REPORT OF RRS SHACKLETON CRUISE 1/76

1 APRIL - 26 APRIL 1976

CALLAO - CALLAO

CRUISE OBJECTIVES

The cruise had two main objectives.

1. Ocean Bottom Seismograph observations close to the junction of the East Pacific Rise and the 9°S Fracture Zone. All previous deployments of the Blacknest OBS have been on the Mid-Atlantic ridge where the half-spreading rate has not exceeded about 1.5cm/year. Near 9°S the East Pacific Rise is spreading at about 8cm/year, faster than any other mid-oceanic ridge. Differences in microearthquake seismicity between the East Pacific Rise and the Mid-Atlantic ridge could throw light on the different tectonic processes involved at fast and slow-spreading ridges.

2. An extensive coring programme, supervised by Dr David Cronan of Imperial College. The main aim of the coring programme was to test the hypothesis of the selective dispersion of metals (Mn, Fe, Cu, Pb, Zn, Ni) from submarine hydrothermal centres. To this end a series of cores were taken along the 9°S fracture zone. Another series of cores was planned for the Bauer Deep, to determine whether these sediments originated on the East Pacific Rise crest and were transported to their present situation or whether they are of local volcanic origin. Finally, a traverse between the East Pacific Rise crest and the South American coast was planned for the benefit of Dr Roy Chester of Liverpool University.

NARRATIVE

Thanks to monotonously steady trade-wind weather and some good fortune the main objectives of the cruse were largely achieved. An array of 5 OBS was deployed on 9-10 April and recovered on 15-16 April. No instruments were lost, but one OBS (V) failed to run tape. All the other OBS ran tape appropriate to their time on the bottom. At the time of writing these have not been played back. Tho locations of the OBS are given in table 1.

Fifty-six core stations were occupied during the cruise, all but five yielding samples. The results of the coring programme are summarised in table 2. Forty-two of the core stations were close to the East Pacific Rise crest and should be sufficient in geographical distribution and depth range to meet the first aim of the coring programme. Because of anxieties about returning to Callao on time, however, only four cores were taken in the Bauer Deep, statistically too small a sample to resolve the problems of this area.

In addition to the bottom sampling programme, atmospheric dust samples were collected throughout the cruise on terylene meshes. Trace element and mineralogical analysis of these samples will be undertaken by David Cross of IUDO. Together with dust samples collected above the Atlantic and Indian oceans they contribute to a study of aeolian dusts over the world oceans, in which it is hoped to determine both the composition and sources of the component material.

GENERAL COMMENTS

Although in the end the main objectives of the cruise were achieved, it success was threatened on a number of occasions by equipment malfunctions.

The most serious problem arose only one day out from Callao when the ship's stern gland was found to be consuming oil excessively. By partially repacking the gland the oil consumption was reduced, but the problem recurred just before the OBS were deployed. At this stage it looked as though the ship might have to shut down the main engine and lie to for the time the OBS were on the bottom in order to conserve oil for the passage home. This would have ruined the coring programme. Fortunately, by judicious mixing of oil and grease, the ship's engineers were able to reduce the overall consumption so that in the end the scientific programme was unimpaired. It is likely that no problems would have arisen with the stern gland had it been completely repacked during the October 1975 refit at Durban.

Another important item of ship's equipment which did not operate to its full capability was the Bow Thruster. This was because the ship's generators were unable to drive it at more than half power. Full servicing of these generators during the Durban refit would have avoided this difficulty. I understand that due to financial difficulties the Durban refit was not as extensive as originally planned. I hope that sufficient money will be available to ensure that the ship's next refit will be unabbreviated. It is worth stating that Shackleton is essentially a very sound and seaworthy ship and with proper refits there is no reason why she should not continue to operate successfully on a worldwide basis for many years to come.

I was suprised to learn that only one block existed on the ship for the main warp. This did not operate entirely satisfactorily because of wear on its bearing surfaces. Failure of this block would have eliminated the coring programme. There should always be a spare block on board.

The position of the block in the A-frame might also be improved. Although after fifty stations coring was being conducted smoothly and efficiently, the operation could be simplified and speeded up by raising the block in the A-frame. This would allow a standard length core barrel to be swung inboard directly.

A radar transponder was again used and worked well. The same cannot be said for the laboratory radar which, after operating well for a day, broke down. Thereafter we relied on the bridge radar for fixing on the moored buoy. Once again the problem with the laboratory radar was with the motor generator supplying it rather than with the radar itself. When it works it is an excellent radar, but on four cruises on the Shackleton in the past four years it has never remained serviceable for an entire cruise.

