OCEAN DRILLING PROGRAM

LEG 108 SCIENTIFIC PROSPECTUS

NORTHWEST AFRICA

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INTRODUCTION

Beginning with the METEOR cruise reports in the 1930's and the Swedish Deep-Sea Expedition reports in the 1940's, and continuing with the oxygen isotopic work of Emiliani (1955, 1966), the more recent glacial maximum reconstruction of CLIMAP (1981), and the results of the Deep Sea Drilling Project (von Rad et al., 1982), the subtropical and equatorial Atlantic ocean has from the outset figured prominently in the history of paleoceanography. This can be attributed to several factors: excellent preservation of the calcareous fauna and flora, high sedimentation rates, windblown and fluvial delivery of diverse indicators of continental climate, and large bathymetric contrasts for studies of depth-dependent parameters. Though several holes have been rotary-drilled in the subtropical Atlantic on Legs 2, 3, 14, 41, 47A, 50, and 79, no HPC or XCB cores have yet been taken in any part of this region. All fine-scale paleoceanographic studies to date have therefore been based on the shorter records obtained in conventional piston and gravity cores.

Leg 108 is scheduled to depart from Marseilles, France on February 23, 1986. The ship will drill a transect of 11 sites from 23° N to 2° S. Leg 108 ends in Dakar, Senegal on April 21, 1986. These sites will provide a latitudinal transect allowing integration of records of surface and deep-water paleoceanography with those of the zonal and meridional paleo-wind circulation.

OBJECTIVES

The eleven proposed sites form a north-south paleoenvironmental transect from 2°S to 23° N across a number of oceanic and atmospheric regimes and boundaries (Figure 1). This transect will also link up the six sites occupied during DSDP Leg 94 from 37° to 54° N in the eastern North Atlantic (Ruddiman, Kidd et al., in press) and thus provide a paleoenvironmental transect of incomparable value spanning nearly 60° of latitude.

1. Surface-Ocean Paleoceanography

A) The equatorial Atlantic is a climatic boundary zone that is tightly linked to climatic changes across the rest of the planet. The Intertropical Convergence Zone (ITCZ) in the atmosphere and the thermal equator in the ocean are two such boundaries. Their seasonal and mean annual positions in part reflect local forcing by trade winds, low-latitude insolation, and African monsoonal winds.

Equatorial circulation also responds to remote forcing from higher latitudes, particularly the relative strengths of the Arctic and Antarctic polar cells and the subpolar westerly circulation in each hemisphere. Over geologic time scales, equatorial changes are thus in part directly related to the amount of land and sea ice in each polar hemisphere.

There are also important variations near the equator related to the weakened Coriolis influence. One feature of the modern equatorial Atlantic is unique in the world oceans: the net flow of heat across the equator from the southern to the northern hemisphere.

B) The subtropical Atlantic off Northwest Africa is also a critical region for paleoceanography. Here the oceanic responses are tied to changes in the Canary Current, a strong eastern boundary current in the northern subtropical gyre with links to the subpolar gyre to the north.

Changes in trade winds also cause detectable variations in near-coastal upwelling off Africa, as measured by assemblages of planktonic foraminifers and estimated sea surface temperatures, the flux of organic carbon and biogenic opal, isotopic parameters, and the composition of benthic foraminifers (Seibold, 1982; Ganssen & Sarnthein, 1983).

This large number of climatic controls suggests a complicated response of the equatorial and subtropical Atlantic ocean over the time scales accessible to paleoceanographic studies, but recent results indicate that the response in some areas may be relatively simple. McIntyre et al. (1982) analyzed a 250,000-year record of estimated sea-surface temperature (SST) change from piston core V30-40, taken from a region of seasonal divergence along the equator (Site EQ-9 in this proposal). The SST signal contains a strong rhythmic component concentrated at just two orbital periodicities (23,000 and 100,000 yrs).

This however, is just one record in a region of potentially vast oceanographic complexity. Some of the late-Quaternary complexity is suggested by the CLIMAP studies showing the February SST anomaly between today and the last glacial maximum. These studies target two regions as particularly important: (1) the divergence along the equator, which grades southeastward into the Benguela Current region of divergence and cold-water advection northward; and (2) the eastern boundary current/upwelling region between the Cape Verde Islands and the northwest African coast. More powerful analytical techniques (EOF analysis, Mix et al., 1983) also pinpoint these two areas as critical. The Leg 108 transect focuses mainly on these two regions, with a view toward tracing the late Neogene latitudinal stability of the meteorological equator and the ITCZ.

The history of upwelling off Northwest Africa is a major oceanographic problem, both in defining the latitudinal persistence of the upwelling cells during varying climates (Sarnthein et al., 1981, 1982; Stein and Sarnthein, 1984) and in assessing its importance in the broader climatic context of: (1) Atlantic-wide changes in paleo-productivity; (2) variations in the global CO_2 budget; and (3) deposition of sediments rich in organic carbon. Our strategy involves sites both within (MAU-6), outside (MAU-5), and marginal to (139-R) the main upwelling area.

The origin of the low-latitude SST signals is still under debate. Ice sheets have been implicated in a number of the responses, but there are alternative explanations that do not call directly on links to the polar regions, such as changes in monsoonal and trade-wind circulation and CO_2-related effects. By opening up access to sediments deposited during times of lesser or negligible ice-volume change, HPC and XCB coring will clarify whether these tropical SST signals are driven by ice volume or by local factors independent of ice. Of particular interest is the tempo of tropical ocean variability prior to the prominent changes in Northern Hemisphere ice-volume variability at 0.9 and 2.5 Ma, and Southern

Hemisphere ice-sheet changes at 6-5 Ma and 14 Ma.

Although sea-surface conditions are usually the focus of paleoclimatic reconstructions, in the equatorial Atlantic there is also an important vertical dimension to the information in microfossil data. Abundance data on species of foraminifers collected in vertically stratified plankton tows, combined with information in temperature and chlorophyll, have shown that the seasonal movement of the thermocline in and out of the euphotic zone leaves an imprint on the foraminiferal assemblages deposited on the sea floor (Fairbanks et al., 1982; Curry et al., 1983). In the equatorial Atlantic, seasonal changes in wind stress due to varying intensity of the trade winds produce sharp variations in thermocline depth. The north and south Equatorial Currents and the Equatorial Countercurrent are all located in regions of steeply dipping thermoclines which also mark planktonic foraminiferal assemblage boundaries on the sea floor. Sites Mau 4/5/6 and EQ-3/7/9 address this problem.

In addition to the rich calcareous biota, other components in equatorial Atlantic sediments are useful indicators of tropical climate. Radiolarians and marine diatoms are generally well-preserved in sediments beneath the silica-rich waters of the eastern part of the equatorial Atlantic and just south of the equator; these opaline plankton provide valuable records of the history of divergence and upwelling in those areas.

Other surface-water paleoceanographic information to be gained from drilling includes: (1) a detailed history of low-latitude evolutionary changes, following up on initial studies of cores drilled during DSDP Leg 41 (Lancelot, Seibold, et al., 1977); and (2) the response of this oceanic region to major gateway changes in Atlantic circulation, including closure of the Tethyan seaway, the Messinian salinity crisis, and closure of the Pan-American isthmus.

2. Atmospheric Circulation and African Aridity

Eastern and central Atlantic cores also contain a variety of windblown components (lithogenic silt, diagnostic clay minerals, freshwater diatoms, pollen, and opal phytoliths) that provide a history of changes in both atmospheric circulation and continental aridity. Changes in atmospheric circulation can involve dislocations of the major cells of high and low pressure, and thereby, changes in position, azimuth and intensity of the meridional and zonal wind systems (Sarnthein et al., 1981, 1982). These changes are vital to an understanding of the evolution of the tropical Hadley Cell during the Neogene. They can be monitored through variations in grain size and in the latitudinal axis of major eolian delivery. Changes in the wind regime are also directly linked to the independently monitored changes in coastal upwelling noted above. Changes in the intensity of the trades have generally paralleled the fluctuations of the global ice under the control of Milankovitch forcing, but Herterich and Sarnthein (1984) recently documented a lag of decreasing wind strength behind the melt phase of global ice volume that should be traced into earlier Neogene records.

The prime dust supply from the Sahara to the Atlantic occurs east-to-west in the Saharan Air Layer between 16° and 22° N, as shown in

Figure 2 (Prospero, 1981; Sarnthein et al., 1981). The Saharan Air Layer also marks the northernmost penetration of the Intertropic Convergence Zone during northern summer. Sites 139-R and MAU-4/5/6 will monitor these changes over the long history of the Neogene.

The windblown indicators also document aridity/humidity cycles in the source areas of equatorial and northwest Africa; these have the potential of unraveling both the history and causes of the gradual Neogene desertification of Africa (Sarnthein et al., 1982) and the evolution of the 23,000-year cycles of aridity documented for the late Quaternary by Pokras and Mix (1985) in piston core V30-40 at the location of Site EQ-9.

3. Deep-Water Paleoceanography

Deep water present in the eastern Atlantic today originates in the western Atlantic and flows through two low-latitude fracture zones (the Romanche and Vema) into the eastern basins, with the flow restricted by a sill between 3750 m (Metcalf et al., 1964) and 3900 m (Tomczak & Annutsch, 1970). In the western equatorial Atlantic, the present depth transition between North Atlantic Deep Water (NADW) and Antarctic Bottom Water (AABW) occurs at about 3900 m. Deep water flowing east through the fracture zones is a mixture of these two water masses and consists of 10% to 20% AABW. The sill between 3750 and 3900 m controls the deep hydrography of the eastern Atlantic and strongly affects its local geochemistry, sedimentation, and benthic ecology. Profiles of potential temperature from the eastern and western basins thus diverge below about 3900 m, with the eastern basins nearly isothermal below that depth.

Differences in the bathymetric distribution of $\delta^{13}C$ (Curry and Lohmann, 1983) indicate that there were dramatic changes in the exchange of deep waters between the western and eastern Atlantic 13,000 years ago. Today, there is no bathymetric gradient in $\delta^{13}C$ in either water-column CO_2 or in Recent benthic foraminifers. During the last glacial maximum, however, benthic foraminifers that lived below 4500 m water depth are 0.7 o/oo depleted in $\delta^{13}C$ relative to benthic foraminifers living in sediments deposited above the sill. This contrast implies a major reduction in dissolved oxygen in the deep eastern Atlantic during the last glacial maximum. Reduced flow of well-oxygenated deep water across low-latitude fracture zones into the eastern basins and/or increased oxidation of organic carbon in these basins below the sill depths resulted in a lowering of dissolved oxygen concentrations by 90 to 100 umoles/kg. This change in the geochemistry of the deep water in the eastern Atlantic is linked to the changes in global climate that increased upwelling and productivity in equatorial regions and decreased formation and flux of deep water in the northern and western Atlantic basins.

