McMASTER/DILLON/ROBB TRIDENT CRUISE REPORT TR-037

TR-037

9 March -- 10 May 1967

Ship's Schedule

Leg 1 — 9 March 0810, depart Narragansett, Rhode Island

13 March 0933, arrive St. George's, Bermuda

Leg 2 — 14 March 0800, depart St. George's, Bermuda

26 March 0744, arrive Puerto de la Luz, Gran Canaria, Canary Islands.

Leg 3 — 28 March 0000, depart Puerto de la Luz, Gran Canaria, Canary Islands.

2 April 1445, arrive Agadir, Morocco

Leg 4 — 4 April 1206, depart Agadir, Morocco

24 April 0750, arrive Puerto de la Luz, Gran Canaria, Canary Islands.

Leg 5 — 26 April 1611, depart Puerto de la Luz, Gran Canaria, Canary Islands

10 May 0850, arrive Newport, Rhode Island

Scientific Party

Dr. Robert McMaster, (legs 2, 3, 4), scientific leader
Dr. Dale Krause, (leg 1), scientific leader
William Dillon, (legs 1, 2, 3, 4), graduate student
James Robb, (legs 3, 4), graduate student
Arthur Buddington, (all legs), marine technician
Timothy Kennard, (all legs), marine technician
Harold Marsh, (all legs), technician
David Smith, (all legs), technician
Dr. Ryan Drum, (legs 1, 2, 3) U. of Massachusetts
Ahmed Haddar Demnati, (leg 4), Departement de la Geophysique, Direction des Mines et de la Geologie du Maroc.
Pedro Balle-Cruellas, (legs 3, 4), Instituto Espanio Oceanografica
George Walsh, (leg 1), Raytheon Corp., and U.R.I. graduate student
Larry McDonald, (leg 1), Raytheon Corp.

Research Programs and Preliminary Results

1. George Walsh of Raytheon and a Ph.D student at U.R.I. tested his experimental seismic reflection profiler on leg 1. This system employs an

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electronic sound source which is a 5000 Hertz narrow beam transducer, combined with a correlation receiver. Three profiles were made on the New England continental slope.

2. Two programs were run for Dr. Dale Krause of the G.S.O. (a) Two profiles of depth and magnetic intensity across the Atlantic were made on legs 1, 2 and 5, and continuous plots of the data were kept. The PESR and magnetometer were operated at all times during the Atlantic crossings, except during 0030 to 1200, 8 May, due to weather conditions. (b) Several crossings were made of the northwestern slope of Bermuda to investigate the possible existence of terraces at depths between 500 and 2000 meters. Terrace-like features were found.

3. Surface water samples were taken twice daily during legs 1 and 2 for Dr. Gote Ostlund of the Institute of Marine Science of the University of Miami. Positions for these 22 samples are shown in Appendix 1. These samples are to be used in a research project on hurricanes, for which tritium in the atmosphere is being utilized as a tracer in order to study the air-sea exchange of water vapor.

4. Dr. Ryan Drum of the Botany Department, University of Massachusetts took 14 vertical haul plankton samples during legs 1, 2 & 3 (see Appendix 2 for positions). Each sample was concentrated by centrifugation, fixed in 4% phosphate-buffered glutaraldehyde, rinsed 4-6 times with phospate buffer and stored in buffer at 5 - 10°C for 45-60 days. After the ship's return samples were warmed to room temperature, postfixed with OsO_4 for 12 hours and then embedded in epon. Examination with the light microscope indicated that preservation was generally good. Diatoms and other photosynthetic organisms seemed better preserved than the various zooplankters. For the future, it is felt that a lower storage temperature (0°- 4°C), and shorter storage time before embedding

would be preferable. The plastic blocks will be sectioned for examination in the electron microscope.

5. Net tows for plankton were taken at 10 stations for Dr. Rudolph Scheltema of WHOI, during legs 2, 4 and 5. Positions of these stations, which represent two transects of the Canary Current, are given in Appendix 3.

