parentheses; F = failed core)
H = Hydrographic station (number of casts in parentheses)
P = Plankton Tow
Cores underlined are those from which pore waters extracted
Hydrocasts underlined at stations where Humics samples taken.

CRUISE OBJECTIVES

The principal cruise objectives were to obtain geochemical samples of the East Pacific Rise, the Peru Basin, the Bauer Deep and the Panama Basin, and also samples of atmospheric dust particles. It was intended to collect bottom sediment using Piston and Gravity Corers, water samples using Niskin and NIO bottles in deep and shallow casts, plankton samples, and air particulates using large fibre screens. Initial analysis of samples on board was proposed following water filtration and removal of pore water from sediments.

These objectives relate to 3 scientific programmes, those of
A. Drs. Elderfield and Price; B. Drs. R. Chester and D. Cronan;
C. Professor J.P. Riley.

A. This programme has 5 main aims:

1. to study the expression of hydrothermal processes in East Pacific sediments with different environmental characteristics;
2. to study the diagenesis of sediments related to the breakdown of organic matter;
3. to study profiles of particulate matter in sea water;
4. to study the geochemistry of plankton;
5. to study the vertical distribution of dissolved iodine species in sea water.

In addition to the cruise participants from Leeds and Edinburgh, Dr. V. Truesdale is associated with this programme (A5).

B. this programme has 3 main aims:

1. to study the loadings and geochemistry of atmospheric dusts in the S.E. Pacific;
2. to study the geochemistry of Pacific metalliferous sediments;
3. to study the geochemistry of sediments on a west-east profile off Peru.

Dr. Chester was represented on the cruise by Dr. Aston and Mr. Morley, and Dr. Cronan by Mr. Thompson.

C. this programme is to study the concentrations and types of humic material in sea water from deep-sea areas, especially in the region of equatorial productivity.

Professor Riley was represented on the cruise by Ms. Hepworth.

REPORT ON STATIONS WORKED

Station Time

An unsatisfactory yet unavoidable aspect of the ship's programme was the low proportion of station time available due to long periods of steaming to and between stations. Because 4 days station time were available on cruise 1/76 for Programme B (Imperial College/Liverpool) it had been decided to divide the available station time on cruise 2/76 in order to equalise the station time used by Programmes A and B over the two cruises as a whole. The original estimate of 10 days available station time for cruise 2/76 proved incorrect and about $7\frac{1}{2}$ days were worked. During this period 38 stations were occupied of which 35 were successful, 23 on behalf of Programme A and 12 on behalf of Programme B.

Ship's Programme

R.R.S. Shackleton worked stations within an area in the S.E. Pacific between 11°30'S and 7°40'N, and 107°W and 78°30'W as shown in FIGURE 1.

Sea and weather conditions were good throughout the cruise.

R.R.S. Shackleton departed from Callao, Peru on 30 April, 1976 and steamed to 11°28'S 85°52'W which was a shakedown station. Following this a series of coring stations were worked (SH 1572 - SH 1576) westward to the Bauer Deep. 11 stations were worked in the Bauer Deep (SH 1577 - SH 1587) followed by a station on the flank of the East Pacific Rise (SH 1588) and 3 stations on the Rise crest (SH 1589 - SH 1591). Moving east from the Rise 5 near-equatorial stations were worked (SH 1592 - SH 1596) and stations SH 1597 and SH 1598 at the Galapagas "hot spot". The remaining stations (SH 1599 - 1608) were worked on the traverse northward through the Panama Basin towards Balboa which was reached on 25 May, 1976.

Ship's Performance

It is a pleasure to acknowledge the help afforded to us by the officers and crew of R.R.S. Shackleton. The Master, Captain M. Harding, gave the Senior Scientist the greatest co-operation and responded generously to our requests for constant rescheduling of stations and deviations from our planned programme; the boatswain, Mr. L. Haggis, gave freely of his advice and experience and both played a significant part in the success of the cruise. There were no problems in the performance of "Shackleton" and excellent time was made to and from stations.

Equipment Performance

1. CORING: The success rate for coring was very high and a total of 35 gravity cores were taken during the cruise. However, there remains several unsatisfactory aspects concerned with coring operations onboard R.R.S. Shackleton. Firstly, it was not possible to carry out any piston coring which was an important part of the proposed programme, especially for the region of the Bauer Deep. The block used for coring was the one which had been repaired following the sheave splitting during cruise 8/75 in the Indian Ocean. Further repairs had been made in Callao prior to the cruise and concern was expressed over its ability to withstand the high pull-out tensions for the stiff clays of the Bauer Deep sediment in the light of the significant observed wear to the sheave. Because of this the advice of the Deck officers and crew was accepted and coring limited to the use of gravity corers. A block in a good state of repair is essential to the success of a cruise of this type and it is strongly recommended that a spare block is always available on board. Several days were spent in Callao in search of a suitable spare. Nothing suitable was available but a small block was obtained as an insurance against failure of the sheave. A further cause for concern remains the state of core barrels. It is absolutely essential that core barrels are clean and rust-free when samples for geochemical studies are to be taken. As with a previous cruise, the barrels for the pistor corer were in a very bad state of repair and arrangements had to be made for their cleaning in Callao. The coring equipment on R.R.S. Shackleton may well be satisfactory for sedimentological or general geochemical studies but leaves much to be desired for careful geochemical work. In many ways the coring equipment is obsolete and it is recommended that steps be taken to investigate the coring facilities required by N.E.R.C. ship users for the next decade. Some aspects of the coring operation (particularly piston coring) will never be satisfactory from R.R.S. Shackleton for basic design reasons and it is recommended that any assessment of future coring requirements takes into account the "Forward Look" on Research Vessels.

2. WATER SAMPLING: There was much improvement in the efficiency of water-bottle stations using the large redesigned messenger to trip Niskin bottles. The thermometers on board were not the ones requested. The temperature range of the protected thermometers (-2 to 12°C) was not appropriate for equatorial Pacific water and since only 5 sets of thermometers were available this considerably increased the number of

casts that were required to cover the water column. The absence of suitable thermometers had a serious effect of the efficiency of the cruise and it is likely that 3 hours could have been saved at each hydrographic station which represents a total of one day of station time. Ideally, what is required is CTD facilities on board research vessels where sea water research or related studies are being performed. The cost of such units is not now prohibitive and such a facility would be of immense value in characterising the waters from which samples are being drawn.

One unexpected observation from our water-bottle stations was that determinations of dissolved oxygen which were made on board differed significantly dependent on whether samples were drawn from Niskin or N10 bottles. This is illustrated in FIGURE 2 which shows that oxygen determinations on water from N10 bottles is consistently higher and, it would seem, in error by one order of magnitude at the low concentrations observed within the water column. We were able to rule out operator error or leakage of specific bottles as a cause of this and it would appear that some exchange takes place for these bottles. It would seem to be worth while drawing this observation to the attention of other scientists who use N10 bottles for this purpose and to suggest the possibility of error at low oxygen concentrations.

