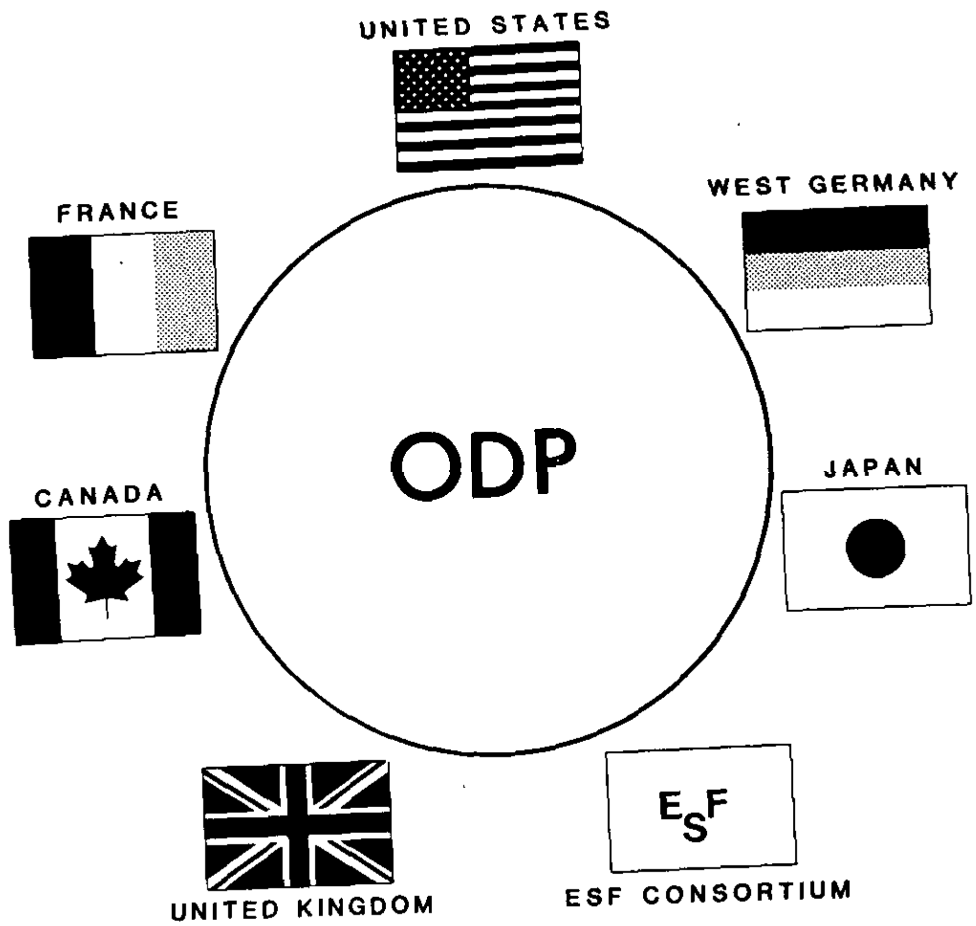
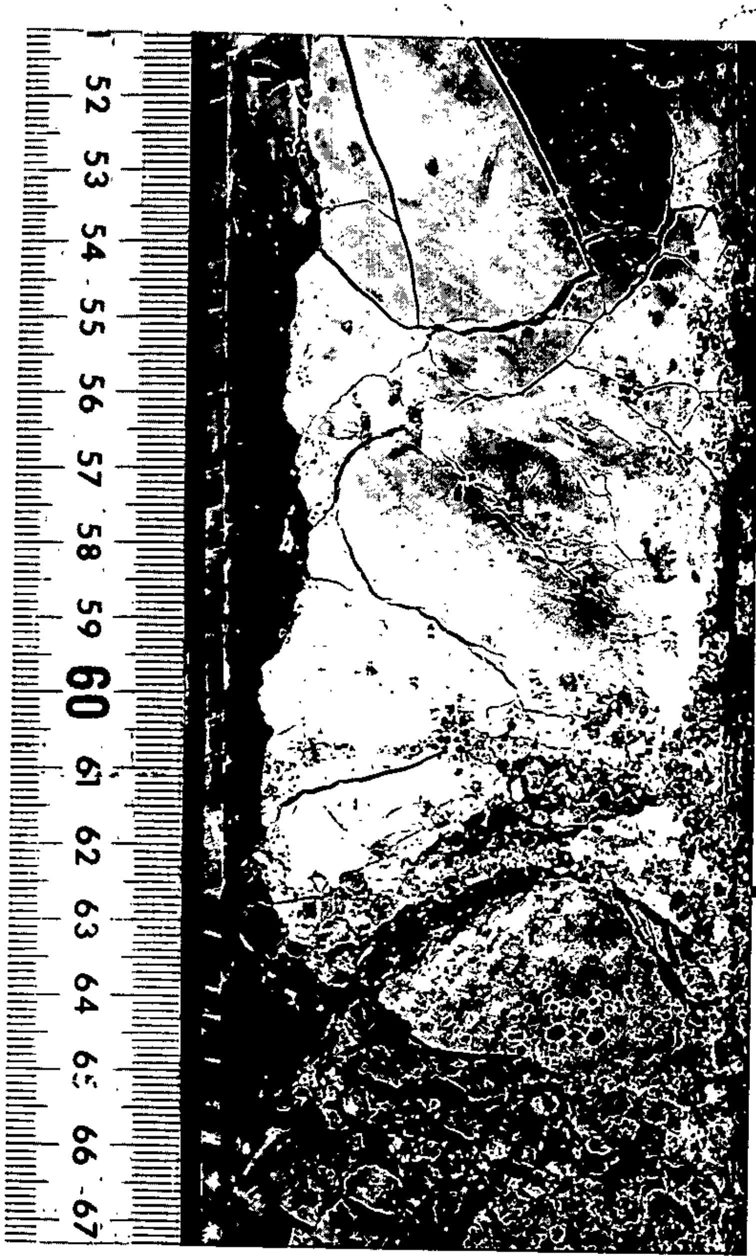
JOIDES Journal

VOL. XII, No. 2 JUNE 1986





The above figure shows the contact between sediment and basalt in Core 66X at Hole 650A in the Marsili Basin of the Tyrrhenian Sea. The sediment above the contact has been dated by biostratigraphy and magnetostratigraphy as uppermost Pliocene. The underlying basalt is extremely vesicular suggesting it was erupted at a depth significantly shallower than its present depth of 4100 m subbottom. These observations combine to imply that the easternmost Tyrrhenian Sea is surprizingly young and has rapidly subsided.

FRONT COVER

With the signing of a Memorandum of Understanding by the European Science Foundation Consortium in April, 1986, the Ocean Drilling Program now has seven members.

JOIDES Journal

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PUBLICATION STATEMENT

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FOCUS

The JOIDES Planning Committee has finally achieved and substantially surpassed the long-term planning goals for ODP. Those goals were first spelled out in the COSOD-I report that called for the "General area and objectives of each drilling leg to be specified" three years prior to drilling that area. At their May meeting, PCOM approved an 18-month scientific plan for the Western Pacific Ocean at that level of planning. This will occur after our more detailed drilling plans for the remainder of the Atlantic Ocean, the Eastern Pacific Ocean, the Weddell Sea, and the Indian Ocean. Executed in a continuous operational sequence, this drilling plan would complete the Western Pacific area in about March of 1990, nearly four years from now.

COSOD-I also pointed out the long-term planning deficiencies inherent in the old Deep Sea Drilling Project that was funded in approximately two-year increments and made planning beyond the end of the existing grant period impossible. The need for long-term funding and planning was successfully argued to the funding agencies in all of the countries participating in the ODP, so there now exits an in-principle, 10-year commitment by a total of six partners, including most recently the 12-country ESF Consortium. I now am able to state that the long-term planning goals for ODP have been met, and that Scientific Ocean Drilling rests on a firmer foundation than at any previous time in its entire 19-year history. Furthermore, there is every reason to believe that the planning process will be able to keep pace with upcoming drilling. PCOM will now focus long-range planning on the Central and Eastern Pacific region for the 1990-1991 time frame, and has established plans for COSOD-II to consider post-1991 drilling objectives. Thus, the operational elements of ODP should have ample time to turn these plans into reality.

If your read the above and come to the conclusion that I am bragging, you are correct. However, I believe that all of the above is accurate, and stands as testimony to the entire JOIDES advisory structure of over 200 scientists organized into an interlocking set of panels and committees to devise the best possible set of scientific plans for ODP. I certainly do not claim that the present scientific plan represents the unanimous view of the entire advisory structure, nor do I claim that it will remain unaltered until its execution. Furthermore, this drilling schedule will never attain the accuracy of the Swiss railroad system. Instead, we are planning a program of worldwide oceanographic research by a multinational consortium operating in large part in the territorial waters of underdeveloped countries on a barely adequate budget. The present plan is what government bureaucrats like to call a "living document" that will evolve with new drilling results, new engineering developments, changing political conditions, and purely scientific considerations within the JOIDES advisory structure. It is our continuing goal to provide long-term scientific guidance to ODP while retaining the flexibility to adapt to changing parameters on medium-term, and even short-term time frames. This will continue to be done by an informed, creative group of scientists who make decisions by employing (to quote Ralph Waldo Emerson) "common sense and plain dealing."

Roger L. Larson
Planning Committee Chairman

OPERATIONS SCHEDULE

OCEAN DRILLING PROGRAM
Legs 110-115

LEG	DEPARTS LOCATION	DEPARTS DATE	ARRIVES AT DESTINATION	ARRIVES AT DATE	IN PORT	OBJECTIVE	CO-CHIEF SCIENTISTS
110	Barbados West Indies	25 June	Barbados West Indies	15 Aug	Aug 15-16	Lesser Antilles Forearc	A. Mascle J.C. Moore
111T	Barbados West Indies	17 Aug	Panama, Panama	23 Aug	Aug 23-27	Transit	-------
111	Panama, Panama	28 Aug	Callao, Peru	21 Oct	Oct 21-25	DSDP Hole 504B	K. Becker H. Sakai
112	Callao, Peru	26 Oct	Callao, Peru	19 Dec	Dec 19-21	Peru Margin/ Upwelling Studies	R.von Huene E. Suess
112T	Callao, Peru	22 Dec	Punta Arenas, Chile	2 Jan 1987	Jan 02-03	Transit	-------
113	Punta Arenas, Chile	04 Jan	Port Stanley Falkland Is.	10 Mar	Mar 10-14	Weddell Sea	P.F. Barker J. Kennett
114	Port Stanley, Falkland Is.	15 Mar	Mauritius	10 May	May 10-14	Sub-Antarctic So. Atlantic	P.Cieselski J.LaBrecque
115	Mauritius	15 May	Djibouti or Colombo,Sri Lanka	30 June		S.W.Indian Ridge Fracture Zone	

Revised 6/13/86

SCIENTIFIC OBJECTIVES FOR LEG 110

The following paragraphs are excerpted from the Scientific Prospectus for Leg 110 as prepared by the Ocean Drilling Program. Additional information may be obtained from Elliott Taylor, Staff Science Representative for Leg 110 or Robert Kidd, Manager of Science Operations. Both are located at Texas A&M University, College Station, Texas 77843-3469.

JOIDES RESOLUTION will sail from Bridgetown, Barbados on June 25 and return to Bridgetown on August 19, 1986.

SCIENTIFIC OBJECTIVES

Leg 110 will address the geohydrological problems and structural styles associated with an active accretionary margin by coring, logging and conducting a series of downhole experiments within the Barbados forearc (Fig. 1). In order to accomplish these objectives, a transect of three primary sites (LAF 1, LAF 2 and LAF 3; Fig. 1), perpendicular to the convergent margin, will be drilled in an attempt to better understand the modes and mechanisms of accretionary prism evolution and development. Further, drilling these sites will provide an opportunity to investigate the geohydrological conditions that exist along the decollement between the downgoing oceanic lithosphere and the overlying accretionary wedge (Fig. 2). A reference hole (Site LAF 0, Fig. 1) seaward of the convergent margin will be drilled and logged.

DRILLING PLAN

The overall operational plans for drilling at each of the proposed sites are briefly summarized in Table 1.

Previous experience at DSDP Sites 541 and 542 (Fig. 2) during Leg 78A has shown that penetration of the decollement results in severe hole-cleaning problems and jamming of the drillstring in an overpressured zone between the descending lithosphere and the accretionary wedge. Operations during Leg 78A discovered that the lower surface of the prism was defined by an anomalously porous (75% porosity) smectite mud situated between a less porous (50% porosity) mud. During operations at Site 542, porefluids at near-lithostatic pressure were measured in a thrust fault which splayed off the decollement, implying that the detachment fault also contains overpressured fluids. Therefore, a successful drilling/coring program for Leg 110 requires that the overpressured area be isolated behind casing in order to allow for sampling and testing of the geologic formation. To accomplish this task three options are proposed. In addition to standard rotary drilling and re-entry systems, Leg 110 will employ for operations through the decollement at LAF-1, a triple casing string, drill-in casing and a downhole motor and under-reamer. Sites LAF-2 and LAF-3, however, require only standard ODP operational systems since they are projected to penetrate to the decollement or terminate above the decollement, respectively.

The back-up program for Leg 110 consists of three additional sites (LAF-4, LAF-5 and LAF-6; Fig. 1) as alternates to the primary sites. Piston coring operations are recommended for these sites.