6. James Robb, (M.S. student), and William Dillon, (Ph.D. candidate), graduate students at the Graduate School of Oceanography, employed TRIDENT to obtain thesis material during legs 3 and 4. Robb studied the continental shelf and upper slope of Morocco from Cap Sim to Cap Rhir (see location map). In this area the Atlas Mountains, which trend roughly east-west, reach the coast. Dillon's area of interest included the continental shelf and slope from Cap Rhir to Cabo Juby (see map). Thus research on one area will complement that done on the other. The Cap Rhir-Cabo Juby coast includes: (a) a region of recent sediment deposition, the Sous trough, near Agadir; (b) ancient folded and uplifted rocks, the Anti-Atlas Mountains, from about 30°N to Cap Dra; (c) an area of long term subsidence and coastal deposition, the Tarfaya "Basin," south from Cap Dra. On land major faulting separates the Tarfaya Basin from the Anti-Atlas and the Sous trough from the Atlas Mountains to the north. Forty seismic reflection profiles were obtained. Preliminary examination of the records shows areas of flat lying beds, notably in the Sous trough. However extensive areas of folding and crumpling in the Tarfaya Basin area indicated much more tectonic activity than had been anticipated, based on reports of land geology. Of course, extensive tectonism was inticipated and observed in the Atlas Mountains area. Detailed surveys were carried out to attempt to locate the major faults. Slumping is visible on the slope. Extensive erosion is apparent on the shelf and several unconformities

exist within the sedimentary rocks.

A great deal of magnetic intensity information was obtained along the 330 miles of coast. Spacing between magnetic survey lines is less than 20 miles almost everywhere, and in many cases is much less. Due to the high density of data, it will be possible to construct a magnetic intensity map of the area. Preliminary plotting, done aboard ship shows one, very noticeable magnetic anomaly which is indicated on the location map. It appears to be located on the trend of the Canary Islands volcanoes and may be caused by a mafic intrusion related to those volcanoes.

Dredging was carried out at nine localities (see location map). Most of the rocks taken are carbonates - limestone or marble. Representative samples of organisms taken in these dredge hauls were preserved for the use of any interested biologist.

The PESR was run continuously. This depth information will be used to assist in the study of the structural geology and evolution of the shelf.

7. Five stations were occupied off Cabo Juby on leg 4 in order to take large quantities of sediment for Dr. Robert McMaster of the G.S.O. Grab samples taken with the Van Veen sampler were wet sieved aboard ship in order to retain shells for possible radiocarbon dating.

8. A quantity of Sargassum weed and 90 liters of sea water were obtained for Dr. Howard Winn of the G.S.O. during leg 5.

In summary, the separate programs of research or sampling of 9 investigators were accommodated. These include the research necessary for one doctoral thesis and one master's thesis. In addition biological samples from the geological dredge hauls were preserved for general use. Two observers from other countries (Morocco and Spain) were aboard during a large part of the work.

We are very pleased to acknowledge the excellent cooperation given by the ship's crew, often far beyond their assigned duties. In addition, although Loran was not available, preliminary plots seem to indicate that the navigation was quite good.

Appendix 1

Ostlund Water Samples

1	0900	3/14/67	32°21.24'N	64° 35.75'W
2	2200	3/14/67	31°38.8'N	63° 38'W
3	0800	3/15/67	30° 56.5'N	61° 19.2'W
4	2000	3/15/67	30° 10.9'N	59° 27.8'W
5	0815	3/16/67	29° 45'N	57° 53.8'W
6	2000	3/16/67	29° 27.8'N	53°56.8'W
7	0800	3/17/67	29° 06.9'N	51° 35.2'W
8	2030	3/17/67	28° 51.1'N	49° 13.6'W
9	0930	3/18/67	28° 52'N	46° 50.2'W
10	2015	3/18/67	28° 50'N	44° 34.1'W
11	0800	3/19/67	28° 43'N	42° 44'W
12	2015	3/19/67	28° 37.8'N	40° 39.5'W
13	0900	3/20/67	28° 33.6'N	38° 27'W
14	2000	3/20/67	28° 35.0'N	36° 53.8'W
15	0900	3/21/67	28° 44.0'N	34° 20.0'W
16	2000	3/21/67	28° 45'N	32° 42.2'W
17	0900	3/22/67	28° 31.8'N	30° 27.0'W
18	2000	3/22/67	28° 24.1'N	28° 30.6'W
19	0900	3/23/67	28° 20.0'N	25° 59.5'W
20	2100	3/23/67	28° 15.0'N	23° 52.0'W
21	0900	3/24/67	28° 08.2'N	21° 46.2'W
22	2000	3/24/67	28°03.2'N	19° 53.8'W

