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R/V CHAIN CRUISE N° 61

SUMMARY CRUISE REPORT
TRACK CHARTS, BATHYMETRY,
AND LOCATION OF OBSERVATIONS

NORTH ATLANTIC OCEAN
MEDITERRANEAN AND RED SEAS
11 JULY - 17 DECEMBER, 1966

WOODS HOLE, MASSACHUSETTS

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R/V CHAIN

WOODS HOLE OCEANOGRAPHIC INSTITUTION
Woods Hole, Massachusetts

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R/V CHAIN CRUISE NO. 61
NORTH ATLANTIC OCEAN - MEDITERRANEAN AND RED SEAS
SUMMARY CRUISE REPORT PREPARED BY CHIEF SCIENTISTS, TRACK CHARTS,
BATHYMETRY, AND LOCATION OF OBSERVATIONS
JULY 11, 1966 - DECEMBER 17, 1966

Compiled by

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H. C. Hays

September 1967

TECHNICAL REPORT

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Approved for Distribution

J. M. Hunt, Department Chairman
Department of Chemistry

Approved for Distribution

E. E. Hays, Department Chairman
Department of Geology and Geophysics

ABSTRACT

This report contains a summary and charts for R/V CHAIN Cruise 61 in the North Atlantic Ocean, Mediterranean and Red Seas. There are 133 charts plotted on a Mercator Projection (Scale 1° longitude equals 4 inches) showing the track of the entire cruise except for special surveys. All types of observations made during the cruise are noted by suitable symbols or legends along the ship's track. The locations of Special Surveys are shown on Charts I - II - III and IV. Charts V and VI show special observations made in the Hot Brine Region. There are 20 pages listing information gathered at each of the 178 stations made. Soundings are read at equal time intervals, usually every ten minutes, and in some cases at each break in slope. They are written along the ship's track as often as space permits. Soundings are based on a sound velocity of 800 fathoms/second and are corrected only for the depth of transducer.

CHART II
CHAIN CRUISE No. 61

JULY-DECEMBER 1966

MEDITERRANEAN SEA

AUGUST 4, 1966-OCTOBER 11, 1966

NOVEMBER 15, 1966-NOVEMBER 27, 1966

STATION

NOTE: Continuous Echo Sounding - Gravity -

Magnetometer and Surface Temperature

Measurements were taken except where noted

by their line symbol

(SEE KEY TO NAVIGATIONAL PLOTTING)

CHART III
CHAIN CRUISE No. 61
JULY-DECEMBER 1966
MEDITERRANEAN SEA
AUGUST 7, 1966-OCTOBER 5, 1966
Continuous Seismic Profiling

CHART V
CHAIN CRUISE No. 61

JUL Y-DECEMBER 1966

RED SEA

HOT BRINE REGION

OCT. 16, 1966-OCT. 26, 1966

OCT. 29, 1966-NOV. 3, 1966

NOV. 7, 1966-NOV. 9, 1966

● TEMPERATURE TELEMETERING FINGER STATION

CHART VI
CHAIN CRUISE No. 61
 JULY-DECEMBER 1966
 RED SEA
 HOT BRINE REGION
 OCT. 16, 1966 - OCT. 26, 1966
 OCT. 29, 1966 - NOV. 3, 1966
 NOV. 7, 1966 - NOV. 9, 1966

- PISTON CORE
- GRAVITY CORE
- ◆ FREE FALL CORE
- BOX CORE
- ⚓ DREDGE STATION

SUMMARY

Woods Hole to Lisbon - E. E. Hays

CHAIN departed Woods Hole 1030 on 11 July 1966. This was the first leg on a cruise of five and one half months with most of the time to be spent in the Mediterranean.

A NATO group was conducting an oceanographic study of an area west of Ireland during the latter part of July and CHAIN was scheduled to participate. Due to heavy fog in the area east of New England, the transit speed was reduced for several days and time was only taken for one 'testing' station before arriving at the exercise area.

During the exercise CHAIN made 15 sound velocity stations, 15 hydrographic casts and 15 current meter stations. The Geomagnetic kinetograph was towed during all transits of the exercise, and BT's were taken.

The quartz thermometer at 5 meter depth gave a continuous record of temperature at that depth, during the complete leg. Another quartz thermometer was towed at a depth of 10 fathoms during the longer transits of CHAIN, but was not used during the short runs in the exercise.

Measurements were made of the earth's magnetic and gravitational field along the track.

CHAIN arrived in Lisbon, Portugal on 29 July 1966.

Lisbon to Beirut - E. F. K. Zarudzki

The principal objective of this portion of Cruise 61 was to extend and deepen our knowledge of the physical, geographical and geological parameters in the Eastern Mediterranean. This was the fifth Mediterranean cruise mounted by the Department of Geophysics of W.H.O.I. since 1958. The ship's track during the cruise is shown in Fig. 1.

Specifically, we investigated: (a) the sea water environment; (b) the sea floor and, (c) the upper crust of the earth. The study of the sea water environment comprised nine "on station" and "underway" research programs, one station was occupied during each 24 hour period. The stations were interspaced by an average of 20 hours steaming (approximately 130 miles), during which underway observations were made. Information collected during the daily station included continuous measurement of the velocity of sound in water, the water temperature, and its light scattering properties (nephelometry), each from the sea surface to the bottom, measurement of bottom currents, and collection of water samples for analysis of particulate matter. Underway investigations comprised: continuous monitoring of the sea water temperature with sensors towed at the surface, at 5 meter and 35 meter depths; and a two-hourly measurement of temperature, with bucket thermometer, of surface water salinity with a Schleicher salinometer, and of the near-surface thermal gradient, with a bathythermograph.

The main objective of these programs was to better define the sonar environment of the Eastern Mediterranean. The principal parameters by which this environment may be described are spatial and temporal variations of sound velocity and temperature as a function of depth. The nephelometry, sampling of particulate matter and bottom current measurement were included to obtain information about the structure and movement of water masses.

Study of the sea-floor comprised five research programs, all executed on station except bathymetry. Bathymetric profiles were made with the 12 kc EDO transducer, driven by a Giffit Precision Sonar Transceiver and recorded on the Precision Graphic Recorder (PGR) #1, in the top laboratory. "On station" programs were: bottom photography, dredging and sediment coring, the latter combined with measurement of heat flow through the sea floor.

These studies were aimed at further improvement of our knowledge of the sea-floor, and in particular, of sea-floor characters which affect the sonar environment. These include the roughness of the sea-floor, on scales ranging from less than an inch to many miles, its reflectivity and its composition. As a by-product we obtained useful geological and geophysical data.

The geophysical study of the upper crust of the earth utilized acoustical (reflection seismic), gravity and magnetic measurements, made while R/V CHAIN was steaming at an average speed of 6.5 knots. The continuous seismic profiling utilized two sound sources: a WHOI 100,000 joule sparker and a Bolt PAR 600 air gun. They were employed individually, and together (firing alternatively) enabling us to make comparisons of their performance. The air gun started malfunctioning on August 14th and was eventually used only as a back-up. The seismic receiving system was a Chesapeake hydrophone array. The signal from the array was amplified by a Dow 5-channel amplifier, filtered through Allison single and cascaded filters, and recorded by PGR's #2 and #3 on electro-sensitive paper by a Crown tape recorder on analog magnetic tape.

The total magnetic field was measured by a Varian proton precession magnetometer system and fed into the memory discs of an IBM 1710 shipboard computer system. Gravity was measured by a La Coste-Romberg sea gravimeter, which fed data into the computer for shipboard processing and storage.

The investigation of the Eastern Mediterranean covered 15 sub-provinces shown in Fig. 2. The terminology is from "Bathymetry of the Eastern Mediterranean Sea" by K. O. Emery, Bruce C. Heezen and T. D. Allan (Deep-Sea Research, Vol 13, pp 173 to 192). Preliminary geophysical and geological results, from sub-provinces 2, 2a, 4, 5, 6a, 7 and 8b, worked out during the cruise and immediately afterwards in collaboration with W. B. F. Ryan and others of Lamont Geological Observatory follow below.

The Sicilian Escarpment; Sub-province 2 (Fig. 2)

The Sicilian Escarpment forms the eastern flanks of a submerged land bridge between Sicily and North Africa. This land bridge divides the Mediterranean into western and eastern basins; thus the Sicilian Escarpment is the western physiographic and oceanographic boundary of the Eastern Mediterranean. The Plio-Quaternary crustal displacements in this area further lowered the adjacent sea-floor of the Eastern Mediterranean, while the Calabro-Sicilian arch rose.

The continuous seismic profiles (CSP) showed the escarpment to be the up-thrown side of a large and complex fault system striking roughly north-south. The fault blocks are down-thrown 7000 to 9000 feet to the east, as postulated by Glangeaud (1962) and by Russian workers (Emilianov, et al, 1965).

One profile suggests the existence of another, hitherto uncharted, fault system striking southwest and down-thrown to the southeast, at the southern end of the above-mentioned main fault system. Two large seamounts in front of the escarpment are elevated fault-blocks.

