

Mc MASTER

REPORT

TR-015

Mc MASTER

R/V TRIDENT Cruise 15
"Morhara"

April 13, 1964 - June 2, 1964

AREA

During this cruise major attention was confined to the continental shelf of West Africa-Southern Spain bounded on the south by 18°30'N-17°W and on the north by 36°30'N-6°W (see chart). The direct steaming legs from Bermuda to 18°N-17°W and Cadiz, Spain to Narragansett Bay, R. I. were also working courses.

PROGRAM

Primary emphasis was on a shallow water geological program along the West African and Spanish coasts. Topographic features of this shelf area were investigated by the Echo Sounder and the Sparker was used to study sub-bottom structures. Grab samples were collected at locations defined, in part, by topography and sub-bottom features. Also bottom photographs were taken at appropriate sites and a daily line for B.T.'s was made across the shelf.

In conjunction with the grab sampling phase S, Pratt utilized a part of the sediment sample to obtain biological specimens.

Pratt

On the out bound leg from Bermuda and the inbound leg from Spain sounding profiles were made and magnetometer data were obtained along these courses for D. Krause.

Plankton

Finally each evening of the cruise, weather permitting, plankton tows were made by N. Hillman.

SCHEDULE

- Bermuda-Africa leg April 13, 1964 → 24 April 11 days
- Shelf studies (Africa-Spain) 25 April → 20 May 20½ days
- Spain-Rhode Island ^{20 miles to} June 2, 1964 13 days
- Ports (Las Palmas, Canaries and Cadiz, Spain) 5½ days

SHIP'S CREW

	Master	R. L. Hempstead	
	Chief Eng.	R. S. Jackson	
Ch. Mate	J. D. Schmouth	Ord. Seaman	A. U. Howes
2nd Mate	M. Fanning	Steward	C. F. Wood
Radio Off.	W. P. James	Messman	T. F. Holland
-Bos'n	L. W. Palmer	1st Ass't. Eng.	J. P. Symonds
AB Seaman	H. F. Martin	2nd Ass't. Eng.	J. E. Layman
AB Seaman	J. M. Llopis	Electrician	P. M. DiCenso
Ord. Seaman	P. G. Ouelette	Oiler	E. Z. Martinez
Ord. Seaman	F. A. Robinson	Oiler	G. A. Alves
Ord. Seaman	G. E. Destremps	Oiler	E. G. Mason

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SCIENTIFIC PARTY

15

- T. D'Ambra
- J. Frey
- N. Hillman
- R. McMaster (Cruise Leader)
- J. Piety
- F. Powell
- R. Radulski

WORK DATA

The 21-day period in the major study area produced the following accomplishments:

Transverse sounding profiles. . .	50
Sparker profiles.	27
Grab samples (geology-biology). . .	132
Dredge Hauls.	9
Camera Stations	14
B.T.'s.	48
Plankton tows	20 (total for cruise - 42)

PRELIMINARY FINDINGS

Geology. As the nature of this work was primarily exploratory, specific objectives were not firmly established. However the Afram Cruise of 1963 had shown that well-developed and well-preserved drowned shorelines were common features at 80 and 100m over most of the 700 miles of shelf which was investigated in 1963 and it was hoped that these features could be traced further northward and studied more in detail.

Our investigation began at 17°30'N (some 200 miles north of Afram). In this area many of the characteristics of the shelf were found to be similar to the Dakar-Portuguese Guinea shelf. Sub-bottom profiles showed deeper seaward dipping strata truncated and lapped by younger beds of more gentle inclination. Those profiles parallel to the coast indicated that the strata lie parallel to the bottom surface. One sparker run crossed the upper reach of a major submarine canyon (190°N) and it revealed a much deeper valley partially filled with stratified sediments. Middle and outer shelf sediments were characterized too, just as further south, by light colored shell sands. In this area the shelf showed a gradual but smooth slope seaward with a "break" at about 100m. With the exception of the initial traverse (the 80m shoreline of Afram was noted here) none of the persistent drowned features of the south were found. A 40m shore was observed and this proved to be continuous as far north as 26°N. Dredge hauls along this feature revealed that it was composed of cemented shells.