Shipboard Operations

1. A total of 38 stations were worked of which 3 were unsuccessful. Cores were taken at 33 stations, and 8 detailed hydrographic stations were worked at which up to 63 water samples were taken per station. Plankton tows were performed at 5 stations. General organisation of stations was the responsibility of the Senior Scientist.

2. Each hydrographic station consisted of 4 or 5 casts with 7 or 8 Niskin bottles and 5 N10 bottles per cast. The 30 litre Niskin samples were split into 2 aliquots. From one aliquot of approx 15 litres particulate matter was removed for inorganic analysis by pressure filtration through Nucleopore filters. The other aliquot was pressure filtered through Glass Fibre paper for organic analysis. Particulate sampling was performed by Brian Price and Steve Malcolm.

3. 1 litre samples were drawn from the Glass Fibre filtered water and stored in the cooler (approx. $6^{\circ}C$) for iodine analysis. The remaining water was used for extraction of humics using Amberlite ion-exchange resin. The humics experiments were performed by Annie Hepworth.

4. From each water bottle samples were drawn for salinity, phosphate and silicate, and dissolved oxygen samples were drawn from all Niskin and some N10 bottles. Protected and unprotected thermometer readings were taken from the N10 bottles. On board phosphate and silicate analysis was carried out by Steve Middleton with help from Annie Hepworth, and dissolved oxygen determinations were made by Steve Malcolm.

5. Pore waters were extracted at in situ temperatures from 10 of the cores using a hydraulic squeezer and a thermoregulator. Up to about 50 sections of 2 - 5 cm. were squeezed per core and onboard analysis made for phosphate, silicate and ammonia. Sub-samples were stored, cooled, for alkalinity, major elements and metal analysis. The pore water work was carried out by Simon Wakefield and Tom Pedersen.

6. The scientists involved in deck work on station were a) Peter Mason and Brian Thompson; b) Simon Aston and Nick Morley.

7. Atmospheric dust sampling was made throughout the cruise, and meshes changed usually daily, by Nick Morley and Simon Aston.

STATION LOGS

The following pages list details of the work performed at each station together with the hydrographic data obtained from on-board records and analysis. These data are the property of cruise participants and permission to use this information by others must be obtained from the Senior Scientist. Please note that the data tables are incomplete in that true temperatures and depths have not been calculated from the thermometer records at the time of production of this report. In addition, the dissolved oxygen results are uncorrected for bottle volume and are based on an oxygen-bottle volume of 250 ml. The corrected oxygen data, temperatures, depths, and salinity results will be available at a later date and will be supplied to cruise participants. Shipboard analytical data on pore waters is not reproduced here.

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STATION SH1571 2/5/1976 2318-1438 11° 27.7'S 85° 52.2'W to 11° 26.4'S 85° 49.3'W

4443m. SHAKEDOWN STATION

Operations

5 hydro casts each using six Niskin + six N10 bottles: 0-200, 250-1100, 1200-2250, 2600-4000, 4200-4443m. Samples drawn for salinity, O_2, P, Si, I, filtered for particulates (inorg. and org.). One gravity core using Edinburgh corer "CORE LDI" 66cm carbonate ooze. Core squeezed for pore water. Samples drawn for P, Si. Onboard analysis: O_2, P, Si.

Hydrographic Data

Wire Depth (M)	T	t	T^1	t^1	Temp °C	Depth M	Salinity ‰	O_2 ml l^{-1}	P uM	Si uM	I Bottle Number
0	>12	-	-	-	23.8	0		-	0.42	16.8	31
10	>12	-	26.33	23.7		10		4.74	0.55	0.36	
25						25		3.86	0.39	1.79	100
35	>12	-	25.27	23.7		35		4.83	0.65	2.14	
50						50		3.45	0.74	6.43	99
60	>12	-	19.62	23.5		60		5.81	0.90	2.14	
75						75		2.91	1.29	8.57	98
85	>12	-	17.23	23.3		85		3.19	1.58	7.14	
100						100		1.63	1.90	10.0	97
125	>12	-	14.32	23.5		125		0.70	2.39	24.6	
150						150		0.30	2.55	27.5	104
175	>12	-	13.95	23.2		175		0.62	2.58	30.0	
200						200		0.26	2.35	29.6	103
250	11.10	22.6	13.12	21.7				0.61	2.29	37.5	
300								0.26	2.45	36.4	26
350	9.84	22.7	12.63	21.7				0.84	2.45	40.7	
400								0.41	2.55	42.9	25

450					0.97	2.55	43.6	
500					0.39	2.58	44.3	27
600	7.10	22.5	12.03	21.6	0.85	2.87		
700					0.40	2.97	63.9	28
800	5.97	22.7	12.31	21.6	1.18	2.87	76.1	
900					1.10	2.90	84.3	29
1000	4.86	22.1	12.95	21.6	1.63	2.87	92.5	
1100						3.00	106	30
1200	4.21	22.4	13.83	22.3	1.86	2.68	110	
1300						2.71	120	115
1400	3.69	22.5	14.31	22.0	2.10	2.68	124	
1500						2.71	127	116
1600	-	-	15.82	21.8	2.30	2.68	136	
1750						2.77	147	119
1900	2.88	22.3	18.03	21.7		2.45	147	
2000						2.55	151	120
2100	2.60	22.2	18.61	21.8	2.79	2.65	163	
2250						2.45	155	117
2350	2.35	21.5	20.95	21.3	2.73	2.52	161	
2500						2.32	163	118

2600	2.24	22.2	23.23	21.7		3.32	2.35	163	
2750							2.55	169	109
2850	2.18	22.3	24.47	21.6		3.37	2.32	165	
300							2.42	159	111
3100	2.18	22.5	26.55	21.7		3.63	2.32	163	
3250							2.52	156	110
3350	2.22	22.3	29.03	22.0		3.57	2.19	159	
3500							2.35	157	112
3600	2.16	21.9	30.65	22.3		3.58	2.26	152	
3750							2.13	151	113
3850	2.13	22.0	32.70	22.1		3.82	2.26	152	
4000							2.26	151	114
4200	2.16	22.6	35.03	21.8		3.64	2.35	150	
4250							2.39	150	105
4300	2.19	22.8	35.90	22.5		3.66	2.13	150	
4350							2.45	150	106
4360	2.22	22.8	37.05	22.6		3.65	2.26	150	
4375							2.29	150	107
4385	2.18	22.7	14.26*	23.4		3.66	2.32	150	

* results underlined throughout this log are of questionable value

4405						2.35	150	108
4410	2.17	22.8	37.15	23.5	3.53	2.29	160	
4420						2.19	150	101
4435					2.29		150	102

STATION SH1572 4/5/1976 1335-1430 11°10.28'S 89° 59.3'W
3947m.

Operations

One gravity core using RVB corer "LUDO 1572" 215cm pale to dark brown, highly mottled carbonate/clay ooze; Mn nodule at surface. Core split and subsampled before storage.

STATION SH1573 5/5/1976 1820-1924 10° 50.5'S 93° 55.8'W
3700m.

Operations

One gravity core using RVB corer "LUDO 1573" 238cm mottled dark brown-pale cream carbonate ooze. Core split and subsampled before storage. 150 litres surface water collected for humics experiment.