The Seamount Complex off Libya; Sub-province 2a (Fig. 2)

The group of seamounts located 80 miles north of Benghazi, Libya, was investigated by Russian workers (Mikhailov, 1965) who thought them to be of volcanic origin. Our CSP, magnetic and gravity profiles showed them to be sedimentary with volcanic plugs and sills. The area is one of the few in the Mediterranean where rock outcrops at depths of 1,000 fms are not covered with unconsolidated sediments.

Western Approaches to Greece; Sub-province 5 (Fig. 2)

The cruise track crossed the zone of maximum seismicity off Greece (Galanopoulos, 1963). The morphology and structure of the sea-floor indicated continuing earth movements and rapid sedimentation. Tilted, elevated sedimentary basins and faulted blocks abound in the area. A deep undisturbed, sedimentary basin, over 2800 feet ~~thick~~ was also found south of Kafallinia Island.
thick

LEG 2

1. STRAITS OF MALTA
2. SICILIAN ESCARPMENT
- 2a. SEAMOUNT COMPLEX
3. MID-MEDITERRANEAN RIDGE
4. PFANNENSTIEL "CALDERA"
5. WESTERN APPROACHES TO GREECE

LEG 3

6. HELLENIC FAULT ZONE
- 6a. THERA "CALDERA"
7. NORTH CRETE ABYSSAL PLAIN
- 8a. ANDIKITHIRA CHANNEL
- 8b. CASSO STRAIT
- 8c. KARPATOS STRAIT

LEG 3 cont.

9. GAVDHOS ISLAND, PTOLEMY MTNS., PLINY TRENCH
10. STRABO TRENCH
11. RHODES ABYSSAL PLAIN
12. HERODOTUS ABYSSAL PLAIN

LEG 4

13. ABYSSAL HILLS AND ERATOSTHENES SEAMOUNT
14. CILICIA PLATEAU AREA
15. CONT. SLOPE AND RISE, EAST OF CYPRUS

The Volcanic Island of Thira (Santorini); Sub-province 6a (Fig. 2)

The Thira caldera was formed about 1450 B.C. (Ninkovitch and Heezen 1965) by a Krakatoan-type eruption of Santorini. The ship crossed the caldera and then circumnavigated it, during the course of geophysical investigation. The profiles of total magnetic intensity proved useful in elucidating the morphology and structure revealed by CSP. A 1000 gamma positive anomaly is associated with the central volcanic vent. A large external volcanic vent was discovered to the southwest of the caldera.

Cretean Sills; Sub-provinces 7 and 8b (Fig. 2)

To the northeast of Crete, two submarine sills were crossed. One sill forms the floor of Casso Strait; another 15 miles further north divides an adjacent deep basin in two. Both sills are of tectonic origin, and are located close to a second zone of maximum seismicity (Galanopoulos, 1963). Elevated sedimentary basins, about 1200 feet thick, are found on the sills' crests. The average height of these basins above the adjacent abyssal plains is 2400 feet. The genesis of such sedimentary basins is still unclear and requires further study.

Deep Water Circulation in the Ionian Sea by W. B. F. Ryan, E. F. K. Zarudski, M. Ewing and E. M. Thorndike

A counter-clockwise circulation of deep water within the Ionian basin of the Mediterranean Sea has been suggested previously from investigations of the oxygen content of water samples. Current measurements have been made on the sea-floor at the base of the Malta Escarpment and reveal a current with a velocity of 6 to 8 centimeters per second flowing southeast along the margin of the basin.

The concentration of particulate matter was estimated by measurements of light scattering by sea water utilizing a nephelometer and by sampling sea water along vertical profiles. This study indicates that the deep water is presently free of detectable quantities of suspended sediments. Despite the rapid post-glacial sedimentation rates of 10-20 centimeters per 1,000 years of material with a biogenous component of less than 60% the deep water circulation appears to be too sluggish to transport suspended sediment over in this very homogeneous deep water.

In the past currents have been strong enough to erode scour channels, expose outcrops of sedimentary rocks, and control the distribution of some of the terrigenous sediments. The quaternary stagnations of the Eastern Mediterranean occurred when this circulation ceased.

Conclusions and Statistics of the Cruise

The cruise accomplished all its primary and secondary objectives. Data is presently being studied, interpreted and reported. Time loss due to serious break-down of scientific equipment and its back-up did not exceed 5% of the total working time, and weather was favorable throughout the cruise. While the ship was docked in Lisbon, Athens, Rhodes and Beirut, a considerable interest in the scientific work was evinced by visiting foreign scientists. Two Greek scientists, Dr. A. Hadjikakides and Dr. A. Galanopoulos participated in the cruise during the leg from Athens to Rhodes.

Red Sea Leg - Beirut to Port Sudan - E. E. Hays - Port Sudan to Palermo - J. Hunt

CHAIN left Beirut 10 October, steamed to the hot hole area with some seismic profiling on the way, and entered Port Sudan 27 October - E. Hays, Chief Scientist. CHAIN departed Port Sudan 29 October, worked in the hot hole area and then steamed to Palermo, Sicily, arriving 20 November - J. Hunt, Chief Scientist.

The objective of the Red Sea trip was to develop a better understanding of the origin of the hot brines and their associated heavy metal deposits at the bottom of the Red Sea. The trip made 100 stations in the Red Sea, took about

60 cores, 25 hydrocasts, 30 heat flow measurements, and 50 water temperature measurements. In all cases relative positions were determined by radar fixes on anchored buoys.

In addition, continuous seismic profiling, gravity and magnetics were run on all sides of the holes and to the North in order to define the relationship of the hot brine area to the rift valley. A seismic recording bandwidth of 37.5 to 150 Hz was used to obtain reflections from the hot brine layers in the ATLANTIS II and DISCOVERY Deeps.

A third hot brine hole, the CHAIN Deep was discovered between the ATLANTIS II and DISCOVERY Deeps. This area was so small (2.6 x 0.7 km) that there was considerable difficulty maintaining the ship's position over the hole.

Several relatively new pieces of equipment were used extensively for the first time. The first, a temperature telemetering pinger was successfully used in measuring temperature changes with depth in all three holes plus testing of waters in other deeps of the Red Sea. Another temperature recorder with a range of 2°C and precision of 0.002°C was successfully used by Dr. Pugh of Cambridge. However, both of these instruments failed in the deepest part of the ATLANTIS II hole because of the effect of the 56°C water on the electronics. Also, several free fall cores were lost in the muck of the ATLANTIS II hole.

A new Kasten (square box) core 15 cm x 15 cm x 4 meters obtained some beautiful highly colored cores from areas in and adjacent to the deep holes. These cores were relatively undisturbed and clearly showed cyclic periods of deposition of the heavy metal oxides.

A nissen bacteriological sampler was also successfully used to get sterile water samples. An elephant size plastic bag was used to get deep water samples for C¹⁴ analysis. The increased density of the hot water was quite obvious during the handling of the sample at the surface.

In general, this was a very successful cruise from the standpoint of samples collected and the wide variety of gear used.

Palermo, Sicily to Woods Hole - J. D. Phillips

CHAIN departed from Palermo 24 November for Woods Hole via Madeira. After leaving Madeira on 2 December, CHAIN steamed to the Mid-Atlantic Ridge near 27°N. Here a geophysical study using bathymetry, gravimetric and magnetic profiling techniques was undertaken. In addition, 8 heat flow and piston core stations were made in the ridge area (Stations 171-178).

The scientific objective of the work was to determine the nature of the total intensity magnetic anomalies over the ridge and their relation to topography, heat flow and current theories regarding sea-floor spreading, and upper mantle convection. Shipboard analysis of the magnetic profiles showed linear trends that are parallel to the ridge axis and symmetrical about the axis. Subsequent computer analyses made at WHOI indicated that the configuration of magnetic bodies that could account for the anomaly pattern supports the sea-floor spreading hypothesis for the origin of magnetic anomalies over oceanic ridges. Sea-floor spreading at the rate of 1.25 cm/yr appears to have been active during the last 6 million years and a rate of 1.65 cm/yr seems to have prevailed between 6 and 10 million years ago.

Of the 8 piston core and heat flow stations, 7 stations recovered samples of sediment and 5 stations showed that useful heatflow data may have been obtained. Subsequent paleomagnetic and micropaleontologic analysis of the sediment samples showed that 2 cores penetrated the Pleistocene sediments. In fact, the bottom of the core at Station 171 appears to be on the order of 2-2.5 million years old based on the paleomagnetic stratigraphy. Correlation of the Foraminiferal fossil fauna with paleomagnetic dating of the core shows that the Plio-Pleistocene boundary is about 1.8 million years ago and the onset of the colder glacial stages (as indicated by the increase of cold water species at the top of the core) seems to have commenced about 1.9 million years ago. Although analysis of the heat flow data is currently underway, no summary of results is available at this time.

SCIENTIFIC PARTY - R/V CHAIN Cruise #61

Aboard for Entire Cruise

Allstrom, F.	McCoy, F.	Kraus, N.
Turcotte, R.	Woodside, J.	
Pearce, B.	Hillard, C.	

Leg 7 - Palermo to Madeira 24 - 29 November 1966

C.S. Phillips, J.	Densmore, D.
Leonard, P.	Erickson, A.
Rice, A.	

