

I.O.S.

R.R.S. DISCOVERY

CRUISE 98

27 December 1978 – 10 January 1979

**CRUISE REPORT NO. 75
(1979)**

**NATURAL ENVIRONMENT
INSTITUTE OF OCEANOGRAPHIC
SCIENCES
RESEARCH COUNCIL**

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Recife to Cape Town section

CRUISE REPORT NO. 75

Institute of Oceanographic Sciences,
Wormley, Godalming,
Surrey, GU8 5UB.

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SCIENTIFIC PERSONNEL

R.T. Pollard	Principal Scientist	IOS Wormley
R.J. Burnham	Computer Engineer	RVS Barry
T.R. Crocker	Acoustic log	IOS Wormley
R. Spencer	Tide guage	IOS Bidston
J.M. Vassie	Tide guage	IOS Bidston

SHIP'S OFFICERS

M.A. Harding	Master
J.D. Noden	Chief Officer
S. Sykes	Second Officer
C.J. Dixon	Third Officer
A.C. Coombes	Chief Engineer
N. Wilson de Rce	Second Engineer
D.E. Anderson	Third Engineer
D. Hornsby	Fourth Engineer
R.M. Thomas	Fifth Engineer
A. Greenhorn	Fifth Engineer
L. Wilson	Electrical Engineer
A. Chivers	Doctor
R. Cridland	P.C.O.
J. Field	Radio Officer

CRUISE OBJECTIVES

Cruise 98 was primarily a passage leg from Recife, Brazil, to Cape Town, South Africa. Work on passage consisted of

- (1) two hourly XBTs to 750 m
- (2) towed magnetometer
- (3) echo sounding
- (4) surface temperature and salinity profiler

In addition,

- (5) a tide guage was laid on the mid-Atlantic Ridge
- (6) trials of an acoustic doppler log were carried out

NARRATIVE

After clearing the berth at Recife at 0800 local time on 27th December 1978, four hours were lost waiting for members of the crew and putting baggage ashore. Course was then set for the tide guage position (T7, 17°S, 14°W) on three engines, but no gear could be deployed until the 200 mile limit was reached at 0900Z on 28th. The PES fish, Moorey temperature/salinity fish, and magnetometer were streamed at 0930Z, but the magnetometer and XBT launcher had to be relocated several times before positions could be found so that the magnetometer did not foul XBTs. This was accomplished at 1800Z.

The tide guage position was reached at 1400Z on 1st January 1979, after five days steaming on three engines. The persistent trade wind (easterly, 10 - 20 kt) and adverse current (to south west, 0.2 - 0.5 kt) kept the speed made good to 11.4 kt. Seven hours were spent surveying the tide guage area for a suitable depth of water and waiting for satisfactory satellite passes. By the time the tide guage was in position, ten hours had been spent on the station (9933).

The vessel then proceeded (0000Z/2nd January 1979) on a great circle course to Cape Town, alternately on two and three engines to keep to schedule, and to allow time for tests of the acoustic doppler log on four occasions (4th, 5th, 7th, 9th January). A minor course alteration made it possible to survey the Vema Seamount (31°38'S,

8°21'E), being considered as a possible site for tide gauge deployment, between 2000Z and 2200Z on 7th January. The doppler log was tested at the same time, and bottom returns were possible over the seamount. The minimum echo sounder depth was 35 m.

Computer logging was terminated, the magnetometer hauled, and XBT drops ceased at 2230Z on 9th January, shortly after the 1000 m line was reached. Discovery berthed at Cape Town at 0700Z on 10th January 1979. A track plot is shown at the end of this report.

PROJECT REPORTS

XBTs

T7 (760 m) XBT probes were launched at two hour intervals throughout the cruise (see XBT station list) excepting only 1600Z-2200Z on 1st January during the tide gauge survey and deployment. The fixed launcher was initially attached to the centre of the poop rail. However, all XBTs fouled the magnetometer in this position. The problem was solved by placing the XBT launcher and magnetometer as far apart as possible (see Magnetometer).

All observations were coded and transmitted into the IGOSS network. A running plot of the sea surface temperature and depths of several isotherms was kept, partly as an aid to identifying bad profiles. Out of a total of 168 probes deployed, 17 were dud.

