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I.O.S.

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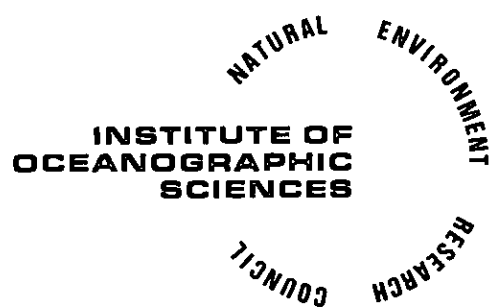
CRUISE 7/75

21 JULY-14 AUGUST 1975

CURRENT MEASUREMENTS AND HYDROGRAPHIC STATIONS
BETWEEN SEYCHELLES, MADAGASCAR AND EAST AFRICA

CRUISE REPORT NO. 37

1975



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R.R.S. SHACKLETON

CRUISE 7/75

21 July - 14 August 1975

Current measurements and hydrographic stations
between Seychelles, Madagascar and East Africa

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Institute of Oceanographic Sciences,
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Godalming,
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Contents

	<u>Page</u>
Introduction	1
List of Scientific Participants	1
Narrative	1
Current meter moorings	2
Hydrographic and CTD work	3
Sediment sampling	3
Navigation notes	3
Table 1. Station List	4
Table 2. Moored Current Meters	6
Fig. 1. Track and Station Positions	7

Introduction

In "Shackleton's" cruise 2/75 leg 1, in February-March 1975, two current meter moorings were set and a hydrographic section was occupied, between Madagascar and the Seychelles. The purpose of the cruise reported here was to re-occupy that section, to recover the two moorings, and to make further hydrographic sections at the western end of the South Equatorial Current and at intervals northward across the western boundary current. In the early stages of planning, it was hoped that moorings could be set in the Somali Current, for the University of Miami. For diplomatic reasons that work had to be left out of the programme; fortunately as it turned out since, as will be seen in the narrative following, mechanical troubles limited the extent of the cruise and no work was done north of 4°S. In the revised plan, as in the original one, the aim was to observe the water masses in the South Equatorial Current, and their transport, to provide an estimate of their contribution to the western boundary current. Subsidiary aims were to dredge for manganese nodules in deep water (Imperial College) and to collect samples of sediment from the Seychelles Bank.

List of scientific participants

J. Crease	I.O.S. Wormley
M.J. Harris	" "
D. Lewis	I.O.S. Barry
T. Moorby	Imperial College
G.K. Morrison	I.O.S. Wormley
J.C. Swallow	I.O.S. Wormley (Pr. Sci.)
R. Williams	Imperial College

Narrative

Left Seychelles 21 July 1975
at anchor off Farquhar Is. 24-25 July
arrive Diego Suarez 28 July
left " " 31 July
arrive Seychelles 14 August 1975

Leaving Port Victoria at 0630 GMT on 21 July, and passing southward over Seychelles Bank, course was set for the first CTD station in a section across the gaps between Seychelles and Madagascar, near 6½°S, 53½°E. The MK III echo sounder was run on passage, and the speed readings from the E.M. log were recorded every 10 minutes. The latter, plus the gyro course record, were combined with satellite fixes to give estimates of surface current throughout the cruise. Overnight, leakage of oil was noticed from the variable pitch propeller. The CTD section was started at 0430 GMT/22nd, and the first two stations were completed without incident. On arrival in the neighbourhood of mooring 189, the second one set during the earlier cruise, the loss of oil had become too great for use of the variable pitch on stations. This made recovery more difficult, but the mooring was located and recovered successfully in the morning of the 23rd. At the same time attempts were made, unsuccessfully, to collect geological samples with free-fall grabs and corer.

So that the increased loss of oil from the propeller could be investigated, 'Shackleton' then went directly to an anchorage in the Farquhar Is. During the period at anchor, currents (predominantly tidal) were measured using the E.M. log and a direct-reading current meter. The source of the leak was

identified, but could not be repaired without dry docking. Consequently, after working two more CTD stations to the north of Farquhar Is. to complete the northern part of the section, course was set for Diego Suarez, where repairs were made during 28-31 July.