Leg 1 - Woods Hole to Lisbon 11 - 29 July 1966

C.S. Hays, E. E.	Nichols, W.	Scott, C.
Bubeck, R.	Power, G.	Wooding, F.
Piani, J.	Nowak, R.	Sohlberg, R.
Leonard, P.	Church, W.	Birch, F.
Flood, E.	Witzell, W.	

Leg 8 - Madeira to Woods Hole 2 - 17 December 1966

C.S. Phillips, J.	Rice, A.
Leonard, P.	Erickson, A.

Leg 2 - Lisbon to Athens 2 - 22 August 1966

C.S. Zarudzki, E.	Nichols, W.	Chase, R.
Bubeck, R.	Boutin, P.	Wooding, F.
Piani, J.	Church, W.	Erickson, A.
Leonard, P.	Witzell, W.	Sohlberg, R.
Lovenich, (IBM)	Scott, C.	Ryan, W.
Birch, F.		

Leg 3 - Athens to Rhodes 26 Aug - 13 Sept 1966

C.S. Zarudzki, E.	Dugan, E.	Chase, R.
Bubeck, R.	Dow, W.	Erickson, A.
Piani, J.	Rice, A.	Sohlberg, R.
Leonard, P.	Boutin, P.	Ryan, W.
Flood, E.	Church, W.	Hadjikakidus, A. & Galanopoulos, A. (Greece)

Leg 4 - Rhodes to Beirut 17 Sept - 6 October 1966

C.S. Zarudzki, E.	Dugan, E.	Chase, R.	Sohlberg, R.
Bubeck, R.	Church, W.	Ryan, W.	
Piani, J.	Young, E.	Flood, E.	
Rice, A.	Wooding, F.	Erickson, A.	

Leg 5 - Beirut to Port Sudan 10 - 27 October 1966

C.S. Hays, E. E.	Erickson, A.	Ross, D.
Flood, E.	Degens, E.	Densmore, D.
Dugan, E.	Waterbury, J.	Peterson, M.
Young, E.	Munns, R.	Schatz, C.
Wooding, F.	Stanley, R.	Watson, S.
Weiss, R.	Jokela, A.	

Leg 6 - Port Sudan to Palermo 29 Oct - 20 November 1966

C.S. Hunt, J.	Waterbury, J.	Densmore, D.
Gerbrecht, H. (Germany)	Olausson, E. (Sweden)	Peterson, M.
Young, E.	Mumms, R.	Truper, H. (Germany)
Wooding, F.	Stanley, R.	Pugh, D. (England)
Erickson, A.	Ross, D.	

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- Emilianov, E. M. : Mikailov, O. V.; Shimkus, K. M., 1965. "Nekotoriye Osobiennosti Geolomorficheskogo Stroyeniya i Tektonicheskogo Razvitiya Sredizemnogo Morya," in *Osnovnye Cherty Geologicheskogo Stroeniya Gidrologicheskogo Rezhima i Biologii Sredizemnogo Morya*, Nauka, Moscow.
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- Ninkovitch, D. and Heezen, B. C., 1965. "Santorini Tephra", in vol. XVII of the Colston Papers, Butterworths Scientific Publications, London.

CHAIN 61 - STATION SUMMARY

<u>Station</u>	<u>Type</u>	<u>Date-1966</u>	<u>Time</u>	<u>Starting Depth</u>	<u>End Depth</u>	<u>Start Pos.</u>	<u>End Pos.</u>	<u>Physiog. Area</u>
1	Velocimeter #1	13 July	1425-1745	2650 fms	2650 fms	40°30'N-60°00'W		North Atlantic Ocean
2	Hydro Station #695	18 July	0952-1027			48°52'N-31°00'W		
3	Velocimeter #2	21 July	1050-1136	1725 fms		Special Survey		
	Hydro Station #696	21 July	1045-1136	1725 fms		" "		
	Current Meter sta #1	21 July	1208-1309			" "		
4	Velocimeter #3	21 July	1504-1621	1705 fms		" "		
	Hydro Station #697	21 July	1520-1621			" "		
	Current Meter sta #2	21 July	1648-1718			" "		
5	Velocimeter #4	21 July	1813-1902	1599 fms		" "		
	Hydro Station #698	21 July	1825-1857	1599 fms		" "		
	Current Meter sta #3	21 July	1907-1941			" "		
6	Velocimeter #5	21 July	2224-2320	1500 fms	1500 fms	" "		
	Hydro Station #699	21 July	2240-2319	1500 fms	1500 fms	" "		
	Current Meter sta #4	21 July	2341-2355			" "		
7	Velocimeter #6	22 July	0210-0308	1520 fms		" "		
	Hydro Station #700	22 July	0216-0307	1520 fms		" "		
	Current Meter #5	22 July	0319-0355			" "		
8	Velocimeter #7	22 July	0604-0645	2110 fms		" "		
	Hydro Station #701	22 July	0606-0643	2110 fms		" "		
	Current Meter sta #6	22 July	0652-0740	2110 fms		" "		
9	Velocimeter #8	22 July	1000-1049	1635 fms		" "		
	Hydro Station #702	22 July	1000-1045	1635 fms		" "		
	Current Meter sta #7	22 July	1051-1137	1635 fms		" "		
10	Velocimeter #9	22 July	1404-1502	1470 fms		" "		
	Hydro Station #703	22 July	1414-1502	1470 fms		" "		
	Current Meter sta #8	22 July	1508-1558			" "		
11	Velocimeter #10	22 July	1827-1858			" "		
	Hydro Station #704	22 July	1827-1858			" "		
	Current Meter sta #9	22 July	1903-2001			" "		
12	Velocimeter #11	22 July	2219-2315	1700 fms	1700 fms	" "		
	Hydro Station #705	22 July	2223-2304	1700 fms	1700 fms	" "		
	Current Meter sta #10	22 July	2323-0004			" "		
13	Velocimeter #12	23 July	0212-0255	1700 fms		" "		
	Hydro Station #706	23 July	0212-0254	1700 fms		" "		
	Current Meter sta #11	23 July	0300-0346			" "		
14	Velocimeter #13	23 July	0609-0638			" "		
	Hydro Station #707	23 July	0609-0638			" "		
	Current Meter sta #12	23 July	0645-0730			" "		

<u>Station</u>	<u>Type</u>	<u>Date-1966</u>	<u>Time</u>	<u>Starting Depth</u>	<u>End Depth</u>	<u>Start Pos.</u>	<u>End Pos.</u>	<u>Physiog. Area</u>
15	Velocimeter #14	23 July	0951-1029	1530 fms		Special Survey		North Atlantic Ocean
	Hydro Station #708	23 July	0952-1029	1530 fms		" "		
	Current Meter sta #13	23 July	1038-1125	1530 fms		" "		
16	Velocimeter #15	23 July	1349-1433	1700 fms		" "		
	Hydro Station #709	23 July	1358-1432	1700 fms		" "		
	Current Meter sta #14	23 July	1439-1535	1700 fms		" "		
17	Velocimeter #16	23 July	1840-1911	1370 fms		" "		
	Hydro Station #710	23 July	1840-1911	1370 fms		" "		
18	Nephelometer #1	3 Aug	0352-0521	428 fms	451 fms	36°20'N 7°23.5'W		
19	Core #19	8 Aug	0722-0842	806 fms		35°47'N-13°09'E		
	Heat Flow #19	8 Aug	0722-0842	806 fms				
20	Nephelometer #2							Mediterranean Sea
	w/Thorndike Camera	8 Aug	2155-2332	698 fms		36°15.5'N-13°35.5'E		
	Lamont Current Meter #1	8-9 Aug	2350-0049	698 fms		36°16'N-13°35.8'E		
21	Dredge #1	9 Aug	0216-0410			36°13.5'N-13°24.6'E		
22	Velocimeter #17	10 Aug	1154-1425	1905 fms	1945 fms	36°05'N-15°53'E		
	Nephelometer #3							
	w/Thorndike Camera	10 Aug	1138-1435	1902 fms				
	Lamont Current meter #2	10 Aug	1441-1622	3701 m			36°03.3'N-15°50.4'E	
23	Camera #1	10 Aug	2043-2245			35°55'N-15°38'E		
24	Velocimeter #18	12 Aug	0844-1150			35°22'N-16°45'E		
	Nephelometer #4							
	w/Thorndike Camera	12 Aug	0834-1158	1959 fms				
25	Heat Flow #25	12 Aug	1909-2020	770 fms		35°12.2'N-16°31.7'E	35°12.5'N-16°30.5'E	
	Core #25	12 Aug	1909-2020	770 fms				
26	Camera #2	12-13 Aug	2235-0057	1050 fms	770 fms	35°06'N-16°23.5'E		
27	Camera #3	14 Aug	0823-1120	1170 fms	1570 fms	35°06'N-17°35'E	35°08.4'N-17°37.8'E	
28	Velocimeter #19	14 Aug	1208-1430	1770 fms				
	Nephelometer #5							
	w/Thorndike Camera	14 Aug	1157-1430	3368 m		35°12.8'N-17°41'E		
29	Core #29	15-16 Aug	2301-0119	2056 fms				
	Heat Flow #29	15-16 Aug	2301-0119	2056 fms				
	Velocimeter #20	16 Aug	0133-0421	2055 fms				
	Nephelometer #6							
	w/Thorndike Camera	16 Aug	0133-0421	3955 m		33°55.9'N-19°38.8'E		
30	Camera #4	17 Aug	0300-0523	612 fms	1125 fms	33°21'N-19°41.2'E	33°22'N-19°41'E	