STATION SH1574 6/5/1976 0724-0885 10° 40.4'S 97° 00.1'W
3945m.

Operations

One gravity core using RVB corer "LUDO 1574" 185cm Carbonate ooze with chocolate brown Fe Mn-rich base. Core split and subsampled before storage.

STATION SH1575 6/5/1976 2026-2218 10° 22.1'S 99° 00.0'W
4249m.

Operations

One gravity core attempted using RVB corer. Attempt unsuccessful. Rock fragments with thin Mn encrustation found in core catcher.

STATION SH1576 7/5/1976 0950-1120 10° 09.4'S 101° 84.1'W
4265m.

Operations

One gravity core with RVB corer "LUDO 1576" 167cm Carbonate ooze with chocolate-brown Fe Mn - rich base.. Mn nodules at surface. Core split and subsampled before storage.

STATION SH1577 7/5/1976 1430-1547 9° 59.18'S 101° 31.0'W
4330m.

Operations

One gravity core with RVB corer "IC-SH1577" 193cm 0-120cm dark brown clay, 120-193 Ca banded ooze. Core cut at 50cm and stored.

STATION SH1578 7/5/1976 1746-1917 10° 00.12'S 101° 48.86'W to 9° 59.68'S 101° 49.3'W
4540m.

Operations

One gravity core using RVB corer "IC-SH1578 187cm dark brown clay, Mn nodule at surface. Cut at 178cm.

STATION SH1579 7/5/1976 2304-0045 9° 30.3'S 101° 30.0'W
4440m.

Operations

One gravity core using RVB corer "LUDO 1579" 150cm chocolate brown clay. Core split and subsampled before storage.

STATION SH1580 8/5/1976 0245-0418 9° 12.7'S 101° 30.5'W
4330m.

Operations

One gravity core using RVB corer "LUDO 1580" 143cm dark chocolate brown ooze. Core split and subsampled before storage.

STATION SH1581 8/5/1976 0600-0730 9° 14.78'S 101° 31.08'W to 8° 54.41'S to 101° 31.74'W
4280m.

Operations

One gravity core using RVB corer "LUDO 1581" 150cm chocolate brown clay. Core split and subsampled before storage.

STATION SH1582 8/5/1976 0914-1419 8° 39.5'S 101° 28.6'W to 8° 38.5'S 101° 28.4'W
4150m.

Operations

One gravity core attempted using Edinburgh corer, plastic barrel not recovered. One gravity core using RVB corer "CORE LD 2" 130cm chocolate brown Fe Mn clay, core squeezed for pore water. Samples drawn for P, Si and analysed.

STATION SH1583 8/5/1976 1622-1740 8° 22.3'S 101° 27.4'W to 8° 21.3'S 101° 26.9'W
4015m.

Operations

One gravity core using RVB corer "LUDO 1583" 180cm dark-light brown mottled clay. Core split and subsampled before storage.

STATION SH1584 8/5/1976 1842-2055 8° 12.08'S 101° 24.4'W to 8° 5.62'S 101° 23.2'W
4175m.

Operations

One gravity core using RVB corer "LUDO 1584" 120cm chocolate brown clay with carbonate, mottled, Core split and subsampled before storage.

STATION SH1585 8/5/1976 2225-2350 7° 51.9'S 101° 20.1'W
4310m.

Operations

One gravity core using RVB corer "LUDO 1585" 141cm chocolate brown clay. Core split and subsampled before storage.

STATION SH1586 9/5/1976 1042-1211 9° 03.88'S 102° 48.4'W
4385m

Operations

One gravity core with RVB corer "CORE LD 3" 177cm dark brown clay. Core Uncut. Frozen.

STATION SH1587 9/5/1976 1609-1400 9° 26.68'S 103° 18.34'W to 9° 26.99'S 103° 19.02'W
5293m. (depth variable, prob. range 4700-5510m. 5293m is probable depth when core taken but since PDR difficult to interpret it is possible that core at up to 5510m).

Operations

5 hydro casts each using six Niskin + five N10 bottles: 0-250, 275-1700, 1800-3750, 3850-4900, 5000-5300m. Samples drawn for salinity, O_2, P, Si, I, filtered for particulates (inorg. and org.).
One gravity core using RVB corer "CORE LD 4" 137cm dark chocolate-brown clay. Core squeezed for pore water. Samples drawn for P, Si. Onboard analysis: O_2, P, Si. Humics extraction by resin.

Hydrographic Data

Wire Depth (M)	T	t	T^1	t^1	Temp °C	Depth M	Salinity ‰	O_2 ml l^{-1}	P uM	Si uM	I Bottle Number
0	-	-	-	-		0		5.86	1.2	0	32
25	-	-	-	-		25		5.68	0.72	0	36
37	>12	-	26.38	25.3		37		5.71	0.84	6.1	
50						50		5.87	0.72	4.3	33
75						75		5.80	1.08	2.1	37
87	>12	-	20.66	25.0		87		5.54	0.84	0	
100						100		4.54	1.56	10.4	

125	>12	-	16.23	24.8	125	3.87	1.92	8.2	
150					150	1.71	2.4	20.7	34
175	>12	-	14.24	24.8	175	0.33	3.12	26.8	
200						0.74	3.00	33.2	35‡
225	11.79	24.3	13.80	25.0		0.71	3.24	35.4	
250						0.63	2.63	35.4	35‡
275	11.26	24.2	13.50	24.5		0.48	3.24	25	
300						0.30	2.43*	32*	242
400	9.63	24.4	12.92	24.3		0.36	3.24	50	
500						0.76	3.24	56	246
600	7.26	23.8	12.33	23.8		0.85	3.96	73	
700						1.40	3.84	81	244
800	5.82	24.0	12.3	23.8		1.64	4.08	83	
900						1.94	3.6	85	252
1100						2.32	3.36	101	245
1200	4.14	23.8	13.87	23.4		3.19	3.24	108	
1300						2.78	3.24	110	40
1500						4.09	3.24	120	

‡ 35 is mixed sample of 200 and 250m bottles

* Analysed on Station SH1590

1700					2.78	3.12	122	262
1800	2.87	24.6	17.20	24.3	3.08	3.6	135	
2000						3.2	139	42
2100	2.63	23.3	19.21	24.0	3.51	3.6	139	
2250						3.2		46
2500						3.0	139	38
2600	2.28	23.8	23.83	23.8	4.17	3.0	139	
2750							143	48
2900	2.15	23.8	24.66	23.8	3.80	3.00	126	
3000						3.12	143	47
3250						2.88	143	44
3400	2.16	23.7	29.33	23.4	3.91	3.24	145	
3500						3.36	147	43
3750						3.24	130	256
3900						3.36	137	255
3950	2.17	24.2	33.5	24.0	4.03	3.36	139	
4000	2.21	24.1	33.76	24.2	4.03	3.36	143	
4150						3.36	141	263
4200	2.29	23.3	35.75	23.7	3.83	2.47*	140*	

* Analysed with Station SH1590 samples.