In the eastern Atlantic, the Sierra Leone Rise (5° N, 21° W) spans a range of depths from below the sill between 3650 m and 3900 m to more than 1000 m above it, thus intersecting the major hydrographic features of the western and eastern basins. This rise originated 80 m.y. ago at the Mid-Atlantic Ridge and has received a largely continuous cover of pelagic calcareous and siliceous sediment throughout the Tertiary (Supko, Perch-Nielson et al., 1977; Lancelot, Seibold, et al., 1977) and particularly the Plio-Pleistocene (Sarnthein et al., 1984; Stein and

Sarnthein, 1984).

The studies by Curry and Lohmann (1983) of abyssal circulation are limited to the last few hundreds of thousands of years by the length of conventional piston cores. HPC/XCB techniques will extend the history of the deep-water circulation back into the Neogene. Four sites along the summit and southern slope of the Sierra Leone Rise have been chosen (Sites Eq-3/4/5/6; Figure 1 and Table 1).

In addition, a separate effort at Site SLR-1 will be devoted to investigating the history and cause of incursions of Antarctic-source bottom-water into the northeastern Atlantic, including conspicuous events strong enough to cause large scale erosion of sediments in Kane Gap between the basins. Erosional gaps have been detected at existing DSDP sites (566, 397, and 141) and have created widespread reflectors in seismic records. Site SLR-1 is located in Kane Gap to monitor bottom-water exchange and erosional events in this passage. Sites 139-R and MAU-4/5/6 on the northwest African margin will also help to monitor the vertical and geographic extent of the strongest erosional events.

4. Ice Volume/Sea Level/Ocean-Isotopic Composition

The surface oceanography and excellent preservation of calcareous sediments of the equatorial Atlantic together provide another important paleoceanographic opportunity: the use of oxygen isotopes to monitor changes in global ice volume during the Tertiary. Because bottom-water temperatures decrease throughout the Tertiary, benthic foraminifers cannot be used to monitor changes in ice volume as in the Quaternary. Instead, non-spinose species of planktonic foraminifers offer the best such opportunity, because measurements have shown that most non-spinose species grow at near-constant temperatures throughout the year in the eastern sector of the equatorial oceans (Fairbanks et al., 1982; Curry et al., 1983). They are able to grow within their narrow preferred temperature range year-round because the shallow thermocline in the eastern equatorial oceans brings a wide range of isotherms into the euphotic zone in all seasons.

In addition, changes in oceanic $\delta^{13}C$ during the last 40 million years may also be monitored in sediments underlying shallow thermocline regions in the eastern equatorial regions (Shackleton et al., 1983). Sites 139-R, MAU-4/5/6 and EQ-6/7/9 will address both these objectives.

5. Investigation of Eolian Sand Turbidites

Large-scale sand turbidites exist on the continental rise off the central Sahara. These have been attributed to phases of extreme continental aridity, with strong winds blowing Saharan sands onto the adjacent continental shelf exposed during eustatically lowered sea level and resulting in enhanced sediment instability and downslope flow (Sarnthein and Diester-Hass, 1977). Coring efforts at Site MAU-5 will help to unravel the formation, diagenetic history, and physical properties of these sand deposits.

6. Other Objectives

In addition to the above objectives, HPC/XCB coring at these sites will open up detailed studies of Neogene biostratigraphy, including the evolution of the low-latitude biota. Coring at these sites will also make possible detailed studies of vertical movements in the lysocline and other dissolution-related parameters.

DRILLING PLAN

Eleven sites comprise the full cruise plan outlined in Table 1 and Figure 1. These will provide a latitudinal transect for surface paleoceanographic studies, and for zonal and meridional control on Saharan wind changes, and a depth transect on the Sierra Leone Rise for deep-water studies. Most sites will penetrate well into the Neogene. All coring will be continuous, with double-HPC coring to refusal at all sites. One hole at each site will be XCB-drilled to the total depth. We anticipate little by way of weather constraints during this leg. It is unlikely that logging will be completed at any site unless a sub-bottom depth greater then 400 meters is reached.

The first five sites (139R, MAU4, MAU5, MAU6, and SLR1) are in coastal-margin regions with relatively complicated tectonic and sedimentologic settings. Figure 3 shows the bathymetry of the region. Numerous seismic lines are available from previous cruises (Figure 4).

The last six sites (EQ3, EQ4a, EQ5, EQ6, EQ7, and EQ9) were chosen based on the same philosophy that guided the successful site placement on DSDP Leg 94: they are selected in mid-ocean settings at the locations of piston cores with good late Quaternary pelagic sediments and/or with air-gun seismic coverage. Figure 5 shows the bathymetry in the region of these sites and Figure 6 shows the locations of seismic profile records available from previous cruises in the area.

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Table 1
LEG 108 OCEAN DRILLING PROGRAM
NORTHWEST AFRICAN MARGIN

Location of proposed sites

Drill Sequence	Site Number	Latitude	Longitude	Water Depth	Locality	Hole Type
1	139R	23°22.3'N	18°25.5'W	2887m	outer rise off ex-Spanish Sahara	double HPC/XCB to 350m
1	MAU5	21°20.0'N	20°45.0'W	4023m	Outer rise W of Cape Blanc (close to Site 140)	double HPC/XCB to 250m
1	MAU6	20°56.5'N	18°40.0'W	2662m	upper rise W of Cape Blanc	double HPC/XCB to 300m
1	MAU4	18°04.5'N	21°01.5'W	3050m	Cape Verde Rise (close to Site 368)	double HPC/XCB to 300m
1	SLR1	09°58.9'N	19°15.3'W	4300m	NE Sierra Leone Rise; Kane Gap	double HPC/XCB to 300m
2	EQ3	04°45.0'N	20°58.0'W	2650m	South Slope of Sierra Leone Rise	double HPC/XCB to 400m
2	EQ4a	04°12.0'N	20°35.0'W	3900m	South Slope of Sierra Leone Rise	double HPC/XCB to 150m
2	EQ5	03°30.0'N	20°10,0'W	4300m	South Slope of Sierra Leone Rise	double HPC/XCB to 150m
2	EQ6	02°45.0'N	19°04.0'W	4800m	South Slope of Sierra Leone Rise	double HPC/XCB to 150m
3	EQ9	00°12.0'S	23°09.0'W	3706m	East flank Mid-Atlantic Ridge	double HPC/XCB to 180m
3	EQ7	01°21.0'S	11°55.0'W	3899m	East flank Mid-Atlantic Ridge	double HPC/XCB to 150m

TENTATIVE SCHEDULE
LEG 108

Site	Location	Travel Time (Days)	Drilling Time (Days)	Logging Time* (Days)	Departure Date
Depart:	Marseille, France				February 23, 1986
Underway		6.5	-	-	
139R	23°22'N 18°25'W	-	3.7	0.6	
transit		0.5	-	-	
MAU6	20°56'N 18°40'W	-	3.2	0.5	
transit		0.4	-	-	
MAU5	21°20'N 20°45'W	-	4.1	0.7	
transit		0.7	-	-	
MAU4	18°04'N 21°01'W	-	3.7	0.5	
transit		1.7	-	-	
SLR1	09°58'N 19°15'W	-	4.8	0.8	
transit		1.1	-	-	
EQ3	04°45'N 20°58'W	-	3.0	0.6	
transit		0.2	-	-	
EQ4a	04°12'N 20°35'W	-	2.8	-	
transit		0.2	-	-	

Site	Location	Travel Time (Days)	Drilling Time (Days)	Logging Time* (Days)	Departure Date
EQ5	03°30'N 20°10'W	-	2.5	-	
	transit	0.3	-	-	
EQ6	02°45'N 19°04'W	-	3.6	-	
	transit	1.0	-	-	
EQ9	00°12'S 23°09'W	-	3.0	-	
	transit	2.4	-	-	
EQ7	01°21'S 11°55'W	-	3.0	-	
	Underway	4.0	-	-	
	Arrive: Dakar, Senegal				April 21, 1986
		19.0	37.4	(3.7 days)*	56.4 days

Drilling time estimate assumes HPC/XCB to desired depth followed by a second HPC hole to 200 meters (with the exception of Sites EQ-4, -5, -6, -7, and -9 in which the second HPC hole only penetrates to about 150 meters).

* It is unlikely that Logging will be completed at any site unless a sub-bottom depth greater then 400 meters is reached.