R. Pollard.

TIDE GAUGE WORK

An off shore tidal recorder was deployed at a position designated T7 17°S 13°40'W, on the eastern side of the mid Atlantic ridge. Previously a tidal record had been taken by IOS at St. Helena, also in October 1978 a temporary tide gauge was installed on Ascension Island. These locations provide a suitable triad from which to study the tides in the central south Atlantic.

The tidal capsule was a new design using a Sea Data logging system and incorporated two temperature sensors and three pressure sensors. A separate experimental tidal recorder of the Aanderaa type was also fitted to the frame.

Bathymetric charts of the area had shown that it was predominantly around 2800 m, so the pressure sensors were calibrated at the

equivalent pressure. However, on site the nominal depth was in the region of 3200 m with occasional peaks of 2800 m about 1-2 miles wide. A bathymetric survey was carried out to examine the topography of the area and to aid the future recovery of the instrument. The only area at 2800 m was the tops of the peaks found. Thus a suitable "hill" was chosen and it was hoped that this could be used as a means of locating the correct position.

In view of the difficulty with soundings it was essential to obtain a good satellite fix for the deployment of the instrument. This was achieved in the late evening around 2100Z hours when three satellites gave good positions in the space of two hours. Prior to this no good satellites were available from 1000Z hours.

The instrument was deployed at 2136Z hours on 1st January 1979 at a depth of 2827 corr. m. and at a position 17°04.2'S, 13°39.6'W.

R. Spencer.
I.M. Vassie.

MAGNETOMETER

The magnetometer was initially deployed over the Gloria hydrophone guide aft of the starboard A-frame at 1000Z on 28th December. In that position, however, it fouled all XBTs. After trying several alternative positions of magnetometer and XBT launcher, the problem was finally cured by leading the magnetometer cable through the port fair lead forward of the port A-frame position. The XBT launcher was mounted on the starboard quarter of the stern rail.

In its final position, the magnetometer was streamed and logged almost continuously from 1800Z on 28th December to 2200Z on 9th January. It was recovered temporarily twice during this period,

- (1) 1400Z - 2400Z on 1st January, during tide gauge deployment.
- (2) 2000Z - 2200Z on 7th January, during passage over Vema Seamount, where a minimum depth of 11m is charted.

Erratic behaviour of the recorder on 2nd January was traced to a faulty pre-amp relay board, which was replaced.

R. Spencer.
R. Pollard.

DOPPLER SONAR PROFILING SYSTEM TRIALS

Trials were made of an experimental current profiling system intended to determine the ship's speed with respect to successive

depth slices in the ocean, down to depths of ~ 500 m. The equipment uses two 74 kHz, narrow beam acoustic transducers mounted on the 'Asdic' platform and it is hoped to determine the relative velocity of each layer by detecting the doppler drift in the frequency of the scattered returns of transmitted pulses.

It was only possible to deploy the 'Asdic' pod for short periods, however the four periods of deployment yielded some useful results, although not perhaps those hoped for.

The measurement of the strength of the acoustic returns agreed well with that predicted on paper.

i) It has been shown that transmission with the pod retracted is not satisfactory, although the acoustic path is known to be geometrically good. The difficulty is probably obstruction by air bubbles trapped by the ship's hull. Similarly the level of received sea noise with the pod retracted and the ship in motion is sufficiently high to blank out returns from further than ~ 100 metres.

ii) The level of sea noise with the 'pod' deployed and the ship moving slowly (e.g. 2 knot deployment speed) is very low, not much above the thermal noise of the transducer, and does not increase significantly for speeds up to about 6 knots. Even at 8 knots the returns from 60 m sec pulses (200 w electrical power) are seen above the noise out to 800 m secs.

iii) The level of ship induced noise is very significant (even with the pod deployed) if the ship is pitching, as in the swell in the latter part of the trip. This is presumed to be due to the trapped and bursting air bubbles under the hull.

Attempts to detect the doppler shift in frequency were not so successful, and it will take further analysis of the data to determine the cause. It would appear that the spectrum of the returned signals is broader than expected, or that the level of contamination of the wanted signal by returns from outside the angle of the main beam (and therefore having different expected doppler shifts) is sufficient to give apparent broadening. The coarse level of doppler shift can be seen however, if the receiver band pass is moved away from the expected frequency, by the significant decline in received levels.