4250						3.36	143	258
4400						3.36	139	254
4500	2.24	23.95	37.33	23.2	3.81	3.36	137	
4650						3.24	143	260
4750						3.36	143	259
4900	2.31	23.2	41.80	22.7	4.10	3.24	141	
5000						1.94*	46*	264
5025	2.30	23.9	41.15	24.5	3.93	3.36	143	
5100						3.36	143	45
5110	2.30	24.1	40.53	24.3	4.04	3.36	141	
5150						3.24	141	257
5170	2.35	23.8	41.90	24.0	3.99	3.36		
5200						3.36	141	41
5210	2.33	23.5	41.82	24.5	3.94	3.24	141	
5225						3.12	141	261
5250						3.24	141	39
5260	2.32	24.6	42.40	24.6	4.00	3.24	141	
5290						3.36	141	265
5300						3.24	143	251

* Analysed with Station SH1590 samples

Humics Samples

Depth M	vol l
0- 500	126
1700-3900	135
4650-5300	110

STATION SH1588 11/5/1976 0457-2117 7° 50.5'S 105° 29.8'W to 7° 48.9'S 105° 32.8'W 3660m.

Operations

5 hydro casts of six Niskin + five N10 bottles: 0-250, 275-1000, 1100-2000, 2100-3250, 3300-3600m. Samples drawn for salinity, O_2, P, Si, I filtered for particulates (inorg. and org.). One gravity core using RVB corer "CORE LD 5" 186cm yellow-cream foram. ooze. Core squeezed for pore water. Samples drawn for P, Si. Onboard analysis: O_2, P, Si. Humics extraction by resin. Plankton tow.

Hydrographic Data

Wire Depth (M)	T	t	T^1	t^1	Temp °C	Depth M	Salinity ‰	O_2 ml l^{-1}	P um	Si um	I Bottle Number
0						0		5.63	0.61	2	243
25						25		5.56	0.59	3	316
37	>12	-	26.63	24.7		37		5.50	0.85	27	
50						50		5.53	0.51	9	248
75						75		5.67	0.99	0	317

87	> 12	-	20.36	25.0	87	5.41	0.80	0	
100					100	4.53	1.20	15	253
125	> 12	-	15.43	24.6	125	1.04	2.32	15	
150						0.21	2.54	27	248
175	12.3	25.20	13.92	24.8		0.69	2.35	25	
200						0.76	2.30	26	247
225	11.69	25.10	13.70	24.8		0.92	2.53	28	
250						0.69	2.51	26	250
275	11.18	24.65	12.72	24.5		0.75	2.54	30	
300						0.51	2.56	32	239
350	10.45	24.65	12.61	24.3		0.82	2.73	34	
400						0.31	2.75	38	230
450	9.30	24.65	12.48	24.2		0.76	2.98	42	
500						0.42	2.94	41	238
600						0.64	3.04	45	236
650	7.16	24.45	17.41	24.3		0.89	3.08	51	
700						1.04	3.13	52	234
800						1.80	3.13	62	237
850	5.66	24.40	17.50	24.2		1.78	2.98	65	
900						1.78	3.04	72	235

1000						-	-	
1100						3.08	87	333
1150	4.34	24.9	13.60	24.2	2.61	2.83	90	
1200						2.91	93	327
1300	3.88	23.3	14.26	22.5	2.68	2.94	100	
1400						2.89	101	331
1500						2.91	107	335
1550						2.91	112	330
1600	3.21	24.1	16.13	23.7	3.37	2.89	113	
1700						2.91	121	240
1750	2.93	23.9	16.61	22.7	3.40	2.72	119	
1800						2.89	127	241
1900	2.73	22.5	18.12	22.0	3.10	3.00	129	
2000						2.81	124	337
2100						2.71	134	322
2200	2.52	24.7	20.28	24.7	3.43	2.75	120	
2300						2.73	137	332
2400	2.36	24.2	21.12	24.2	3.52	2.92	133	
2500						2.62	139	329
2600						2.62	140	328

2700	2.31	24.2	23.83	23.8	3.59	2.54	136
2800						2.60	140 326
2900	2.18	24.2	25.06	23.7	4.00	2.66	136
3000						2.64	137 323
3100						2.64	143 334
3200	2.11	24.2	27.40	22.4	3.83	2.54	140
3250						2.68	138 336
3300						2.60	142 315
3325	2.12	24.9	28.45	24.8	3.92	2.53	142
3400						2.68	139 325
3410	2.16	24.7	29.15	24.7	3.99	2.64	144
3450						2.60	142 314
3470	2.21	24.7	29.88	24.5	3.93	2.66	140
3500						2.60	144 318
3510	2.14	24.9	29.58	24.5	4.09	2.62	146
3525						2.60	144 321
3550						2.54	143 319
3560	2.16	25.1	30.88	25.0	3.96	2.53	142
3590						2.62	144 320

3600 1.06* 0* 324

* Pretripped

Humics Samples

Depth M	vol. l
0- 400	133
900-2100	145
3000-3590	143

STATION SH1589 12/5/1976 0644-1004 6° 59.9'S 107° 00.8'W

3155m.

Operations

Two gravity cores using RVB corer "CORE LD 6" 220cm carbonate sand/ooze, stored unopened in cooler; "CORE LD 7" 206cm carbonate/sand ooze, core squeezed for pore water. Samples drawn and analysed for P and Si.

STATION SH1590 12/5/1976 1547-0436 6° 09.5'S 106° 54.8'W to 6° 11.7'S 107° 00.0'W

3007m

Operations

5 hydro casts of five Niskin + five N10 bottles: 0-225, 250-850, 900-1800, 1900-2800, 2825-3150m. Samples drawn for salinity, O_2, P, Si, I, filters for particulates (inorg. and org.). One gravity

core attempted using RVB corer. Core failed. Humics extraction by resin.

Hydrographic Data

Wire Depth (M)	T	t	T^1	t^1	Temp °C	Depth M	Salinity ‰.	O_2 ml l^{-1}	P um	Si um	I* Bottle Number	
0								5.70	0.57	3	231	
25								5.63	0.63	7	75	
37	>12	-	25.33	25.1				5.17	0.70	7		
50								4.59	1.29	15	232	77
75								2.92	1.52	9	78	
87	>12	-	16.11	24.7				4.81	1.56	13		
100								0.54	2.01	19	233	
125	>12	-	14.43	24.5				0.42	2.19	22		
150								0.34	2.19	25	79	
175	>12	-	14.32	24.7				0.54	2.19	24		
200								0.41	2.68	26	73	74
225	>12	-	14.30	24.5				1.04	2.24	28		
250									-	-		
275								0.45	2.30	29		
300								0.26	2.32	4	124	
350	10.90	24.26	13.76	24.0				0.28	2.41	34		

* occasional sample duplicated or triplicated.