Leg 110 will also include several special experiments which include packer tests, pore pressure and fluid sampling, temperature measurements and logging (including the borehole televiewer). Also, for the first time, a rotatable TAM packer

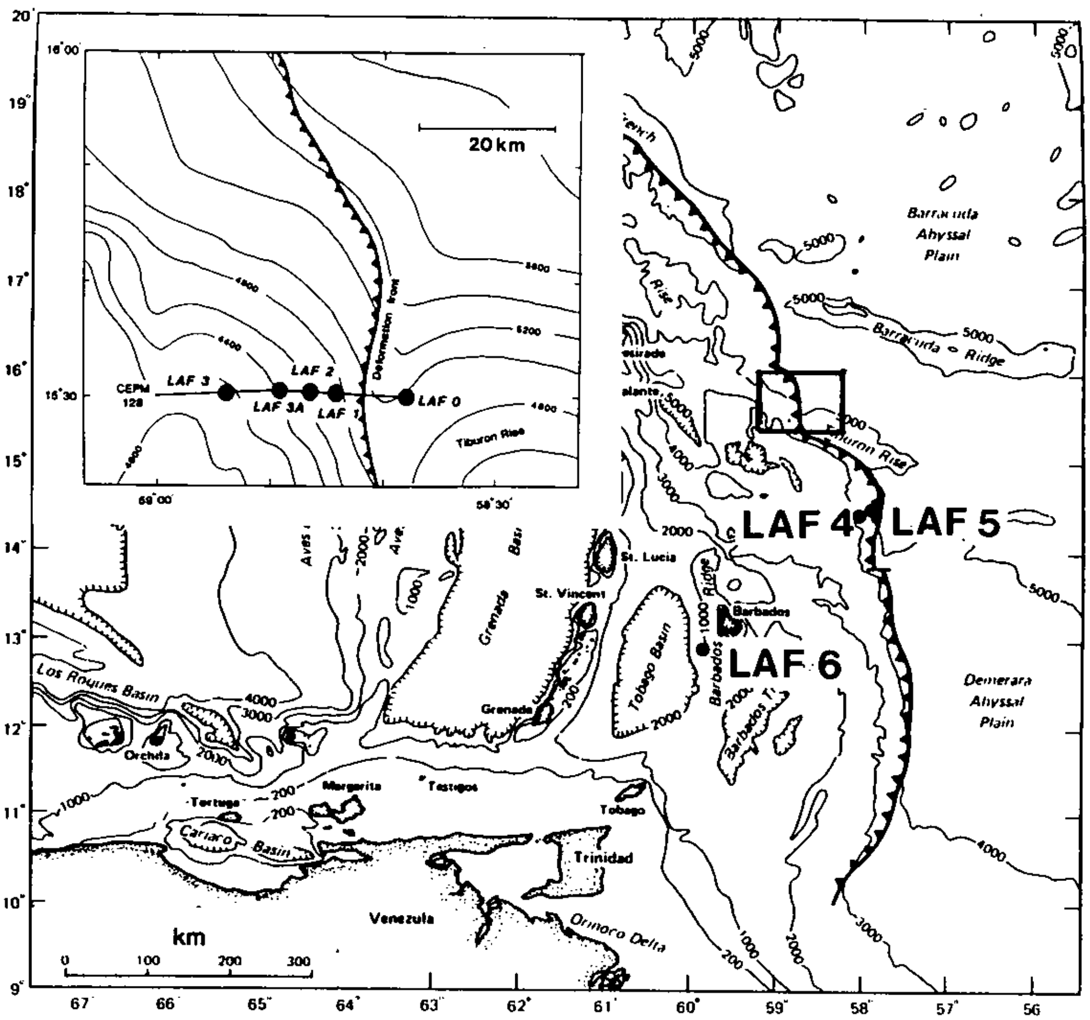


Figure 1. Eastern Caribbean (Bathymetric contours 200 and 1000 m) Inserts are the locations of DSDP Leg 78A and proposed Leg 110 operations areas.

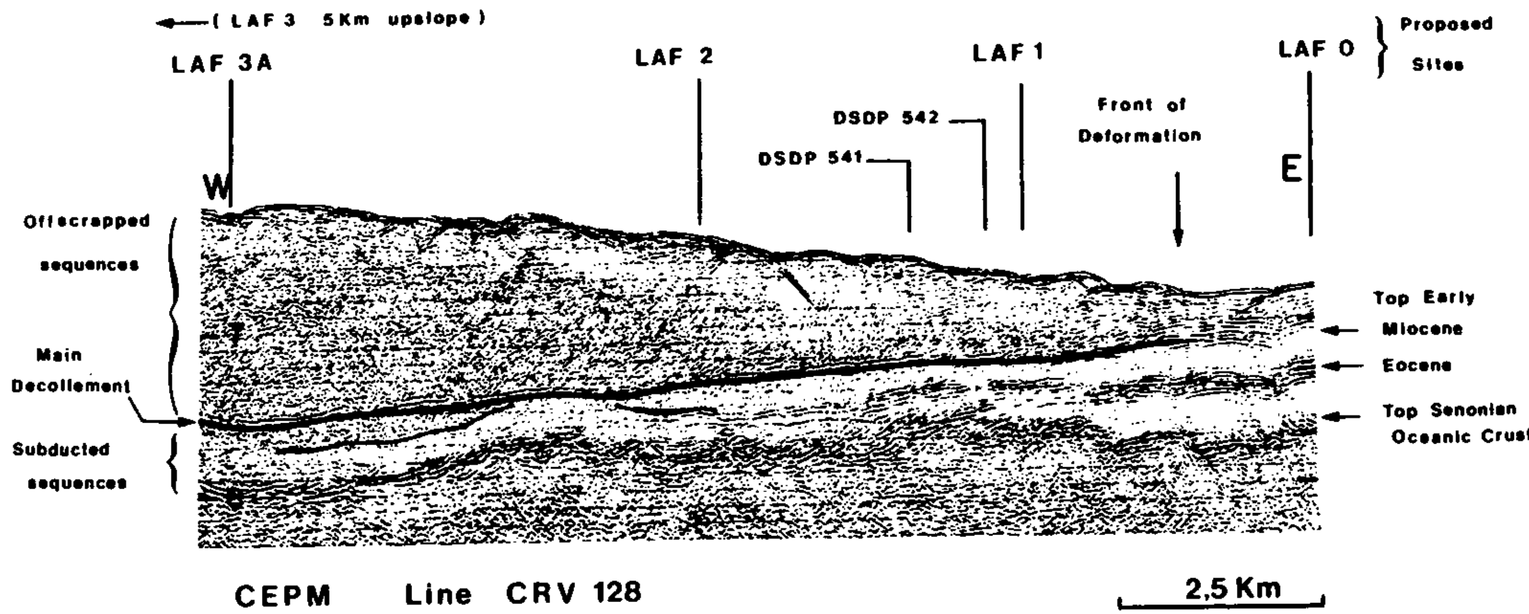


Figure 2. Multichannel seismic profile (time section) across the Barbados forearc with local geological features and location of proposed drillsites (See Figure 1 for location of profile).

TABLE 1
LEG 110 OCEAN DRILLING PROGRAM
LESSER ANTILLES FOREARC

Location of Proposed Sites

SITE No.	LATITUDE	LONGITUDE	WATER DEPTH	MAX. PENETRA.	OPERATIONS	PRIMARY OBJECTIVES
LAF-0	15°30'N	58°38'W	5000	900	Wash/log	Establish logged oceanic reference site.
LAF-1	15°30'N	58°44'W	5025	860	HPC/XCB/Re-entry Logging, Special Experiments	Penetrate and sample décollement; structural, geotechnical, and hydrogeologic character of accretionary wedge.
LAF-2	15°31'N	58°46'W	4800	850	HPC/XCB/RCB Logging, Special Experiments	Structural, geotechnical, and hydrogeologic character of accretionary wedge.
LAF-3	15°30'N	58°54'W	4275	500	HPC/XCB/RCB Logging, Special Experiments	Structural, geotechnical, and hydrogeologic character of accretionary wedge.
*LAF-3A	15°31'N	58°49'W	4650	600	HPC/XCB/RCB Logging Special Experiments	Structural, geotechnical, and hydrogeologic character of accretionary wedge.
*LAF-4	14°20'N	57°53'W	4400	600	HPC/XCB/RCB Logging	Accretion style, structural geology.
*LAF-5	14°20'N	57°46'W	5200	400	HPC/XCB/RCB Logging	Accretion style, folds, thrusts.
*LAF-6	12°48'N	60°05'W	2200	700	HPC/XCB/RCB Logging	Forearc basin Accretion

* Alternate Sites

will complement the TAM Straddle packer on RESOLUTION in testing formation pore pressures and permeability. In addition, the Barnes/Uyeda tool will support pore fluid sampling, temperature measurements and pore pressure measurements.

SAMPLING PLAN

In consultation with the Information Handling Panel, the ODP has made special sampling arrangements for the samples collected on this cruise. An extensive porewater analysis program will be conducted to clearly identify the pathways of pore fluid migration and diffusion through faulted and unfaulted sediments. In addition, detailed geotechnical testing (including consolidation, triaxial and creep tests) and biostratigraphic sampling will be conducted in order to achieve the goals of the entire Program.

SCIENTIFIC OBJECTIVES OF LEG 111

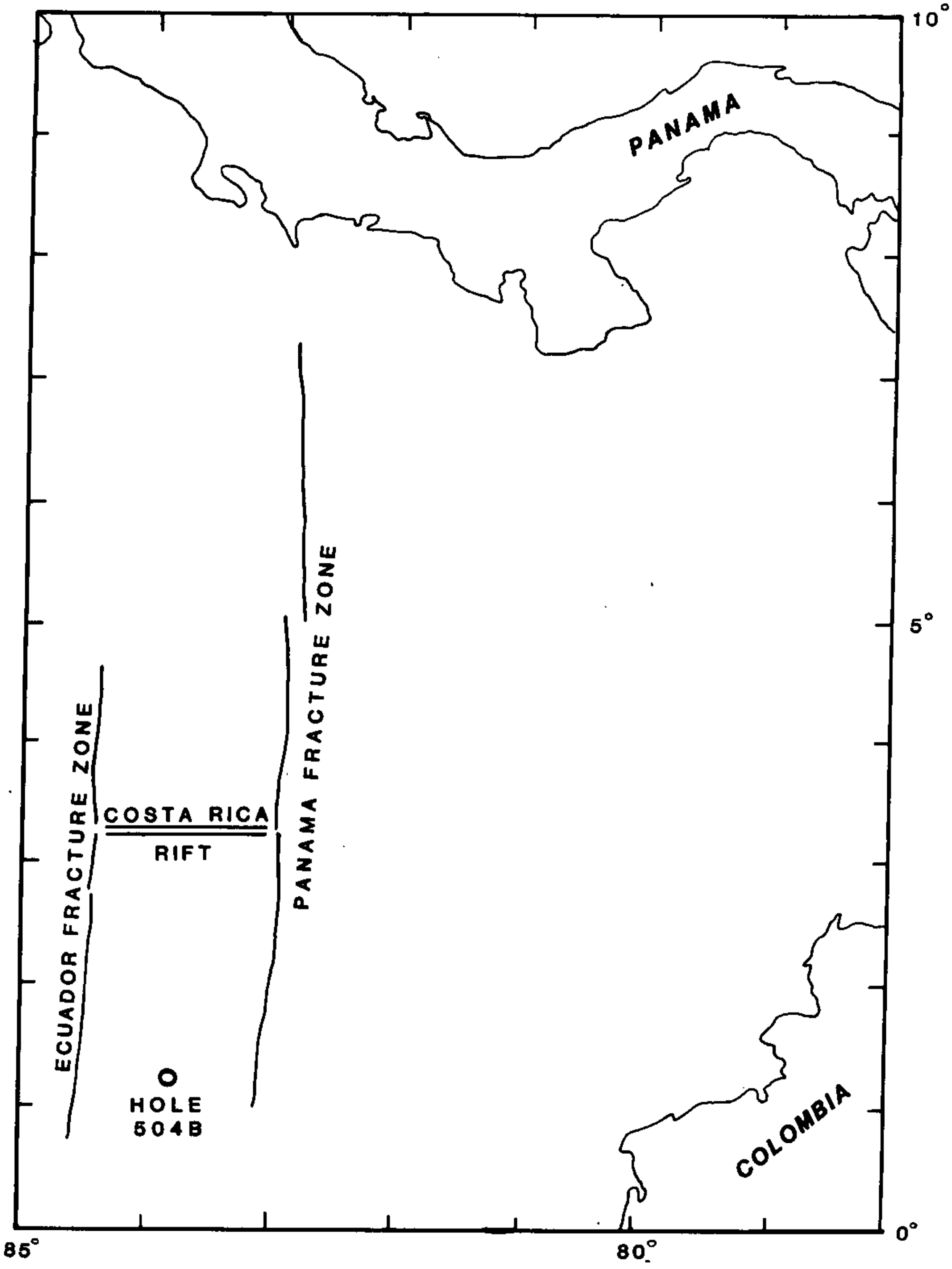
The following paragraphs are excerpted from the ODP FY 87 Program Plan. Additional information may be obtained from Russ Merrill, Staff Science Representative for Leg 111 or Robert Kidd, Manager of Science Operations. Both are located at Texas A&M University, College Station, Texas 77843-3469.

Leg 111 will depart from Panama on 28 August and arrive in Callao, Peru on 21 October 1986. During this 54-day cruise, the drillship will revisit DSDP Hole 504B (Fig. 1) in the Panama Basin which was drilled to a total depth of 1350 m by DSDP Legs 69, 70, and 83. Hole 504B is the deepest penetration to date of normal ocean crust. It is expected that Leg 111 will deepen the hole another few hundred meters in the sheeted dike complex of Layer 2C, possibly putting the layer 2/3 boundary (which corresponds to the transition from the dike complex to underlying gabbros) within reach of one more drilling leg. Such an operation would address one of the principle COSOD objectives, namely, to learn the character and composition of the deep portion of the ocean crust.