On the last day of the cruise it was possible to adapt the equipment

to make recordings of a few typical transmission cycles. It is hoped that these will contain information to determine the frequency structure of the signal, and to indicate the modifications necessary to make the system viable.

T. Crocker

COMPUTER REPORT

The main requirement for cruise 98 was accurate navigation provided by the Magnavox Satellite Navigation System and the IBM 1800 computer. Intermittent failure of the analogue input channels to the IBM 1800 persisted during the passage and the particular amplifier board was replaced upon arrival in Cape Town.

The New Year created a whole series of software problems as the dumping and plotting programs could not cope with the day change from day 365 to day 1. The fault was traced to the program FINDT which makes file finding decisions based on one day having a greater Julian value than another. The problems were overcome by altering the FINDX file such that the computer dealt with the two years separately. With hind-sight it would have been better to have split the cruise into two legs, the first ending on day 365 at midnight.

The PDP 11/04 computer was used to transfer tide gauge cassette information onto half inch magnetic tape and proved to be very reliable. The seadata suite of programs was successfully used, although the computer sometimes crashed with parity errors for no apparent reason. If the normal sampling was stopped the seadata programs ran successfully.

T. Burnham

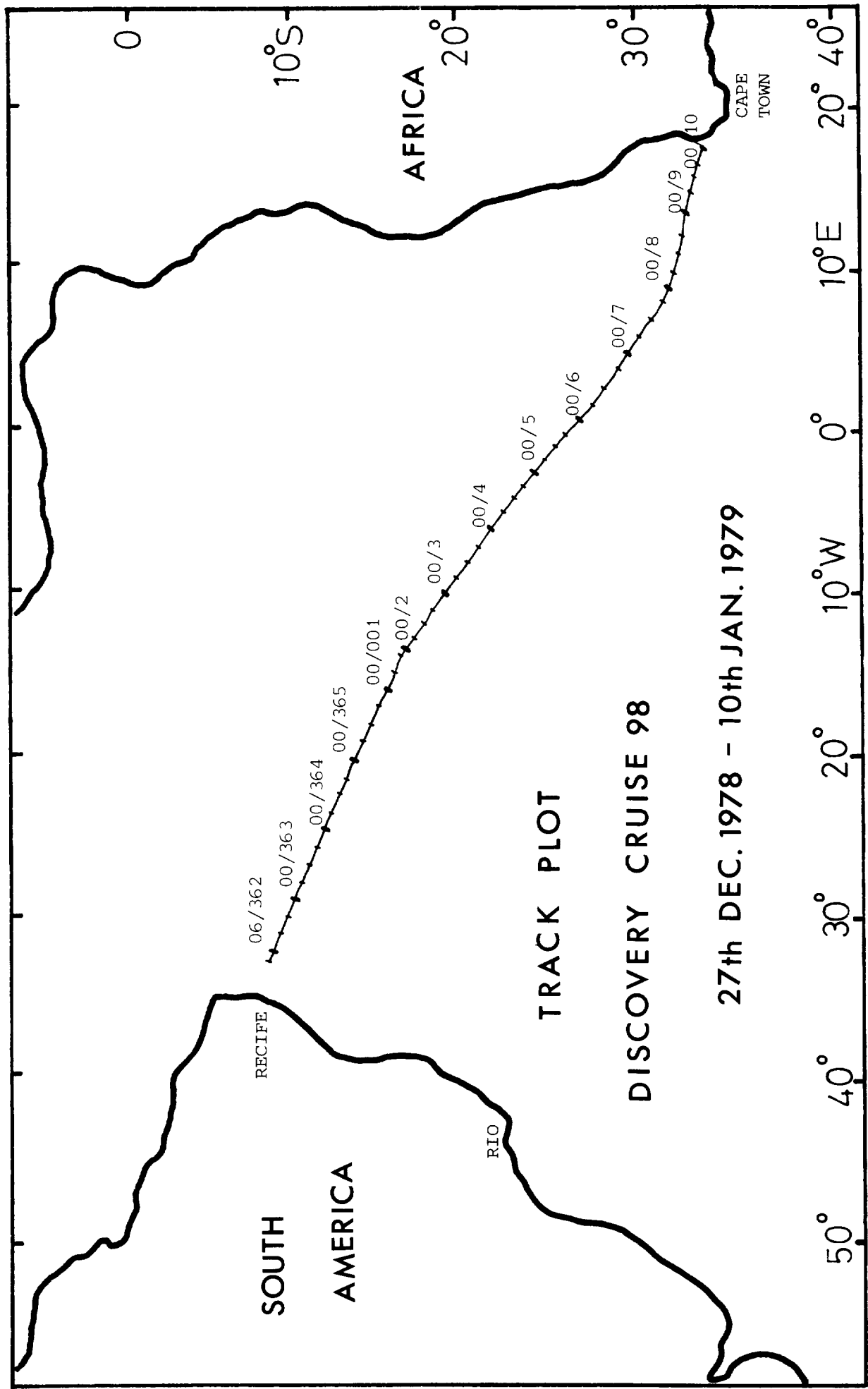
XBT Station List

No.	date	time GMT	latitude	longitude	depth(m) reached	comments	
9800	1	28	0930	9°39.3'S	31°34.9'W	535	recorder set for shallow probe
	2	DEC	1000	9°41.8'S	31°29.5'W	760	