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31	Core #31	17 Aug	0739-0827	630 fms		33°30'N-19°49.5'E		Mediterranean Sea
	Heat Flow #31	17 Aug	0739-0827	630 fms				
32	Velocimeter #21	18 Aug	1317-1631	1914 fms		35°52.8'N-21°11.5'E		
	Nephelometer #7	18 Aug	1337-1633	1914 fms				
33	Core #33	19 Aug	0944-1155	1914 fms		36°36.3'N-20°56'E		
	Heat Flow #33	19 Aug	0944-1155	3881 (corr. met.)				
34	Velocimeter #22	20 Aug	1501-1659	1674 fms		37°43'N-19°16.5'E		
	Nephelometer #8	20 Aug	1501-1703	1674 fms				
	T Bird Camera #5	20 Aug	1712-2038			37°44.2'N-19°16.2'E		
35	Piston core #35	27 Aug	1353-1429	200 fms		36°25.8'N-25°23.3'E		
	Heat flow #35	27 Aug	1353-1429	200 fms				
36	T.V. Camera sta	27 Aug	1733-1738			36°24.55'N-25°25'E		
37	Velocimeter #23	28 Aug	1138-1320	980 fms	980 fms	35°44.1'N-25°16.6'E	35°47.1'N-25°13.3'E	
	Piston core #37	28 Aug	1400-1445	980 fms				
	Heat Flow #37	28 Aug	1400-1445	980 fms		35°46'N-25°16'E		
38	Nephelometer					35°43.5'N-23°26.1'E		
	w/Thorndike camera #9	29 Aug	1621-1708	435 fms				
	Current Meter sta #15	29 Aug	1717-1816			35°44'N-23°26'E		
39	Nephelometer					34°21.8'N-22°32.1'E	34°21.6'N-22°32'E	
	w/Thorndike Camera #10	30 Aug	1310-1539	1535 fms	1425 fms			
	Velocimeter #24	30 Aug	1315-1535	1535 fms	1430 fms			
	Piston Core #39	30 Aug	1546-1708	1380 fms				
	Heat Flow #39	30 Aug	1546-1708	1405 fms		34°20'N-22°30'E	34°21.6'N-22°32'E	
40	Piston Core #40	31 Aug	1354-1500	1297 fms		33°17'N-23°09.6'E	33°15.8'N-23°09.9'E	
	Heat Flow #40	31 Aug	1354-1500	1297 fms				
	Nephelometer							
	w/Thorndike Camera #11	31 Aug	1521-1725	1119 fms		33°14'N-23°11'E	33°12.6'N-23°11'E	
	Velocimeter #25	31 Aug	1521-1720	1119 fms	1046 fms			
41	Core #41	1 Sept	1503-1606	1130 fms		34°42.2'N-24°34.1'E		
	Heat Flow #41	1 Sept	1503-1606	1130 fms				
	Nephelometer							
	w/Thorndike Camera #12	1 Sept	1615-1813	1030 fms		34°42.4'N-24°34.1'E		
	Velocimeter #26	1 Sept	1620-1637	1030 fms	Abort			
	Camera Sta #6	1 Sept	1848-2209			34°38'N-24°34'E		
42	Velocimeter #27	3 Sept	1320-1547	1827 fms	1827 fms	34°15'N-25°01'E	34°15'N-25°01'E	
	Nephelometer							
	w/Thorndike Camera #13	3 Sept	1320-1547	1827 fms				
	Piston Core #42	3 Sept	1552-1731	1827 fms		34°14.5'N-25°01'E	34°14.5'N-25°01'E	
	Heat Flow #42	3 Sept	1552-1731	1827 fms				
43	Heat Flow #43	5 Sept	1136-1150	1520 fms		32°33'N-25°15.2'E	32°34'N-25°15'E	
	Piston Core #43	5 Sept	1610-1715	1480 fms				
	Velocimeter #28	5 Sept	1229-1506	1530 fms	1330 fms			

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43	Nephelometer with Thorndike camera#14	5 Sept	1229-1506	1530 fms	1330 fms	32°33.8'N-25°15.3'E	32°32'N-25°17.2'E	Mediterranean Sea
44	Thorndike Current Meter #4	6 Sept	1857-2058	1601 fms		32°33'N-27°01.5'E		
	Velocimeter #29	6 Sept	2122-2345	1601 fms	1632 fms	32°31.5'N-27°02'E	32°30'N-27°03'E	
	Nephelometer with Thorndike camera#15	6 Sept	2122-2345	1601 fms	1632 fms	32°31.5'N-27°02'E	32°30'N-27°03'E	
45	Piston Core #45	7 Sept	1859-2022	1590 fms	1587 fms	33°13.3'N-27°50.1'E	33°14.2'N-27°51.5'E	
	Heat Flow #45	7 Sept	1859-2022	1590 fms				
	Velocimeter #30	7 Sept	2058-2341	1587 fms	1555 fms			
	Nephelometer with Thorndike Camera#16	7 Sept	2058-2341	1587 fms	1555 fms	33°14'N-27°51'E		
46	Piston Core #46	8-9 Sept	2257-0031	1642 fms	1618 fms	34°17.5'N-26°13.1'E	34°18'N-26°11.7'E	
	Heat Flow #46	8-9 Sept	2257-0031	1640 fms				
	Velocimeter #31	9 Sept	0046-0308	1618 fms	1639 fms			
	Nephelometer with Thorndike Camera#17	9 Sept	0046-0308	1618 fms		34°18'N-26°11.7'E	34°17.5'N-26°11'E	
47	Camera #7	9 Sept	1410-1644	1070 fms		34°58'N-26°42'E		
	Nephelometer with Thorndike Camera#18	9 Sept	1655-1823	1070 fms				
	Velocimeter #32	9 Sept	1659-1821	384 fms	600 fms	34°59.5'N-26°43'E	34°53'N-26°42'E	
48	Nephelometer #19	10 Sept	1115-1326	384 fms				
	Velocimeter #33	10 Sept	1121-1325	1080 fms	1268 fms	35°47.5'N-26°58.2'E	35°46'N-26°59.5'E	
49	Velocimeter #34	11 Sept	1326-1530	1310 fms	1264 fms			
	Nephelometer with Thorndike Camera#20	11 Sept	1326-1530	1310 fms		34°24.1'N-28°20.1'E	34°24.1'N-28°22.5'E	
50	Piston Core #50	12 Sept	0634-0735	1289 fms		35°30.9'N-28°11.8'E	35°30.9'N-28°11.8'E	
	Heat Flow #50	12 Sept	0634-0735	1289 fms				
	Velocimeter #35	12 Sept	0814-1021	1300 fms	1294 fms			
	Nephelometer with Thorndike Camera#21	12 Sept	0814-1021	1300 fms	1294 fms	35°30.9'N-28°12'E	35°29.8'N-28°13.6'E	
51	Core #51	17 Sept	1827-1938	1260 fms		36°26'N-28°50.2'E		
	Heat Flow #51	17 Sept	1827-1938	1260 fms				
	Velocimeter #36	17 Sept	1955-2155	1320 fms	1262 fms			
	Nephelometer with Thorndike Camera#22	17 Sept	1946-2155	1327 fms		36°26.1'N-28°50.5'E	36°27.5'N-28°50.9'E	
52	Core #52	18 Sept	2014-2135			35°06.2'N-28°36.2'E		
	Heat Flow #52	18 Sept	2014-2135					
	Velocimeter #37	18 Sept	2159-2357	1472 fms				
	Nephelometer #23	18 Sept	2159-2359	1472 fms		35°05.3'N-28°35.5'E	35°04'N-28°36'E	
53	Core #53	19 Sept	1000-1112	1350 fms		34°11.9'N-28°57.8'E		
	Heat Flow #53	19 Sept	1000-1112	1350 fms				
	Velocimeter #38	19 Sept	1125-1307	1367 fms	1392 fms			

