9/54/70

Imperial College

RED SEA METALLIFEROUS SEDIMENT AND BRINE RESEARCH

1970 CRUISE REPORT

13.10.70 – 25.10.70

Ship:- Nereus

December, 1970

SHIP

Panamanian Tug NEREUS

SCIENTIFIC PERSONNEL

Dr J.S. Tooms	Imperial College of Science & Technology
Sir Patrick Skipwith	Directorate General of Mineral Resources
Mr R. Holmes	Imperial College of Science & Technology
Mr L. Downes	Imperial College of Science & Technology

SHIP'S OFFICERS

Capt. G. Theodopolous

Chief Officer	Takis Katranas
2nd Officer	Stathis Efstathioy
Chief Engineer	John Kounitis
2nd Engineer	Stellos Ikonomoy
3rd Engineer	John Iliadis
Radio Operator	Babis Kounakis

CRUISE INTENTIONS

The cruise was concerned with investigating the regional geochemistry of the Red Sea as related to the occurrence of past and present metalliferous brines and associated sediments. Following the reconnaissance investigations completed during 1969 the major aims of the cruise were:-

1. A reconnaissance survey of the area to the north of Atlantis II Deep to determine the general distribution of trace elements in sediments and waters, particularly within the median valley.
2. Detailed investigation of trace elements in sediments and waters in the vicinity of Atlantis II Deep.
3. Detailed investigations in areas to the south of Atlantis II Deep where anomalously high trace element contents had been detected as a result of the 1969 cruise.
4. Reconnaissance sampling on the northern Saudi Arabian Red Sea coast to obtain information on the possibility of there being phosphatic or heavy mineral accumulations and whether there was any tendency for metals to accumulate in the lagoons near on-shore mineral deposits.

NARRATIVE

The equipment for the cruise was shipped from Port Sudan and from London. Because of the dock strike in the United Kingdom, Lep Transport advised sending the London consignment overland despite the considerably higher (two-fold) freight charges. The equipment sent overland was held up for over a month and trans-shipped in Kuwait and arrived in Jeddah more than six weeks after the latest date stated by Lep Transport. Furthermore, misinformation by Lep's agents in Kuwait on the date of arrival of the consignment at the frontier resulted in a Directorate General of Mineral Resources employee being kept at the frontier for some weeks. This resulted in postponement of the commencement of the cruise.

Equipment sent from Port Sudan was delayed for some months in customs dominantly because of the winch having a Ford motor. After daily visits to customs by members of the Directorate General of Mineral Resources, the equipment was released prior to the scheduled cruise sailing date. Unfortunately, equipment sent by air at a late date was not released in time even for the delayed sailing date largely because of the customs changing their documentation requirements for releasing the equipment. Similarly, the Radar for the ship could not be released until a high level committee had met and even two months after the original scheduled sailing date the committee had still not given its approval for the Radar to be fitted to this foreign vessel, the NEREUS. Radar spares had been released, however, without difficulty.

As a result of these delays and the lack of Radar it was agreed with the Directorate General of Mineral Resources to restrict the 1970 cruise to two weeks and to extend the 1971 cruise by which time it is hoped that the committee will have met and approved the installation of Radar on the tug.

In view of the restricted time and the lack of Radar it was decided to concentrate effort on the median valley reconnaissance aspects of the cruise programme (Item 1 of the cruise intentions), where Radar was not essential.

Prior to finally sailing equipment had to be loaded on the ship. Permission to take the equipment into the dock area was obtained from the customs after two days. A further day was required to repair damage to equipment which had occurred during transportation. The tug sailed on the afternoon of the 12th October but returned that same evening as the PDR was not operating satisfactorily. After further repairs the ship sailed again on the morning of the 13th October.

The PDR fish was lowered from a life boat davit on clearing the reef off Jeddah. However, the safety/recovery line became snagged on the tail of the fish and some damage was caused to the upper fibre glass shell by the shackle. This did not affect the operation of the fish.

During passage to Atlantis II Deep the ship's speed at full and half speeds were determined. Two logs were used; the first log being taken by a shark. Due to deteriorating weather the ship reduced to ½ speed. Following a reconnaissance of the topography of Atlantis II Deep a water bottle first station was completed on the afternoon of the 14th over Atlantis II Deep. Considering the inexperienced nature of the ship's crew and scientists and the poor sea and weather conditions further station work was postponed. The opportunity was taken, therefore, to sail to the northern limit of the proposed reconnaissance survey ($25^{o}30'N$) and carry out a topographic survey in this area.