	3	1978	1200	9°48.0'S	31°15.1'W	170	fouled magnetometer cable
	4		1230	9°49.8'S	31°10.8'W	360	" " "
	5		1400	9°55.8'S	30°55.7'W	170	" " "
	6		1600	10°03.4'S	30°35.6'W	140	fouled skew launcher barrel
	7		1606	10°03.8'S	30°34.6'W	760	2nd probe dud, 3rd O.K.
	8		1800	10°11.8'S	30°14.1'W	760	
	9		2000	10°19.5'S	29°53.9'W	760	
980	10		2200	10°27.6'S	29°32.6'W	760	
	11	29	0000	10°35.4'S	29°11.1'W	760	
	12	DEC	0200	10°43.2'S	28°49.5'W	760	
	13	1978	0400	10°51.1'S	28°27.9'W	760	
	14		0600	10°58.7'S	28°05.9'W	760	
	15		0800	11°06.7'S	27°43.8'W	760	
	16		1000	11°14.7'S	27°21.4'W	760	
	17		1200	11°22.3'S	26°59.0'W	760	
	18		1400	11°32.6'S	26°37.4'W	760	
	19		1605	11°41.8'S	26°15.0'W	760	1st probe dud, 2nd O.K.
980	20		1800	11°50.1'S	25°54.0'W	760	
	21		2000	11°58.4'S	25°31.3'W	760	
	22		2200	12°09.1'S	25°12.2'W	760	
	23	30	0000	12°18.4'S	24°50.6'W	760	
	24	DEC	0200	12°27.5'S	24°28.8'W	760	
	25	1978	0400	12°36.5'S	24°07.0'W	760	
	26		0600	12°45.2'S	23°45.2'W	760	
	27		0800	12°53.8'S	23°23.2'W	760	
	28		1000	13°02.2'S	23°01.3'W	760	
	29		1200	13°10.3'S	22°41.3'W	760	
980	30		1400	13°19.8'S	22°19.6'W	760	
	31		1600	13°30.2'S	21°58.4'W	760	
	32		1800	13°40.6'S	21°36.7'W	670	
	33		2000	13°51.1'S	21°15.0'W	760	
	34		2200	14°01.5'S	20°53.2'W	760	
	35	31	0000	14°11.5'S	20°30.8'W	760	
	36	DEC	0200	14°21.8'S	20°08.5'W	45	failed
	37	1978	0400	14°32.1'S	19°46.2'W	760	
	38		0600	14°42.3'S	18°24.1'W	760	
	39		0800	14°42.3'S	19°02.0'W	760	
980	40		1000	15°02.6'S	18°39.8'W	760	
	41		1200	15°12.0'S	18°18.3'W	335	paper feed slipped
	42		1400	15°22.0'S	17°57.5'W	760	depth origin not set
	43		1406	15°22.4'S	17°56.4'W	760	
	44		1600	15°31.9'S	17°36.6'W	760	
	45		1800	15°41.3'S	17°15.7'W	760	
	46		2000	15°50.0'S	16°54.6'W	760	
	47		2200	15°59.0'S	16°32.8'W	760	
	48	1	0000	16°08.0'S	16°11.4'W	760	preceded by dud probe