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53-Contd	Nephelometer with Thorndike Camera#24	19 Sept	1125-1314	1367 fms	1392 fms	34°09.6'N-28°57.2'E	34°09'N-28.58.8'E	Mediterranean Sea
54	Core #54	21 Sept	1112-1218	1010 fms		35°20.1'N-30°07.5'E		
	Heat Flow #54	21 Sept	1112-1218	1060 fms				
	Velocimeter #39	21 Sept	1236-1420	1150 fms		35°19.5'N-30°10.8'E	35°19.5'N-30°10.8'E	
	Nephelometer with Thorndike Camera#25	21 Sept	1235-1420	1150 fms	1012 fms	35°19.5'N-30°10.8'E		
55	Core #55	22 Sept	1627-1732	1293 fms		34°49.3'N-31°04.4'E		
	Heat Flow #55	22 Sept	1627-1732	1293 fms				
	Velocimeter #40	22 Sept	1745-1918	1290 fms				
	Nephelometer #26	22 Sept	1745-1918	1290 fms	1283 fms	34°49.6'N-31°04.4'E	34°49.8'N-31°03.9'E	
56	Core #56	23 Sept	1527-1634	1143 fms		32°59.8'N-31°05.9'E		
	Heat flow #56	23 Sept	1527-1634	1143 fms				
	Velocimeter #41	23 Sept	1642-1800	1098 fms	1105 fms	33°00.4'N-31°07.2'E	32°58.8'N-31°07.2'E	
	Nephelometer #27	23 Sept	1642-1800	1098 fms	1105 fms			
	Bottom Current Met.#5	23 Sept	1808-1945	1105 fms		33°00.9'N-31°08.2'E		
57	Core #57	24 Sept	1347-1448	1010 fms		33°11.2'N-32°29.2'E		
	Heat Flow #57	24 Sept	1347-1448	1010 fms				
	Velocimeter #42	24 Sept	1454-1622	1037 fms	1075 fms			
	Nephelometer with Thorndike Camera#28	24 Sept	1454-1622	1037 fms	1075 fms	33°11.1'N-32°29.5'E	33°11'N-32°29.9'E	
58	Core #58	24 Sept	2300-2333	443 fms		33°30.4'N-32°29.2'E		
	Heat Flow #58	24 Sept	2300-2333	443 fms				
	TBird camera #8	25 Sept	0002-0212	405 fms				
	Velocimeter #43	25 Sept	0330-0508	747 fms	741 fms	33°30.4'N-32°29.2'E	33°30.1'N-32°45.8'E	
	Nephelometer with Thorndike Camera#29	25 Sept	0330-0508	747 fms	741 fms	33°33.5'N-32°36.5'E	33°27.1'N-32°40.5'E	
59	Core #59	26 Sept	0125-0230	1180 fms		33°52.1'N-33°17.2'E		
	Heat Flow #59	26 Sept	0125-0230	1208 fms				
	Velocimeter #44	26 Sept	0242-0442	1195 fms	1177 fms			
	Nephelometer with Thorndike Camera#30	26 Sept	0242-0442	1195 fms	1177 fms	33°52.5'N-33°16'E	33°50.5'N-33°20'E	
60	Bottom Current Met#6	26 Sept	1934-2153			34°12.5'N-33°39'E	34°09'N-32°45'E	
	Velocimeter #45	26-27 Sept	2210-0047	1405 fms	1405 fms			
	Nephelometer with Thorndike Camera#31	26-27 Sept	2210-0047	1405 fms	1400 fms			
61	T-Bird Camera #9	27 Sept	1820-2023	160 fms		34°44'N-32°21.5'E		
	Velocimeter #46	27 Sept	2103-2228	1010 fms	1018 fms	34°44'N-32°13'E		
62	Core #62	28 Sept	1325-1433			36°01.5'N-31°46.5'E	36°01.1'N-31°45.5'E	
	Heat Flow #62	28 Sept	1325-1433					
	Velocimeter #47	28 Sept	1445-1623	1268 fms	1338 fms	36°01.7'N-31°45.2'E		
	Nephelometer with Thorndike Camera#32	28 Sept	1445-1623					
	Bottom Current Met #7	28 Sept	1627-1824	1330 fms	1342 fms	36°01'N-31°45'E		

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63	Core #63	29 Sept	2205-2307	656 fms		35°41.5'N-32°58'E		Mediterranean Sea
	Heat Flow #63	29 Sept	2205-2307	656 fms				
	Velocimeter #48	29-30 Sept	2319-0027	653 fms	670 fms	35°41.6'N-32°59.5'E	35°41.5'N-33°00'E	
	Nephelometer with Thorndike camera#33	29-30 Sept	2315-0027	653 fms	670 fms			
	Bottom Current Met#8	30 Sept	0034-0137			35°41.5'N-33°00'E		
64	Core #64	30 Sept	1711-1757	505 fms		35°56.5'N-34°14'E		
	Heat Flow #64	30 Sept	1711-1757	505 fms				
	Velocimeter #49	30 Sept	1807-1901	501 fms	490 fms	35°56.2'N-34°14.7'E	35°55.5'N-34°15'E	
	Nephelometer with Thorndike Camera#34	30 Sept	1807-1901	501 fms	490 fms			
	Bottom current meter#9	30 Sept	1907-2010			35°56'N-34°15.5'E	35°55.2'N-34°16'E	
65	Core #65	1 Oct	1711-1757	734 fms		35°32'N-35°26'E		
	Heat Flow #65	1 Oct	1711-1745	734 fms				
	Velocimeter #50	1 Oct	1807-1914	734 fms	734 fms	35°32.1'N-35°27.1'E	35°31.6'N-35°26.8'E	
	Nephelometer with Thorndike Camera#35	1 Oct	1807-1914	734 fms	734 fms			
	Current meter #10	1 Oct	1921-2037			35°32.1'N-25°27.1'E		
66	Core #66	2 Oct	1534-1639	1045 fms		34°19.2'N-34°42.2'E		
	Heat Flow #66	2 Oct	1534-1629	1045 fms				
	Nephelometer #36	2 Oct	1648-1813	1046 fms		34°19'N-34°42'E		
	Velocimeter #51	2 Oct	1648-1807	1046 fms	1047 fms			
	Current meter #11	2 Oct	1817-1956	1046 fms		34°19.5'N-34°41.5'E	34°20.5'N-34°41'E	
67	Core #67	3 Oct	1600-1658	1035 fms		34°11'N-33°37'E		
	Heat Flow #67	3 Oct	1605-1650					
	Velocimeter #52	3 Oct	1721-1847	1018 fms	1023 fms	34°11.9'N-33°37'E		
	Nephelometer with Thorndike Camera #37	3 Oct	1721-1847	1018 fms				
	Bottom Current Met #12	3 Oct	1850-2022	1023 fms		34°12'N-33°37'E		
68	Core #68	4 Oct	1638-1732	839 fms		34°53'N-34°53'E		
	Heat Flow #68	4 Oct	1643-1721	839 fms				
	Velocimeter #53	4 Oct	1741-1855	839 fms	846 fms	34°53.2'N-34°53'E		
	Nephelometer with Thorndike Camera#38	4 Oct	1741-1855	839 fms				
	Bottom Current Meter#13	4 Oct	1902-2020	850 fms		34°52.5'N-34°53.5'E		
69	Gravity Core #69	15 Oct	0545-0738	1160 fms		25°22.5'N-36°08.9'E		Red Sea
	Heat Flow #69	15 Oct	0545-0738	1160 fms				
	Temp. TLM Pinger	15 Oct	0545-0853	1160 fms				
70	Temp. TLM Pinger	16 Oct	1343-1510	1086 fms		21°18.5'N-38°01'E		
	Hydro Station #711	16 Oct	1343-1510	1086 fms		21°21.2'N-38°04.7'E		
71	Hydro Station #712	16 Oct	1920-2040	1118 fms				
	Temperature Pinger A	16 Oct	1905-2040	1121 fms				
	Gravity Core #71	16 Oct	2133-2248	1085 fms				
	Heat Flow #71	16 Oct	2133-2248	1085 fms				
	Temp. TLM Pinger B	16 Oct	2133-2233	1085 fms		21°21.2'N-38°04.7'E		

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72	Piston Core #72	17 Oct	1217-1320	1000 fms				Red Sea
	Heat Flow #72	17 Oct	1217-1320	1000 fms				
	Temp TLM Pinger	17 Oct	1219-1315	1000 fms		21°17.8'N-38°02.8'E		
73	Gravity Core	17 Oct	1449-1557	1050 fms				
	Heat Flow	17 Oct	1449-1557	1050 fms				
	Temp. TLM Pinger	17 Oct	1449-1557	1050 fms		21°14.7'N-38°04.7'E		
74	Hydro Station #713	17 Oct	1930-2147	1068 fms		21°21.1'N-38°04.9'E		
	Temp. TLM Pinger	17 Oct	1958-2145	1060 fms		21°22.5'N-38°03'E		
75	Hydro Station #714	18 Oct	0923-1050	1117 fms				
	Temp. TLM Pinger	18 Oct	0927-1052	1117 fms		21°20.5'N-38°04.5'E		
76	Water bag sampler	18 Oct	1527-1655	1120 fms				
	Temp. TLM Pinger	18 Oct	1527-1654	1120 fms		21°22.5'N-38°01.5'E		
77	Hydro Station #715	18 Oct	1720-1935	1115 fms		21°19.9'N-38°04'E		
78	4 Free fall cores (A)	18 Oct	2102-2209	910 fms		21°22.8'N-38°00.5'E		
	Free fall cores (B)	18 Oct	2110-lost					
	Free fall cores (C)	18 Oct	2123-2248	1065 fms		21°22.5'N-38°04'E		
	Free fall cores (D)	18 Oct	2127-2307	1080 fms		21°22.5'N-38°04.7'E		
79	Gravity Core	19 Oct	0100-0158	1120 fms	1096 fms	21°22.5'N-38°01.5'E		
	Heat Flow	19 Oct	0100-0158	1120 fms	1096 fms			
	Hydro Station #715	19 Oct	0245-0400	1115 fms				
	Water bag (Jokela)	19 Oct	0223-0418	1108 fms				
	Temp. TLM Pinger	19 Oct	0223-0418	1108 fms				
	Hydro Station #715	19 Oct	0505-0605	1120 fms				
	Hydro Station #715	19 Oct	0630-0800	1124 fms			21°18'N-37°59.5'E	
80	Piston Core	19 Oct	1205-1258	1137 fms	1142 fms	21°17.2'N-38°01.9'E		
	Heat Flow	19 Oct	1205-1258	1137 fms	1142 fms			
	Temp. TLM Pinger A	19 Oct	1320-1452	1125 fms	1142 fms			
	Hydro Station #716	19 Oct	1320-1452	1125 fms	1142 fms			
	Temp. TLM Pinger A	19 Oct	1453-1645	1145 fms				
	Hydro Station #716	19 Oct		1145 fms			21°16.9'N-38°02.0'E	
81	Piston Core	19 Oct	1650-1807	1120 fms		21°17.0'N-38°02.1'E		
	Heat Flow	19 Oct	1650-1754	1120 fms				
82	4 Free Fall Cores (A)	19 Oct	1916-lost	1008-1018 fms				
	Free Fall Cores (B)	19 Oct	1918-2032	1030 fms		21°18.8'N-38°03.8'E		
	Free Fall Cores (C)	19 Oct	1924-2024	1007 fms		21°18.8'N-38°03.5'E		
	Free Fall Cores (D)	19 Oct	1929-2023	1018 fms		21°18.8'N-38°03.2'E		
83	Hydro Station #717	19 Oct	2210-2335	1138 fms		21°16.7'N-38°02'E		
	Temp. TLM Pinger	19 Oct	2210-2335	1138 fms				
84	Piston Core	20 Oct	1138-1230	1120 fms		21°22.0'N-38°01.5'E		
	Square Core(Kastenlot)	20 Oct	1351-1440	1120 fms				
	Gravity Core (Kastenlot)	20 Oct	1440-1540	1120 fms				