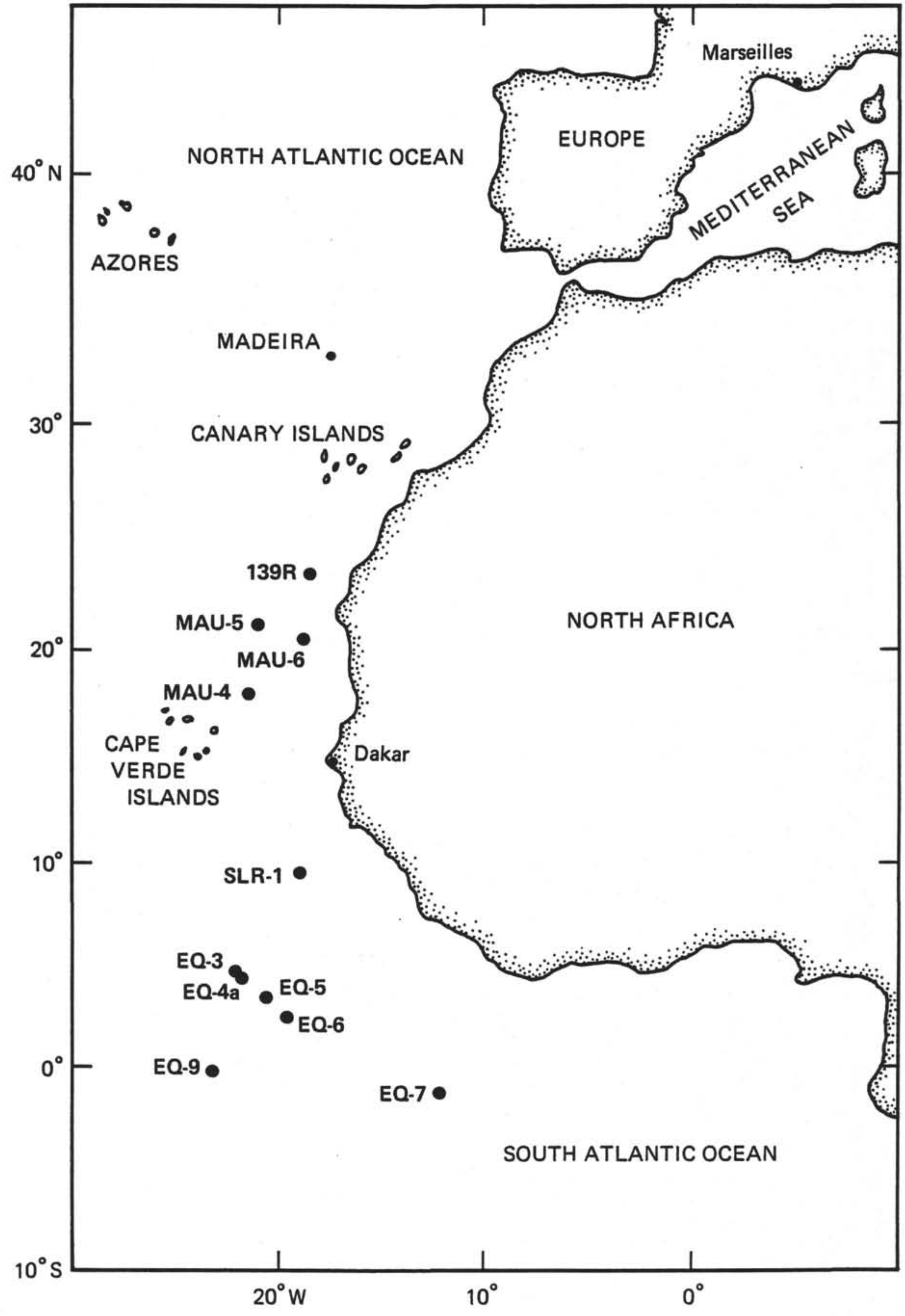


Figure 1. Location of Leg 108 drill sites.

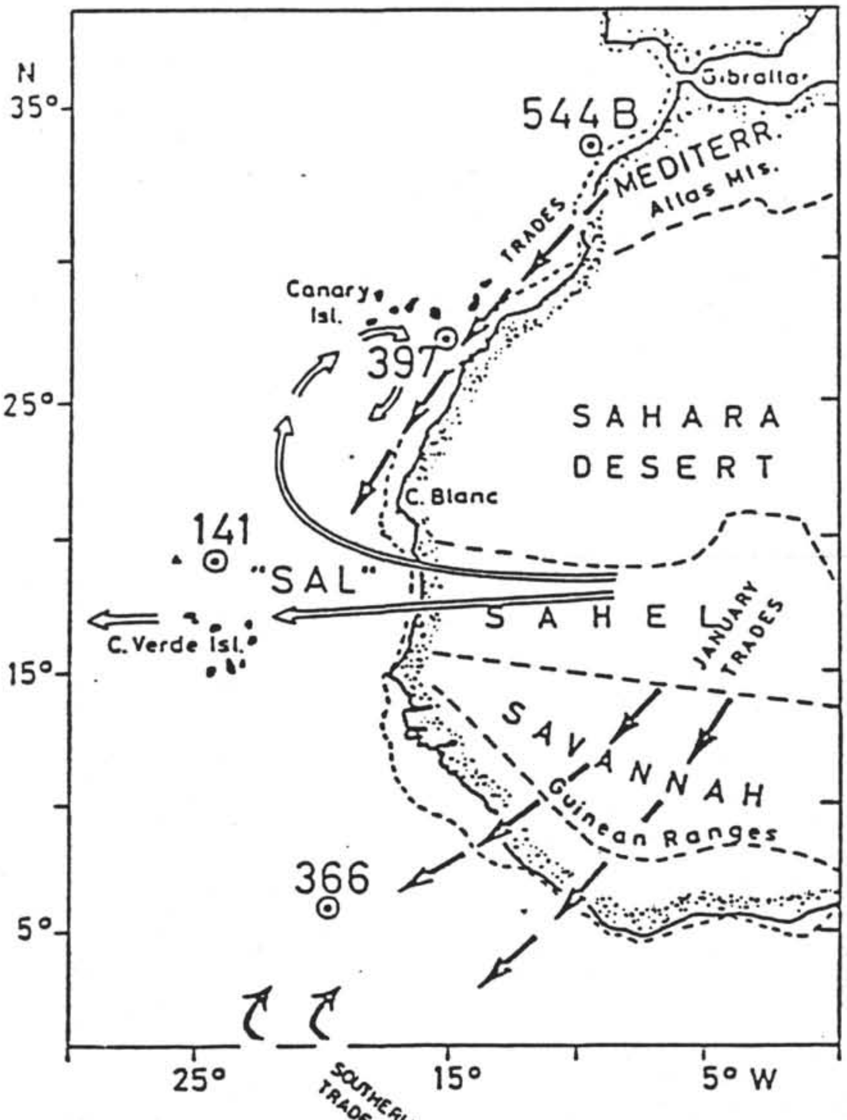


Figure 2. Major climatic zones and flow patterns and directions of dust supply by different wind systems. Open arrows: zonal winds of Saharan Air Layer (SAL). Solid arrows: meridional (surface) trade winds.

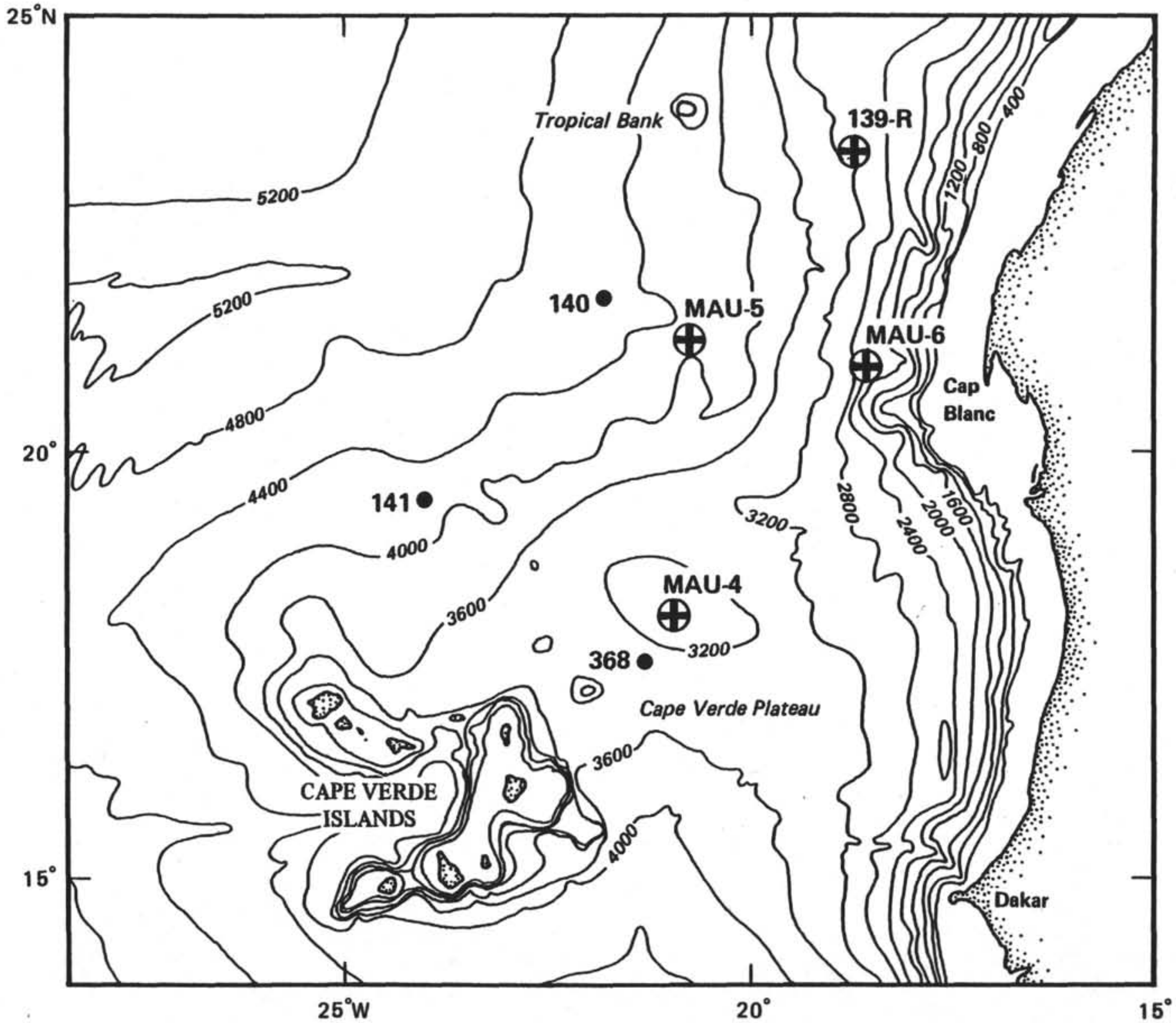


Figure 3. Bathymetry of the region in the vicinity of the five northern sites.