No.	date	time GMT	latitude	longitude	depth(m) reached	comments
49	JAN	0200	16°16.5'S	15°50.0'W	760	
980 50	1979	0400	16°24.7'S	15°27.9'W	760	
51		0600	16°33.3'S	15°06.3'W	760	
52		0800	16°41.9'S	14°44.6'W	760	
53		1000	16°50.4'S	14°23.0'W	760	quality doubtful
54		1235	17°01.5'S	13°55.1'W	760	position extrapolated
55		1400	17°07.6'S	13°39.7'W	300	position extrapolated paper feed slipped
56	2	0000	17°04.3'S	13°39.4'W	760	
57	JAN	0200	17°16.2'S	13°23.0'W	760	
58	1979	0400			0	dud probe
59		0406	17°28.7'S	13°05.8'W	760	
980 60		0600	17°40.0'S	12°50.3'W	760	
61		0800			0	wire broke at surface
62		0801	17°52.2'S	12°33.9'W	760	
63		1000	18°04.9'S	12°17.3'W	760	
64		1200	18°16.3'S	12°03.2'W	500	
65		1400	18°28.8'S	11°47.1'W	760	
66		1606	18°41.3'S	11°30.2'W	760	
67		1800	18°53.2'S	11°13.7'W	760	
68		1900	18°59.7'S	11°04.4'W	760	
69		2000			0	dud probe
980 70		2004	19°06.8'S	10°54.2'W	760	depth zero not aligned
71		2200	19°19.0'S	10°35.9'W	760	
72	3	0000	19°31.4'S	10°16.8'W	760	
73	JAN	0200	19°43.3'S	9°56.5'W	760	
74	1979	0400	19°54.9'S	9°37.0'W	760	
75		0600	20°06.5'S	9°17.3'W	760	
76		0800	20°18.1'S	8°57.7'W	760	
77		1000	20°30.6'S	8°39.0'W	760	
78		1200	20°44.3'S	8°20.9'W	760	
79		1400	20°59.2'S	8°00.7'W	760	
980 80		1600	21°14.1'S	7°40.5'W	760	
81		1800	21°28.4'S	7°19.9'W	760	
82		2000	21°42.6'S	6°59.2'W	760	
83		2200	21°57.1'S	6°38.5'W	760	
84	4	0000	22°11.6'S	6°16.9'W	760	
85	JAN	0200	22°26.1'S	5°55.4'W	760	
86	1979	0400	22°40.2'S	5°33.6'W	760	
87		0600	22°53.3'S	5°11.6'W	760	
88		0800	23°06.5'S	4°50.0'W	760	
89		1000	23°14.2'S	4°39.6'W	760	
980 90		1200	23°24.9'S	4°24.4'W	760	
91		1400	23°35.0'S	4°07.0'W	760	
92		1600	23°45.1'S	3°50.2'W	760	
93		1800	23°57.4'S	3°35.0'W	347	wire broke
94		2000	24°09.8'S	3°19.6'W	760	
95		2200	24°22.7'S	3°04.1'W	760	
96	5	0000	24°35.6'S	2°48.0'W	760	
97	JAN	0200	24°47.5'S	2°31.5'W	430	
98	1979	0400	24°59.1'S	2°15.2'W	760	chart feed problem, 0.4° errors.