Appendix 2

Drum Vertical Net Tows

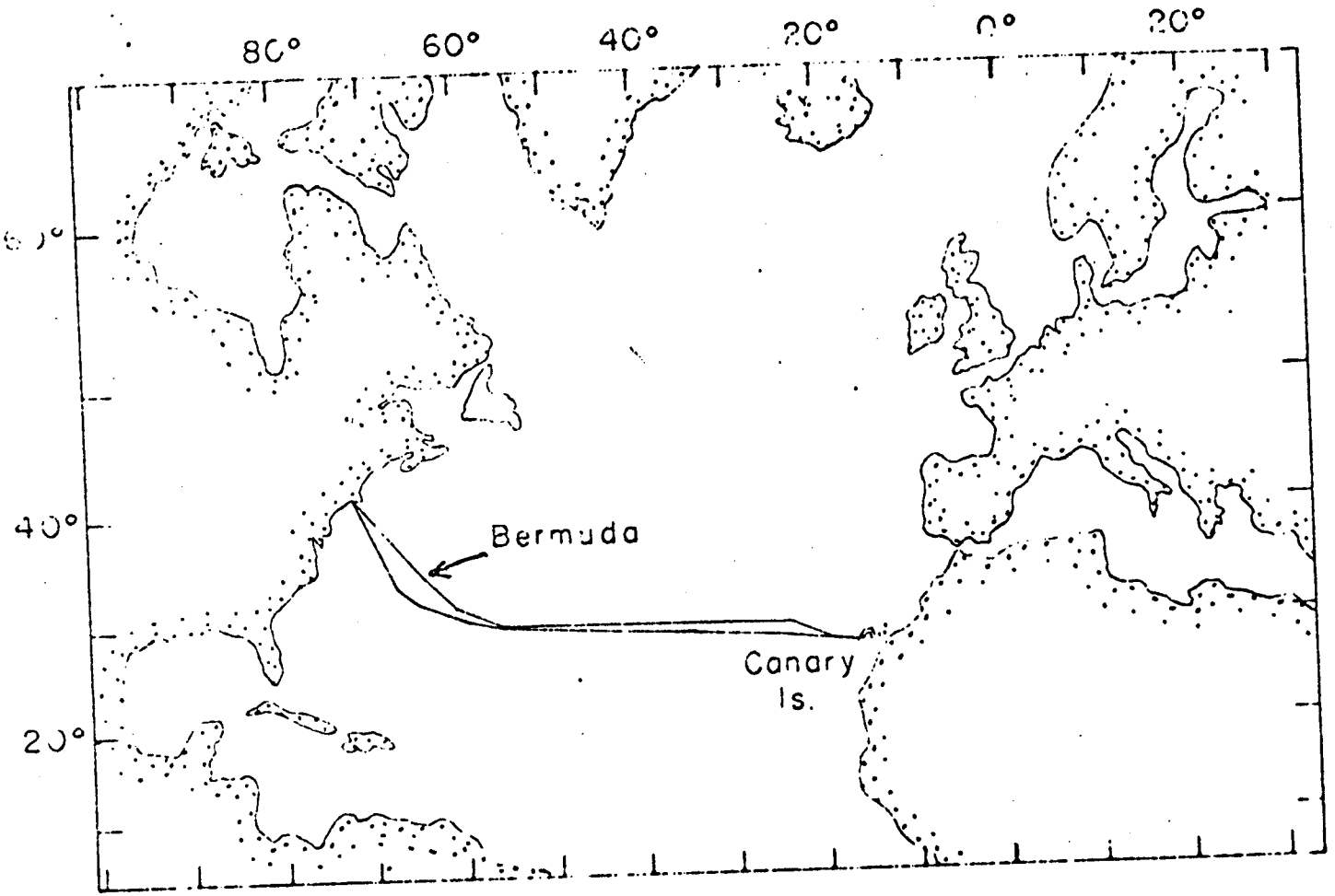
(Information supplied by Dr. R. Drum)