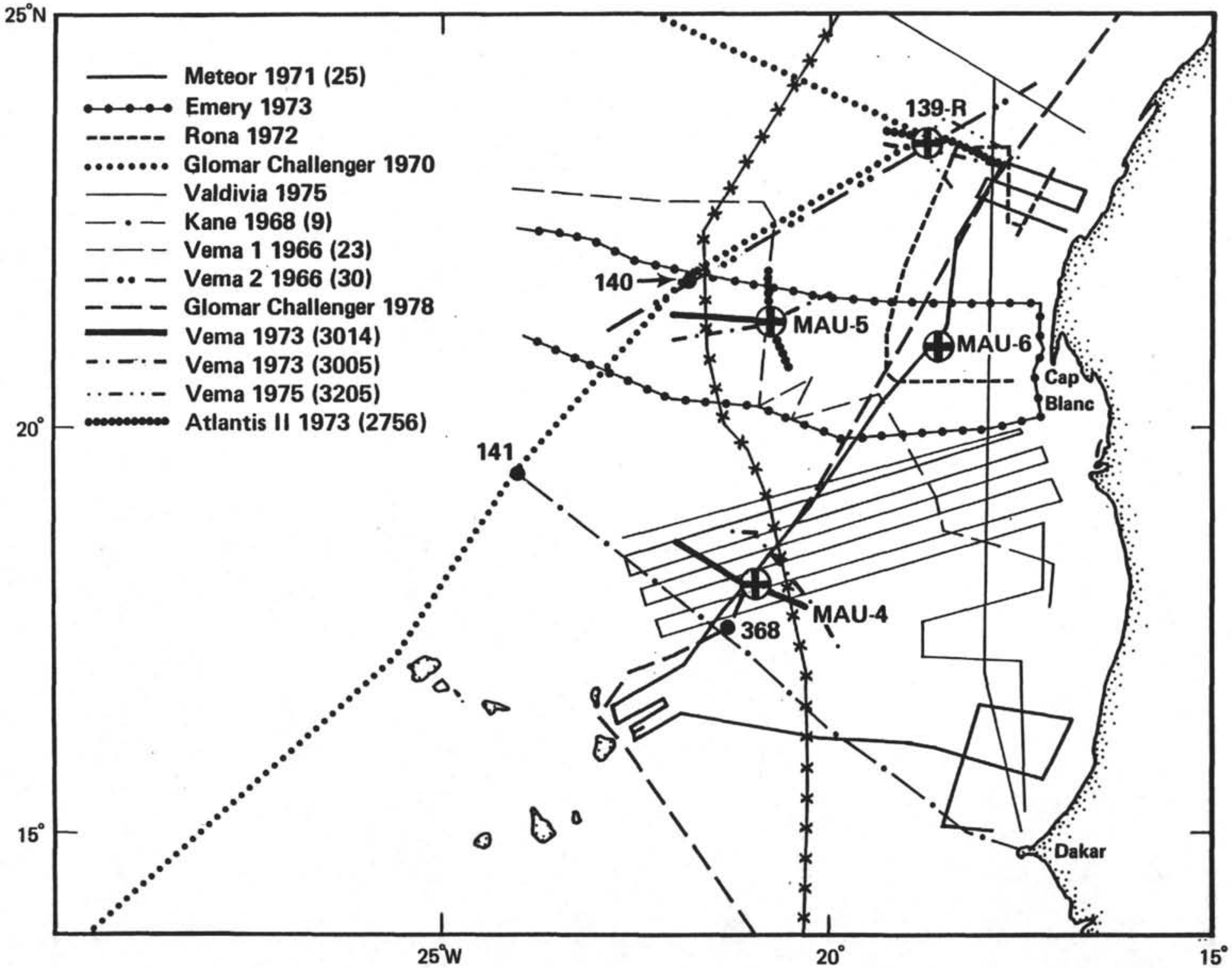


Figure 4. Tracklines with seismic data for the northern sites.

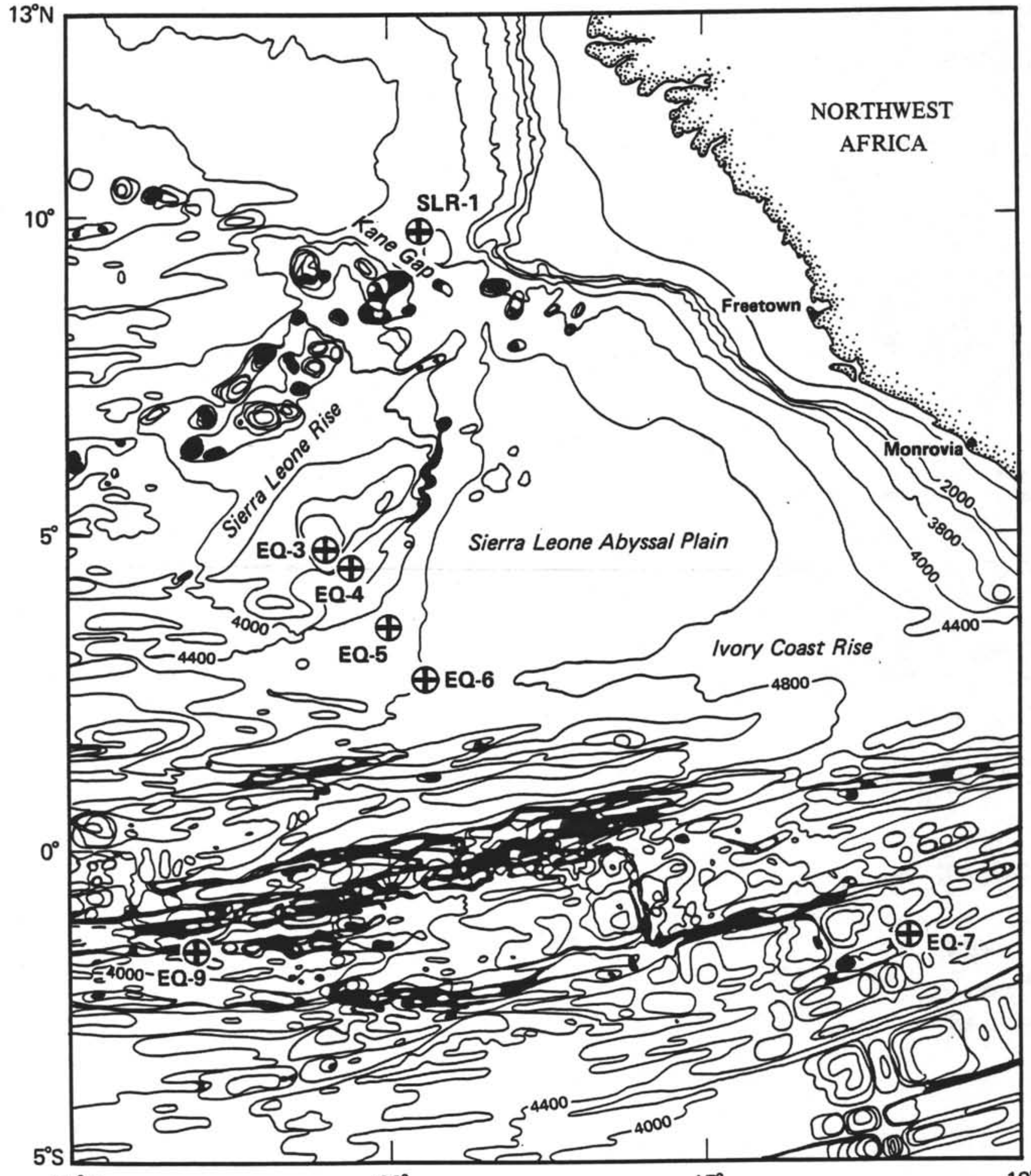


Figure 5. Bathymetry of the region in the vincinty of the seven southern sites.

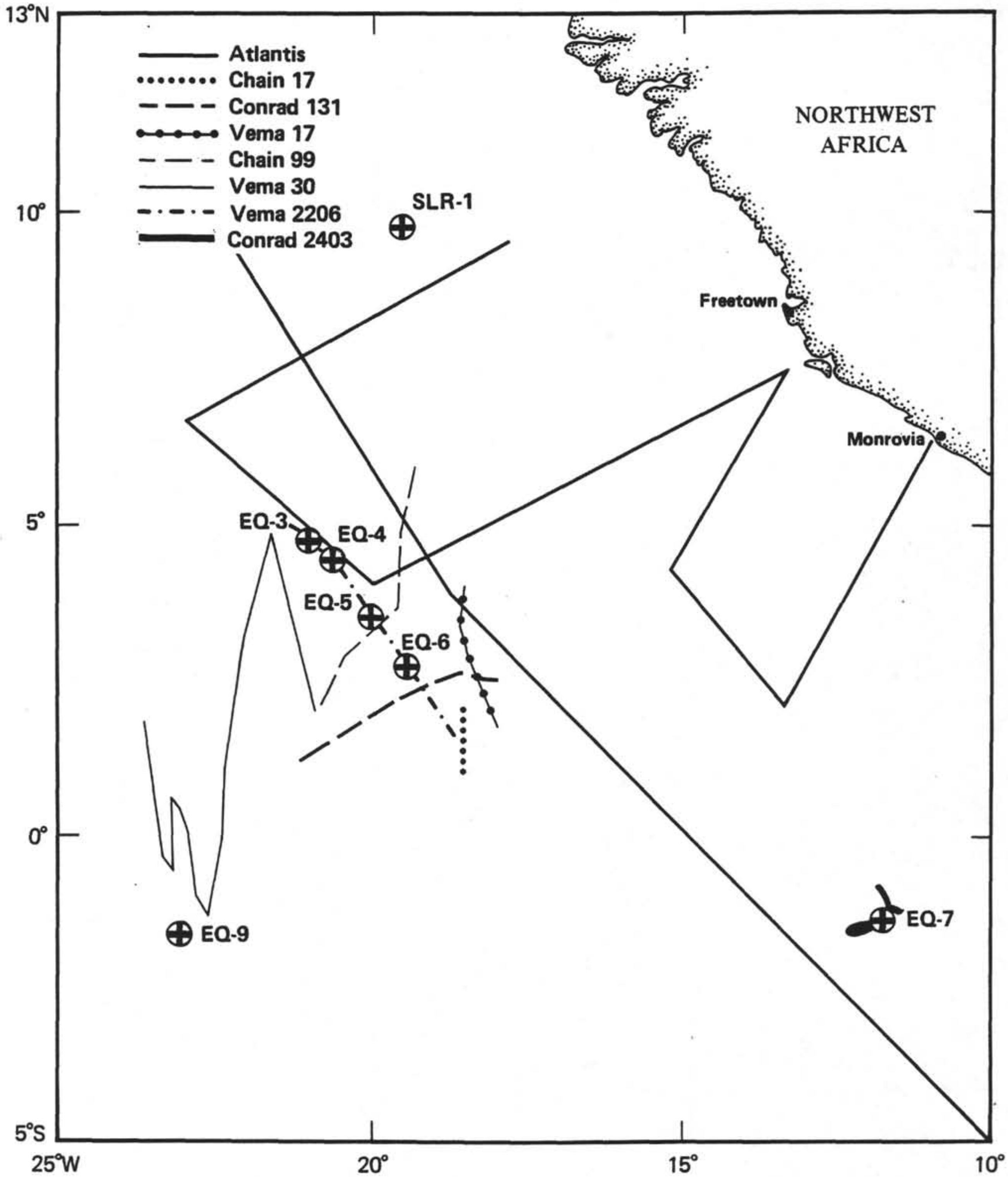


Figure 6. Tracklines with seismic data for the southern sites.