In addition to deepening Hole 504B, other important objectives will be attained during the scheduled 14 days of logging and downhole experiments. These will include measurements of borehole temperature and samples of borehole fluid taken immediately upon re-entry in the hole in order to estimate the rate of seawater in-flow to the hole and to examine fluid chemistry before disturbance by drilling operations.

Approximately thirty days will be devoted to deepening the hole. This is to be followed by standard logging runs, packer-permeability tests, long spaced resistivity measurements and vertical seismic profiling (VSP). The latter will provide information on the depth remaining to be drilled before the layer 2/3 transition is reached.

Finally, in order to learn more about ridge-flank hydrothermal systems, up to 5 days will be spent at one or two sites near Hole 504B coring sediments with the Advanced Piston Corer (APC) and the Extended Core Barrel (XCB) to a depth of approximately 275 meters sub-bottom. APC cores of the uppermost 100 meters of seafloor will provide valuable biostratigraphic data for the east-central Pacific Neogene. Finally, collecting profiles of temperature and pore water chemistry, conducting logging and setting a packer in the basement to measure pressure and permeability will test the hypothesis that warm, altered seawater flows upward through the sediments in zones centered over heat-flow highs.


10°
PANAMA
PANAMA FRACTURE ZONE
5°
ECUADOR FRACTURE ZONE
COSTA RICA
RIFT
HOLE
504B
COLOMBIA
0°
85°
80°

ODP SCIENCE OPERATOR REPORT

CRUISES AND SITES COMPLETED

Leg 107

Introduction

The Tyrrhenian Sea is the small triangular sea surrounded by peninsular Italy, Sicily, Sardinia and Corsica (Figure 1). Drilling objectives for Leg 107 of the Ocean Drilling Program considered the Tyrrhenian Sea from three different perspectives: (1) as a backarc basin, (2) as a young, passive margin and (3) as a stratigraphic type locality.

To meet these objectives, D/V JOIDES Resolution drilled a NNW/SSE transect of seven sites across the passive margin and two deep oceanic type basins (Figure 1). More than 3500 meters of sediments and hard-rocks were drilled, in a total of 11 holes. The cruise comprised 45 operational days and 5 days of transit, between 30 December 1985 and 18 February 1986, beginning in Malaga, Spain, and ending in Marseilles, France.

Principle Results

SITE 650 (MARSILI BASIN)

Site 650 is located near the western rim of the Marsili Basin which is the southeastern of two deep basins in the Tyrrhenian Sea. The lithologic units are as follows:

Sedimentary Unit 1: (0-354 m subbottom; age: 0.45 Ma; NN20/NN21) Normally graded thin sequences of gravel- to sand-sized clastics with low carbonate content, interbedded with mud. The normally graded sequences are interpreted as turbidites.

Sedimentary Unit 2: (354-602 m subbottom; age: upper Pleistocene to upper Pliocene: 0.45- 2.0 Ma; NN18/NN19) The upper part of unit 2 (354-546 m subbottom) is predominantly calcareous mud and mudstone, interbedded with thin normally graded clastic sequences interpreted as volcanoclastic turbidites. The lower part (546-602 m subbottom) consists of nannofossil ooze, calcareous muds, pebbly mudstone thin sapropels, and slump deposits. A ten meter thick basal unit of red-brown to greyish green nannofossil ooze, possibly a metalliferous facies, lies in contact with basalt.

Vesicular Basalt: (602-634 m subbottom) The top part of the basalt unit consists of strongly altered glass containing a few scattered skeletal Ca-plagioclase crystals and pseudomorphs after olivine. Further down in the section, the crystallinity increases and the basalt shows intersertal to intergranular texture. Vesicles are large (up to 2 or 3 mm diameter) and abundant (about 20% of rock volume).

Downhole Measurements: Three successful heat flow measurements gave a linear thermal gradient of 14 degrees/hundred meters, implying a heat flow of approximately 4 HFU.

The acoustic basement in the western Marsili Basin is identified as highly vesicular basalt, overlain by an unexpectedly young sedimentary section. It was emplaced as a flow. The contact between the basalt and the sediment was recovered intact, and has been dated as uppermost Pliocene. The basalt now lies at 4100 m subbottom. The high vesicularity of the basalt suggests it may have been emplaced at significantly shallower depths and that the basin has undergone rapid subsidence.

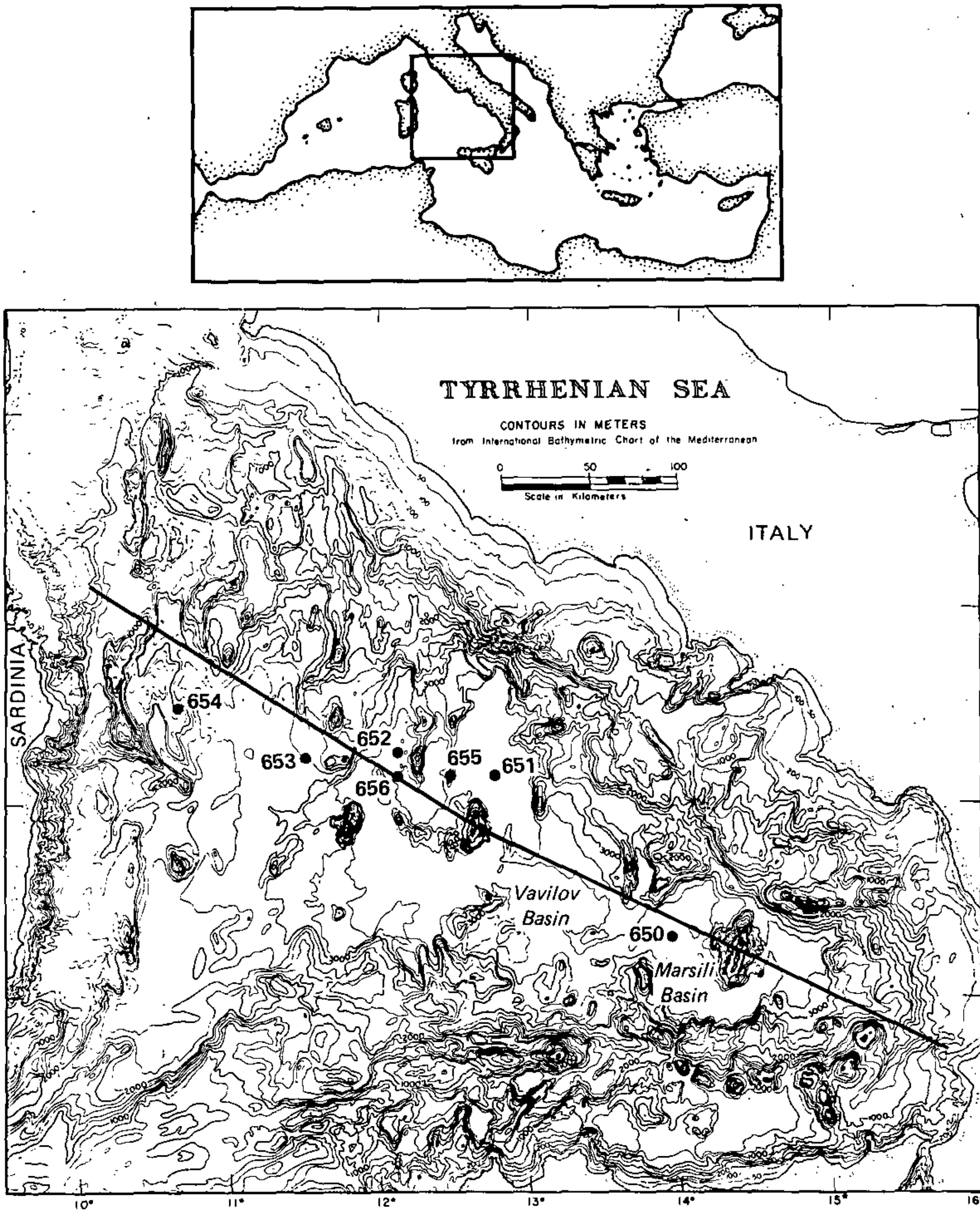


Figure 1: Locations of Leg 107 drillsites 650 to 656.

It has been possible to establish a high-resolution paleomagnetic chronology down to the top of the Olduvai epoch, and to tie this magnetostratigraphy to biostratigraphic datums. Site 650 will thus provide a calibration point between western Mediterranean stratigraphy and open ocean records.

SITE 651 (VAVILOV BASIN)

This site is located on the eastern flank of a basement swell which lies at the axis of the Vavilov Basin. The units recovered are as follows:

Sedimentary Unit 1: (0-136 m subbottom; age: upper Pleistocene) The unit consists mostly of volcanogenic sediments interbedded with volumetrically subordinate marly, nannofossil-rich mud. Beneath the superficial muds, the succession is dominated by pumaceous sand and gravel.

Sedimentary Unit 2: (136-388 m subbottom; age: upper Pleistocene to upper Pliocene) This unit is composed of nannofossil chalk with very subordinate volcanogenic claystone and siltstone turbidites. The upper part of this unit includes volcanoclastic siltstone and sandstone, while the lower part is dominated by nannofossil chalk. A 40-m thick section immediately above basement comprises brilliantly colored dolomite-rich sediment, relatively enriched in Fe and Mn.

Basement Unit 1: (388-464 m subbottom) The upper part of the basement section consists of basalt with carbonate veins, plus carbonate-opal cemented basaltic breccias. The basalt is aphanitic, highly altered, and of low vesicularity. Several distinct flows were recognized.

Basement Unit 2: (464-492 m subbottom) Basement unit 1 grades into basement unit 4 through a complex transition zone. The upper part of the transition zone comprises highly altered peridotite, dolerites and metadolerites, dolomitic chalk, alkali feld-spar rich leucocratic rocks.

Basement Unit 3: (492-522 m subbottom) The lower part of the transition zone includes carbonate-cemented basaltic breccias, a very-coarse-sand to fine-gravel graded layer (possible drilling disturbance), and a few rounded loose pebbles of metabasalt.

Basement Unit 4: (522-551 m subbottom) Highly serpentinized peridotites show a tectonite fabric. Relict mineralogy suggests that these peridotites are prevalently lherzolitic.

Downhole Measurements: Standard downhole measurements (DIL-LSS-GR-CAL and LDT-CNL-NGS) were made from 119 m to approximately 325 m subbottom. In intervals of poor recovery, the logs indicate that volcanoclastics were dominant. The upper part of the sedimentary section is of mostly pyroclastic originand has been extensively reworked by gravitational processes from subaerial source areas including the Roman volcanic province. The lower part of the section records a more normal hemipelagic sedimentary regime, with only minor volcano-clastic input.

The basalts of basement unit 1 probably have tholeiitic to transitional affinity. The peridotites may represent a young upper mantle protrusion related to the stretching and rifting of the Tyrrhenian basement.

SITE 652 (LOWER SARDINIAN CONTINENTAL MARGIN)

Site 652 is situated on a small tilted block of the lower Sardinian Margin. The sedimentary units are described as follows:

Sedimentary Unit 1: (0-55 m subbottom; age: Pleistocene) This unit consists mainly of gray calcareous mud and gray mud, with volcanic glass as a common minor constituent. The succession includes four distinct sapropel layers.

Sedimentary Unit 2: (55-188.2 m subbottom; age: lower Pleistocene-Pliocene) Sedimentary unit 2 consists of marly nannofossil oozes. Four sapropel layers were found. The interval between 65-113 m subbottom contains relatively abundant volcanic glass. The bottom of this unit shows intense red and brown oozes directly above the Mio/Pliocene boundary.

Sedimentary Unit 3: (188.2-188.6 m subbottom; age: uppermost Messinian) This unit is a transitional interval between the normal marine Pliocene and the barren Messinian sediments. The unit is composed of a succession of cm-thick layers of strongly colored clay and mud.

Sedimentary Unit 4: (188.6-345 m subbottom; age: probable upper Messinian) The interval 188.6-286 m subbottom is dominated by gray, thinly bedded, gypsum- and carbonate-bearing sandy mud, interpreted as turbidites. From 286 to 335 m subbottom frequent water escape structures, syn-sedimentary microfaults and microbreccias were observed. The lowest core of the unit recovered only fourteen smooth, rounded pebbles of sedimentary and low-grade metamorphic origin known in the southern Apenneninic and/or the Sicilian Maghrebide mountain chains.

Sedimentary Unit 5: (345-721 m subbottom; age: undetermined, probable Messinian) The interval 345-684 m subbottom is characterized by a succession of dark gray, well-graded and cross-bedded, gypsum- and carbonate-bearing sandy muds, with several cyclic zones containing up to 5-cm-thick crystalline anhydrite. From 684 to 721 m subbottom, sedimentary unit 5 is very indurated and contains highly variable detrital elements.

Downhole Measurements: Five successful heat flow measurements gave a thermal gradient of 14°/100 m, for an average heat flow of about 4 HFU. The hole was logged between 78 and 375 m subbottom with a DIL/LSS/GR/CALI combination and a GST/NGT/CNTG combination.

The pre-Pliocene section at Site 652 is characterized by a thick sequence of subaqueously deposited, clastic sediments. The environment of deposition seems to have been highly variable through time. The pebble horizon may indicate a temporary fluviatile or beach environment. We consider that the most probable sedimentary environment for the pre-Pliocene units is lacustrine.