A change in this pattern occurred in the vicinity of 25°N. Although the shelf edge was still about 100m, the bottom surface became rough (3-5m displacement) over considerable area of the offshore bottom. Sub-bottom profiles indicated that the underlying beds intersect the surface at a relatively steep angle and that along the strike, these beds showed a dip toward the south. This area may also mark the beginning of a region of longitudinal flexure along the coast. The irregularities, mentioned above, may reflect either differential erosion effects along the angular

unconformity at the bottom surface or volcanic outpourings or both. No obvious faulting was noted. A dredge haul at 40m produced a collection of thin, flat rock fragments (shale?, sandstone, and volcanics?). The sediments continue to be shell sands so common toward the south although over the "highs" of the irregularities there may be a thin veneer of sediments or exposed rock.

In the vicinity of 29°30'N several more changes were introduced. First the shelf edge deepened to 150m and this depth for the shelf break continued northward to Spain. Moreover the shell sand finally gave way to inorganic sediments and mud-sand mixtures became dominant. A sparker run along the coast crossed the offshore flank of the Atlas Mountains (30°N) but revealed no faulting in the upper 50-100m section of the bottom. However the strata showed dips toward the south as well as northeast which could be more evidence of longitudinal flexure cited above.

Toward the north from 30°N, irregular features continued in random patterns on the shelf in both transverse and longitudinal directions. The 40m scarp appears again along this stretch of coast. Volcanic features were identified on several crossings. One cone showed what is believed to be a caldera. A dredge haul across the base of one of these volcanoes (110m) produced a number of slabs of rock. In this region a pronounced fracture zone (70-75m) was observed and also several isolated faults were noted. Again the regional dip of strata was found to vary from N.W. to south which could result from flexures along the shelf strike or transverse faulting. The underlying beds, in general, had greater inclinations than the present bottom surface and these strata either intersected this surface or were covered by more gently dipping sediments. Near the shelf edge offlapping was observed. Apparently these sedimentary materials of the shelf can be cut by volcanic intrusions. Thus the irregular topographic features, noted above, may be produced by erosion, faulting or volcanic activity. The apparent effect of each of these was observed. Mud and mud-sand are the major sediment types of this region.

Near the Gibraltar Strait, the topographic profile from shelf edge (135m) to about 100m is smooth and featureless but shoreward of this depth the surface becomes rough to at least 30m. A sparker run revealed an unconformity near or at the surface as far offshore as the 100m line. From this point seaward more recent sediments lapped these older strata. Along the shelf strike, the underlying beds are inclined to north or N.W. In this area well-sorted sands are found along the entire profile and probably are the result of current action in and out of the Strait.

On the Cadiz line, the shelf showed a gradual slope offshore with a minor break at 125-130m but otherwise featureless. The sub-bottom record indicated that beds offlap between 100-200m but from 50-100m the underlying strata are essentially parallel to surface. The parallelism of beds was also noted on the profile along the coast.

Several lines were worked in the Canary Islands (Gran Canaria, Fuerteventura, and a bank northwest of this latter island). Here the shelf edge was found to be at 100m but scarps or benches were noted on each transect. Heavy concentrations of unknown nodules were encountered on the bank and outer parts of the insular shelves.

Benthos Survey - S. D. Pratt

A collection of macrobenthonic forms was made from the surface of the S.M. grab sample, from material brought up in the rock dredge, and from grab sample subsamples of 1000 to 4000 CC which were passed through a 1mm sieve. Microbenthonic forms were collected in 450 CC samples. Fine sediments were frozen and the sands preserved in formaldehyde.

While in general the samples were too small and widely scattered to enable plotting the quantity or distribution of the macrobenthos a number of interesting animals were collected.

In the region south of the Canary Islands holothurians, elongate echinioids and shortened polychaets seemed to fill the same niche, feeding along the sediment surface. "Lobster-like" crabs, "sea feathers" (stalkless crinoids), scophopods and gastropods were found. Annelid and nemertine worms were present but not abundant.