In conclusion, we found Shackleton as pleasant a ship to work on as ever and the ship's company most friendly and co-operative.

T J G Francis
IOS, Blacknest
12 May 1976

SCIENTIFIC PERSONNEL

Dr T J G Francis	IOS Blacknest	Senior Scientist
Mr I T Porter	"	
Mr P L C MacKeith	"	
Mr S Jones	IOS Barry	
Mr A R Cummings	"	
Dr D S Cronan	Dept. Geology, Imperial College	
Mr R O Williams	" " " "	
Mr B Thompson	" " " "	
Mr J M Hirst	Dept. Oceanography, University of Liverpool (LUDO)	
Mr N H Morley	" " " " " "	

Daily Log (local times) and movements of IOS Blacknest Team

11-12 March			Porter and MacKeith flew to Punta Arenas, Chile.
15 March			Porter and MacKeith joined Shackleton. Shackleton left Punta Arenas.
			On passage to Callao, Porter and MacKeith uncrate and prepare OBS equipment.
25 March			Francis and Lilwall flew to Lima, Peru.
26 March		1300	Shackleton arrived Callao (Lima) Airfreight consignment of 6 crates (5 OBS bottom spheres and test equipment) delivered to ship.
27-30 March			Preparation of OBS for sea by Blacknest team.
29 March			Francis and Lilwall joined ship.
1 April			Lilwall landed to hospital in Lima (flew home 7-8 April)
		0900	Shackleton left Callao.
1-8 April			On passage to East Pacific Rise crest. PES, Magnetometer, Gravimeter operated beyond 200nm limit.
2 April		1900-2100	Ship stopped for repairs to stern gland.
8 April	099	1705	Radar transponder buoy launched with 3160m wire in water depth of 2917m. Position 8°52'S, 108°6'.5W Core stations 1515-1520 overnight in vicinity of buoy.
9 April	100	0733	OBS I launched six miles E of buoy.
		1207	OBS III launched five miles NNE of buoy.
		1812	OBS IV launched five miles SSE of buoy. Core stations 1521-1524 overnight in vicinity of buoy.
10 April	101	0725	OBS V launched six miles NW of buoy.
		1208	OBS VI launched six miles SW of buoy.
		1621(2121Z)	Commenced firing airgun every minute on tracks over OBS array for sound-ranging.
		2250(0350Z/102)	Last airgun shot.
		2355	Radar transponder buoy recovered.
11-14 April			Core stations 1525-1552 along 9°S fracture zone.

14 April		2105	Radar transponder buoy launched with 3100m wire in water depth of 2938m. Position 8°53'S, 108°6'W. Bathymetric survey overnight.
15 April	106	0700	OBS I lift off. Explosive bolt heard on PES
		0842	OBS I inboard.
			Core station 1553.
		1205	OBS III pinger detected. Explosive bolt not heard.
		1330	OBS III inboard.
			Core stations 1554-1555.
		1808	OBS IV lift off. Explosive bold heard on PES.
		1910	OBS IV surfaced. Problems with main engines delayed recovery for nearly two hours. Bathymetric survey overnight.
16 April	107	0714	OBS V lift off. Explosive bolt heard on PES.
		0856	OBS V inboard.
			Core station 1556.
		1200	OBS VI lift off. Explosive bolt heard on PES.
		1324	OBS VI inboard.
		1450	Radar transponder buoy recovered.
			On passage to Callao. Core stations 1557-1570 en route.
26 April		1106	Shackleton alongside in Callao.

	Launched	Surfaced	Latitude	Longitude	Depth
OBS I	1233/100	1254/106	8° 52.'1 S	108° 01.'0 W	3102 met
OBS III	1707/100	1759/106	8° 47.'2 S	108° 03.'5 W	3028
OBS IV	2312/100	0010/107	8° 56.'6 S	108° 04.'6 S	3244
OBS V	1225/101	1312/107	8° 47.'0 S	108° 11.'0 W	2924
OBS VI	1708/101	1800/107	8° 55.'0 S	108° 12.'1 W	3063

All times are UTC, depths are corrected metres (Matthews Area 41)