The strong red-brown coloration around the Miocene/Pliocene boundary is attributed to iron oxides, suggesting that sediments which had been subaerially weathered during the Messinian drawdown were reworked during the terminal Messinian transgression. The Plio-Pleistocene sediments are characterized by open marine conditions, with a small volcanic influx. Interbedded sapropels reflect the recurrence of anoxic conditions during the late Pliocene and Pleistocene.

SITE 653 (REOCCUPATION OF DSDP SITE 132)

This site was located one-half mile northeast of DSDP Site 132, on the eastern rim of the Cornaglia Basin in the western Tyrrhenian Sea. Two major sedimentary units were recovered:

Sedimentary Unit 1: (Hole 653A: 0-220 m subbottom; Hole 653B: 0-216 m subbottom; age: Pliocene-Quaternary) In general, unit 1 represents an interval of open-marine hemipelagic to pelagic sedimentation; the sediments are dominantly nannofossil ooze and foraminiferal-nannofossil ooze. The unit can be divided into: (1) subunit 1A, characterized by a lower carbonate content and the occurrence of sapropels, clastic and volcanic ash layers; (2) subunit 1B, characterized by a higher carbonate content and the absence of sapropels, clastic layers and volcanic ash layers; (3) subunit 1C, characterized by a reddish and yellowish coloration attributed to iron oxides.

Sedimentary Unit 2: (Hole 653A: 220-240.7 m subbottom; Hole 653B: 216- 264.3 m subbottom; age: Messinian) Unit 2 includes sediments deposited in restricted marine to evaporitic and subaerial environments. Lithologies present include biotite- and gypsum-bearing sand, calcite-cemented siltstone, nannofossil mud, dolomitic nannofossil mud, calcareous mud, nannofossil- and foraminifer-bearing marly calcareous mud, and brilliant yellow and red mud and silt.

Downhole Measurements: Five heat flow measurements in Hole 653A revealed a thermal gradient that decreases steeply downsection from 12.9°/100 m in the top of the hole to 5.04°/100 m near the base of the hole.

The section at Site 653 is very similar to that recovered at DSDP Site 132. The quality and quantity of core recovered seem suitable for the high-resolution shore-based stratigraphic studies which were the main objective ofthis site.

SITE 654 (UPPER SARDINIAN MARGIN)

This site is located on a fault-bounded, tilted block on the upper margin of Sardinia. Seismic lines across Site 654 exhibit a geometry suggestive of pre-rift, syn-rift and post-rift sequences. Six major sedimentary units are present:

Sedimentary Unit 1: (0-242.7 m subbottom; age: Pleistocene and Pliocene) Unit 1 consists of nannofossil ooze with subordinate calcareous mud, and minor terrigenous clastics, volcanic ashes and probable sapropels. An interval of non-vesicular, aphanitic, olivine-phyric basalt was encountered between 71 and 73 m subbottom, near the Pliocene-Pleistocene boundary.

Sedimentary Unit 2: (242.7-312.6 m subbottom; age: Messinian) Unit 2 comprises gypsum interbedded with calcareous clay, mudstone, minor sandstone, breccia, dolostone, anhydrite and very rare nannofossil chalk. Numerous discrete intercalations of gypsum were penetrated. Structures indicative of current activity are common in the intra-gypsum clastic layers. Evidence of sedimentary instability is sparse.

Sedimentary Unit 3: (312.6-348.9 m subbottom; age: inferred lower to middle Messinian) Unit 3 is dominated by dark-colored, finely laminated, organic carbon-rich claystone and dolomitic/calcareous siltstone, with minor volcanic ash. Syn-sedimentary debris-flows, convolute-laminations and microfaults are common.

Sedimentary Unit 4: (348.9-403.9 m subbottom; age: upper Tortonian to lowermost Messinian) Unit 4 comprises homogeneous, highly burrowed nannofossil ooze. The benthic foraminfer assemblages are interpreted as suggesting a slight shoaling of the water depth downsection; while the nannofossil assemblages suggest a downsection trend from open marine to more restricted marine environment. Trace quantities of asphaltine hydrocarbons were found in the upper part of this unit.

Sedimentary Unit 5: (403.9-415.7 m subbottom; age: not determined) This unit comprises polymict glauconitic sandstone and marly calcareous chalk with large forams and fragments of molluscs and echinoderms. The base of the unit is marked by large, thick-walled oyster shells.

Sedimentary Unit 6: (415.7-473.8 m subbottom; age: indeterminate) Unit 6 comprises reddish gravel-bearing calcareous mudstones, underlain by matrix-supported conglomerate, gravel and gravelly mudstone. The pebbles consist mostly of limestone, marble, dolostone and quartzitic rocks, and are subrounded.

Downhole Measurements: A series of four heatflow measurements gave an average thermal gradient of 4.2^{o}C/100 m or approximately 1.20 HFU (50 mW/m^{2}-sec).

The Plio-Pleistocene section (unit 1) was deposited under open marine conditions. The basalt interval is interpreted as a flow. The sediments deposited during the latter part of the Messinian salinity crisis (unit 2) represent an alternation between intervals of hypersaline and less saline conditions. Unit 3, deposited during the earlier part of the Messinian drawdown, is thought to have accumulated in an organically productive sea. The lowermost 140 m of Hole 654A contain a textbook example of a transgressive sequence. Unit 6 is interpreted as an alluvial fan deposit; the shallow-water macrofauna of unit 5 suggest a coastal marine environment; and the nannofossil oozes of unit 4 suggest a gradually deepening, fertile, open-marine sea. We attribute this transgressive sequence to rapid subsidence of the continental crust during the rifting stage of the Tyrrhenian Basin.

The pebbles in the unit 6 conglomerate are inferred to be derived from an erosional uncomformity which is observed on seismic reflection profiles up-dip (i.e. east) of the site. The lithologies recovered suggest that the pre-rift unit of the tilted block comprises a deformed and metamorphosed carbonate platform and its underlying quartzitic basement.

SITE 655 (WESTERN RIDGE OF VAVILOV BASIN)

This site was located near the crest of a north-south trending ridge which lies near the inferred contact between oceanic and continental crust at the western rim of the Vavilov Basin:

Sedimentary unit: (Hole 655A: 0-79.9 m subbottom; age: upper Pliocene (MPl-4) to Quaternary) The dominant sedimentary lithology is a marly nannofossil ooze, with occasional volcanoclastic layers and detrital sand layers. Six sapropels and/or sapropelic layers occur in the Pleistocene sequence. The lower 6 m overlying basement exhibit a downsection color change from pale yellow to brown.

Basement unit: (Hole 655B: 79.9-196.1 m subbottom; age: inferred 3.4-3.6 Ma) This unit consists of basalt, with little obvious vertical variability in modal composition or structure. The basalt is generally aphanitic, but with occasional large (up to 2-3 mm) phenocrysts of plagioclase. Chilled glass margins were observed throughout the basalt unit, spaced an average of 2m apart. The entire basalt section is reversely magnetized.

Sediment within the basalt: Throughout the basalt unit veins and fractures were filled with indurated limestones. Planktonic foraminifers of biozone MP1-4 and nannofossils of biozone NN15 are present in these carbonates.

Downhole Measurements: Three heat flow measurements in Hole 655A yielded amean heat flow value of approximately 2 HFU. One logging run was completed in Hole 655B with a DIL-LSS-GR-CALI combination.

Site 655 was designed to identify the nature of basement of a linear ridge located near the transition between stretched continental and inferred oceanic crust. The curved, glassy rims of the basalts suggest that the ridge is constructed of pillow basalts. The magnetic inclination values of 50-60 degrees indicate that the pillow stack has not been tectonically disrupted. Magnetic and paleontologic observations suggest that the age of the basalt is 3.4-3.6 Ma.

SITE 656 (LAST TILTED BLOCK OF THE SARDINIAN MARGIN)

Site 656 was located on the westward flank of de Marchi seamount, which is the easternmost continental fault-bounded tilted block on the lower Sardinian margin. Four sedimentary units were recovered:

Sedimentary Unit 1: (Hole 656A: 102.8-131.3 m subbottom; Hole 656B: 55.5-83.9 m subbottom; age: upper Pleistocene) Unit 1 contains detrital and volcanogenic sediments, mostly fine-grained, with a subordinate fraction of biogenic carbonates. The detrital component includes zircon, pyroxene and blue amphibole; the latter suggests a high pressure/low temperature metamorphic source terrain.

Sedimentary Unit 2: (Hole 656A: 131.3-169.7 m subbottom; Hole 656B: 83.9-93.3 m subbottom; age: middle Pleistocene to lower Pliocene) Unit 2 consists of nannofossil ooze and less abundant foraminifer-nannofossil ooze, with minor zeolite-bearing sandy mud layers, volcanic glass, and micrite.

Sedimentary Unit 3: (Hole 656A: 169.7-179.1 m subbottom; hole 656B: 93.3-105.6 m subbottom age: Hole 656A: undetermined; Hole 656B: lower Pliocene) Unit 3 is mostly homogeneous, structureless calcareous dolomitic mud.

Sedimentary Unit 4: (Hole 656A: 179.1-236.4 m subbottom; hole 656B: 105.6-121.8 m subbottom; age: pre-Pliocene, possibly Messinian) The major lithology of unit 4 is a conglomerate containing clasts of the following lithologies: greenish siltstone and fine-grained sandstone, altered greenstone, red chert, white chert, silicified micritic limestone, limonitic clay, pyrite, chalcopyrite, galena, amphibole-rich rocks, mudstones, altered metagabbro, amphibolite, metadolerite, chloritic marble, and metaquartzite. The matrix is a red carbonate mud.

Units 1 and 2 were deposited in a normal open marine environment, however part of unit 2 (from lower Pliocene to lower Pleistocene) is very condensed and contains at least two major hiatuses. Unit 3 represents a transition in age from lower Pliocene to probable Miocene and in facies from open marine to continental environment. This observation verifies that the lower Sardinian continental margin was not a lowstanding evaporitic-collecting basin during the Messinian. Unit 4 includes numerous basement rock types of alpine orogenic units, confirming the continental affinity of this thin crust.

CONCLUSIONS

In this very preliminary report, we choose to emphasize two outstanding results. First, the Tyrrhenian Sea is very young and has evolved extremely quickly. Second, the locus of intense tectonic activity and of oceanic crust formation has migrated through time from northwest to southeast, i.e., towards the subduction zone.

On the upper Sardinian margin (Site 654, Figure 2), rifting began in the upper Tortonian and slowed significantly or stopped in the upper Messinian. In contrast, on the lower Sardinian margin (Sites 652 and 656), rifting was apparently initiated during the Messinian and probably ended in the lower Pliocene. Rifting and subsidence thus appear to be diachronous across the continental margin.

By the Messinian, rifting and subsidence of what is now the upper and middle Sardinian margin were sufficiently advanced to allow deposition of basinal evaporites at Sites 654 and 653. Rifting and subsidence on what is now the lower Sardinian margin was apparently less advanced; thus the Messinian facies at Sites 652 and 656 are lacustrine and subaerial, respectively. Since the water depth at Site 654 is now 1.3 km shallower than at Site 652, a drastic reorganization of the morphology of the ancestral Tyrrhenian basin must have occurred during and since the Messinian; we attribute this reorganization to progressive rifting.

Neither Vavilov nor Marsili Basin seems to have existed as a deep oceanic basin during the Messinian. Just as the locus of intense rifting migrated from northwest to southeast, a comparable shift in the location of crustal accretion occurred from the northwestern deep basin (Vavilov) to the southeastern deep basin (Marsili). Basalts cored in the Vavilov Basin (Sites 655 and 651) are inferred to be approximately 3.5 million years old (biostratigraphic control). Age of the basalt drilled in the Marsili Basin (Site 650) is biostratigraphically and magnetostratigraphically constrained at 1.6-1.9 Ma. Therefore, injection of basaltic crust began at least 1.5 million years later in Marsili Basin than in Vavilov Basin.