SITE NUMBER: 139R

POSITION: 23° 22.3'N, 18° 25.5'W

SEDIMENT THICKNESS: several kilometers

WATER DEPTH: 2887 meters

PRIORITY: 10

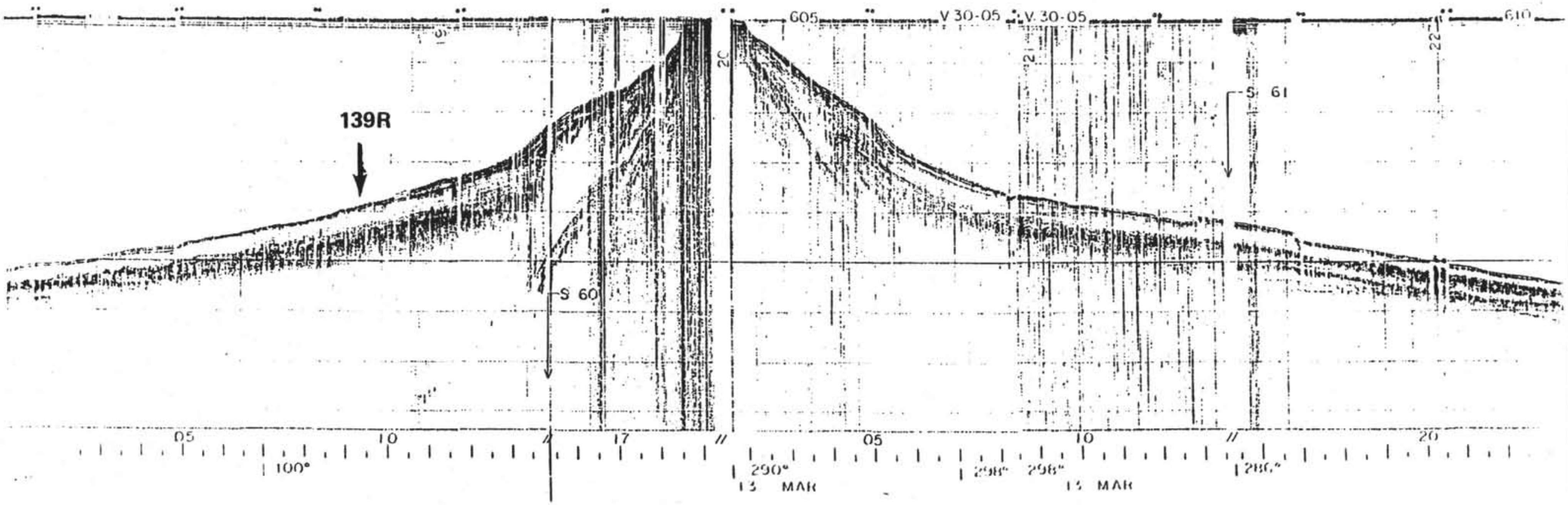
PROPOSED DRILLING PROGRAM: double HPC to refusal then XCB to 350 meters sub-bottom.

SEISMIC RECORD: Meteor-25-Bl (single channel) 2 Nov. 1971, 20.25 h
Glomar Challenger Leg 14 (single channel)

LOGGING: ?

OBJECTIVES: To obtain a high-resolution record of the Neogene evolution of the Canary Current outside the centers of coastal upwelling; To measure the variation of eolian-dust discharge in order to monitor fluctuations of the meridional trade-wind regime; To calibrate a sequence of hiatuses with phases of enhanced contour-current activity along the eastern North Atlantic continental margin.

SEDIMENT TYPE: nannofossil chalk and nannofossil ooze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298°
13 MAR
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Vema 30

SITE NUMBER: MAU-4

POSITION: 18^{O} 4.5'N, 21^{O} 1.5'W

SEDIMENT THICKNESS: several kilometers

WATER DEPTH: 3050 meters

PRIORITY: 3

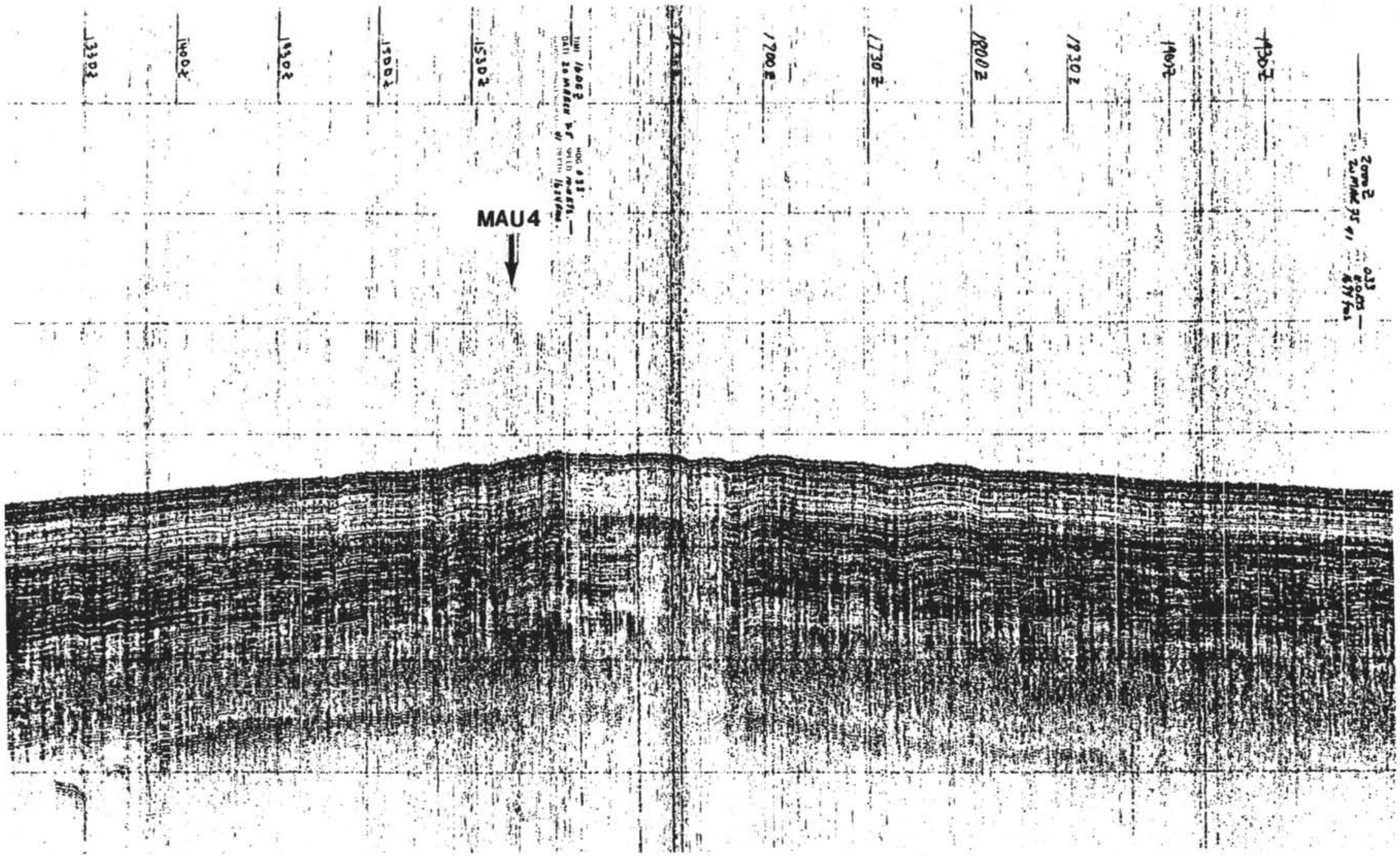
PROPOSED DRILLING PROGRAM: double HPC to refusal then XCB to 300 meters sub-bottom.

SEISMIC RECORD: Meteor-25-Bl (single channel)
Glomar Challenger Leg 41 (single channel)
Valdivia 10-II (single trace)

LOGGING: ?

OBJECTIVES: Deep-water paleoceanography and circulation history of Saharan Air Layer.

SEDIMENT TYPE: nannofossil chalk and nannofossil ooze


MAU4

SITE NUMBER: MAU-5

POSITION: 21° 20.0'N, 20°45.0'W

SEDIMENT THICKNESS: ~1800 m

WATER DEPTH: 4023 meters

PRIORITY: 1

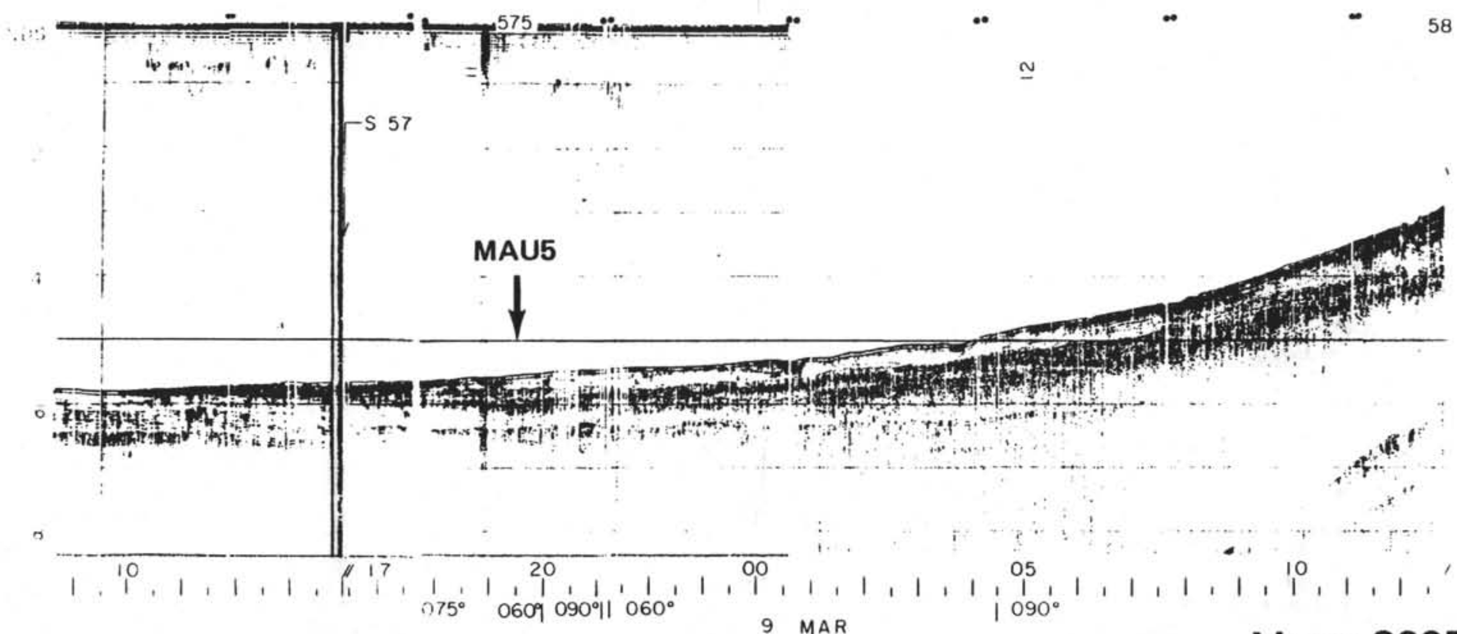
PROPOSED DRILLING PROGRAM: double HPC to refusal then XCB to 250 meters sub-bottom.