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84	Hydro Station #718	20 Oct	1505-1617	1120 fms		21°22.0'N-38°01.5'E		Red Sea
(Cont'd)	Temp. TLM Pinger	20 Oct	1505-1617	1120 fms			21°20.9'N-38°03.8'E	
85	Square core(Kastenlot)	20 Oct	1728-1848	1020 fms		21°18.8'N-38°03.9'E		
	Temp. TLM Pinger	20 Oct	1728-1823	1020 fms				
86	Water Bag Sampler	21 Oct	0930-1055	1113 fms		21°21.0'N-38°02.0'E		
	Hydro Station #719	21 Oct	1223-1403	1117 fms				
	Nephelometer	21 Oct	1222-1400	1112 fms			21°20.0'N-38°04.0'E	
	Temp. TLM Pinger		Aborted					
87	Gravity Core	21 Oct	1729-1851	1082 fms		21°21.5'N-38°03.6'E		
	Temp. TLM Pinger	21 Oct	1729-1847	1082 fms				
88	Edgerton Camera #10	21 Oct	1953-2156	965 fms		21°20.5'N-38°02'E		
89	4 Free Fall Cores							
	(Boomerang)	21 Oct	2317-2354					
	Free Fall Cores (A)	21 Oct	2333-lost			21°23.3'N-38°03.4'E		
	Free Fall Cores (B)	21 Oct	2340- ---	992 fms		21°23.2'N-38°03.1'E		
	Free Fall Cores (C)	21 Oct	2345- ---	1010-1088 fms		21°22.8'N-38°02.3'E		
	Free Fall Cores (D)	21 Oct	2354- ---	1090 fms				
90	Temp. TLM Pinger	22 Oct	0510-0557	1065 fms		21°23.4'N-38°04.9'E		
91	Temp. TLM Pinger	22 Oct	0613-0659	1079 fms		21°24.7'N-38°03.8'E		
92	Temp. TLM Pinger	22 Oct	0753-0831	1082 fms		21°23.6'N-38°02.3'E		
93	Temp. TLM Pinger	22 Oct	0925-0959	1082 fms		21°23.0'N-38°02.6'E		
94	Temp. TLM Pinger	22 Oct	1246-1347	1122 fms		21°20.8'N-38°03.9'E		
	Water Bag	22 Oct	1045-1235	1123 fms				
	Gravity Core	22 Oct	1243-1354	1122 fms	1124 fms			
	Heat Flow	22 Oct	1243-1354	1122 fms	1124 fms			
95	Square Core(Kastenlot)	22 Oct	1502-1549	990 fms		21°23.4'N-38°03.3'E		
	Gravity core	22 Oct	1615-1727	1000 fms				
	Heat Flow	22 Oct	1615-1727	1005 fms			21°24.3'N-38°00.7'E	
96	Gravity Core	22 Oct	1818-1934	1060 fms		21°26.5'N-38°03.0'E		
	Heat Flow	22 Oct	1818-1934	1060 fms				
97	Gravity Core	22 Oct	2014-2144	1057 fms		21°25.4'N-38°01.9'E		
	Heat Flow	22 Oct	2014-2144	1057 fms				
	Temp. TLM Pinger	22 Oct	2019-2136	1057 fms				
98	Hydro Station #720	22-23 Oct	2236-0015	1105 fms		21°22'N-38°03'E		
	Temp. TLM Pinger	22-23 Oct	2236-0015	1105 fms				
99	Temp. TLM Pinger	23 Oct	0050-0122	1070 fms		21°22.3'N-38°04.9'E		
100	Temp. TLM Pinger	23 Oct	0143-0209	1080 fms		21°23.7'N-38°04.4'E		

<u>Station</u>	<u>Type</u>	<u>Date-1966</u>	<u>Time</u>	<u>Starting Depth</u>	<u>End Depth</u>	<u>Start Pos.</u>	<u>End Pos.</u>	<u>Physiog. Area</u>
101	Temp. TLM Pinger	23 Oct	0227-0257	1052 fms		21°22.7'N-38°03.6'E		Red Sea
102	Temp. TLM Pinger	23 Oct	0328-0354	1040 fms		21°24.7'N-38°01.0'E		
103	Temp. TLM Pinger	23 Oct	0420-0451	1083 fms		21°24.0'N-38°04.5'E		
104	Temp. TLM Pinger	23 Oct	0509-0543	1075 fms		21°23.5'N-38°03.8'E		
105	Temp. TLM Pinger	23 Oct	0627-0646	1080 fms		21°23.3'N-38°04.4'E		
106A	Water Bag (Jokela)	23 Oct	0740-0745	1122 fms		21°21.6'N-38°01.8'E		
106B	Gravity Core	23 Oct	1010-1118	1120 fms		21°21.2'N-38°03.5'E		
	Heat Flow	23 Oct	1010-1118	1120 fms				
	Temp. TLM Pinger	23 Oct	0814-0907	1120 fms		21°21.6'N-38°01.1'E		
107	Gravity Core	23 Oct	1151-1253	1113 fms		21°21.7'N-38°03.3'E		
	Heat Flow	23 Oct	1151-1253	1113 fms				
108	Gravity Core	23 Oct	1353-1453	1072 fms		21°22.4'N-38°04.7'E		
	Heat Flow	23 Oct	1353-1447	1072 fms				
109	Gravity Core	23 Oct	1533-1638	1075 fms		21°24.1'N-38°04.0'E		
	Heat Flow	23 Oct	1533-1634	1075 fms				
110A	Hydro Station #721	23 Oct	2218-2335	1115 fms		21°21.2'N-38°01.0'E		
110B	Hydro Station #721	23 Oct	2342-2353	1115 fms		21°21.2'N-38°01.0'E		
110C	Hydro Station #721	24 Oct	0035-0155	1115 fms		21°21.2'N-38°01.0'E		
110D	Hydro Station #721	24 Oct	0225-0302	1115 fms				
	Hydro Station #721	24 Oct	0328-0444	1115 fms		21°21.2'N-38°01.0'E		
111	4 Free Fall Cores (Boomerang)	24 Oct						
	A lost		2041	1040 fms				
	B lost		2044	1055 fms				
	C		2047-2323	1044 fms		21°21.6'N-38°05.3'E		
	D	24-25 Oct	2049-0016	1118 fms		21°21.6'N-38°05.5'E		
112	Temp. TLM Pinger	25 Oct	0210-0240	1080 fms		21°18.4'N-38°01.8'E		
113	Temp. TLM Pinger	25 Oct	0254-0320	1088 fms		21°18.3'N-38°01.5'E		
114	Temp. TLM Pinger	25 Oct	0333-0401	1115 fms		21°18.3'N-38°01.5'E		
115	Temp. TLM Pinger	25 Oct	0439-0452	995 fms		21°17.6'N-38°01.8'E		
116	Hydro Station #722	25 Oct	0645-0805	1068 fms		21°22.3'N-38°04.9'E		
117	Hydro Station #723	25 Oct	0925-1041	1076 fms		21°23.3'N-38°04.4'E		
118	Square Core (Kastenlot)	25 Oct	1313-1422	1026-1043 fms		21°14.4'N-38°04.3'E		