The scientific party aboard JOIDES RESOLUTION for Leg 107 of the Ocean Drilling Program consisted of:

Kim Kastens, Co-Chief Scientist (L-DGO); Jean Mascle, Co-Chief Scientist (France); Christian Auroux, Staff Scientist (TAMU); Enrico Bonatti (L-DGO); Christina Broglia (L-DGO); James Channell (Univ. of Fla.); Pietro Curzi (Italy); Kay-Christian Emeis (TAMU); Georgette

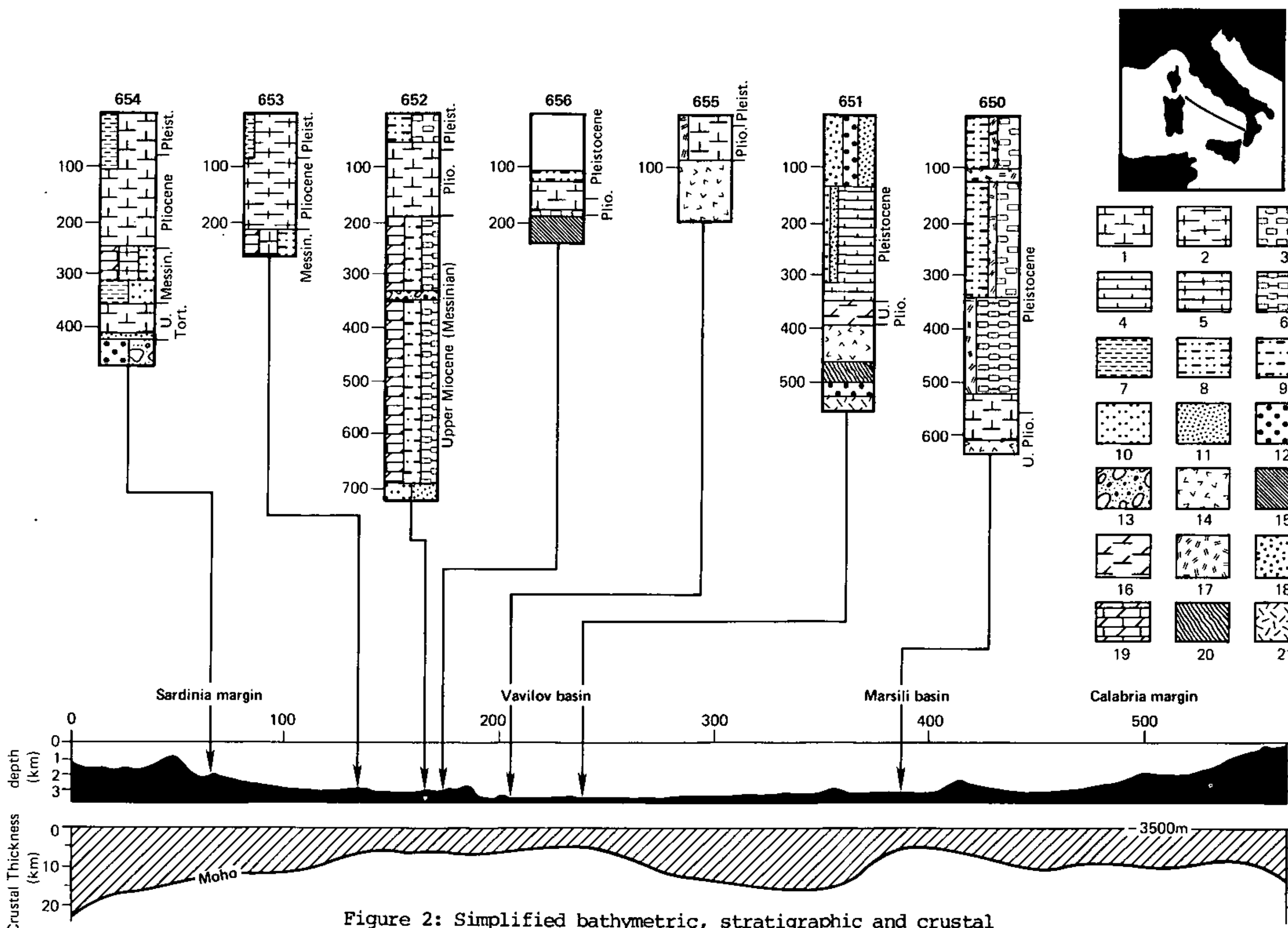


Figure 2: Simplified bathymetric, stratigraphic and crustal cross-section across a NW-SE transect of the Tyrrhenian Sea.

Glacon (France); Shiro Hasegawa (Japan); Werner Hieke (FRG); George Mascle (France); Floyd McCoy (L-DGO); Judith McKenzie (Univ. of Fla.); James Mendelson (MIT); Carla Muller (FRG); Jean-Pierre Rehault; (France); Alastair Robertson (UK); Renzo Sartori (Italy); Rodolfo Sprovieri (Italy); Masayuki Torii (Japan).

Leg 108: Preliminary Results

Introduction

Leg 108 of the Ocean Drilling Program, which began on February 21, 1986 in Marseilles, France and ended on April 17, 1986 in Dakar, Senegal drilled 12 sites in the eastern Equatorial Atlantic and along the northwest African margin. The geographic positions of these sites (Tab. 1; Fig. 1) provide a transect spanning 22^{o} of latitude designed to answer the objectives listed above. The majority of the holes were cored continuously with double or tripleAPC coring to refusal at all sites. XCB-drilling was used when further penetration was required. In excess of 3.8 km of sediment was recovered during Leg 108.

During Leg 108, continuous curves of magnetic susceptibility and P-wave velocity data allowed for the first time in the history of ocean drilling a continuous high-resolution correlation between holes and even between sites. Down-hole logging was unsuccessfully attempted at two sites.

Drilling Results

SITES 657 - 659

Sites 657 through 659 were selected to investigate the late Neogene paleoceanography of the Canary Current, the paleo-productivity history ofthe upwelling region offshore from Cape Blanc, and the wind-blown dust component of sediments in this region.

SITE 657

Site 657 lies on the lower continental rise 380 km west of Cape Blanc (Tab. 1; Fig. 1) and was drilled on a smooth plain of a distal turbidite fan into a well-layered, thick seismic sequence that appears relatively undisturbed. The recovered 178 m thick sequence consists of two major, mainly pelagic lithostratigraphic units. Excellent biostratigraphic control combined with the careful correlation of distinct units indicates that an early complete uppermost Miocene to Holocene sequence was obtained.

The lower Pliocene through Holocene sedimentological record oflithologic Unit 1 was dominated by the deposition of pelagic nannofossil ooze cycles which vary from light to dark grey in color and alternate in bearing foraminifers and wind-blown silt and clays. The amplitude of the sediment cycles has markedly increased during the last 2 m.y. The influence of the Canary Current at this site is registered by planktonic foraminifers characteristic of cool water and which occur in the sediment record as farback as the early Pliocene. Including several small turbidites throughout the section, the average sedimentation rates vary from 20 to 28 m/m.y. for the interval representing the last 4.6 m.y., and indicate an ongoing regime of low oceanic productivity.

The record of pelagic sedimentation is broken twice at about 0.7 Ma (sub-Unit 1b) and about 3.8 Ma (sub-Unit 1d) by episodes of gravitational sedimentation. Based on the high organic carbon content, the source of the greenish gray mudflow

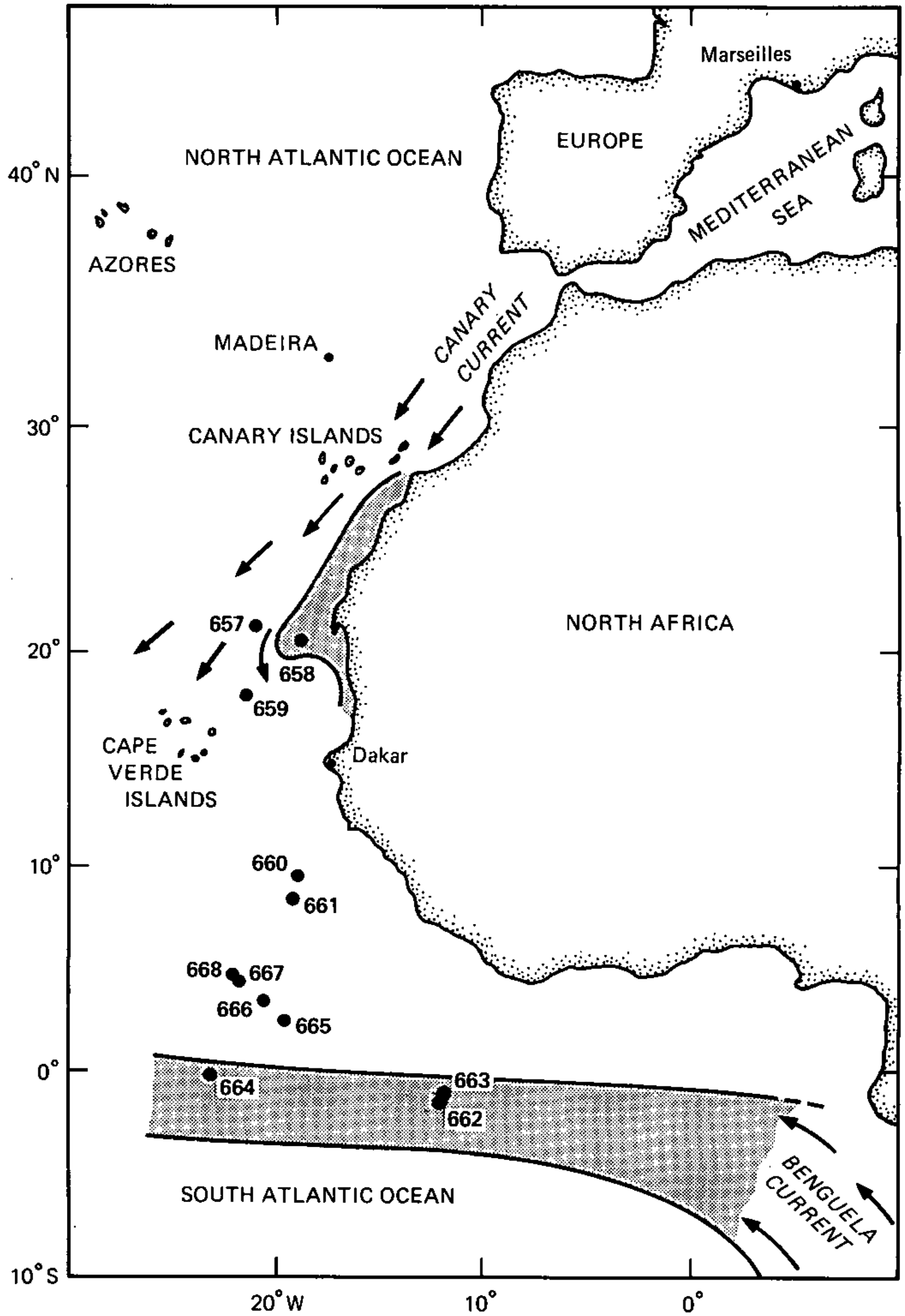


Figure 1: Geographic position of Leg 108 drillsites. Arrows mark major current systems; shaded areas indicate regions of strong Plio-Pleistocene upwelling and divergence.

TABLE 1

SITE	HOLE	LATITUDE	LONGITUDE	WATER DEPTH (m)	SUB-BOTTOM DEPTH (m)	OLDEST SEDIMENT (Ma)	LITHOLOGY (type)
657	A	21°19.89'N	20°56.93'W	4221.8	178.2	about 8.0	zeol. clay
657	B	21°19.89'N	20°56.93'W	4226.8	166.1	about 9-10	red clay
658	A	20°44.95'N	18°34.85'W	2262.8	300.4	3.5-3.8	nanno-ooze
658	B	20°44.95'N	18°34.85'W	2262.8	163.8	about 2.4	silic-ooze
658	C	20°44.95'N	18°34.85'W	2262.8	72.9	0.5	nanno-ooze
659	A	18°04.63'N	21°01.57'W	3069.8	273.8	about 24	clay
659	B	18°04.63'N	21°01.57'W	3069.8	202.0	about 11.0	clay
659	C	18°04.63'N	21°01.57'W	3069.8	72.5	<9.0	nanno-ooze
660	A	10°00.81'N	19°14.74'W	4327.8	163.7	mid. Eocene	rad-ooze
660	B	10°00.81'N	19°14.74'W	4327.8	148.8	mid. Eocene	rad-ooze
661	A	09°26.81'N	19°23.17'W	4005.8	296.1	mid-upp. Cret.	clay
661	B	09°26.81'N	19°23.17'W	4005.8	81.7	about 8.0	clay
662	A	01°23.41'S	11°44.35'W	3821.3	200.0	about 3.6	nanno-ooze
662	B	01°23.41'S	11°44.35'W	3821.3	188.2	about 3.6	nanno-ooze
663	A	01°11.87'S	11°52.71'W	3855.3	147.2	<2.7	nanno-ooze
663	B	01°11.87'S	11°52.71'W	3706.0	152.0	<2.7	nanno-ooze
664	A	0°06.44'N	23°13.65'W	3806.0	28.9	about 0.7	nanno-ooze
664	B	0°06.44'N	23°13.65'W	3806.0	247.0	about 4.5	nanno-ooze
664	C	0°06.44'N	23°16.5'W	3810.0	61.2	about 1.4	nanno-ooze
664	D	0°06.44'N	23°16.5'W	3807.0	296.8	about 9.0	nanno-ooze

that comprises sub-Unit 1b is a high-productivity area at the nearby continental slope of northwest Africa such as sampled at Site 658. The slump fold of sub-Unit 1d is most likely locally derived based on its similar composition to the underlying and overlying sediments.

A hiatus of 1.5 m.y. representing most of the Messinian (4.6 to 6.0Ma) occurs at 145 m subbottom in Hole 657B, at the top of lithologic Unit 2. This hiatus corresponds in time to a major lowering of the CCD, possibly associated with a major event of bottom-water circulation at about 4200 m water depth. The upper Miocene sediment cycles present in Unit 2 are brownish nannofossil bearing and barren silty clay. Similar to the low carbonate content, the low sedimentation rates which decrease downhole from 7 m/m.y. (6 to 6.6 Ma) to 2.5 m/m.y. (until 8.4 Ma), indicate a sedimentation regime near or below the CCD, in a low oceanic productivity region dominated by the deposition of little wind blown silty clay. In addition, occasional deposition of sand and silt by turbidity and/or contour currents continued into the Miocene.

SITE 658

Site 658 is located on the continental slope 160 km west from Cape Blanc, at 2263 m water depth (Tab. 1; Fig.1). Site 658 cored, for the first time in the history of "DSDP/ODP", hemipelagic sediments lying directly underneath one of the major nearshore cells of permanent oceanic upwelling in the world ocean. Also, these sediments were deposited in the central region of dust supply from the northern trade winds which control upwelling intensity. At Site 658, 3 holes were cored to a total penetration depth of 300.4 m subbottom into a largely undisturbed, pillow-shaped seismic sediment section near the outer margin of a protruding terrace on the slope, a position which should restrict lateral sediment input from near-bottom down-slope transport. Eight cores from Hole C were dedicated to special organo-chemical analysis.