The CTD section was then resumed, northeastwards from Cape Amber, mooring 188 was recovered on 1st August and that section was completed later the same day. With the limited time available then, it seemed best to work a CTD section westwards along latitude 11°S, starting from 47°E. Strong currents were experienced, up to 4 knots predominantly westward, and the section went quickly, being completed in the evening of 4 August. Moving northwards off the coast of E. Africa, a short section was occupied in latitude 9°S across the north-going current, and by then enough time had been gained to allow a diversion southwards back to the 11°S section, so that further stations could be occupied closing off the offshore ends of the two sections across the coastal current. Returning northwards, from 9°S the section was continued northeastwards to 5°S, then slightly north of east towards the Seychelles. Only weak surface currents were encountered north of 8°S on the northeastwards section and beyond, and the station spacing was increased. Dredging was attempted on some hills in an abyssal plain near 4°15'S, 51°20'E, in deep water thought to be favourable for the occurrence of manganese nodules, but none were caught on the first try and the dredge was lost on the second. The last CTD station was worked a.m. 13th August, and that evening a line of seven shipek grab samples was occupied across the western side of the Seychelles bank on the way into Mahé.

Current meter moorings

The two moorings, nos. 188 and 189, had been set in early March during leg 1 of 'Shackleton' cruise 2/75. They were set buoy-first (unusual for I.O.S. moorings) and there had been some doubts whether enough tension had been maintained in the mooring lines during launching. However, the instruments in both moorings were recovered in good condition, the only external damage being a broken rotor on one current meter. That appeared to have happened on the way up after the mooring had been released. These were amongst the longest-exposed I.O.S. moorings; no. 188 had been in place for 156 days and no. 189 for 144 days. Some of the 6 mm wire (Brunton's "Kilindo") was sufficiently corroded that it easily kinked and broke when being pulled off the winch drum after recovery. The polypropylene multiplait lines used below 2000 m were in good condition, however. Further details of the moorings, and of the current meter records, are listed in Table 2. Only one of the 4 current meters worked properly for the whole period. Two others gave short records (clock failures) and the fourth had no speeds, apparently due to the magnetic coupling from the rotor being too weak, though it had worked properly when tested beforehand.

The one complete record and the longest partial record were from mooring 188. It had been placed as near as seemed prudent to the strong current flowing generally west or northwest just off Cape Amber. It was intended to monitor that current through the onset of the summer monsoon. It seems, though, that it was placed too far to the northeast; the current meters at approximately 200m and 500m depths did not experience a slowly varying northwestward current, but a pronounced oscillation with a period of approximately 50 days and a weak mean flow to the southeast.

Hydrographic and CTD work

Thirty-six CTD and water sampling stations were occupied, to 2000m or to 1200m if the depth was shallower. Up to 12 water bottles were put on the wire during the CTD lowering, to provide calibration values and some back-up station data in the event of trouble with the CTD. Its output was recorded on magnetic tape and values logged by hand at 100 decibar intervals. Salinity samples were measured on board on an Autolab salinometer. Direct measurements of relative currents in the upper 200m were attempted at several stations, using a pair of direct-reading current meters. Many of these were only partly successful because of frequent leaks in plugs and cables, and lack of time for repeated attempts.

Sediment sampling

As arranged by Dr. D.S. Cronan, two of his colleagues from Imperial College came on this cruise, to make use of any opportunities there might be for collecting manganese nodules. As will be clear from the narrative, few such chances occurred, and those attempts that could be made were unsuccessful.

The line of 7 Shipek grab samples of sediment in shallow water on the Seychelles Bank, running eastwards towards Mahé, were collected at the request of Dr. C.J.R. Braithwaite of the Geology Department, University of Dundee. The samples were left on board in a freezer.