400					0.66	2.47	35	125
450	9.56	24.16	13.27	23.6	0.89	2.64	41	
500					0.66	2.62	41	128
600					0.63	2.91	50	
650	7.11	24.11	12.42	23.6	1.00	2.91	57	
700					1.45	2.70	57	127
800					1.41	2.98	65	131
850	5.71	24.41	12.60	23.7	1.94	2.76	67	
900					2.05	2.89	70	121
1000	5.04	24.70	11.95	23.6	2.15	2.66	75	
1100					2.34	2.66	86	122
1200	4.32	24.21	13.72	23.8	2.76	2.66	92	
1250					2.68	2.72	95	93
1300	4.10	24.36	14.23	23.9	2.68	2.34	100	
1400					2.64	2.79	109	123
1500					2.93	2.72	115	85
1600	3.23	24.65	15.61	23.4	2.95	2.64	116	
1700						2.22	126	126
1750					2.98	2.57	130	130
1800	2.83	22.90	17.33	21.2	2.99	2.64	130	

1900					3.28	2.57	133	96	
2000	2.65	24.21	18.25	23.0	3.06	2.64	128		
2100					3.23	2.74	131	81	
2200					2.27	2.76	138	80	
2250					3.30	2.49	129	82	
2300	2.47	24.12	20.31	23.3	3.56	2.57	125		
2400					3.36	-	140	83	
2500	2.37	23.68	21.98		3.53	2.41	140		
2550					3.53	2.51	139	90	
2600	2.26	23.77	22.21	22.1	3.87	2.51	138		
2700					3.71	2.22	139	84	
2800	2.16	22.79	24.43	21.5	4.16	2.51	141		
2825	2.18	24.17	24.43	23.2	3.87	2.45	140		
2850						2.53	142	86	
2900						2.53	144	89	91 94
2915	2.17	24.46	24.46	23.8	3.84	2.51	132		
2950						2.45	142	87	
2965	2.25	24.36	25.43	23.9	3.82	2.45	145		
3000						2.77	141	95	
3015	2.23	24.61	25.47	24.2	3.78	2.57			

3050						2.43	135	88	
3065	2.17	24.60	25.9	23.9	3.78	2.32	145		
3100						2.38	-	92	96
3150						-	-		

Humics Samples

Depth M	vol l
0-500	134

STATION SH1591 13/5/1976 1615-0853 4° 25.3'S 106° 48.0'W to 4° 28.02'S 106° 49.5'W
3139m

Operations

5 hydro casts initially with 6 Niskin + 5 N10 bottles. serious problems with bottles not tripping, attributed to high density of tunicates attaching themselves to wire and preventing movement of messenger. Casts worked over: 0-225, 250-1100, 1200-3050 (1800-3050 not tripped), 2825-3120 (2950-3120 not tripped). Samples drawn for salinity, O_2, P, Si, I. Filtered for particulates (inorg. and org.). One gravity core using RVB corer "CORE LD 8" 118 cm carbonate ooze grading to darker ooze/clay at base. stored unopened in cooler. On board analysis: O_2, P, Si. Detailed humics sampling over euphatic zone and resin extraction. Plankton tow.

Hydrographic Data

Wire Depth (M)	T	t	T^1	t^1	Temp °C	Depth M	Salinity ‰	O_2 ml l^{-1}	P um	Si um	I Bottle Number
0								5.60	0.25	4	129
25								2.78	1.37	14	138
37	>12	-	15.67	24.5					1.32	16	
50								1.72	1.66	18	137
75								0.43	2.00	23	142
87	>12	-	15.06	23.8					2.00	23	
100								0.17	1.97	25	139
125	>12	-	14.23	23.7					1.97	26	
150								0.18	2.31	26	133
175	>12	-	14.22	23.7					1.95	26	
200								0.28	2.00	27	144
225	>12	-	-	-					2.06	28	
250								0.27	2.02	26	355
275	>12	-	14.45	24.0					2.16	29	
300								0.30	2.14	29	360
350	11.30	23.9	14.22	23.0					2.18	32	
400								0.24	1.95	32	356
550								0.82	2.52	42	358

650	7.23	23.48	12.63	22.6		2.35	45	
700					1.80	2.60	49	357
800					2.20	2.60	59	359
850	5.53	23.17	12.36	20.6		2.56	65	
950					2.17	2.63	76	361
1000						2.71	80	
1100					2.44	2.48	91	339
1200					2.69	2.52	87	350
1300	3.86	24.36	14.36	23.5		2.56	100	
1400					2.96	2.39	112	354
1500	3.32	24.26	15.06	23.0		2.48	117	
1550					3.03	2.63	121	351
1650	3.15	24.41	16.33	23.3		[illegible]	122	
1900						2.52	128	134
2000	2.64	25.4	18.20	24.4		2.50	136	
2100					3.08	2.52	134	135
2200					3.40	2.52	126	136
2250					3.25	2.60	142	141
2300	2.43	24.90	20.61	24.3		2.27	142	
2400					3.34	2.37	128	338

2500	2.35	24.65	22.28	23.8			2.39	141
2550						3.44	2.18	150 140
2600	2.24	24.65	22.46	23.5			2.14	139
2700						3.49	3.31	141 143
2800	2.18	24.65	24.68	23.3			2.25	140
2825	3.99	24.75	13.86	24.5			2.37	37
2850						2.71	2.58	99 342
2900						2.45	2.35	101
2915	3.73	24.75	14.01	24.3			2.35	103

Humics Samples

Depth M	vol l	Depth M	vol l
0	8.3	250	14.9
25	11.6	300	13.75
50	14.1	400	14.6
75	14.0	550-1900	130
100	14.8	2400-2900	70
150	14.1		
200	15.0		

STATION SH1592 17/5/1976 0921-1154 1° 17.7'S 94° 37.4'W
3422m

Operations

One gravity core (on second attempt) using RVB corer "CORE P1" 150cm with 12cm oxic top grading from brown to green/grey. Core squeezed for pore water. Samples drawn and analysed for P, Si, NH_3.

STATION SH1593 17/5/1976 1645-2252 1° 21.06's 93° 47.5'W
3400m.

Operations

Two attempts at gravity core using Edinburgh corer. both failed: first time barrel broken; second, core of 20cm slipped out of barrel. Station abandoned.

STATION SH1594 18/5/1976 0408-0603 1° 24.5'S 92° 58.9'W
3510m.

Operations

One gravity core using RVB corer "CORE P2" 170cm brown oxic top of 4-5cm with green/grey below. Core squeezed for pore water. Samples drawn and analysed for P, Si, NH_3.

STATION SH1595 18/5/1976 1110-1250 1° 32.7'S 92° 12.0'W
3190m.

Operations

One gravity core using RVB corer "CORE P3" 190cm brown oxic top of 4-5cm anoxic grey/green. Several light (ash?) bands around 80-100cm. core cut into 2 sections and frozen horizontally.

STATION SH1596 19/5/1976 1632-1805 00° 55.1'S 87° 51.5'W

1540m.

Operations

Two gravity cores using RVB corer "CORE P4" 275cm grey-green highly foraminifera ooze. Top of core lost. Core cut at 135cm and sections frozen horizontally. "CORE P5" 263 cm pale grey-green foraminiferal homogeneous sand. Sectioned and stored as P4.