No.	date	time GMT	latitude	longitude	depth(m) reached	comments
99		0600	25°10.9'S	1° 59.5'W	760	
98 100		0800	25°23.1'S	1°43.6'W	30	jittery trace
101		1000	25°34.7'S	1°28.3'W	760	
102		1200	25°46.2'S	1°13.0'W	760	
103		1400	25°54.7'S	1°03.0'W	760	some spikes on trace
104		1600	26°07.7'S	0°45.7'W	760	
105		1800	26°20.7'S	0°28.4'W	760	0.2° noise on trace
106		2000	26°35.1'S	0°08.8'W	760	
107		2200	26°49.2'S	0°10.5'E	760	1st probe dud, 2nd O.K.
108	6	0000	27°02.8'S	0°30.2'E	760	
109	JAN	0200	27°16.5'S	0°50.0'E	760	some spikes on trace
98 110	1979	0400	27°29.9'S	1°10.4'E	760	
111		0600	27°43.5'S	1°30.9'E	760	
112		0800	27°57.3'S	1°51.1'E	760	
113		1000	28°11.1'S	2°10.9'E	760	
114		1200	28°24.9'S	2°30.8'E	760	
115		1400				probe twisted in air
116		1404	28°37.1'S	2°53.9'E	760	
117		1600	28°48.6'S	3°15.4'E	760	
118		1800	29°00.4'S	3°37.3'E	760	1st probe dud, 2nd O.K.
119		2000	29°12.4'S	3°59.6'E	760	
98 120		2200	29°24.4'S	4°21.6'E	760	
121	7	0000	29°36.3'S	4°43.8'E	760	
122	JAN	0200	29°48.2'S	5°06.0'E	760	
123	1979	0400	30°02.6'S	5°27.3'E	760?	bottom temp. 0.5° high
124		0600	30°17.5'S	5°48.5'E	760	
125		0800	30°24.4'S	6°12.3'E	760?	bottom temp. 0.4° high
126		1000			0	dud probe
127		1005	30°34.5'S	6°35.5'E	760	
128		1200	30°46.1'S	6°55.3'E	760	
129		1400	30°57.8'S	7°16.0'E	760	
98 130		1600	31°10.9'S	7°34.9'E	760	
131		1800	31°23.9'S	7°53.8'E	640	
132		2000	31°37.0'S	8°12.7'E	760?	poor trace
133		2210	31°39.3'S	8°27.6'E	760	
134	8	0000			80	failed
135	JAN	0005	31°45.6'S	8°43.8'E	760	
136	1979	0200	31°52.1'S	9°02.2'E	760	
137		0400	31°58.3'S	9°21.6'E	760	
138		0600	32°04.3'S	9°41.0'E	760	
139		0800	32°08.1'S	10°01.3'E	418	
98 140		1000			0	failed
141		1005	32°13.4'S	10°28.8'E	760	
142		1200	32°17.6'S	10°52.3'E	760	
143		1400	32°21.3'S	11°16.7'E	144	
144		1406	32°21.5'S	11°18.0'E	760	jitter trace
145		1600			32	failed
146		1606	32°24.9'S	11°42.9'E	760	
147		1800	32°27.9'S	12°06.3'E	760	
148		2000	32°32.2'S	12°31.0'E	230	
149		2200	32°37.7'S	12°55.5'E	760?	inversion at 60m?
98 150	9	0000	32°43.4'S	13°21.6'E	760	

No.	date	time GMT	latitude	longitude	depth(m) reached	comments
98 151	JAN	0200	32°50.7'S	13°47.5'E	760	
152	1979	0400	32°57.9'S	14°13.3'E	760	
153		0600	33°04.9'S	14°38.6'E	760	chart wind too fast, 45m out.
154		0800	33°08.8'S	14°58.0'E	260	
155		1000	33°11.4'S	15°17.6'E	660	
156		1200	33°13.7'S	15°36.8'E	760	
157		1400	33°17.3'S	15°54.6'E	760	
158		1600	33°22.2'S	16°13.4'E	760	
159		1800	33°26.8'S	16°30.5'E	760	
98 160		2000	33°30.3'S	16°42.9'E	505	
161		2200	33°35.6'S	17°04.2'E	255	
162		2230	33°36.4'S	17°08.3'E	760	