The lower Pliocene to Holocene sediment section comprises three major hemipelagic lithologic units. Unit 1 consists of gray to olive gray nannofossil ooze grading into a diatom-nannofossil ooze deposited during the last 0.7 m.y. The sediments include minor amounts of quartz silt and foraminifers. Cyclic variations of the measured carbonate content (28-69 %) and of organic carbon (up to 2.3 %) occur through the unit. Unit 2 consists of olive to olive gray cyclic nannofossil ooze interbedded with mixtures of calcareous, siliceous, and siliciclastic sediments and is late Pliocene to early Pleistocene in age. This unit contains the highest contents of biogenic opal according to bulk grain-density data and up to 3.3 % organic carbon, while carbonate decreased to 19-50 %. Unit 3 contains lower and upper Pliocene cycles of gray to dark gray nannofossil-bearing mud to nannofossil ooze with up to 3 % organic carbon but only minor amounts of siliceous biogenic debris.

Good paleomagnetic and biostratigraphic time control indicate exceedingly high sedimentation rates of 146 m/m.y. for the last 0.7 m.y., a hiatus from 0.7-1.5 Ma, medium high rates of 68 m/m.y. from 1.5-2.5 Ma and again, very high rates of 112 m/m.y. from 2.5-3.7 Ma.

The ongoing hemipelagic deposition during the last 3.7 m.y., combined with the very high sedimentation rates, provided an excellent record of the history of the Cape Blanc upwelling cell and its ongoing exceptionally high organic productivity. After 0.7 Ma, it fluctuated in cycles of approximately 100 Ky depicted by the varying contents of organic carbon and diatomaceous silica. Both variables were particularly abundant prior to 1.5 Ma. The change in sedimentation rates occurring at 2.5 Ma and a uniform increase in both $CaCO_3$ and biogenic opal subsequent to 3.1 Ma may signify important changes in productivity. They may be related to thresholds of the major climatic deterioration during late Neogene times, with cause and effect relationships between upwelling productivity and climatic change being considered plausible. However, only estimates of mass accumulation rates and time series analyses will provide possible insights into the actual variations of upwelling productivity and its implications for the climate. In addition, the lowtemperature regime of the upwelling cell may have caused the first and last-occurrence datums of some planktonic species to occur at times similar to those found in transitional and higher latitudes of the Atlantic.

The varying nearshore input of wind-borne and possibly river-borne fine-grained siliciclastic sediment was most abundant prior to 3.1 Ma and lowest from 3.1-1.5 Ma. The detection of both the actual trade-wind signal and the proportions of fluvial mud indicating Saharan humidity in this fraction will require detailed laboratory work.

The major hiatus spanning from about 0.7 to 1.5 Ma corresponds to two adjoining slump-style pinch-out structures on the seismic record from near the site. The resulting mass flow is considered similar in composition and age to a slump deposit found at companion Site 657 on the continental rise.

Below the hiatus, two independent quantitative estimates suggest a correlation of lithologic Unit 2 with a bowl-shaped, almost transparent seismic section assuming seismic velocities near 900-950 m/s which would indicate free gas in the sediment. This assumption is in harmony with the high content of biogenic gas in the sediment cores, particularly below 90 m subbottom, probably the result of the high content of organic carbon, with the methane-ethane ratio increasing downhole from 5000-6000 at 60 m to 1250 at 300 m subbottom.

Curves from magnetic susceptibility data enabled us to establish a detailed composite depth section of Holes A and B down to 90 m subbottom, despite numerous artificial voids in the core recovery because of extensive degassing in the core liners.

SITE 659

Site 659, one of the two "non-upwelling" reference sites, is located near DSDP Site 368 on top of the smooth Cape Verde Plateau near the east Atlantic continental margin (Tab. 1; Fig. 1), a plateau which was formed during the early Miocene (Lancelot, Seibold, et al., 1978). The upper portion of the seismic record at Site 659 is finely laminated, almost transparent with a thick series of stronger seismic layering underneath.

The Neogene sediment section recovered at Site 659 is 273.8 m thick and comprises two major lithologic units with good magnetic stratigraphy for the last 3 m.y. and good biostratigraphic time control until the Oligocene/Miocene boundary. Thus, one of the few continuous and complete pelagic sediment sections for calcareous biostratigraphy of the middle and late Miocene was recovered at this site. Lithologic Unit 1 consists of 166m of Pleistocene to upper Miocene pelagic sediment cycles of light gray foraminifer-nannofossil ooze interbedded with whitish nannofossil ooze,including minor amounts of silt and clay. The sediment cycles during the last 2 m.y. have large amplitudes and are distinguished from the underlying cycles formed 4.6 to 2.0 Ma by their uniformly lower carbonate content and more moderate foraminifer preservation, which again decreased between 4.6 and 7.0 Ma. Lithologic Unit 2 consists of Miocene nannofossil ooze in cycles interbedded with silty nannofossil ooze. In the upper portion formed 11.2 to 7.0 Ma, it is grey to yellowish brown. The lower portion of Unit 2 is bluish green, shows stronger variations of $CaCO_3$ and was deposited between 24 and 11.2 Ma. It contains a volcanic ash layer at 233 m subbottom that parallels ash layers at the nearby Site 368 which were ascribed to the early Miocene maximum of volcanic activity on the Cape Verde Islands (Lancelot, Seibold, et al., 1978).

The deposition rates varied from 30 m/m.y. during the last 4.6 m.y.to 13 m/m.y. from 4.6-9.0 Ma. They were 4 m/m.y. from 9.0-14.4 Ma and 6 or 8 m/m.y. from 14.4 Ma to a long-lasting hiatus from 18.5-23.5 Ma. These rates can be applied to the thickness of the sediment cycles, which varies from 30-140 cm in Unit 1 to 15-90 cm in Unit 2. As a result, the cycles represent time intervals of about 10,000 to 90,000 yrs. which are in the order of Milankovitch-type climatic cycles. The sediment cycles may be largely a product of fluctuating carbonate dissolution, but in part may be also caused by a fluctuating supply of wind-borne siliciclastic sediment, particularly during the last two m.y. when more abundant clay and silt particles indicate an increased dust flux from the Sahara. Low-amplitude sediment cycles already changed to high-amplitude cycles near 3.2 Ma, i.e.an age clearly preceeding the onset of major northern hemisphere glaciation at about 2.5 Ma.

Also, planktonic foraminifers (common N. pachyderma) record a very early onset of enhanced cold-water advection by the Canary eastern boundary current to the Site 659 region, as early as about 2.9 Ma. On the otherhand, N. pachyderma was common at the more northerly Site 657 throughout the Pliocene since 4.6 Ma. This difference may imply that the anti-clockwise warm-water eddy east of the Cape Verde Islands was much more active prior to about 2.9 Ma than later. This eddy is driven by monsoonal winds from the southwest during summer and carries warm water to as far as about 21^{o} N and also to Site 659. The change suggests a decrease of the monsoon winds as well.

Finally, the striking change of sediment color during ongoing sedimentation near 11 Ma and the change in sedimentation rates and $CaCO_3$ dissolution at 4.6 Ma may signify major events of deep-water paleoceanography. The younger event is also observed at some neighboring sites in greater water depths (Sites 657, 660, and 661).

SITES 660 and 661

These two sites lie on a depth transect positioned near the upper boundary of a bottom water mass mixed with North Atlantic Deep Water and Antarctic Bottom water to investigate sediment signals of bottom-current action and deep-water stagnation, as well as bottom-water circulation between the southern and the northern east Atlantic.

Other important objectives were to analyze accumulation rates of organic carbon and other sediment components in order to monitor the Cenozoic history of north equatorial surface-water oceanography; and to document the advection of dust during northern winter recording the history of aridity in the African Sahel zone.

SITE 660

Site 660 is located on the lower slope about 80 km northeast of the northern end of the Kane Gap (Tab.1; Fig.1). The seismic record at this site contains a layered unit of standing sediment waves in the upper portion lying on top of a rather transparent horizon and another layered seismic unit, the top of which pinches out in the Kane Gap.

Holes 660A and B cored three lithologic units to a maximum penetration depth of about 165 m subbottom. There is good biostratigraphic time control for Units 1 and 3, and good magnetostratigraphy for the last 4 m.y., but very little time control for Unit 2. As a result, sedimentation rates varied from about 28 m/m.y. during the last 0.7 m.y. to about 17m/m.y. from 0.7 to 3.9 Ma, and 3.3 m/m.y. from 3.9 to about 6.0 Ma.

A complete uppermost Miocene to Recent section forms Lithologic Unit 1 spanning the last 6.0 m.y. Similar to previous sites, it consists of sedimentary cycles. Olive light gray nannofossil ooze is interbedded with dark gray silty clay containing up to 1.6 % organic carbon in the uppermost 21 m subbottom. Further below, that is prior to 0.73 Ma, the carbonate and foraminifer preservation markedly increased, but again gradually decreased prior to 3.9 Ma. From the enhanced sedimentation rates and increased abundance of biogenic opal and organic carbon in the uppermost 21 m subbottom, we infer increased oceanic upwelling and organic productivity at the Northern Equatorial Divergence combined with phases of enhanced bottom-water stagnation during the last 0.7 m.y.

Lithologic Unit 2 is composed of cyclic yellowish brown clay which in most parts is fossil-barren and compares well with similar units found at Sites 657 and 659. Lithologic Unit 3 consists of middle Eocene yellowish radiolarian ooze with chips of chert near the base. The almost pure radiolarian ooze from about 149 to 130 m subbottom and probably up to a manganese-rich layer at 126 m subbottom possibly formed during a single radiolarian zone, that of Podocyrtis mitra which spans less than 1 m.y. at about 43 Ma. Several features such as this relatively rapid deposition, the laminated fabric free of bioturbation, the lack of clay and organic matter, and a mound-like seismic structure associated with this facies may reveal the ooze as displaced sediment, for example as a sediment dune reflecting a regime of cyclic bottom-current activity.

Similar to Sites 657 and 659, the drastic change in the carbonate content and in sedimentation rates between 3.9 and 4.6 Ma indicates a major event of deep-water paleoceanography in the east Atlantic.

SITE 661

Site 661 is located on a plateau east of the Kane Gap, and lies almost 600 m above the floor of this passage (Tab.1; Fig.1). The upper portion of the seismic record at this site is nearly transparent with few faint reflectors. The lower portion contains a layered and another transparent seismic unit on top of a thick layered unit draping middle Cretaceous basement. Holes A and B cored a 296.1 m thick section at this profile consisting of 3 different lithologic units which are late Cretaceous to Pleistocene in age. Biostratigraphic age control was good in Unit 1 and upper parts of Unit 3, magnetostratigraphy was good for the last 3.2 m.y.Unit 2 was fossil-barren except for its uppermost part, the lower part of Unit 3 was completely non-fossiliferous.

Lithologic Unit 1 consists of uppermost Miocene to Recent sediment cycles which comprise light gray foram-nannofossil ooze interbedded with gray muddy nannofossil ooze or clay. Sedimentation rates averaged 15 m/m.y. during the last 4.2 m.y. and 4.1 m/m.y. prior to this time. The upper part of Unit 1, which formed during the last 1.4 m.y., displays high-amplitude carbonate cycles which are distinguished from those further below by a uniformly lower carbonate content and higher proportions of organic carbon (up to 0.65 %) and biogenic opal. Both variables may imply increased ocean productivity for most of the Pleistocene such as at Site 660. Different from previous Sites 657-659, the planktonic foraminifer fauna at Site 661 continuously has a tropical aspect during the Pleistocene. The lower portion of Unit 1 is smaller-amplitude sediment cycles with only minor amounts of clay, and decreasing contents of carbonate prior to 4.0 Ma. This lithostratigraphy closely matches that of the neighboring Site 660 up to the precision of susceptibility curve cycles, but with more carbonate and less organic carbon. The marked changes in $CaCO_3$ and in sedimentation rate at about 4.0 to 4.2 Ma compare to similar rate changes at Sites 657, 659, and 660 and likewise indicate a major event of deep-water oceanography in the earliest Pliocene.

Olive brownish to brownish red cycles of silty clay interbedded with rare nannofossil ooze near the top form the 18 m thin Unit 2, which is early late Miocene and older in age. At its base, we encountered three distinctly weathered bedding planes with manganese nodules and clay (20 cm thick), or yellowish dolomite clay between 92.5 and 93.75 m subbottom. Undoubtedly, these horizons signify extended hiatuses. Possibly, they maybe contemporaneous with the thick radiolarian ooze and manganese horizon at Site 660, dated at about 43 Ma and younger.

Below, lithologic Unit 3 is composed of about 200 m thick upper Cretaceous and younger bluish-greenish zeolite clay and claystone cycles.In the upper 60 m, it is interbedded with nannofossil ooze covering almost the entire Maastrichtian (76-66.5 Ma). Based on the most conservative estimates of sedimentation rates, the K/T boundary could occur 0.8 m (=0.13 m.y.), or less, above the uppermost nannofossil ooze bed ending at 105.3 m subbottom. Further work is required to pin down this possibly existing boundary more exactly.

SITES 662 - 664

Sites 662 through 664 were selected to retrieve a late Neogene record of climatic variability from the equator. The primary objective at these sites was to trace several paleoceanographic signals back through the late Neogene to distinguish the paleoceanographic and paleoclimatic history of this region. A secondary primary objective at Sites 662, 663 and 664 was to monitor late Neogene variations in African aridity, as indicated by clay and biogenic material contained in wind-blown terrigenous dust from the continent.