<u>Station</u>	<u>Type</u>	<u>Date-1966</u>	<u>Time</u>	<u>Starting Depth</u>	<u>End Depth</u>	<u>Start Pos.</u>	<u>End Pos.</u>	<u>Physiog. Area</u>
119	Square Core(Kastenlot)	25 Oct	1613-1710	1125 fms		21°16.8'N-38°01.7'E		Red Sea
120	Square Core(Kastenlot)	25 Oct	1928-2021	1070-1064 fms		21°22.6'N-38°04.5'E		
121	Gravity Core	26 Oct	0856-1007	1069 fms				
	Heat Flow	26 Oct	0856-1007	1069 fms				
	Temp. TLM Pinger	26 Oct	0904-1007	1069 fms		21°22.8'N-38°04.3'E		
122	Gravity Core	26 Oct	1133-1222	1100 fms				
	Heat Flow	26 Oct	1133-1222	1100 fms				
	Temp. TLM Pinger	26 Oct	1304-1350	1087 fms		21°17.6'N-38°01.5'E		
123	Square Core(Kastenlot)	26 Oct	1539-1623	871 fms		21°28.4'N-37°57.6'E		
124	Piston Core	30 Oct	0031-0150	1065 fms		21°23.2'N-38°04.3'E		
	Heat Flow	30 Oct.	0031-0137	1065 fms				
	Hydro Station #724	30 Oct	0210-0408	1085 fms		21°23.2'N-38°04.2'E		
125	Hydro Station #725	30 Oct	0500-0707	1100 fms		21°21.8'N-38°01.2'E		
126	Piston Core	30 Oct	0939-1053	1070 fms				
	Heat Flow	30 Oct	0939-1043	1068 fms		21°21.9'N-38°04.4'E		
127	Piston Core	30 Oct	1304-1404	1075-1108 fms				
	Heat Flow	30 Oct	1304-1404	1075-1108 fms				
	Hydro Station #726	30 Oct	1420-1535	1090 fms		21°22.4'N-38°02.9'E		
128	Piston Core	30 Oct	1628-1740	1075 fms				
	Heat Flow(didn't work)	30 Oct	1628-1732	1075 fms		21°25.4'N-38°03.4'E		
129	Piston Core	30 Oct	1937-2101	1050 fms		21°25.3'N-38°02.9'E		
	Heat Flow	30 Oct	1942-2043	1050 fms				
	Hydro Station #727	30-31 Oct	2150-2311	1075 fms		21°24.4'N-38°03.6'E		
130	Temp. TLM Pinger	30-31 Oct	2338-0012	1050 fms		21°25.1'N-38°00.8'E		
	Temp. TLM Pinger	31 Oct	0020-0050	Aborted				
132	Temp. TLM Pinger	31 Oct	0113-0133	1053 fms		21°26.3'N-38°00.8'E		
133	Nephelometer	31 Oct	0605-0727	1115 fms		21°21.2'N-38°03.7'E		
	Temp. TLM Pinger	31 Oct	0612-0725	1115 fms				
	Pugh's Probe	31 Oct	0813-0920	1030-1115 fms		21°22'N-38°01.3'E		
134	Dredge	31 Oct	1008-1220	1120 fms	960 fms	21°20'12'N-38°02.0'E		
135	Gravity Core	1 Nov	1146-1225	392 fms				
	Heat Flow	1 Nov	1146-1225	392 fms		21°30'N-38°16'E		
136	Gravity Core	1 Nov	1327-1415	654 fms				
	Heat Flow	1 Nov	1327-1406	654 fms		21°28'N-38°13'E		
137	Gravity Core	1 Nov	1533-1627	872 fms				
	Heat Flow	1 Nov	1533-1623	872 fms		21°26'N-38°07'E		

<u>Station</u>	<u>Type</u>	<u>Date-1966</u>	<u>Time</u>	<u>Starting Depth</u>	<u>End Depth</u>	<u>Start Pos.</u>	<u>End Pos.</u>	<u>Physiog. Area</u>
138	Pugh's Probe	1 Nov	1951-2055	1120 fms		21°23'N-38°02'E		Red Sea
	Temp TLM Pinger w/inverted E/S	1 Nov	2010-2211	1119 fms		21°22.8'N-38°02'E		
139	2 Free Fall Cores	1-2 Nov	A 2312-0002	1022 fms		21°25.7'N-38°02.8'E		
	Core B	1-2 Nov	B 2314-0027	1040 fms		21°25.7'N-38°02.7'E		
140	Temp. TLM Pinger							
	w/inverted E/S	2 Nov	0110-0404	1070 fms		21°23'N-38°06.5'E		
	Pugh's Probe (EG&G pinger)	2 Nov	0413-0517	1025 fms		21°23'N-38°02.5'E		
141	Pugh's Probe (EG&G Pinger)	2 Nov	0550-0703	1114 fms		21°23'N-38°01'E		
142	Pugh's Probe (EG&G Pinger)	2 Nov	0815-0842	1020-1040 fms		21°27'N-38°00'E		
143	Square Core(Kastenlot)	2 Nov	1021-1110	990 fms		21°27.1'N-38°03.0'E		
144	Temp. TLM Pinger	2 Nov	1555-1627	1119 fms		21°22'N-38°02'E		
145	Dredge	2 Nov	1709-1910	980-110 fms		21°22'N-38°04.2'E		
146	Gravity Core	2 Nov	2033-2122	940 fms				
	Heat Flow	2 Nov	2033-2122	940 fms		21°20.5'N-38°00'E		
147	Pugh's Probe	2-3 Nov	2220-0032	1110 fms				
	Temp. TLM Pinger w/inverted E/S	2-3 Nov	2330-0032	1107 fms		21°18'N-38°01'E		
148	Temp. TLM Pinger w/inverted E/S	3 Nov	0127-0211	1115 fms		21°22'N-38°02'E		
149	Temp. TLM Pinger	3 Nov	1250-1303	1163 fms				
	Plankton tow	3 Nov	1319-1352	1163 fms		20°51'N-38°13.2'E		
150	Temp. TLM Pinger	3 Nov	1756-1846	1210 fms		20°44.5'N-38°13'E		
151	Gravity Core	3 Nov	1942-2254	1188 fms				
	Heat Flow	3 Nov	1442-2054	1188 fms		20°42'N-38°15'E		
152	Piston Core	4 Nov	0943-1057	1218 fms				
	Heat Flow	4 Nov	0943-1047	1218 fms		19°48.5'N-38°30'E		
153	Piston Core	4 Nov	1432-1555	1390 fms				
	Heat Flow	4 Nov	1432-1544	1390 fms		19°43'N-38°41'E		
154	Piston Core	4 Nov	1859-1954	662 fms				
	Heat Flow	4 Nov	1901-1954	662 fms		19°34'N-38°59.5'E		
155	Piston Core	4-5 Nov	2252-0023	1050 fms				
	Heat Flow	4 Nov	2252-2355	1047 fms		19°27.5'N-38°56.5'E		

<u>Station</u>	<u>Type</u>	<u>Date-1966</u>	<u>Time</u>	<u>Starting Depth</u>	<u>End Depth</u>	<u>Start Pos.</u>	<u>End Pos.</u>	<u>Physiog. Area</u>
156	2 Free Fall Cores (Boomerang)	6 Nov	A-2037-2141	900 fms		20°58.5'N-38°20.5'E		Red Sea
		6 Nov	B-2051-2124	690 fms				
157	Temp. TLM Pinger	7 Nov	0219-0256	1075 fms		21°25'N-38°03.5'E		
158	Temp. TLM Pinger	7 Nov	0530-0558	1140 fms		21°17.2'N-38°02.8'E		
	Hydro Station #728	7 Nov	0620-0723	1103 fms				
	Hydro Station #728	7 Nov	0900-1012	1143 fms				
	Hydro Station #728	7 Nov	1025-1318	1079 fms		21°17.8'N-38°02.8'E		
159	Piston Core	7 Nov	1539-1646	1026 fms		21°18.2'N-38°03.5'E		
	Temp. TLM Pinger	7 Nov	1539-1646	1054 fms				
	Hydro Station #729	7 Nov	1801-1918	1030 fms		21°17'N-38°03.5'E		
	Free Fall Core	7 Nov	1846-	1054 fms		21°18.9'N-38°04.7'E		
160	Hydro Station #730	8 Nov	0910-1009	1010-1018 fms		21°18.4'N-38°03.6'E		
161	Hydro Station #731	8 Nov	1210-1358	1052 fms		21°19.2'N-38°03.9'E		
	Square Core(Kastenlot)	8 Nov	1408-1513	1010 fms				
	Temp. TLM Pinger w/inverted E/S	8 Nov	1530-1624	1045 fms		21°19.4'N-38°03.9'E		
162	Hydro Station #732	8 Nov	1742-1951	1081 fms				
	Hydro Station #732	8 Nov	2042-2220	1070 fms				
	Hydro Station #732	8-9 Nov	2331-0100	1103 fms		21°17.3'N-38°01.5'E		
163	Temp. TLM Pinger	9 Nov	1023-1130	968 fms		21°53.5'N-37°58'E		
	Pugh's Probe	9 Nov	1023-1130	968 fms				
164	Temp. TLM Pinger	9 Nov	1244-1348	1180 fms		21°59'N-37°58.5'E		
	Pugh's Probe	9 Nov	1244-1348	1180 fms				
	Piston Core	9 Nov	1426-1535	1178 fms				
	Heat Flow	9 Nov	1426-1535	1177 fms				
165	Piston Core	9 Nov	2000-2104	1120 fms		22°28.2'N-37°46.5'E		
	Heat Flow	9 Nov	2000-2104	1122 fms				
	Plankton Tow	9 Nov	2000-2143	1120 fms				
166	Temp. TLM Pinger	10 Nov	0351-0428	1261 fms		23°16'N-37°16.5'E		
167	Piston Core	10 Nov	0600-0630	430 fms		23°20'N-37°20'E		
	Heat Flow	10 Nov	0603-0630	430 fms				
168	Dredge	11 Nov	0929-1108	1120 fms	980 fms	25°20.8'N-36°13'E		
169	Square Core(Kastenlot)	16 Nov	1538-1609	738 fms		32°21'N-30°14'E		Mediterranean Sea
	Hydro Station	16 Nov	1609-1645	740 fms				
	Plankton Tow	16 Nov	1645-1714	740 fms				
170	Square Core(Kastenlot)	19 Nov	0830-0954	1980 fms		36°35'N-18°54.5'E		
171	Piston Core	6 Dec	0721-0900	2470 fms		26°42'N-39°23'E		North Atlantic Ocean
	Heat Flow	6 Dec	0721-0900	2470 fms				