In contrast to south of Atlantis II Deep most of the deeps to the north were found to be simple flat bottom deeps without ridges. Furthermore,

except in the area of the median valley 22°N the chart (Laughton, 1970) proved extremely accurate.

Water and sediment samples were collected from deeps and rises along the median valley to the north of Atlantis II Deep. Confirmation of the topography shown on Laughton's chart was obtained by surveying the median valley using the PDR. This aspect of the cruise is of critical importance for any follow-up work required in 1971. During passage north and whilst working south a number of definite fixes were obtained from islands and lighthouses near the median valley. In addition, morning and evening star fixes and noon position were obtained.

On the 23rd a number of stations were completed in and south of Atlantis II Deep. During the 24th a further topographic survey was completed about 30 n.m. north of this deep in an area where the charts appeared to be inaccurate. Again, some stations were completed in deteriorating weather conditions. During the early hours of the 25th a further position check was obtained by relocating Atlantis II Deep (using the extremely precise and accurate Preussag A.G. charts we could determine our location to within a few chains length). Immediately after relocating Atlantis II Deep course was set for Jeddah which was entered at 0900 hours on the 25th October.

Cores collected during the cruise were taken out of the docks immediately on landing without difficulty. The remaining equipment and samples were bought out on a lorry. Difficulties were encountered with customs about taking these samples and equipment from the docks. After obtaining 8 signatures on the necessary document the 9th customs officer demanded an assurance from customs on the east coast that the

equipment was that specified on the document as having been originally imported via Kuwait. After some 10 days of negotiation and unloading of the lorry so that the equipment could be inspected, the equipment and samples were released and taken to the Ministry of Petroleum's laboratories for storage and (in the case of the samples) onward shipment.

The 2-week cruise was extremely productive and successful and laid firm foundations for the 1971 cruise. This was due in no small part to the wholehearted cooperation of the Ministry of Petroleum and Mineral Resources and from the officers and crew of the NEREUS.

Performance: Corers and Pingers

(a) Corers. The use of corers with a portable winch raises a number of problems in that the wire is only 4 mm and the breaking strain is correspondingly low. To avoid losses due to the breaking strain of the wire being exceeded during pull out from clay sediments the core barrel was attached to the body by shear pins. In addition, a weak link was used to attach the wire to the body. In practice, these precautions proved unnecessary.

Loses of corers occurred due to the difficulties of bringing the corer inboard. To bring the corer inboard it had to be raised to the sheave and then the core barrel manhandled over the bulwark. One corer was lost when it caught beneath the rubbing band of the tug and the wire parted. This was under perfect sea conditions (flat calm) and resulted in part due to the winch operator being over-confident after working in less ideal conditions. Another corer (but not the barrel) was lost through being raised instead of lowered

after being bought inboard. The wire parted at the sheave and after taking a ¼" out of the deck the corer broke in two and the body went overboard. This accident was basically due to the controls on the winch being extirely hand operated and the brake requiring considerable force to hold on when the corer was out of the water. The winch operator was being assisted in holding on the brake and instead of letting the brake slip to lower the corer he put in the clutch. Further similar occurrences were avoided by driving the winch against the brake during the final stages of bringing in gear and during lowering to the deck. In 1971 it is planned to have a foot operated brake in addition to the hand brake.

Following loss of corer bodies, a make shift corer was constructed from two barrels joined by a sleeve and weights held in position on the upper barrel with sleeves. A non-return value was made using a tulip core catcher and polythene sheeting. This corer proved successful on about 50 per cent of stations where it was operated.

(b) Pingers. A UMEL pinger with a temperature thermistor was used on all hydrographic stations. The signal strength of this pinger was weak. The gain of the PDR had to be set close to maximum to record the direct return from the pinger at depths of more than 2000 m and a return echo was only picked up at a few stations.