Table 1

TABLE 2

Coring Summary

Shackleton 1/76

STATION	START	FINISH	DEPTH	LATITUDE		LONGITUDE		RESULT
1515	2347/099	0134/100	1503 un fm	8°	51'S	108°	07'W	Water bottle, glassy rock fragments
1516	0159/100	0318	1532	8	50	108	08	Water bottle, glassy rock fragments
1517	0333/100	0431	1600	8	50	108	09	Nil
1518	0442/100	0549	1600	8	49	108	10	Nil
1519	0804/100	0856	1506	8	55	108	00	Water bottle, 71cm core
1520	0919/100	1011	1240	8	55	108	01	65cm core
1521	0342/101	0450	1684	8	52	108	04	Water bottle, 56cm core
1522	0530/101	0628	1684	8	52	108	05	86cm core
1523	0707/101	0834	1690	8	50	108	02	145cm core, multiple hits on bottom
1524	0916/101	1005	1548	8	47	108	05	Nil
1525	0616/102	0710	1650	8	53	108	15	86cm core, rock fragment at top
1526	0816/102	0912	1740	8	55	108	20	Water bottle, 122cm core
1527	1053/102	1206	1760	8	59	108	33	Nil
1528	1218/102	1319	1770	8	59	108	33	165cm core
1529	1504/102	1708	2028	9	08	108	42	Water bottle, 154cm core
1530	1909/102	2005	1922	9	08	108	38	135cm core

STATION	START	FINISH	DEPTH	LATITUTDE		LONGITUDE		RESULT
1531	2252/102	0001/103	2046 un fm	9°	05'S	108°	55'W	Water bottle, 124cm core
1532	0937/103	1035	1896	8	57	109	09	Water bottle, 130cm core
1533	1314/103	1407	1494	8	52	109	15	168cm core
1534	1527/103	1648	1736	8	55	109	09	Water bottle, 153cm core
1535	2053/103	2158	1672	9	05	108	46	168cm core
1536	0113/104	0204	1778	9	13	108	24	84cm core
1537	0356/104	0452	1759	9	09	108	14	100cm core
1538	0550/104	0647	1802	9	08	108	12	Water bottle, 172cm core
1539	0749/104	0849	1868	9	08	108	08	139cm core
1540	0920/104	1039	1858	9	10	108	08	Water bottle, 150cm core
1541	1130/104	1239	1780	9	10	108	02	174cm core
1542	1403/104	1450	1280	9	11	107	58	No core, few fragments of ooze
1543	1517/104	1612	1740	9	08	107	57	Water bottle, 177cm core on second lowering
1544	1808/104	1903	1782	9	10	108	03	170cm core
1545	2026/104	2125	1932	9	13	108	11	Water bottle, 127cm core
1546	0046/105	0155	1946	9	08	108	36	Water bottle, 145cm core
1547	0321/105	0523	1750	9	05	108	25	162cm core

FINISH	DEPTH	LATITUDE		LONGITUDE		RESULT
0710	1548 un fm	9°	09'S	108°	22'W	107cm core
0922	1774	9	05	108	19	Hit rock bottom, bent corer, rock fragment
1446	1820	9	10	107	49	Water bottle, 166cm core
1715	1776	9	14	107	40	Water bottle, 175cm core
2045	2032	9	14	107	26	Water bottle, 120cm core
1509	1700	8	52	108	02	130cm core
1944	1618	8	47	108	04	93cm core, bent cutter, corer probably hit basement
2200	1724	8	55	108	05	181cm core
1626	1700	8	55	108	11	97cm core
1550	2376	10	02	102	08	139cm core Bauer Deep
1858	2382	10	05	101	55	124cm core Bauer Deep
2206	2364	10	05	101	40	104cm core Bauer Deep
0125	2216	10	04	101	25	74cm core Bauer Deep
1630	2204	11	09	92	10	154cm core
0106/113	2038	11	16	91	07	60cm core
2010	2246	11	28	88	25	Nil
0100/114	2192	11	29	87	58	156cm core and 2Mn modules

STATION	START	FINISH	DEPTH	LATITUDE		LONGITUDE		RESULT
1565	1449/114	1620	2382 un fm	11°	40'S	85°	53'W	179cm core
1566	1850/114	2030	2346	11	42	85	31	270cm core
1567	2335/114	0100/115	2314	11	40	85	05	270cm core
1568	1457/115	1632/115	2300	12	01	83	00	255cm core
1569	1922/115	2100	2502	12	03	82	33	231cm core
1570	2313/115	0035/116	2540	12	04	82	14	215cm core

Notes: (1) 7.5 litre water bottle located just above corer to sample bottom water. Triggered by corer hitting bottom.

(2) All times UTC.

(3) All cores gravity, no triggering, no pinger.
Run into bottom at 2½m/sec.