SEISMIC RECORD: Vema 32-0 (Feb. 7, 1975, 22:50)
Vema 23 lines
Glomar Challenger (Site 140, Leg 14)

LOGGING: ?

OBJECTIVES: To document the non-upwelling paleoceanography and paleo-productivity of the Canary Current off Cape Blanc and compare with the record of the nearby permanent upwelling cell at twin site MAU-6; To monitor the dust supply and zonal wind velocities of the Saharan Air Layer. To document the long term history of central Saharan aridity and humidity as recorded by eolian sand and fluvial mud turbidites, and by pollen; To study the diagenisis of shallow sand lenses at the continental rise.

SEDIMENT TYPE: Siliceous calcareous oozes with interbedded turbidites



Vema 3005

SITE NUMBER: MAU-6

POSITION: 20° 56.5'N, 18° 40.0'W

SEDIMENT THICKNESS: 3000 m

WATER DEPTH: 2662 meters

PRIORITY: 2

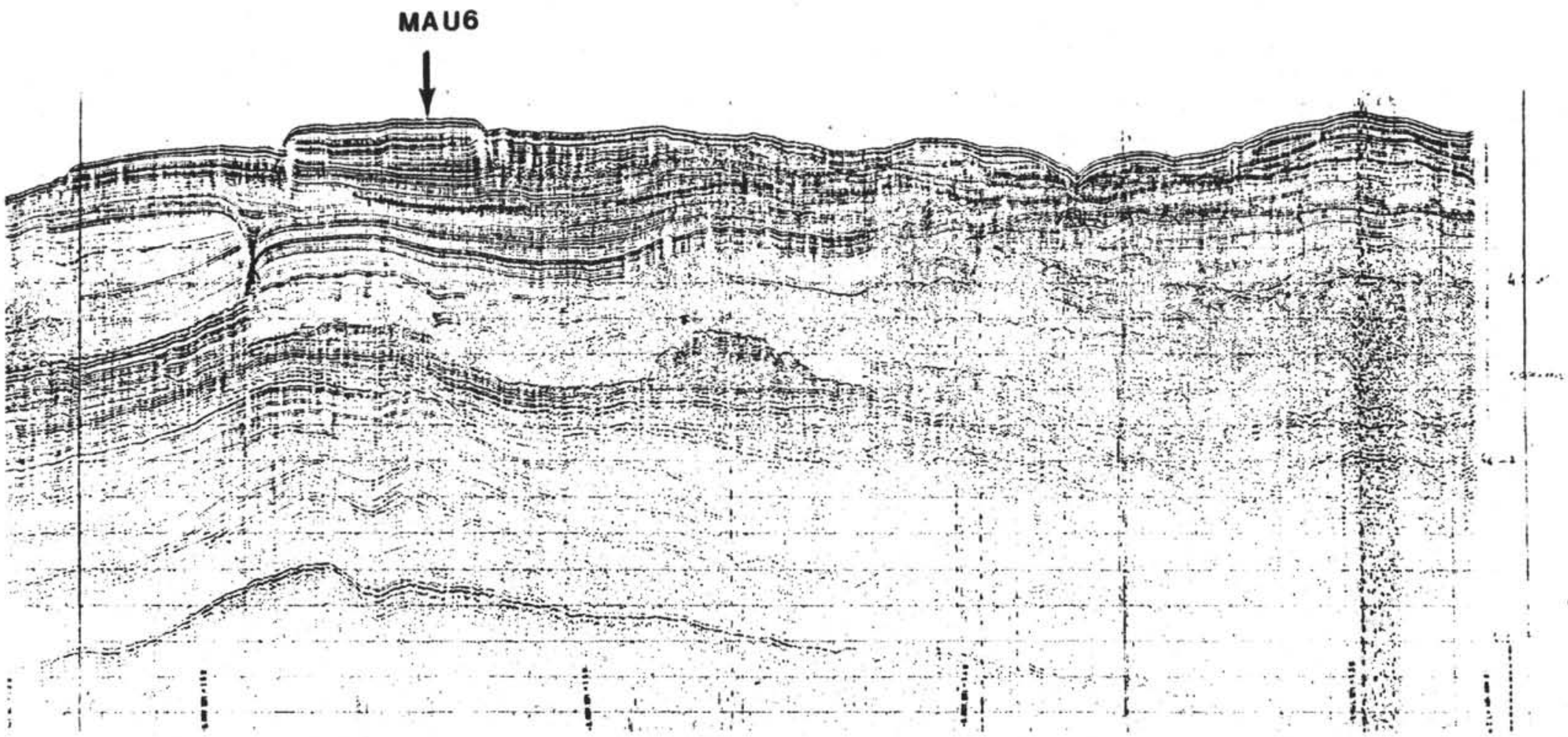
PROPOSED DRILLING PROGRAM: Double HPC to refusal then XCB to 300 meters sub-bottom.

SEISMIC RECORD: Meteor-25 single channel line
Kiel 3.5 KHZ record
Orgon III cruise
BGR Hanover 8 Nov. 1971, 15.21 h
GSI AlE-Line s. p. 2585

LOGGING: ?

OBJECTIVES: To obtain a high resolution hemipelagic sediment record of the Late Neogene; To investigate the paleoceanography and paleo-productivity of the permanent upwelling cell West of Cape Blanc and compare with the record of non-upwelling record of twin site MAU-5; To monitor the dust supply and strength of meridional trade winds which control the upwelling intensity; To trace back the evolution of cool-water species domestic in the upwelling cell; To study the diagenisis of organic matter; To date major unconformities and seismic reflectors.

SEDIMENT TYPE: Siliceous nanno ooze



Meteor 25

NUMBER: SLR-1

POSITION: 9° 58.9'N, 19° 15.3'W

SEDIMENT THICKNESS: >1000 m

WATER DEPTH: 4400 meters

PRIORITY: 8

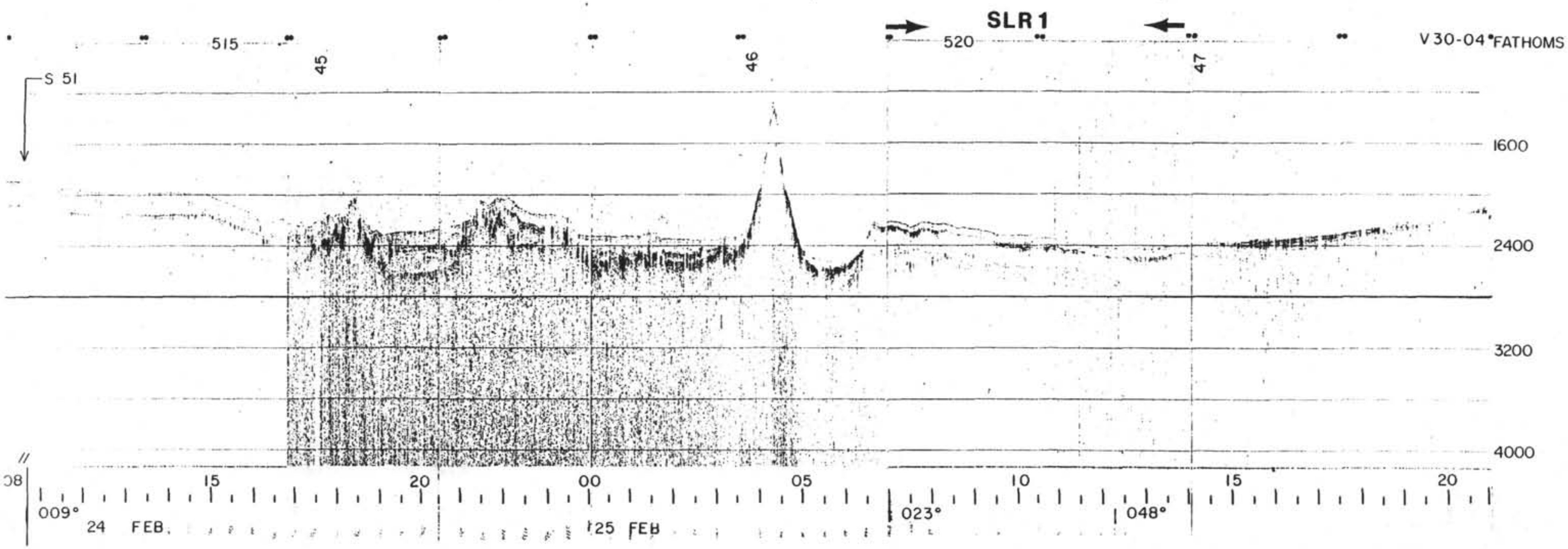
PROPOSED DRILLING PROGRAM: Double HPC to refusal then XCB to 300 meters sub-bottom.

SEISMIC RECORD: RRS Shackleton airgun seismic records
Kiel 3.5 kHZ records M65-36
12 meter gravity core M16414-1

LOGGING: ?

OBJECTIVES: To monitor the exchange of bottom water between the southern and northern parts of the eastern Atlantic through the key passage of the Kane Gap; To document phases with strongly reduced oxygen content as compared to local surface water productivity and the global glaciation history; To date a major current induced reflector at 100 meters sub-bottom; To monitor the history of trade-wind borne dust plumes which records the fluctuations of aridity in the African sahara.