Results of Topographic Surveys

The corrected ship's track is shown on the attached chart. The amount of drift recorded over various periods of time between definite fixes was as follows:

Fix	Time	Fix	Time	Time Lapse (Hrs & Mins)	Drift Distance	Drift Direction	Av. Rate of Drift
Atlantis II	09.47/15.10	Daedalus Reef	10.25/17.10	48.40	9.8	030°	0.2
Daedalus Reef	10.25/17.10	Daedalus Reef	22.30/18.10	36.05	7.9	227°	0.22
Daedalus Reef	22:30/18.10	St Johns Is.	06.39/20.10	32.09	3.6	221½°	0.11
St Johns Is.	06.39/20.10	Atlantis II	04.22/23.10	69.43	15.9	141°	0.26
Atlantis II	23.48/23.10	Atlantis II	23.35/24.10	23.47	1.6	231°	0.07

In no period was the amount of drift excessive and, accordingly, only relatively minor corrections have had to be made. The bathymetry recorded agrees reasonably closely with that shown on Laughton's chart except in the area immediately north of Atlantis II Deep to 23°N. In the area of 22°N Laughton's chart shows two large parallel deeps in the median valley. Only one of these deeps could be discovered during the survey. However, this deep either extends further south than shown on the chart or possibly there is a second deep to the south of that shown on the Laughton chart (see attched chart).

Elsewhere the corrected positions of the deeps tend to be consistently slightly north of the positions shown on Laughton's chart.

Sediment Samples

All sediment samples were collected using a gravity corer. During the curtailed cruise a major aim was to collect reconnaissance cores from deeps north of Atlantis II. In this the cruise was successful in that samples were obtained from 11 stations. However, several of the samples collected with the makeshift corer were largely lost during recovery of the corer.

Most of the cores collected north of Atlantis II were dominantly globigerina ooze with narrow bands of red, black and brown sediment. The core at 23°13.6'N 37°16.3'E was badly disturbed during recovery (hitting the deck when the wire parted at the sheave) but appeared to be entirely composed of black/dark brown material. The significance of this core, in particular, can only be determined after it has been studied in more detail.

Two cores were collected from Atlantis II Deep. Both were typical black-red oozes. However, each core was stopped on hard bands. One of these bands appears to be anhydrite whilst the other is a compact mat of fibres of almost wood like texture. The mineralogy of this latter band has not been determined at this time.

Water Samples

Water samples were collected from 15 stations within the median valley. Samples were collected from over both deeps and shallower portions of the median valley and to the north and south of Atlantis II Deep. These samples will be studied as soon as they arrive in this country.

Air Sampling

In addition to the water and sediment samples, material was collected to determine the mercury content of the air at a number of stations up-wind and down-wind of Atlantis II Deep. Analysis of these samples will be undertaken in Canada.

Station No.	Type	Date	Time LMT From	To	Position N	E	Depth UCF	CF	M	Comments
[illegible]0-1	WB	14.10.70	1420	1620	21°20.7'	38°05.2'	1080	1142	2088	2 bottles failed to trigger
[illegible]0-2	WB	17.10.70	1600	1803	25°20'	36°11.2'	1160	1228	2246	complete recovery
[illegible]0-3	GC	"	1805	1945	25°19.6'	36°10.75'	1160	1228	2246	approx. 0.3 m grey yellowish brown foram ooze with black mottling towards base
[illegible]0-4	GC	18.10.70	1453	1625	25°22.8'	36°12.1'	1140	1207	2207	approx. 1.5 m red and black at top, light yellowish brown intermediate, grey at bottom
[illegible]0-5	WB	"	1642	1830	22°22.6'	36°11.9'	1143	1210	2213	complete recovery
[illegible]0-6	WB	19.10.70	0855	0905	24°57.25'	36°12.4'	730	770	1408	complete recovery
[illegible]0-7a	GC	"	1010	1103	24°57"	36°12.1'	747	788	1441	no sample
[illegible]0-7b	GC	"	1120	1210	24°57'	36°12.1'	750	791	1447	approx. 1 m greyishn brown calc. ooze with part black and yellowish brown banding at top.
[illegible]0-8	WB	"	1810	1916	24°43.9'	36°12.0'	680	717	1311	complete recovery
[illegible]0-9	GC	20.10.70	1110	1212	23°31.75'	36°42'	918	970	1774	core barrel and lower collar lost
[illegible]0-10	WB	"	1230	1400	23°31.75'	36°42'	840	887	1622	complete recovery
[illegible]0-11	GC	"	1425	1526	23°31.4'	36°42.25'	920	972	1778	approx. 1.3 m mostly grey yellowish brown calc. ooze with light grey brown and dark grey mottling at top
[illegible]-12	GC	21.10.70	0748	0907	23°14'	37°16'	1207	1280	2340	whole core device lost overboard
[illegible]0-13	G/WB	"	0920	1214	23°14'	37°16'	1200	1272	2326	no grab sample, complete WB recovery
[illegible]0-14	GC	"	1215	1415	23°13.6'	37°16.3'	1200	1272	2326	fin section lost overboard, barrel and core retrieved.
[illegible]0-15	WB	"	2003	2212	22°35'	37°42'	1020	1077	1970	3 bottle recovery from 6
[illegible]0-16	WB	22.10.70	0730	0904	22°13.75'	37°55'	1135	1201	2197	complete recovery
[illegible]0-17	GC	"	0940	1055	22°13'	37°55.75'	1147	1214	2220	approx. 2 m core red brown at top, yellowish brown grey two-thirds down, black-reddish brown at base