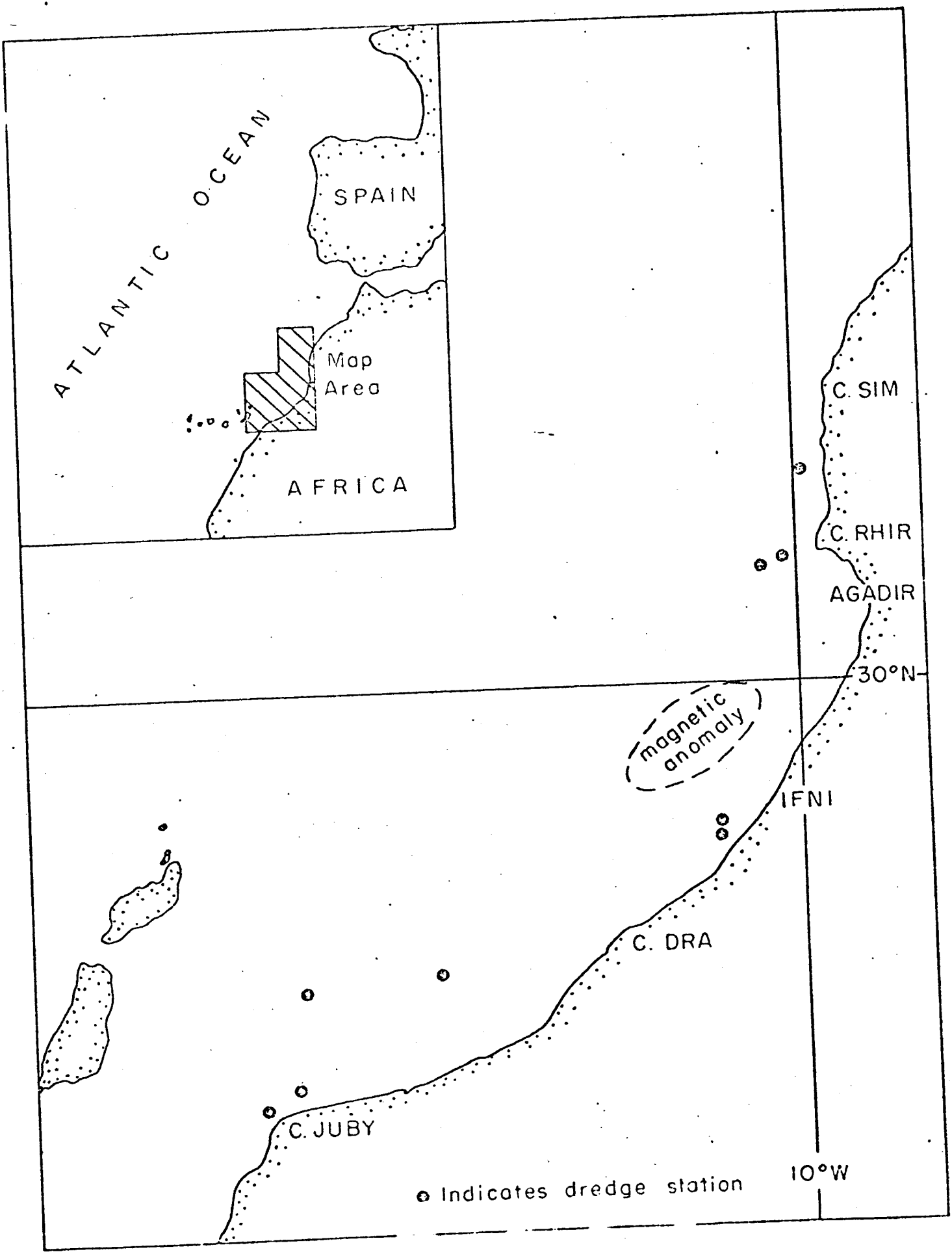
Date	Position	Time	Temp.
3-9-67	40 52.7N 71 06.8W	1600	3 C
3-10-67	39 45.8W 70 52.5W	1400	
3-11-67	36 28.5N 68 14.0W	1600	16 C
3-12-67	33 33.5N 66 02.0W	1600	19 C
3-14-67	32 2N 63 33W	1600	20 C
3-16-67	29 28.2N 54 05.8W	1900	21 C
3-18-67	28 51N 45 00W	1900	
3-19-67	28 38.5N 40 54.5W	1900	
3-21-67	28 45.2N 32 49.8W	1900	
3-22-67	28 24.5N 28 43W		
3-23-67	28 15.5N 24 06.W		
3-24-67	not known		
3-25-67	Off Tenerife (Canary Islands)		
4-2-67	Agadir		

Appendix 3

Scheltema Net Tows

March	23	no position in ship's log	
	24	no position in ship's log	
	24	28°07.0'N	21° 10.0'W
	24	28°04'N	20° 08'W
	25	28°02'N	18° 36'W
	25	27°57.5'N	17° 20.0'W
April	23	27° 49.5'N	14° 05.5'W
	26	28° 13.5'N	15° 50.8'W
	27	28° 21.5'N	19° 21.3'W
	28	28° 57'N	21° 47'W


80°
60°
40°
20°
0°
20°
40°
20°
Bermuda
Canary
Is.


ATLANTIC OCEAN
SPAIN
Map Area
AFRICA
C. SIM
C. RHIR
AGADIR
30°N
magnetic anomaly
IFNI
C. DRA
C. JUBY
Indicates dredge station
10°W