Navigation notes

The Omega receiver was tried, but reception of signals was very poor and no useful position lines were obtained. The satellite receiver worked well throughout the cruise, cooled by a carefully ducted air-conditioner, and was the main navigation aid. The alignment of the E.M. log was checked early in the cruise and at intervals later, and a correction was made to all readings to compensate for the misalignment obscured. Repeated estimates of surface current in areas occupied for some time on various courses (mooring and dredging sites) suggest that the calibration was unlikely to be in error by more than 0.3 knot in either direction at any speed, but no direct speed calibration was done.

Table 1. Station List

No.	Date	Time (GMT)	Lat. S	Long. E	Gear	Remarks
1375	22.7	0557	6°28'.8	53°26'.0	CTD, WB	2000m
1376		1541	7°04'.4	53°07'.0	"	"
1377	23.7	0115	7°29'.1	52°25'.7	Free-fall grab	
		0143	7°28'.9	52°25'.9	Free-fall corer	
		0153	7°28'.8	52°25'.95	Free-fall grab	
		0740			Mooring 189 recovered	
		0912	7°29'.65	52°26'.8	CTD, WB	2000m
1378	24.7	1300	10°06'	51°09'.6	Tidal stream obs.	
-	25.7	1400				
1379	26.7	0543	8°25'.6	51°55'.0	CTD, WB	2000m
1380		1352	9°09'.8	51°32'.0	"	"
1381	31.7	1213	11°42'.3	49°28'.2	CTD, WB, DRCM	1200m
1382		1826	11°22'.8	49°48'.1	CTD, WB	2000m
1383	1.8	0742			Mooring 188 recovered	
		0926	10°55'.5	50°12'.4	CTD, WB	2000m
1384		1656	10°24'.7	50°42'.7	"	"
1385	2.8	1625	11°03'.6	46°53'.0	CTD, WB, DRCM	"
1386		2342	10°58'.6	46°02'.1	"	"
1387	3.8	0800	10°58'.2	44°59'.0	CTD, WB	"
1388		1516	11°00'.0	43°59'.6	"	"
1389		1729	10°59'.2	43°56'.4	"	(repeat 1388)
1390	4.8	0125	11°04'.3	42°57'.6	"	2000m
1391		0711	10°59'.9	42°17'.8	CTD, WB, DRCM	"
1392		1254	11°03'.5	41°40'.3	"	1200m
1393		1745	11°01'.3	41°10'.3	"	2000m
1394		2042	11°01'.4	40°55'.2	"	1200m
1395	5.8	0922	9°02'.7	39°44'.7	"	"
1396		1359	8°57'.5	40°03'.9	"	2000m
1397		2002	8°55'.0	40°34'.8	"	"
1398	6.8	0144	8°53'.9	41°00'.6	CTD, WB, DRCM	2000m
1399		0920	8°45'.4	41°44'.6	CTD, WB	"
1400	7.8	0228	11°00'.6	42°18'.2	CTD, WB, DRCM	"
1401		1035	10°14'.0	42°20'.4	"	"
1402		1837	9°27'.2	42°21'.4	"	"
1403	8.8	0240	8°40'.9	42°25'.6	"	"
1404		1100	7°56'.9	42°54'.2	CTD, WB	"

Table 1. Station List continued

No.	Date	Time (GMT)	Lat. S	Long. E	Gear	Remarks
1405	8.8	1840	7°16'.0	43°19'.1	CTD, WB	2000m
1406	9.8	0123	6°38'.7	43°51'.8	"	"
1407		0837	5°55'.8	44°21'.6	"	"
1408		1519	5°13'.4	44°49'.7	"	"
1409	10.8	0136	5°05'.7	46°00'.0	"	"
1410		1913	4°48'.0	48°21'.6	"	"
1411	11.8	1123	4°23'.3	50°39'.8	"	"
1412	11.8	2132	4°13'.9	51°24'.6	Dredge	5600m wire out
-	12.8	0315	4°15'.9	51°26'.6		
1413		0510	4°16'.8	51°17'.7	"	5800m wire out
-		-1424	4°21'.6	51°16'.8		
1414		1930	4°20'.8	51°49'.5	CTD, WB	2000m
1415	13.8	0526	4°25'.1	52°56'.5	"	"
1416		1529	4°23'.5	54°11'.0	Shipek grab	
1417		1637	4°23'.8	54°18'.2	"	
1418		1731	4°24'.8	54°25'.8	"	
1419		1835	4°25'.7	54°33'.0	"	
1420		1930	4°27'.0	54°41'.0	"	
1421		2032	4°28'.0	54°48'.3	"	
1422		2133	4°30'.5	54°56'.3	"	