Station No.	Type	Date	Time LMT From	To	Position N	E	Depth UCF	CF	M	Comments
70-18	GC	22.10.70	1543	1700	22°03.6'	37°57.6'	1170	1239	2266	core barrel empty
70-19	WB/G	"	1710	1847	22°03.6'	37°58'	1120	1185	2167	no grab sample, complete WB recovery
70-20	GC	"	1919	2025	22°03.1'	37°58'	1137	1203	2201	approx. 1.3 m core yellowish reddish brown with thin red and black layers at base
70-21	GC	23.10.70	0825	0930	21°23.5'	38°32'	1088	1152	2107	only recovery from small amount on core catcher; red-brown colloid
70-22	WB/G	"	1005	1140	21°23'	38°03.4'	1080	1142	2088	possibly 4 bottles in brine grab unsuccessful
70-23	GC	"	1145	1250	27°22.75'	38°04.3'	1100	1163	2127	approx. 1 m core; black flocculent suspension. core catcher blocked off by platy material.
70-24	GC	"	1413	1535	21°22.75'	38°06'	1100	1163	2127	core liner empty except for small amount of white solid.
70-25	WB	"	1605	1743	21°22.75'	38°05.8'	1083	1145	2094	
70-26	GC	"	1800	1916	21°22.75'	38°05.8'	1088	1150	2103	approx. 1 m core; very fine grained dark reddish black. Core catcher blocked off by platy material
70-27	GC	"	2032	2145	21°14'	38°06.4'	1037	1096	2005	Core liner with small amount of grey brown calc. ooze only
70-28	WB	"	2215	2306	21°14.1'	38°06'	1041	1100	2010	full recovery
70-29	WB	24.10.70	1230	1400	21°48.6'	37°56.4'	984	1039	1900	full recovery
70-30	WB	"	1905	2022	21°36.5'	37°56.6'	830	876	1602	full recovery

Abbreviations: WB = Water bottle or hydrocast station; G = Grab station;
GC = Gravity core station

Station No.	Date	LMT	Position	T°C/Pmb	Air Intake Setting
Hg1	21.10.70	1655-1715	37°22'E 22°57.2'N	35/997	5
Hg2	"	1735.1820	37°24.5'E 22°51.7'N	35/997	5
				30/997	
No. One	"	2240-2300	37°43'E 22°32.4'N	30/997	5
No. Two	"	2310-2350	37°44'E 22°29'N	30/997	5
No. Three	22.10.70	1315-1335	37°53'E 22°01.6'N	29/997	5
No. Four	"	1345-?	37°57.3'E 22°01.6'N	29/997	5
No. Five	"	1415-1455	38°01.6'E 22°01.4'N	29/997	5
No. Six	23.10.70	1401-1421	Station 70-24	29/996	5
No. Seven	"	1448-1531	Station 70-24		5
No. Eight	"	2040-2100	Station 70-27	28/995	5
No. Nine	"	2110-2150	Station 70-27	28/995	5
No. Ten	24.10.70	1908-1928	Station 70-30	29/995	5
No. Eleven	"	1934-2014	Station 70-30	29/995	5