STATION SH1597 20/5/1976 0808-0924 00° 35.9'N 86° 09.9'W

2735m

Operations

One gravity core after S → N run onto Galapagos "hot spot" RVB corer "CORE LD 9" 142cm brown floc-like top of 3cm over grey-green anoxic sediment. Stored unopened in cooler.

STATION SH1598 20/5/1976 1050-1957 0° 48.4'N 86° 13.0'W

2500m.

Operations

4 hydro casts using 7 Niskin + 5 N10 bottles: 0-250, 300-1300, 1500-2250, 2275-2490m. Samples drawn for salinity, O_2, P, Si, I. filtered for particulates (inorg. and org) on board analysis: O_2, P, Si. Plankton tow using Zodiac inflatable boat. Humics extraction by resin.

Hydrographic data

Wire Depth (M)	T	t	T^1	t^1	Temp °C	Depth M	Salinity ‰	O_2 $ml\,l^{-1}$	P um	Si um	I bottle number
0								6.02	0	0	345
25								5.68	0	0	349

50	>12	-	19.75	25.3	3.65	0.30	1	166
75					3.47	0.78	8	352
87	>12	-	19.71	25.4	3.47	1.00	7	
100					3.28	0.88	8	353
125	>12	-	18.63	25.4	3.88	-	9	
150					2.87	1.1	13	348
175	>12	-	16.36	25.2	2.85	1.60	15	
200					2.74	1.26	15	346
225	>12	-	16.42	25.3	2.45	1.68	16	
250					2.01	1.87	16	157
250					-	-	20	
300					1.97	1.81	21	147
350	>12	-	14.86	24.8	0.77	2.21	30	
400					0.40	2.56	40	158
500					0.48	2.49*	48	148
600	7.52	15.25	12.31	24.3	0.93	2.94	55	
700					1.66	2.88	66	145
800	6.01	25.15	12.58	24.7	1.49	2.86	74	
900					1.63	3.23	81	149

* Ave. of Replica Samples.

1000	5.11	25.30	13.20	25.3	2.06	2.92	101	
1100					2.00	2.94	96	146
1200	4.18	25.30	13.82	24.8	2.65	2.77	105	
1300					1.92	-	-	152
1500					2.22	2.84	123	159
1600	3.25	26.20	16.05	25.8	2.47	2.77	130	
1700					2.49	2.80	142	163
1800	2.92	26.12	17.26	25.6	2.76	2.90	141	
1900					2.66	2.56	144	160
1950	2.79	25.65	18.48	25.6	2.79	2.63	144	
2000					2.87	2.56	141	164
2050	2.65	25.25	18.81	25.2	2.96	2.52	146	161
2100					2.97	2.56	144	
2200					2.79	2.77	148	165
2225	2.58	25.25	20.63	25.4	3.01	2.71	-	
2275	2.70	25.77	20.63	25.3	2.85	2.79	150	162
2300					2.88	2.56	147	341
2325	2.54	25.67	20.46	25.7		2.79	147	
2350					2.32	2.69	148	340
2375	2.56	25.36	21.28	25.30		2.77	149	

2400					3.00	2.69* 148	347
2410	2.52	25.72	21.31	26.0		2.65 152	
2425					2.99	3.56 152	343
2450					3.04	2.56 149	168
2460	2.46	26.1	21.60	25.7		2.52 150	
2475					2.97	2.97 152	344
2490					2.96	2.77 149	167

Humics Samples

Depth M	vol l
0	8.3
25	6.7
75	14.1
100	14.2
150	14.4
200	14.6
250	14.7
300	12.6
400	11.3

* Avge. of Replica Samples

STATION SH1599 21/5/1976 2052-2155 0° 52.3'N 86° 07.7'W
2712m

Operations

One gravity core using RVB corer "CORE P6" 159cm. top 15cm. oxic brown with 15 base grey/green clay. Core squeezed for pore water. Samples drawn and analysed for P, Si and NH_3.

STATION SH1600 22/5/1976 1430-1542 2° 30.2'N 84° 04.0'W
3085m

Operations

One gravity core using RVB corer "CORE P7" 190cm. top 4cm oxic brown clay with anoxic green/grey below. Core stored in freezer.

STATION SH1601 22/5/1976 0606-2035 4° 40.7'N 81° 53.5'W
4093m

Operations

4 hydro casts using eight Niskin + five N10 bottles: 0-300, 400-1600, 1700-3400, 3470-4010m. Samples drawn for salinity, O_2, P, Si, I (latter in triplicate). filtered for particulates (inorg. and org.). One gravity core using RVB corer "CORE P8" 175cm dark green anoxic clay, no forams. top 4cm oxic brown. Core squeezed for pore water. Samples drawn for P, Si, NH_3. Onboard analysis O_2 P, Si, NH_3.

Hydrographic Data

Wire Depth (M)	T	t	T^1	t^1	Temp.	Depth	Salinity	O_2	P	Si	I* Bottle Numbers A		
0								5.65	0.06	0	201	156	153
25								6.31	0.25	0	198	171	172
50	>12	-	23.95	26.4				5.13	0.80	3			
75								2.42	1.76	9	197	151	154
87	>12	-	18.41	26.4				1.68	1.93	11			
100								1.29	1.97	14	202	176	175
125	>12	-	16.18	26.4				1.30	2.14	16			
150								1.26	1.93	17	193	155	150
175	>12	-	15.41	25.9				1.18	2.10	18			
200								0.94	2.21	19	203	174	173
225	>12	-	15.21	26.1				1.23	2.16	19			
250								0.81	2.60	20	194	170	169
300								0.54	2.46	25	199	180	179
400								0.26	2.71	34	8	65	69
500								0.10	3.07	43	3	62	70
600	7.85	24.85	12.60	24.3					3.40	58			

* I Samples in triplicate "A" refers to samples air freighted from Panama; remainder stored on board ship.

700									
800	6.02	24.85	12.21	24.2					
900									
1000	5.07	24.85	13.03	24.4					
1100									
1300									
1400	3.83	25.20	14.70	24.5					
1500									
1700									
1800									
1900	3.35	25.00	15.80	24.2					
2000									
2100	3.04	24.51	16.86	23.6					
2250									
2400	2.66	24.26	18.68	23.2					
2500									
2750	2.47	24.26	20.51	22.5					
2900									
3000	2.44	24.17	22.83	24.4					
3250									

0.41	3.30	-	9	63	71
	3.38	76			
0.96	3.30	87	4	305	306
	3.30	92			
1.33	3.42	100	185	61	64
1.74	3.30	112	7	310	307
	3.21	120			
2.05	3.11	137	186	68	72
1.85	3.28	119	182	57	58
2.05	3.11	122	187	49	50
	3.19	125			
2.26	3.05	129	184	59	60
	3.19	134			
2.52	3.07	137	190	51	52
	3.32	145			
2.78	3.11	145	183	53	54
	3.26	147			
2.86	3.00	148	188	66	67
	3.09	149			
2.92	2.92	146	192	55	56