CRUISE REPORTS

CRUISE DATES	REPORT NO
RRS "CHALLENGER"	
AUG - SEP 1974	IOS CR 22
MAR - APR 1976	IOS CR 47
MAR - MAY 1976	IOS CR 72
MV "CHRISTILLA"	
NOV - DEC 1976	IOS CR 73
RV "EDMUND FURBER"	
OCT 1974	IOS CR 15 X
JAN - FEB 1975	IOS CR 19
APR 1975	IOS CR 23
MAY 1975	IOS CR 32
MAY - JUN 1975	IOS CR 28
JUL 1975	IOS CR 31
JUL - AUG 1975	IOS CR 36
AUG - SEP 1975	IOS CR 41
AUG - SEP 1975	IOS CR 44
FEB - APR 1976	IOS CR 48
APR - JUN 1976	IOS CR 50
MAY 1976	IOS CR 53
AUG - SEP 1977	IOS CR 64
RRS "JOHN MURRAY"	
APR - MAY 1972	NIO CR 51
SEP 1973	IOS CR 7
MAY - APR 1974	IOS CR 9
OCT - NOV 1974	IOS CR 21
APR - MAY 1975	IOS CR 25
APR 1975	IOS CR 39
OCT - NOV 1975	IOS CR 40
AUG - OCT 1975	IOS CR 42
OCT - NOV 1976	IOS CR 53
MAR - APR 1977	IOS CR 66
JULY - SEP 1978	IOS CR 76
NC "MARCEL BAYARD"	
FEB - APR 1971	NIO CR 44
MV "RESEARCHER"	
AUG - SEP 1972	NIO CR 60
RV "SARSTA"	
MAY - JUN 1975	IOS CR 30
AUG - SEP 1975	IOS CR 38
MAR - APR 1976	IOS CR 44
MARCH 1977	IOS CR 63
RRS "SHACKLETON"	
AUG - SEP 1973	IOS CR 3
JAN - FEB 1975	IOS CR 18
MAR - MAY 1975	IOS CR 24
FEB - MAR 1975	IOS CR 29
JUL - AUG 1975	IOS CR 37
JUN - JUL 1976	IOS CR 45
OCT - NOV 1976	IOS CR 49
JUL 1977	IOS CR 62
MV "SURVEYOR"	
FEB - APR 1971	NIO CR 38
JUN 1971	NIO CR 39 X
AUG 1971	NIO CR 42 X
DE "VICKERS VOYAGER" AND "PISCES III"	
JUN - JUL 1973	IOS CR 1

X NOT DISTRIBUTED

CRUISE REPORTS

PRS DISCOVERY

CRUISE NO		REPORT NO
1	JUN = AUG 1963	1*
2	AUG = DEC 1963	2*
3	DEC 1963 = SEP 1964	3*
NIO CR**		
4	FEB = MAR 1965	4
10	TO	10
37	NOV = DEC 1970	37
38	JAN = APR 1971	41
39	APR = JUN 1971	40
40	JUN = JUL 1971	48
41	AUG = SEP 1971	45
42	SEP = 1971	49
43	OCT = NOV 1971	47
44	DEC 1971	46
45	FEB = APR 1972	50
46	APR = MAY 1972	55
47	JUN = JUL 1972	52
48	JUL = AUG 1972	53
49	AUG = OCT 1972	57
50	OCT 1972	56
51	NOV = DEC 1972	54
52	FEB = MAR 1973	59
53	APR = JUN 1973	58
IOS CR***		
54	JUN = AUG 1973	2
55	SEP = OCT 1973	5
56	OCT = NOV 1973	4
57	NOV = DEC 1973	6
58	DEC 1973	4
59	FEB 1974	14
60	FEB = MAR 1974	8
61	MAR = MAY 1974	10
62	MAY = JUN 1974	11
63	JUN = JUL 1974	12
64	JUL = AUG 1974	13
65	AUG 1974	17
66	AUG = SEP 1974	20
68	NOV = DEC 1974	16
69	JAN = MAR 1975	51
73	JUL = AUG 1975	34
74/1+3	SEP = OCT 1975	35
74/2		33
75	OCT = NOV 1975	43
77	JUL = AUG 1976	46
78	SEP = OCT 1976	52
79	OCT = NOV 1976	54
82	MAR = MAY 1977	59
83	MAY = JUN 1977	61
84	JUN = JUL 1977	60
86	SEP 1977	57
87	OCT 1977	58
88	OCT = NOV 1977	65
89	NOV = DEC 1977	67
90	JAN = MAR 1978	68
91	MAR 1978	69
92	APR = MAY 1978	70
93	MAY = JULY 1978	71
94	JULY = SEPT 1978	74
98	DEC 1978 = JAN 1979	75

* REPORTS 1 TO 3 WERE PUBLISHED AND DISTRIBUTED BY THE ROYAL SOCIETY FOLLOWING THE INTERNATIONAL INDIAN OCEAN EXPEDITION

** NIO CR: NATIONAL INSTITUTE OF OCEANOGRAPHY, CRUISE REPORT

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