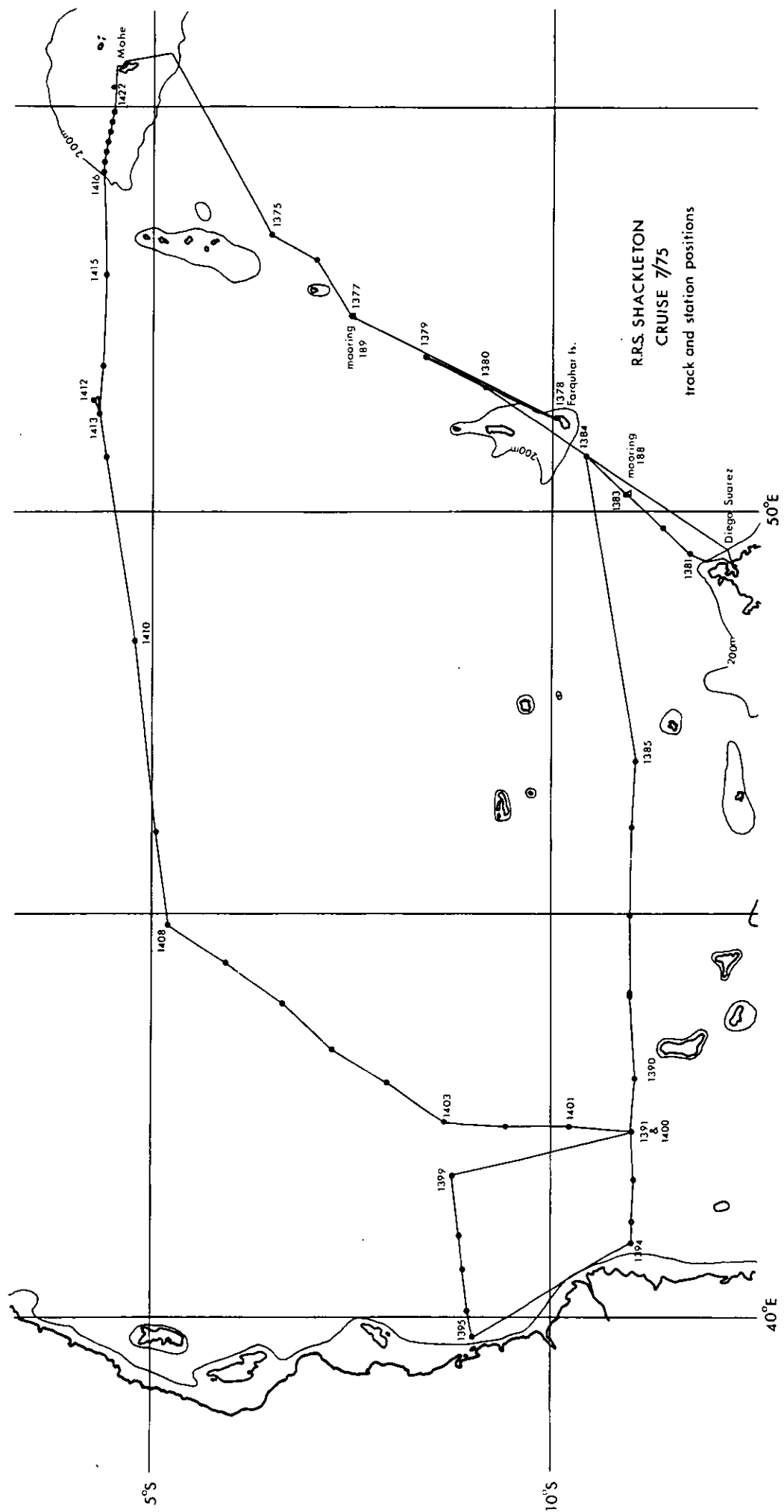
Abbreviations - CTD : Neil Brown Conductivity - Temperature -Depth Probe.
 WB : N.I.O. water sampling bottles plus thermometers.
 DRCM : Kelvin-Hughes direct-reading current meters
 (0-200m only)