3470					2.99	2.96	148	196	206	208
3570					3.01	3.17	148	181	210	213
3670	2.44	25.46	30.73	24.5		2.90	149			
3720					3.02	2.98	147	200	207	211
3770	2.46	25.46	30.63	24.5		2.90	146			
3820					3.12	2.90	148	191	215	212
3870	2.52	25.45	32.04	24.6		2.84	150			
3895					3.07	2.96	148	204	205	216
3920	2.49	25.72	32.16	24.9		2.79	150			
3945					2.42	2.86	149	189	209	217
3970	2.46	25.90	32.2	25.0		2.94	149			
3990					3.08	2.75	148	195	177	178
4010					5.21	1.00	2			

STATION SH1602 23/5/1976 0825-2012 5° 15.7'N 79° 44.5'W

3075m

Operations

One gravity core using RVB corer "CORE P9" 168cm dark green-grey of which top 2cm oxic brown. pronounced H_2S odour at base of core. Core squeezed in part for pore water. Samples drawn and analysed for P, Si, NH_3. Four hydro casts using eight Niskin+ five N10 bottles 0-250, 300-1400, 1500-2400, 2500-3040m. Samples drawn for salinity O_2, P, Si, I. On board analysis O_2, P, Si. Plankton Tow.

Hydrographic Data

Wire Depth (M)	T	t	T^1	t^1	Temp °C	Depth M	Salinity ‰	O_2 ml l^{-1}	P um	Si um	I* Bottle Numbers		
0								5.71	2.29	0	14	292	293
25								5.87	2.29	19	21	298	299
37	>12	-	26.23	27.3					0.48	0			
50								4.50	2.35	19	15	296	297
75								2.52	2.23	16	17	290	294
87	>12	-	17.41	26.5					1.55	13			
100								1.26	1.93	11	18	300	301
125	>12	-	15.83	26.3					1.91	18			
150								0.63	1.20	4	16	302	308
175	>12	-	-	-					1.89	19			
200								1.04	0.14	-	22	295	291
225	> 12	-	15.4	25.7					1.93	20			
250								0.94	-	30	23	309	304
300								0.61	2.12	23	287		
350	>12	26.70	14.9	25.9					2.31	16			
400								0.14	2.48	32	288		

* occasional samples in duplicate or triplicate

0-225m (1st cast) possibly reversed samples

500					0.07	2.90	34	279
600	7.83	26.02	12.62	25.7		2.94	50	
700					0.50	3.36	57	284
800	>12	25.65	12.53	25.0		3.21	66	
900					1.44	3.40	78	286
1000					1.34	3.21	113	289
1100						3.11	86	
1200					1.48	3.40	95	285
1300	4.09	25.46	14.41	24.5		3.11	102	
1400						-	-	
1500					1.89	3.28	114	13 268
1550					2.09	3.21	117	281
1600	3.53	25.56	16.12	24.8		3.00	113	
1700					2.20	3.13	127	20 269
1750	3.24	25.37	16.51	24.6		2.75	125	
1800					2.30	3.11	137	278
1900	2.96	25.25	17.73	24.0		2.86	130	
2000						3.15	0	12 283
2100	2.68	25.10	18.81	24.1		2.79	137	
2200					2.21	3.00	144	280

2250								
2300	2.47	25.70	21.00	24.9				
2500								
2550	2.45	25.70	22.3	25.1				
2600								
2650	2.49	25.1	23.3	24.8				
2700								
2750	2.49	24.56	24.23	24.3				
2800								
2850	2.42	24.75	24.42	24.3				
2900								
2950	2.42	24.75	25.83	24.4				
3000								
3020								

2.64	2.56	138	6	282	
	3.00	137			
2.86	3.00	143	24	303	311
	0	141			
2.90	2.71	143	2	270	271
	2.88	137			
2.81	2.90	143	11	312	313
	2.73	141			
3.06	2.75	143	5	272	273
	2.90	142			
2.92	2.63	143	10	274	275
	2.79	66			
3.12	2.86	139	1	267	266
3.17	2.84	132	19	276	277

STATION SH1603 24/5/1976 0600-0806 6° 27.5'N 78° 25.8'W
4007m

Operations

One gravity core using RVB corer "CORE P10" 150cm. 4cm oxic brown, 4-150cm grey-green clay. No. H_2S odour noticed. Core stored in freezer.

STATION SH1604 24/5/1976 1010-1200 6° 48.3'N 78° 35.3'W
3847m

Operations

One gravity core using RVB corer "CORE P11" 190cm. grey-green "sapropelic" clay with 5cm oxic brown top. Strong H_2S odour at 185cm. Core stored in freezer.

STATION SH1605 24/5/1976 1340-1454 7° 8.6'N 78° 43.9'W
3491m

Operations

One gravity core using RVB corer "CORE P12" 225cm. with 1cm brown oxic top above dark "sapropelic" grey-green clay. Intense H_2S generation at 225cm. Core stored in freezer.

STATION SH1606 24/5/1976 1543-1715 7° 17.8'N 78° 48.1'W
3000m

Operations

One attempted gravity core with RVB corer. Attempt failed.

STATION SH1607 24/5/1976 1856-1950 7° 31.3'N 78° 54.5'W

1803m

Operations

One gravity core with RVB corer "CORE P13" 150cm. ½cm oxic brown underlain by grey-green clay. No H_2S odour.