<u>Station</u>	<u>Type</u>	<u>Date-1966</u>	<u>Time</u>	<u>Starting Depth</u>	<u>End Depth</u>	<u>Start Pos</u>	<u>End Pos.</u>	<u>Physiog. Area</u>
172	Piston Core	6 Dec	1337-1542					North Atlantic Ocean
	Heat Flow	6 Dec	1337-1515			26°33.5'N-39°58.5'E		
173	Piston Core	6 Dec	1948-2129	2310 fms				
	Heat Flow	6 Dec	1948-2129	2310 fms		26°25'N-40°49'E		
174	Piston Core	9 Dec	1410-1607	2200 fms				
	Heat Flow	9 Dec	1410-1542	2200 fms		27°52.5'N-45°55'W		
175	Piston Core	9 Dec	2027-2150	2065 tripped 1981				
	Heat Flow	9 Dec	2027-2150	2065 fms	1960 fms	27°52.5'N-45°10.5'W		
176	Piston Core	10 Dec	2215-2338	1541 fms	1520 fms			
	Heat Flow	10 Dec	2215-2318	1541 fms	1520 fms	28°05.0'N-44°35.0'W	28°04.5'N-44°42.5'W	
177	Piston Core	11 Dec	0444-0603	1884 fms				
	Heat Flow	11 Dec	0444-0603	1884 fms		28°19.0'N-45°32.0'W	28°21'N-45°34'W	
178	Piston Core	11 Dec	1327-1550	2278 fms				
	Heat Flow	11 Dec	1327-1500	2278 fms		28°43.5'N-46°48.0'W	28°39'N-46°52.5'W	

KEY TO NAVIGATIONAL PLOTTING ABBREVIATIONS USED BY WOODS HOLE OCEANOGRAPHIC INSTITUTION

SOUNDINGS:

Echo soundings are taken continually throughout the entire cruise unless otherwise stated.

All soundings are based on a sound velocity of 800 fathoms/sec. and are corrected for depth-of-transducer. Soundings are read at equal time intervals, usually 5 or 10 minutes, and at each break in slope. They are written along the ship's track as often as space permits.

Soundings are read from a Precision Graphic Recorder having a mechanical error of less than one part in one hundred thousand.

NAVIGATIONAL PLOTTING:

All times and dates are written on one side of the ship's track; soundings in fathoms are entered on the other side. Ship's drift when lying to is indicated by a wavy line.

When No Sounding is noted along ship's track, one of four reasons applies:

1. Equipment failure.
2. Unable to distinguish bottom trace.
3. Poor navigation.
4. Equipment not needed in scientific investigation.

KEY TO ABBREVIATIONS USED

Navigational Abbreviations

DR	Dead Reckoning Position
LF	Loran Fix
RAD	Radar Fix
VB	Visual Bearing
SUN	Sun Line
*	Star Fix

Soundings:

Echo-soundings are taken routinely throughout the entire cruise unless otherwise stated along the ship's track. Echo-soundings are made using an EDO Corp. UQN-1b transducer and an Alden Precision Graphic Recorder, which assumes a sound velocity of 4800 ft. per second. Soundings are read in fathoms at scales such that they are judged to be accurate to one fathom. All soundings are corrected for depth of transducer. Soundings are read at equal time intervals, usually every five minutes and at each break in slope. They are written along the ship track as often as space permits.

Scientific Observations with Abbreviation, if used

Bottom Current Measurement
 C.G.M. Continuous Gravity Measurements
 C.M.M. Continuous Magnetometer Measurements
 C.S.P. Continuous Seismic Profile (Sparker)
 C.S.T. Continuous Surface Temperature Measurement
 C.T.M. Continuous Temperature Measurement (Various Depths)
 Core (Piston) (Gravity) (Free Fall Boomerang)
 Current Meter Measurements (Various Depths)
 Dredge (Chain Bag)
 E.C.L. Edgerton Camera Lowering (WHOI)
 G.E.K. Geomagnetic Electrokinetograph Measurements
 H.F. Heat Flow Measurement
 H.S. Hydrographic Station
 Nephelometer Measurements
 P.T. Plankton Tow
 Pugh's Temperature Probe
 Square Core (Kastenlot)
 S.V.P. Sound Velocity Profile
 T.Bird Camera - Edgerton Camera Lowering (WHOI)
 Temperature Telemetry (TLM) Pinger (Various Depths)
 Thorndike Camera - Bottom Photos (Lamont)
 Water Bag Sampler

CHAIN 61 (4)
12 JULY 1966

(See page 3)

40°N
67°W

41°N
67°W

190 1000(LF)
312 12 July

poor records
due to ship traffic
& technical difficulties

852
886 1102(LF)
937
910
890
982
1012
872
1002
1045 1150(LF)
1167
1140
1150
1070
1092
1122
1097
1107
1202
1229
942

1212
poor

1249
1247
1237
1267
1212
1228
1262
1275 1350(LF)
1307
1385
1400

1454
1517

1557
1557
1607
16822
16470

Shallow Canyon

1602
1612
1642

1687
1764

1814 1548(LF)

12 July

40°N
66°W

41°N
66°W

Detail of Continental Slope
in 40°-41°N - 66°-67°W
near Lydonia Canyon
Using all available data
2x

CHAIN 61 (5)
13 JULY 1966

CHAIN 61- (7)
14 JULY 1966

⑧

CHAIN 61 (10) 15 JULY 1966

CHAIN 61 (11)
16 JULY 1966

12

CHAIN 61
16-17 JULY 1966

13

CHAIN 61 (14)
17 JULY 1966

CHAIN 61 (15)

17-18 JULY 1966

CHAIN 61 (17)
18-19 JULY 1966

CHAIN 61 (18)
19 JULY 1966

19

20/21

CHAIN 61 (22)
26 JULY 1966

CHAIN 61
26 JULY 1966

(23)

CHAIN 61 26-27 JULY 1966

(24)

CHAIN 61
27 JULY 1966

(25)

CHAIN 61 (26)
27-28 JULY 1966

CHAIN 61 (27)
28 JULY 1966

CHAIN 61 (28)
28-29 JULY 1966

CHAIN 61

29 JULY - 2 AUG. 1966

(29)

30

CHAIN 61 (31)
3 Aug. 1966

Chain #61
3 Aug., 1966

(32)

Chain #61
3 Aug. - 4 Aug, 1966

(33)

Chain #61
4 Aug. - 5 Aug. 1966

(34)

Chain #61
5 Aug., 1966

(35)

Chain #61 (36)
5 Aug. - 6 Aug., 1966

37

Chart #61
6 August 1966

38

Chain #61 (39)
7 August, 1966

CHAIN 61 (41)
8-9 Aug. 1966

CHAIN 61
9-13 AUG. 1966

(42)

CHAIN 61
11-15 Aug. 1966

43

CHAIN 61 (44)
13-14 AUG. 1966

35° 52' N 17° E

18° E

Chain #61 (44A)
14+15 Aug 1966
See Page (43)
19° E 35° 52' N

35° N

14 Aug

35°

15 Aug

CHAIN 61 (46)
15-16-17 AUG. 1966

CHAIN 61 (58)
Aug 29-30, 1966

CHAIN 61 (59) 30 AUG. - 1 SEPT. 1966

CHAIN 61 (60)
1-2 SEPT. 1966

(62)

CHAIN 61
SEPT 17-19

(61)

31°E

35°N

36°N

CHAIN 61
SEPT. 27-29

(73)

31°E

32°E

32°E

35°N

36°N

27 Sept. STA #61
T-Bird Camera #9
1820-2023
Vel. # 46 2103-2228

STA #62-28 Sept.
Cone # 62 1825-1423
M.F. # 62 1825-1423
Vel. # 47 1445-1623
Neph. # 32 1445-1623
B.C.M. # 7 1627-1824

74

SEPT. 29 - OCT. 2

CHAIN 61 (79)
13-14 Oct. 1966

CHAIN 61 (80)
14-15 OCT. 1966

CHAIN 61 (82)
26-27 Oct. 1966

CHAIN 61 (85) 5-6-7 Nov. 1966

HOT BRINE REGION
SEE CHARTS V-VI

STA. #156-6404
CORE A (F.F.) 2037-2141
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