SITE 662

Site 662 is located in the eastern equatorial Atlantic (Table 1; Fig.1) on the upper eastern flank of the mid-Atlantic Ridge just south of the Romanche Fracture Zone. The site position was selected in order to detect both the near-equatorial divergence signal as well as the advective southern-hemisphere contribution from the Benguela Current.

The upper Pliocene and Pleistocene section recovered from Holes 662A and 662B is 200 m thick and comprises one major lithologic unit consisting of nannofossil and foraminifer-nannofossil ooze. Secondary components include clay, diatoms and radiolarians.

Although a useable paleomagnetic stratigraphy could not be obtained at Site 662, the nannofossil and planktonic foraminiferal biostratigraphy provided several well-dated datums. The depositional rates of the pelagic sediments average 42 m/m.y. Preservation of calcareous fossils is good to moderate; preservation of diatoms is moderate to fair.

The pelagic layers are interbedded with several slumps, debris flows and turbidites; these appear to have originated from topographic highs and flowed over the pelagic beds, in some cases tilting the pelagic beds slightly, but not deforming them extensively. It appears that the slumps were added with little loss of the pelagic units to erosion. Using carbonate layering in core photographs, we succeeded in correlating between Holes 662A and 662B and verifying the continuity of recovered section over intervals between 0-0.5 Ma and 1.3-3.6 Ma.

A trend toward higher-amplitude $CaCO_3$ variations and deeper $CaCO_3$ minima began in the late Pliocene at 2.65 Ma and continued into the latest Pleistocene. This prominent change slightly precedes the initiation of significant-scale northern hemisphere glaciation at 2.5 Ma. It may reflect: (1) increased dilution of $CaCO_3$ by opaline silica, (2) increased dilution by eolian dust; (3) increased dissolution of $CaCO_3$, or (4) decreased productivity of $CaCO_3$. Because the mean sedimentation rates do not change, it seems likely that explanations 4 (and possibly 3) must be balanced by explanations 1 and 2.

SITE 663

Site 663 was added to the Leg 108 plan because of the numerous turbidites and slumps encountered in the upper 100 m at Site 662. The objectives at this site were identical to those at Site 662, but with the major focus on the upper 100 m in order to provide a complementary record to Site 662. Site 663 is located in the eastern equatorial Atlantic (Tab.1; Fig.1) on the upper eastern flank of the mid-Atlantic Ridge just south of the Romanche Fracture Zone.

The entire 152 m section cored is one lithologic unit consisting of nannofossil and foraminifer-nannofossil ooze of Pleistocene and late Pliocene age. The lithologic unit includes five slump layers, as well as layers with less deformation (minor tilting). Although a useable paleomagnetic stratigraphy could not be obtained at Site 663, the nannofossil and planktonic foraminiferal biostratigraphy provided several well-dated datums. Preservation of calcareous fossils is generally good; preservation of diatoms is moderate to poor.

The depositional rate of pelagic sediments ranges from about 33 m/m.y. in the uppermost (upper Pleistocene) pelagic section to 38 m/m.y. in the lower two (upper Pliocene) pelagic units. As at Site 662, it appears that the slumps at Site 663 were added as extra sediment to rapidly deposited pelagic sections, with little loss to erosion.

Again using carbonate layering in core photographs to correlate between holes, we found that a continuous composite record was obtained in pelagic layers representing time intervals of roughly 0-0.95 and 1.75-2.6Ma. Combined with Site 662, it appears that we have recovered a continuous record of the last 3.6 Ma, except possibly for a brief interval around 1.2 Ma disturbed by slumps at both sites. As at Site 662, the amplitude of $CaCO_3$ cycles intensified from the upper Pliocene to the uppermost Pleistocene, with larger percentages of clay and silica and organic carbonand lower proportions of $CaCO_3$.

SITE 664

Site 664 is located in the central equatorial Atlantic on the upper-middle flank of the east side of the mid-Atlantic Ridge just north of the Romanche Fracture Zone (Tab.1; Fig.1). The entire 296.8 m section cored is one lithologic unit consisting of nannofossil ooze and foraminifer-nannofossil ooze of Pleistocene, Pliocene, and late Miocene age. Secondary components are clay, zeolitic clay, diatoms, and radiolarians. The two deeper holes (664B and 664D) contain many slump units, as well as several other partially deformed layers.

Paleomagnetic reversal boundaries provided a useful stratigraphy down to the Jaramillo subchron. The nannofossil and planktonic foraminiferal biostratigraphy also provided numerous datums. Preservation of calcareousfossils is generally good, although it deteriorates below 200 m subbottom (4.4Ma). This change in $CaCO_3$ preservation agrees with evidence in previous Leg 108 sites of a major change in bottom-water chemistry in the early Pliocene. Preservation of diatoms is moderate to poor in the upper 200 m subbottom, and the sediments are barren of diatoms below this depth. This suggests a much lower supply of biogenic silica from surface waters due to lower productivity, or poor preservation of silica on the sea floor before 4.4 Ma.

The Pleistocene and upper Pliocene (0-4.4 Ma) pelagic sequence was deposited at average rates of 43-46 m/m.y. Early Pliocene and late Miocene rates averaged about 21 m/m.y. Using carbonate layering in core photographs for between-hole correlations, we verified the continuity ofthe section for the upper Pleistocene pelagic unit (0-1.2 Ma). The high recovery and undisturbed condition of the sections below 200 m subbottom in Hole 664D indicate a valuable upper Miocene sequence deposited at high rates.

The slumps in Holes 664B and 664D show surprising variability in the degree of deformation and age over small lateral scales (1000 m) within the same sediment pond. The slump at about 1.25 Ma appears to correspónd to similar deformation at Sites 662 and 663 at that time. All three sites are located adjacent to the active transform-fault section of the Romanche Fracture Zone, suggesting that a major seismic event associated with this feature may have dislodged pelagic sediments over a broad region of the upper flanks of the Mid-Atlantic Ridge.

As at Sites 662 and 663, $CaCO_3$ cycles intensified from the upper Pliocene to the upper Pleistocene. This occurred because of stronger $CaCO_3$ minima, accompanied by increased silica and clay contents in gray-green sediment layers.

SITES 665 - 668

Sites 665 through 668 compose four sites in a transect taken at different water depths down the southern margin of the Sierra Leone Rise.Our primary objective in the Sierra Leone Rise transect was to retrieve a suite of cores located close together in space, but spanning a large depth range. A secondary depth-related objective was to use this close-spaced group of cores to monitor long-term fluxes of $CaCO_3$ (both bulk calcareous nannofossils and planktonic foraminifers, as well as individual species of planktonic foraminifers), dissolution of $CaCO_3$, and downslope movement of carbonate and non-carbonate fractions.

SITE 665

Site 665 is located in the eastern equatorial Atlantic in relatively flat terrain along the base of the southeastern margin of the Sierra Leone Rise. Site 665 was critical to the depth transect, because it lies well below the 4000-m water depth at which evidence of relative isolation of the eastern Atlantic deep circulation may become evident.

In Holes 665A and 665B, we recovered a total of 20 APC cores to depths of 97.9 and 71.7 m subbottom. The sedimentary sequence at Site 665 is divided into two lithologic units. From 0-73 m subbottom, lithologic Unit 1 is cyclical nannofossil ooze and clay-bearing nannofossil ooze of Pleistocene and late Pliocene age (0-4.6 Ma). Carbonate contents vary between 0% and 80%, with most values between 20% and 80%, and a trend toward deeper $CaCO_3$ minima toward the top of the unit. From 73-97.9 m subbottom, lithologic Unit 2 is red clay of early Pliocene (4.6-5.0 Ma) age and probably older in the un-fossiliferous lower section. There is no $CaCO_3$ in this layer, except in a few turbidite beds brought in from shallower depths.

Opaline silica is a secondary component of both units, except for some 10-cm thick diatom ooze layers in the uppermost 20 m of Unit 1 (0-1Ma). Organic carbon is less than 1% of the sediment, but is slightly more abundant in the upper 50 m of the upper lithologic unit. Several sharp unburrowed contacts were observed in each unit; these are probably indicative of erosion by bottom currents. Several intervals toward the bottom of lithologic Unit 1 (about 60-70 m subbottom) had increased manganese contents, suggesting significant periods of non-deposition or slow deposition.

Depositional rates average 15-21 m/m.y. from 0-3.0 Ma in the upper Pliocene and Pleistocene nannofossil ooze cycles of the upper lithologic unit, but only 4 m/m.y. in the red clay. Between-hole correlations basedon paleomagnetic susceptibility data verify the continuity of the composite section to a depth of 68 m subbottom (roughly 3.5 Ma).

The increasing amplitude of the Pliocene-Pleistocene $CaCO_3$ cycles at Site 665, accompanied by increasing organic carbon and opaline silica, is similar to trends observed at other sites on Leg 108. The Sierra Leone Rise is located in an area marked today by relatively low productivity, with higher productivity both toward the north (the north equatorialdivergence zone) and the south (the south equatorial divergence zone).Nevertheless, the climatic indicators available in shipboard analysis of

Site 665 sediment suggest a trend toward higher productivity, higher terrigenous dilution, and possibly stronger dissolution through the late Pliocene and Pleistocene similar to that observed at the southern sites.

At Site 665, the large early Pliocene shift in the $CaCO_3$ compensation depth marked by the onset of $CaCO_3$ sedimentation occurs between 4.1 and 3.8 Ma. This age is comparable to the late stages of a similar shift observed at other Leg 108 sites.

The stratigraphic sequence at Site 665 records large changes in the depth of the CCD and changes in the productivity of equatorial surface waters. Prior to 4.1 Ma, this site was below the CCD and was characterized by slow deposition of pelagic clays. Carbonate deposition in this interval occurred only by the rapid deposition of two thin carbonate-rich turbidites. At approximately 4.1 Ma, the lowering of the CCD resulted in the deposition of a sequence of nannofossil and foraminifera-nannofossilooze. Little or no siliceous material and organic carbon were deposited from 4.1 to 2.5 Ma. Organic carbon preservation increased at about 2.5 Ma, while biogenic opal preservation increased at about 1.5 Ma. The increase in organic carbon preservation was the result of increased productivity in the surface waters or increased preservation because of reduced oxygen conditions in the deep water. The increase in biogenic opal preservation indicates an increase in surface-water productivity that resulted in generally increased deposition rates for the interval 1.5 Ma through present.

SITE 666

Site 666 is located in the eastern equatorial Atlantic in relatively level terrain along the base of the southeastern margin of the Sierra Leone Rise. Two major lithologic units are recognized at Site 666. Unit 1 (0-140m subbottom) is composed of nannofossil, foraminifer-nannofossil and siliceous-nannofossil pelagic oozes of Pleistocene and early Pliocene age (0-4.1 Ma) interbedded with numerous small and large foraminifer sand turbidites. Mud-bearing, clay-bearing and muddy nannofossil oozes are less common. Biogenic opal is restricted to the upper 27 m subbottom. The unit varies in color from pale brown, very pale brown, light yellowish brown, reddish yellow. Nannofossil oozes and siliceous oozes that are rich in organic carbon are generally dark gray in color. Below 27 m subbottom, the colors are generally light gray, olive gray and white. Numerous turbidites interrupt the pelagic deposits throughout this unit. Large turbidites (up to 12 meters) were also observed and comprise approxmately 50% of the total section.

The carbonate content of this unit varies from near to 0 to greater than 80%. Low carbonate values are found in the upper 27 m of the section and coincide with high percentages of biogenic silica. Diatoms are the primary biogenic opal component, although radiolaria are also present. The primary terrigenous components are clay (up to 35%), accessary minerals and quartz. Organic carbon increases above 10 m subbottom from negligible values togreater than 1% by weight.

Lithologic Unit 2 (140-150 m subbottom) is composed of white to pale yellow clay-bearing nannofossil ooze and pale brown, light yellowish brown to yellowish brown silt-bearing clayey-nannofossil ooze. Graded bedding and sharp lower contacts are common. Foraminifers are gener...

absent or rare in the pelagic deposits, but are quite common in the turbidites. Accessory minerals are an important component of the terrigenous fraction, while clay concentrations reach 25%. This unit appears to correlate with the top of Unit 2 at Site 665.

The depositional history at Site 666 reflects the complex interactions of pelagic deposition interrupted by turbidite deposition. Prior to 4.1 Ma, this site was located near the CCD. Clay with occassional nannofossil ooze layers in the uppermost portion of the clay interval were deposited by pelagic processes. These deposits were interbedded with rapidly deposited foraminifer turbidites. Between 4.1 Ma and approximately 1.5 Ma, the pelagic deposits were generally foraminifer-nannofossil ooze and nannofossil ooze with variations in clay concentrations. After that time, biogenic opal productivity in the surface water increased, and deposition of the biogenic opal fraction has continued throughout the late Pleistocene. Organic carbon preservation in the sediments increased at approximately 2.5 Ma, correlating with the similar increase at Site 665. Throughout the entire record at Site 666, turbidite deposition dominated the sedimentary processes. Based on a rough correlation of lithologic Unit2 at this Site and Unit 2 at Site 665, approximately 75 m of additional sediments (mostly foraminifer sand) was delivered to Site 666 by gravity processes.