SEDIMENT TYPE: Nannofossil ooze and marly clay



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Vema 30

SITE NUMBER: EQ-3

POSITION: 4° 45.0'N, 20° 58.0'W

SEDIMENT THICKNESS: ~1000 m

WATER DEPTH: 2650 meters

PRIORITY: 5

PROPOSED DRILLING PROGRAM: double HPC to refusal, then XCB to the top of the Eocene ~400 m sub-bottom.

SEISMIC RECORD: V22-06

LOGGING: ?

OBJECTIVES: Reconstruction of bathymetric profiles of sediment parameters which record the history of deep water circulation, hydrography and chemistry (e.g. benthic foraminiferal geochemistry, organic carbon accumulation, carbonate accumulation, organic particulate accumulation). Reconstruction of the depth distribution of carbonate accumulation to determine the Tertiary history of carbonate production and dissolution; To provide a low-latitude, magnetobiostratigraphic reference section.

SEDIMENT TYPE: calcareous ooze

SITE NUMBER: EQ-4a

POSITION: 4° 12'N, 20° 35'W

SEDIMENT THICKNESS: >350 m

WATER DEPTH: 3900 meters

PRIORITY: 7

PROPOSED DRILLING PROGRAM: Double HPC to 150 meters sub-bottom

SEISMIC RECORD: V22-06

LOGGING: None

OBJECTIVES: Reconstruction of bathymetric profiles of sediment parameters which record the history of deep water circulation, hydrography and chemistry (E. G. benthic foraminiferal geochemistry, organic carbon accumulation, carbonate accumulation, organic particulate accumulation). Reconstruction of the depth distribution of carbonate accumulation to determine the Tertiary history of carbonate production and dissolution.

SEDIMENT TYPE: Nannofossil marls and oozes

SITE NUMBER: EQ-5

POSITION: 3° 30'N, 20° 10'W

SEDIMENT THICKNESS: 700 m

WATER DEPTH: 4350 meters

PRIORITY: 6

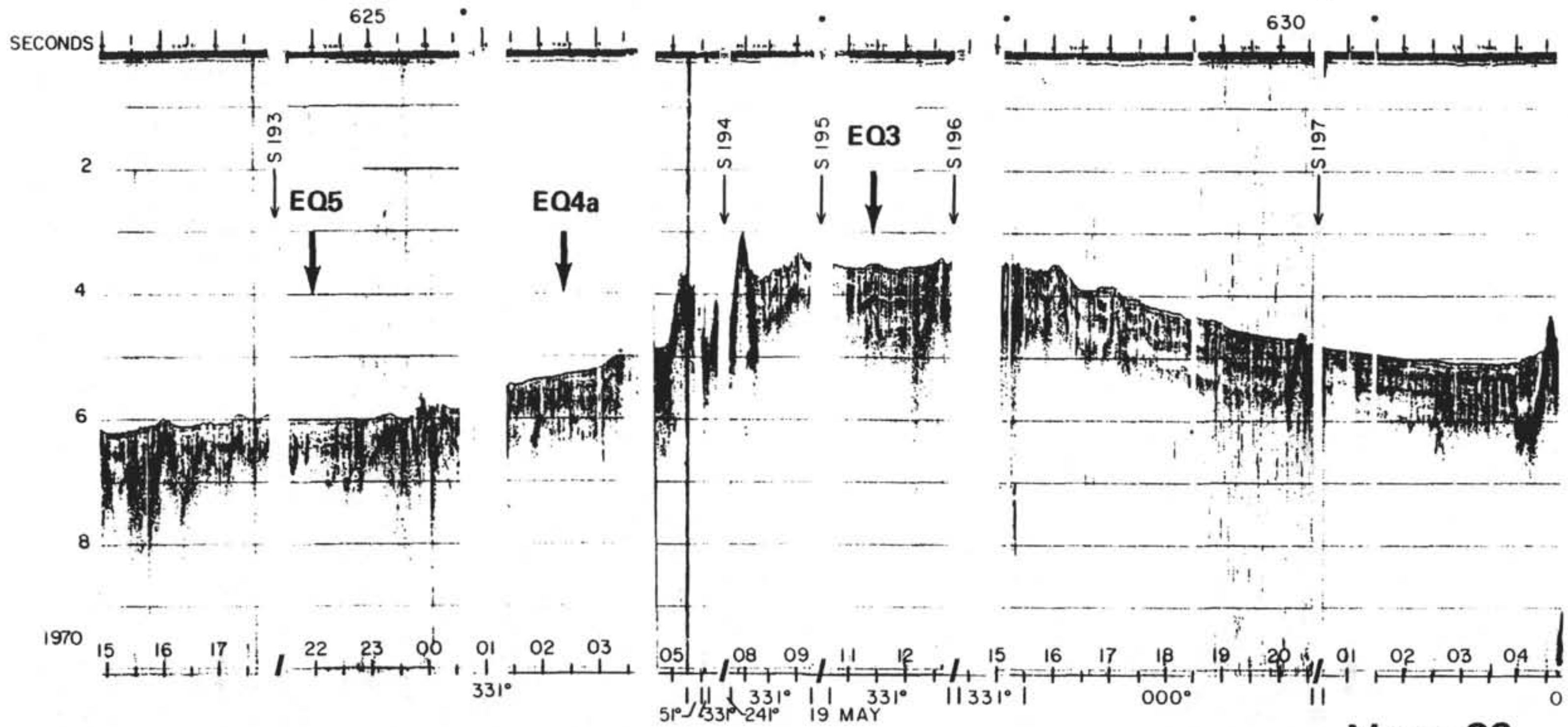
PROPOSED DRILLING PROGRAM: Double HPC to 150 meters sub-bottom

SEISMIC RECORD: V22-06

LOGGING: None

OBJECTIVES: Reconstruction of bathymetric profiles of sediment parameters which record the history of deep water circulation, hydrography and chemistry (E. G. benthic foraminiferal geochemistry, organic carbon accumulation, carbonate accumulation, organic particulate accumulation). Reconstruction of the depth distribution of carbonate accumulation to determine the Tertiary history of carbonate production and dissolution.

SEDIMENT TYPE: Nannofossil marls and oozes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EQ5
EQ4a
EQ3
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Vema 20

SITE NUMBER: EQ-6

POSITION: 2° 45'N, 19° 30'W

SEDIMENT THICKNESS: >600 m

WATER DEPTH: 4600 meters

PRIORITY: 11

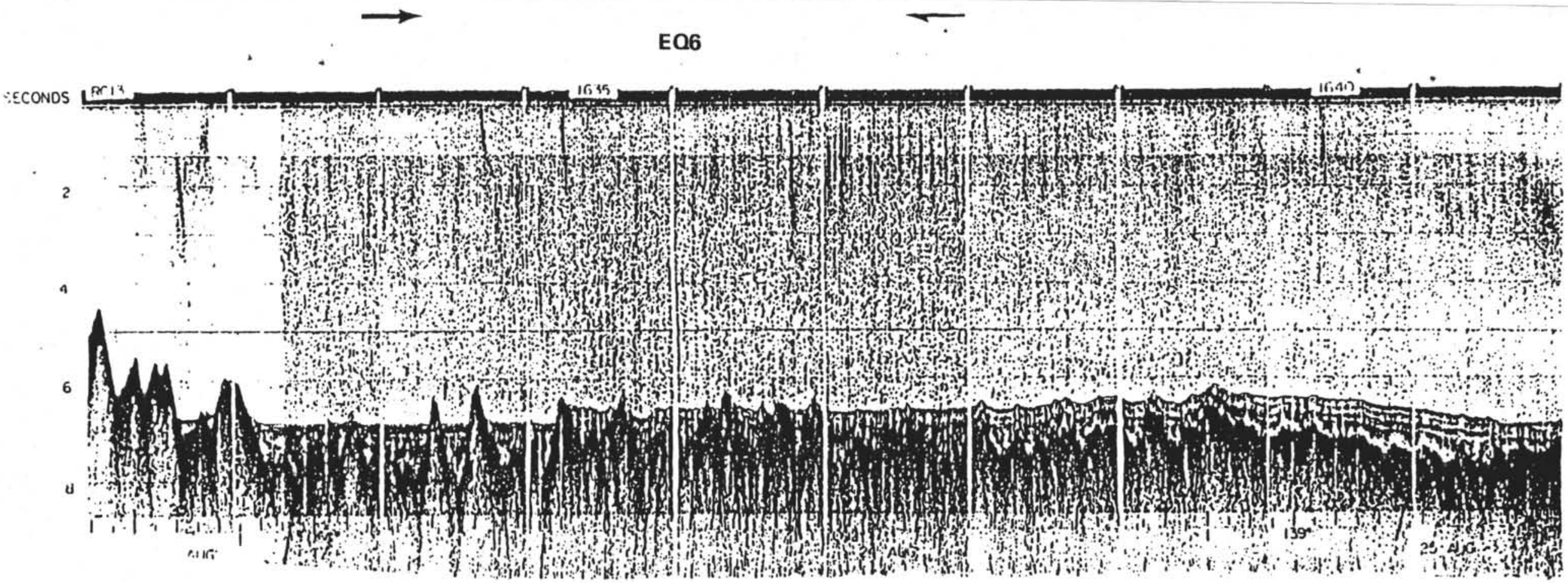
PROPOSED DRILLING PROGRAM: double HPC to 150 meters