Table 2. Moored Current Meters

No.188 Set 0751Z 1 March 1975
 10°56'.3S, 50°14'.0E, water depth 3094m.
 Released 0510Z 1 August 1975
 Record No.18801, depth 208m, short record, (approx. $2\frac{1}{2}$ months),
 clock stopped.
 No.18802, depth 513m, OK.

No.189 Set 0755Z 3 March 1975
 7°29'.6S, 52°25'.2E, water depth 5108m.
 Released 0306Z 23 July 1975
 Record No.18901, depth 583m, no speeds recorded.
 No.18902, depth 3982m, short record, (approx. 3 weeks),
 clock stopped.

All the current records were from Aanderaa meters sampling every 30 minutes.



CRUISE REPORTS

CRUISE No.	DATE	REPORT No.
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R.R.S. "DISCOVERY"

1	(International)	Published and distributed by the Royal Society
2	(Indian Ocean)	
3	(Expedition)	

NIO CR¹

4	February — March 1965	4
37	November — December 1970	37
38	January — April 1971	41
39	April — June 1971	40
40	June — July 1971	48
41	August — September 1971	45
42	September 1971	49
43	October — November 1971	47
44	December 1971	46
45	February — April 1972	50
46	April — May 1972	55
47	June — July 1972	52
48	July — August 1972	53
49	August — October 1972	57
50	October 1972	56
51	November — December 1972	54
52	February — March 1973	59
53	April — June 1973	58

IOS CR²

54	June — August 1973	2
55	September — October 1973	5
56	October — November 1973	4
57	November — December 1973	6
58	December 1973	4
59	February 1974	14
60	February — March 1974	8
61	March — May 1974	10
62	May — June 1974	11
63	June — July 1974	12
64	July — August 1974	13
65	August 1974	17
66	August — September 1974	20
68	November — December 1974	16
73	July — August 1975	34
74	September 1975	33

¹NIO CR

National Institute of Oceanography, Cruise Report.

²IOS CR

Institute of Oceanographic Sciences, Cruise Report.

CRUISE REPORTS

CRUISE No.	DATE	REPORT No.
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R.R.S. "CHALLENGER"

August - September 1974	IOS CR 22
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R.V. "EDWARD FORBES"

October 1974	IOS CR 15*
January - February 1975	IOS CR 19
May - June 1975	IOS CR 28
July 1975	IOS CR 31

R.R.S. "JOHN MURRAY"

April - May 1972	NIO CR 51
September 1973	IOS CR 7
March - April 1974	IOS CR 9
October - November & December 1974	IOS CR 21

N.C. "MARCEL BAYARD"

February - April 1971	NIO CR 44
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M.V. "RESEARCHER"

August - September 1972	NIO CR 60
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R.V. "SARSIA"

May - June 1975	IOS CR 30
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R.R.S. "SHACKLETON"

August - September 1973	IOS CR 3
January - February 1975	IOS CR 18
March - May 1975	IOS CR 24
February - March 1975	IOS CR 29
July - August 1975	IOS CR 37

M.V. "SURVEYOR"

February - April 1971	NIO CR 38
June 1971	NIO CR 39*
August 1971	NIO CR 42*

D.E. "VICKERS VOYAGER" AND "PISCES III"

June - July 1973	IOS CR 1
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*Not distributed