STATION SH1608 24/5/1976 2038-2054 7° 37.5'N 78° 37.6'W

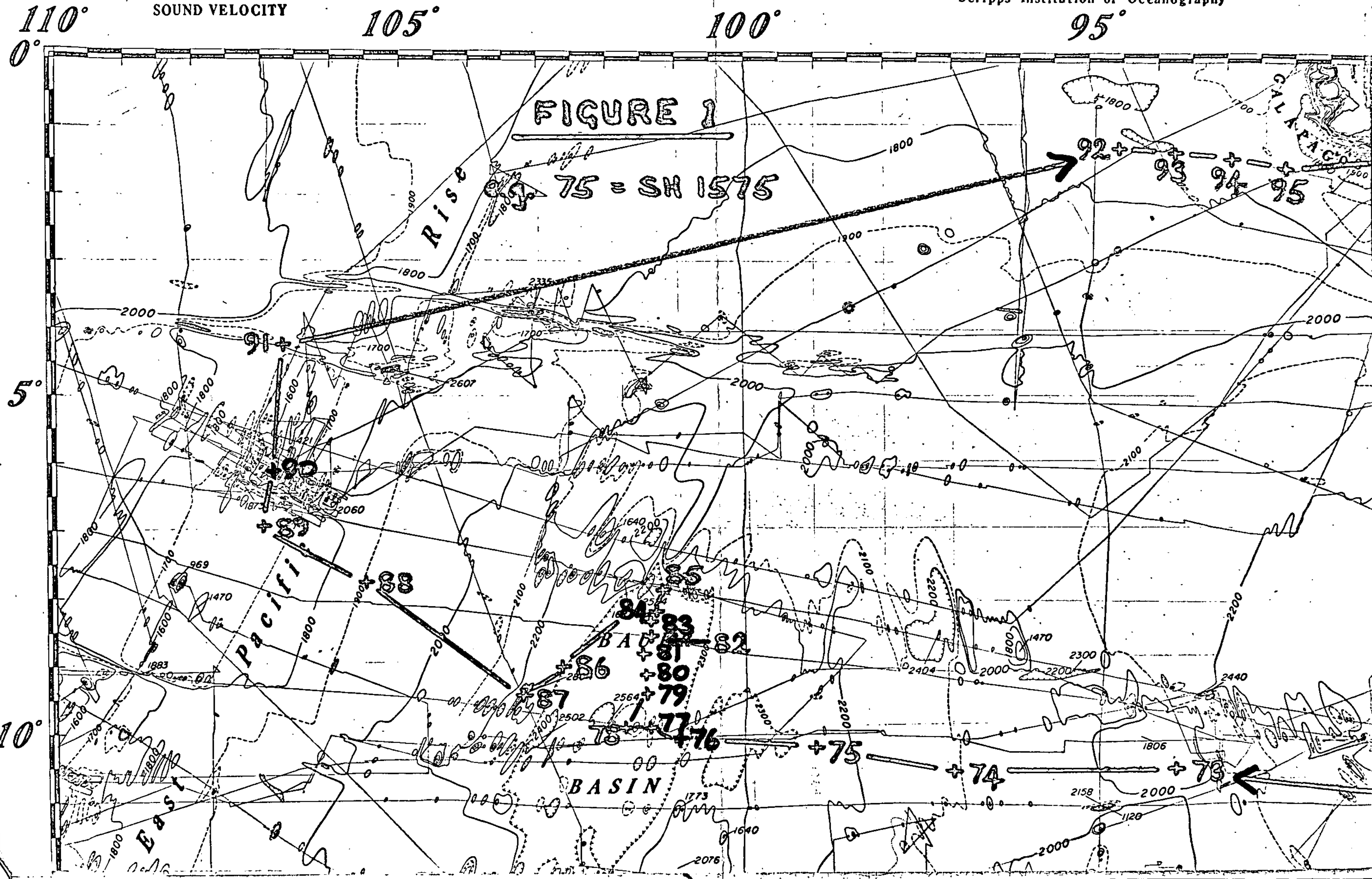
132m.

Operations

One gravity core with RVB corer "CORE P14" 30cm first 4cm includes carbonate debris, sand, organics underlain by anoxic dark green clay.

MERCATOR PROJECTION
CONTOURS IN FATHOMS
UNCORRECTED FOR
SOUND VELOCITY

J. Mammerickx, S. M. Smith, I. L. Taylor and T. E. Chase
Scripps Institution of Oceanography



PANAMA

COLOMBIA

ECUADOR

PERU

COCOS RIDGE

COIBA RIDGE

MALPELO RIDGE

PANAMA BASIN

CARNEGIE RIDGE

GRIJALVA RIDGE

SARMIENTO RIDGE

West Cocos Seamount

Cocos I.

Coiba I.

Malpelo I.

Paramount Bank

Genovesa I.

DSDP SITE 157

DSDP SITE 320

+00 +01 +02 +03 +04 +05 +06 +07 +08

+96 +97 +98 +99

+71 +72

5°

0°

77°

5°

10°

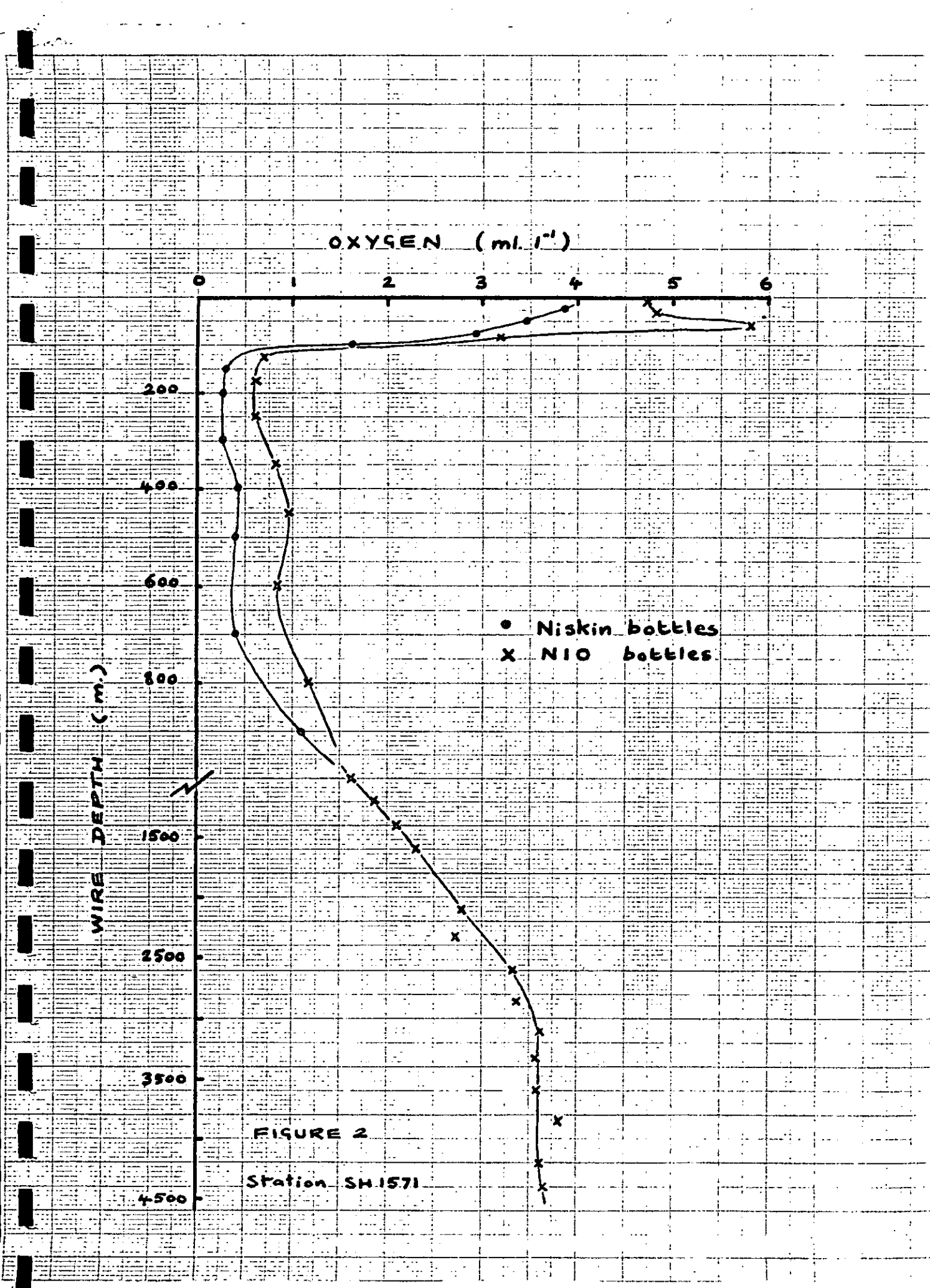


FIGURE 2

Station SH 1571