SEISMIC RECORD: V22-06
V30-04

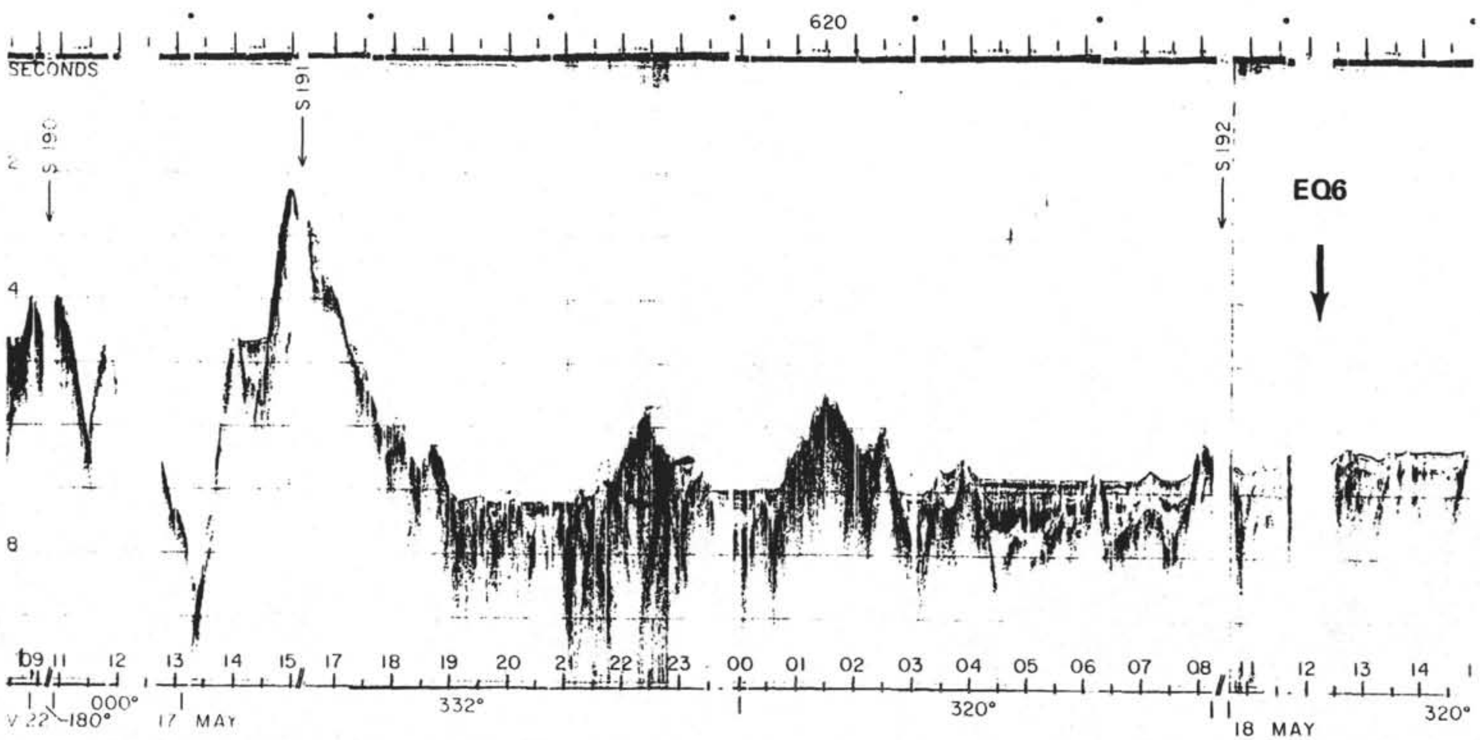
LOGGING: None

OBJECTIVES: Reconstruction of bathymetric profiles of sediment parameters which record the history of deep water circulation, hydrography and chemistry (E. G. benthic foraminiferal geochemistry, organic carbon accumulation, carbonate accumulation, organic particulate accumulation). Reconstruction of the depth distribution of carbonate accumulation to determine the Tertiary history of carbonate production and dissolution.

SEDIMENT TYPE: Nannofossil marls, nannofossil oozes, nannofossil chalk



Conrad 13



Vema 22

SITE NUMBER: EQ-7

POSITION: 1° 21'S, 11° 55'W

SEDIMENT THICKNESS: 250 m

WATER DEPTH: 3899 meters

PRIORITY: 9

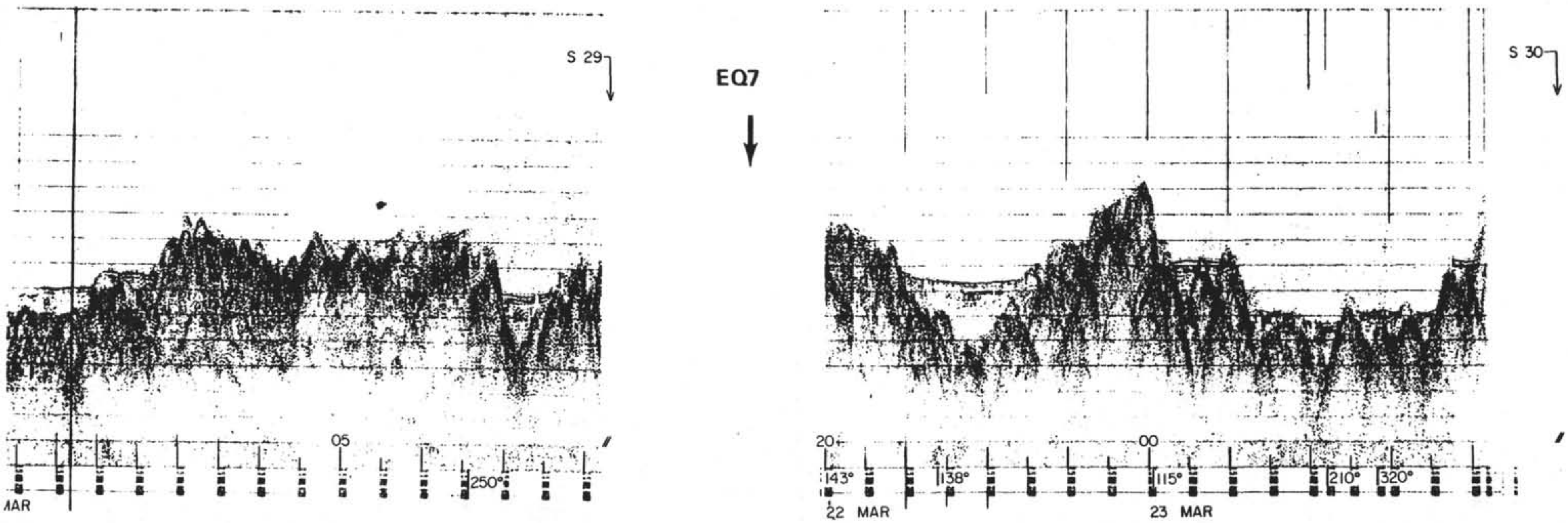
PROPOSED DRILLING PROGRAM: double HPC to 150 meters sub-bottom

SEISMIC RECORD: RC24-03 air-gun profiles, 3.5 kHz records
piston core RC24-7

LOGGING: None

OBJECTIVES: To investigate the history of the divergence in the Equatorial Atlantic and the Benguela Current and to trace its development during and prior to northern hemisphere glaciation; To trace the timing of aridity and eolian delivery from Africa source areas and in the northern and southern trade winds.

SEDIMENT TYPE: calcareous ooze



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210°
320°
22 MAR
23 MAR

SITE NUMBER: EQ-9

POSITION: 0° 12'S, 23° 09'W

SEDIMENT THICKNESS: 300 m

WATER DEPTH: 3706 meters

PRIORITY: 4

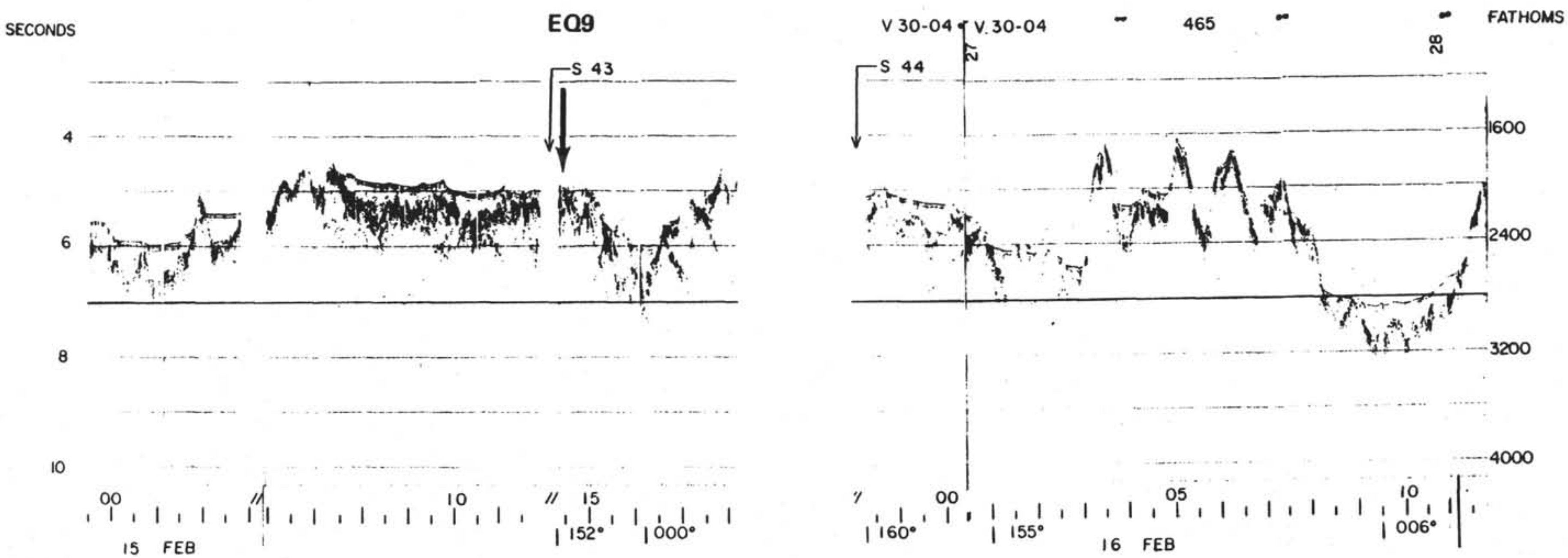
PROPOSED DRILLING PROGRAM: double HPC to 180 meters sub-bottom

SEISMIC RECORD: V30 air-gun, 3.5 kHz
V30-40 piston core

LOGGING: None

OBJECTIVES: To trace the strong 23,000-year rhythm found in late Quaternary piston core V30-40 back into earlier Quaternary and pre-Quaternary time to determine ice-volume effect; To trace the strong 23, 000-year rhythm of eolian input from Equatorial Africa for similar reasons.

SEDIMENT TYPE: calcareous oozes



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V 30-04
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4000
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05
10
160°
155°
16 FEB
006°

Vema 30

OCEAN DRILLING PROGRAM LEG 108
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OCEAN DRILLING PROGRAM

Changes in Leg 108 staffing as of January 2, 1986.

1) Dr. Harold Olsen will not be participating in the cruise.

2) Dr. Philip Weaver will be participating as a specialist in planktonic foraminifera.