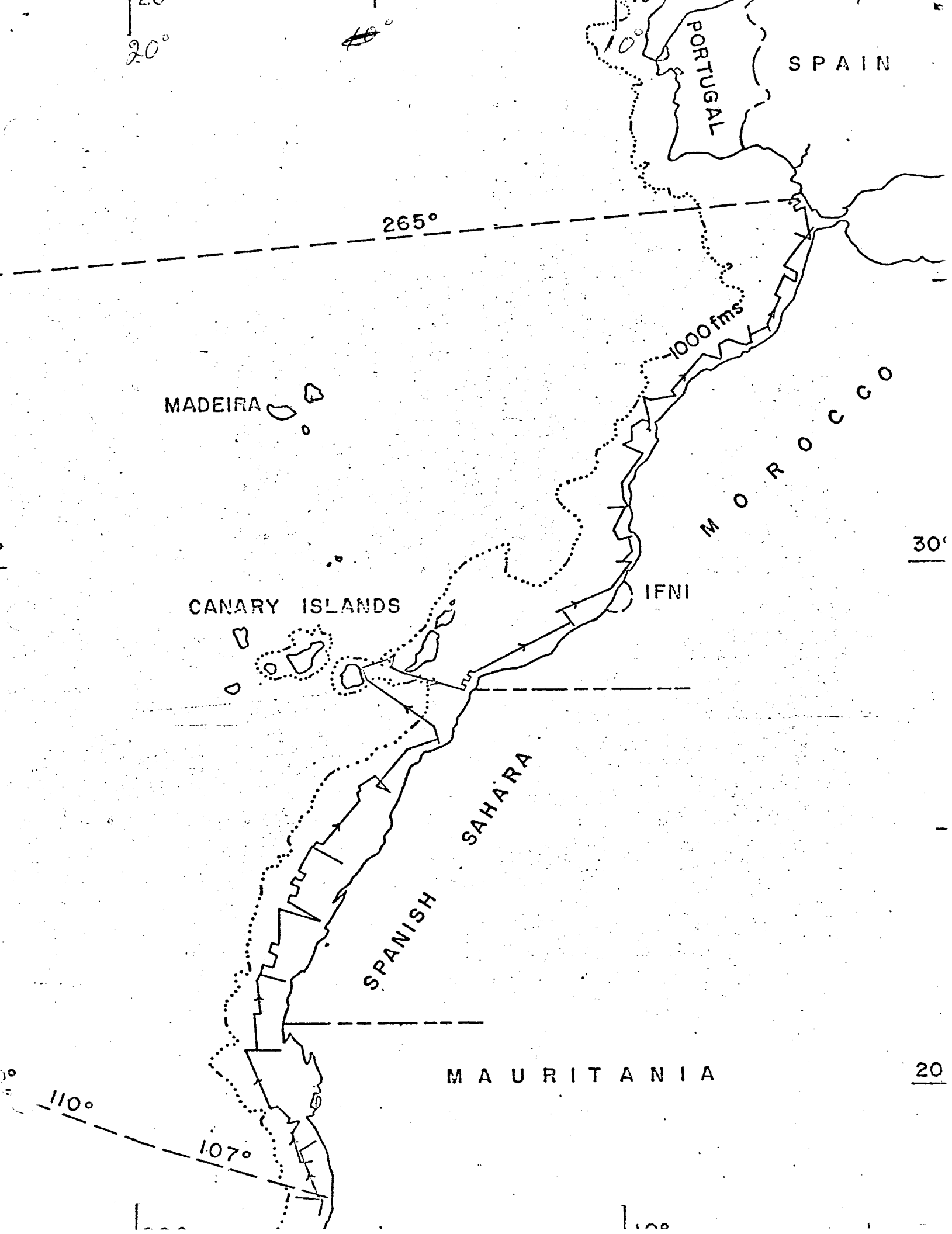
There were abundant amphipods in fine sands while in an area of well washed pink shells there was a very large biomass of the cephalochordate Amphioxus.

A dredge haul on a rock reef in this region yielded several species of gorgonians (soft coral) solitary cup corals, many bryozoa, tunicates and sponges. A single species of brachiopod grew on the rocks. One species of lamellibranch burrowed in the rock while another clung to the coral. Barnacles and brittle stars were also abundant.

On April 28 patches of "red water" were observed along the transect. Under low magnification they were seen to have the form of peridininian dinoflagellates.

In the Canaries green and brown algae were collected from as deep as 60 meters.

The level bottoms north of the Canaries seemed to have fewer numbers as well as species as compared to the southern region. The reefs had communities similar to the first described. One reef off Morocco yielded a heavy calcareous coral which may be Dendrophyllia. If this is so it is our only sample of the "fonds coralligenes" of the Mediterranean which is reported to incrust suitable bottoms from there to Ghana at 70-100 meters.



20°



PORTUGAL

SPAIN

265°

1000 fms

MADEIRA



CANARY ISLANDS



IFNI

M O R O C C O

30°

SAHARA

SPANISH

MAURITANIA

20°

110°

107°

1000

1000