SITE 667

Site 667 was the third site in the Sierra Leone Rise depth transect (Sites 665-668). The 376.5 m section recovered at this site contains six lithologic units. Lithologic Unit 1 consists of alternating layers of Pleistocene foraminifer-nannofossil ooze and clay-bearing foraminifer-nannofossil ooze which vary in color from dark brown to light yellowish brown. The carbonate content of this unit varies from 20 to 80%. Quartz and clay are the principle non-carbonate component, while biogenic opal occurs usually in trace amounts (less than 10%). Lithologic Unit 2 consists of a coarser-grained foraminifer-nannofossil ooze interbedded with foraminifer sands of early Pliocene to early Pleistocene age. The foraminifer-nannofossil ooze and nannofossil ooze are generally light gray to white in color and exhibit both graded and reverse graded bedding. The sand is generally white in color and has shrap contacts.

Lithologic Unit 3 consists of upper Miocene to lower Pliocene cycles of white to light gray foraminifer-nannofossil ooze and nannofossil ooze interbedded with very pale brown to light yellowish brown muddy nannofossil ooze. The carbonate content of this unit varies from 70 to 80%. Unit 4 is an upper Miocene slump deposit about 10 meters thick with mixtures of lithologic Units 3 and 6.

Lithologic Unit 5 consists of middle Miocene cycles (60 to 70 cm thick) of white to very pale brown mud-bearing nannofossil ooze and clayey nannofossil ooze interbedded with yellow and brownish yellow nannofossil-bearing silty clay. The carbonate content varies from less than 20% to greater than 80%. Clay concentrations increase up to 85% and quartz composes up to 10% of the sediment, while biogenic opal occurs only in trace amounts. Unit 6 consists of upper Oligocene to middle Miocene light greenish gray muddy-nannofossil ooze and clayey-nannofossil chalk interbedded with grayish-green siliceous-bearing nannofossil ooze and claystone.

carbonate content of this unit varies from near 0% to greater than 80%. Biogenic opal composes up to 45% of the sediment.

Sedimentation rates are based on paleomagnetic, nannofossil and foraminiferal datums in the middle Miocene to Pleistocene interval. These groups as well as diatoms also provide stratigraphic datums for the Oligocene and lower Miocene interval. Sedimentation rates are 14.7 to 12.4m/m.y. from 0 to about 2.4 Ma. Stratigraphic uncertainties between 2.4 and 14.0 Ma did not allow reliable sedimentation rates to be calculated for this time interval, however, the available resolution does indicate rates ranging from 7.7 to 19.6 m/m.y. Between 14.0 and 16.0 Ma, sedimentation rates averaged 19.7 m/m.y. and then decreased to 12.5 m/m.y. throughout the lower Miocene and upper Oligocene.

The history of sedimentation at this site reflects changes in geographic position relative to the equatorial high-productivity zone and changes in the reworking of sediments because of bottom current scouring. During the late Oligocene through middle Miocene, high concentrations of biogenic opal in these sediments indicate that the productivity in the surface water above this site was generally high. Continuous pelagic deposition continued throughout the middle Miocene, but the concentration of biogenic opal decreases significantly. At this time the sedimentation was cyclic with sediment cycles attaining a thickness of 60 to 70 cm. Pelagic deposition was interrupted in the late Miocene by a slump which mixed the older, more siliceous material with clay-rich depositis. Cyclic deposition of clay-rich and clay-poor nannofossil ooze resumed in the late Miocene and continued until the early Pliocene (about 4.0 Ma). From the early Pliocene to the early Pleistocene (abut 4.0-1.5 Ma), the sediments at this site have significantly higher concentrations of foraminifers. Foraminifer sand are common and may be a result of either winnowing or turbidite deposition. Bottom scouring may have also removed significant portions of the finer material during this time. Normal pelagic sedimentation resumed at about 1.5 Ma and continued throughout the Quaternary. Throughout this time, increased clay concentration suggest that eolian material became a significant component in the sediments deposited at this site.

SITE 668

Site 668 is located near Site 366 in the eastern equatorial Atlantic on the relatively flat crest of the Sierra Leone Rise and is the shallowest of the sites comprising the depth transect on the southern margin of the Sierra Leone Rise.

Operational problems, followed by the illness of a crew member, denied our reaching most of our objecives at this site. One core was retrieved from Hole 668A and a total of four cores were recovered from Hole 668B. The sediments recovered are all nannofossil ooze, varying from muddy- nannofossil ooze to muddy foraminfer nannofossil ooze to mud-bearing foraminifer-bearing nannofossil ooze. Secondary components include clay,quartz, and biogenic opal. Paleomagnetic stratigraphy defined the Matuyama/Bruhnes boundary and the Olduvai subchron. Nannofossils and planktonic foraminifers provide several biostratigraphic datums. Preservation of calcareous fossils was very good, but few siliceous fossils were observed. Deposition rates averaged 12 to 18 m/m.y. in the upper Pliocene to upper Pleistocene sequence

(0-2.0 Ma). Too few shipboard analyses were made to detect significant trends at Site 668. Both from the lithology and the state of preservation, the overall sequence is charateristic of a low-productivity surface-water environment and a deep-water regime not heavily undersaturated with $CaCO_3$.

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Leg 109

Introduction

Leg 109 of the Ocean Drilling Program was the second of two legs dedicated to drilling zero-age crust in the median valley of the Mid-Atlantic Ridge (MAR) south of the Kane Fracture Zone (KFZ). Leg 106 was the first of these legs and started drilling a hole (648B) on the summit plateau of a small axial volcano 70 km south of the fracture zone using a newly designed hard rock guide base (HRGB) (Detrick, Honnorez, et al., Geotimes, May 1986; Nature, May 1986, vol. 321). Legs 106 and 109 were designed to investigate the first of the 12 COSOD top priority program recommendations: "processes of magma generation and crustal construction at mid-oceanic ridges"(COSOD, 1981).

The prime aim of Leg 109 was to re-enter and deepen Hole 648B and to run a comprehensive suite of downhole logs in the basement at this site. Back-up plans included logging DSDP Hole 395A, drilling in the walls of the KFZ, drilling in the active hydrothermal vents of Site 649, and drilling and logging DSDP Hole 418A. The order in which the back-up sites would be drilled or logged depended on the time available following the termination of operations at Hole 648B. (The objectives for Leg 106 were outlined in the October 1985 JOIDES Journal, and the initial report for that leg was detailed in the February 1986 JOIDES Journal.)

Preliminary Results

The following site reports were received from Leg 109 Co-chief Scientists Wilfred Bryan and Thierry Juteau:

Site 648B

ODP Site 648, Hole 648B (22°55.32'N,44°56.85W) is located on the summit of a small axial volcano in the median valley of the Mid-Atlantic Ridge at a depth of 3344 m. This hole was re-entered during Leg 109 on April 29, cased and in re-enterable condition on May 30. Initial drilling and coring removed cement fill left during Leg 106. The hole was deepened from 33.3 m to 50.5 m sub-bottom, a total increase in depth of 17.2 m. Core recovery within the interval advanced was approximately 2.19 m, for a total recovery rate of 12.7%. Much of the time spent in the hole was devoted to attempts to stabilize the hole with cement and in re-drilling fill. Stabilization seems to have been accomplished with the casing. Further attempts at coring and deepening the hole were abandoned because all compatible drilling jars had been damaged in operations at this site.

The additional penetration extended the lithologic sequence recognized by Leg 106 participants. Starting at about 34 m depth, we passed through a fine-grained to glassy dark basalt which appears to be less than 1 m thick; beneath this is a distinctive moderately vesicular basalt 1-2 m thick with both partly filled "segregation vesicles" and numerous miarolitic cavities. Below this gas-enriched zone the basalt becomes massive and more coarsely crystalline and plagioclase crystals increase in size and abundance downward. Alteration is minor, usually appearing as dark halos along fractures or sample margins.

This sequence can reasonably be interpreted as a single cooling unit, very likely the upper part of a lava lake ponded within the lower part of the small volcanic cone penetrated by Hole 648B. The vesicular interval may result from rising gas being trapped beneath the quenched surface skin (the fine-grained to glassy lithology), while the thicker lower massive interval may represent the interior of the lava pond, with some accumulated plagioclase phenocrysts.

Cement fill used to stabilize the upper part of the hole was re-cored and sampled for paleomagnetic analysis. In a unique experiment, the magnetic polarity was measured on samples taken from the cement core. The cement polarity is induced by the field in the adjacent basalt, so it can be used as the equivalent of a downhole magnetic log. This cemented interval (15-25 msub-bottom) included part of the reversed unit recognized on Leg 106. The validity of the method was confirmed by the similarity between the cement polarity and that previously measured in the basalt at the same levels. Detailed interpretation of the data suggests that the reversal is more likely due to rotation of pillow-sized basalt fragments rather than to field reversal.

Using shore-based chemical analyses obtained on Leg 106 samples, detailed comparisons have been made to the existing data base of dredge samples from the vicinity of the drill site. This shows that basalts from Site 648 are members of a distinctive chemical group that has been sampled elsewhere along the central and western side of the median valley, including Site 649. These maybe products of a common rift eruption extending at least from Site 648 to the Kane Fracture Zone.

Site 669

Site 669 (23°31.02'N, 45°02.75'W) is located on the gently sloping summit of a mountain forming the western rift valley wall of the Mid-Atlantic Ridge, immediately to the south of the Kane Fracture Zone at a depth of 1979 m. To the east, the mountain shelves rapidly into a 6200-m deep nodal basin five miles (8 km) distant. Site 669 was chosen to deploy a positive displacement coring motor in an attempt at an unsupported bare-rock spud-in. Submersible dives in this area have shown the top of the rift mountain to be composed of gabbros with surficial rubble and intermixed sediment. The aim of drilling here was to sample these gabbros.

Site 669 was occupied during the period May 31 to June 2, on agently sloping area about 1.5 miles (2.4 km) southeast of the main summit. A 3.5-hour combined TV/sonar survey of the area revealed an almost smooth bottom comprising rubble with intermixed sediment, with local sediment ponds covered by north-south trending ripples. The site chosen for drilling was on a low north-south ridge formed of angular rubble. It was felt this type of bottom would best constrain the coring motor until a hole in the underlying basement could be started.

A single hole was drilled (Hole 669A) to a total depth of 4.0 m sub-bottom through basalt rubble and sediments. At 4.0 m sub-bottom, extremely hard basement was encountered and although drilling continued for several more hours, penetration was virtually zero. On trying to retrieve the core barrel it was found to be jammed, and the pipe was tripped to the surface on June 2. A total of 0.1 m of fine-grained aphyric basalt rubble was recovered, with distinct alteration halos and orange clays on the outer surfaces. The basalt presumably derives from the higher slopes of the mountain; the nature of the underlying basement remains unknown.

JOIDES Resolution departed Site 669 at 0200 hrs June 2 and was on location at DSDP Site 395A by 1200 hrs, to begin logging operations there.

Site 395A

JOIDES Resolution arrived at DSDP Site 395 (22°45.35'N, 46°04.90' W, depth 4484 m) at 1200 June 2, and Hole 395A was re-entered at 1019 June 3 for a nine-day program of logging and downhole experiments. Immediately after re-entry, equilibrium temperatures through the 112 m of casing were measured, verifying that ocean bottom water continues to flow down the hole, at a rate on the order of a thousand liters per hour. A 45-ml sample of undisturbed borehole fluid was taken at 544 m subbottom. The pipe was run very slowly and without circulation or rotation to hole bottom at 606 m subbottom, with minimal disturbance to borehole temperatures. The pipe was then held at the bottom of the hole, and temperatures as close to equilibrium as possible were continuously logged inside the pipe with the BGR temperature probe. The results indicate that the downhole flow extends to about 400 m subbottom, and that a linear, conductive gradient holds in the deeper section of basement.

The pipe was then pulled up within the 112 m of casing, and the 494 m of open hole through basement was successfully logged during the next four days with the following tools (in order of deployment): Schlumberger GST- ACT-NGT (neutron activation), German magnetometer (vertical field only), Schlumberger LSS-DIL-SFL (sonic and resistivity), German magnetic susceptibility, LDGO multi-channel sonic, Japanese magnetometer, large- scale resistivity, and Schlumberger LDT-CNT-NGT (litho-density plus inclinometer). The pipe was then pulled out of the hole and offset 100 m northwest, where the background geothermal gradient was measured in the sediments of Hole 395C. The pipe was pulled to the surface by 1200 June 9, and a straddlepacker was installed in the BHA. After TV verification of mudline depth and re-entry at 0700 June 10, the packer was successfully set at 396 and 536 m, for bulk permeability measurements over the lowermost 210 and 80 m, respectively, ofopen hole. The allotted eight days for logging Hole 395A had expired when the packer go-devil lodged in the pipe on retrieval. Operations at Site 395 were terminated when the bit was pulled on deck at 1930 June 11.

All logs were affected to some degree by irregular hole conditions, but preliminary interpretation of the log data suggests the following results. Deep in the hole, compressional sonic velocities are 5.0-5.5 km/s and shear wave velocities are about 3 km/s, but cycle-skipping mars the data from the shallow section, as occurred in Layer 2A in Hole 504B. Neutron porosities are about 10-20%, and densities are 2.2-2.8 g/cc. Resistivities are about 10-100 ohm-m in the upper 400 m of basement, increasing to about 200 ohm-m in the deepest 100 m. The magnetic data clearly show a single reversal about 150 m into basement. Several distinct units, roughly 10-50 m thick, are apparent in the logs, and the basement is presumably heterogeneous over similar vertical scales. None of the logs show any evidence for the plug of cement that disappeared into the formation during Leg 45. Most of the section is quite permeable, and bulk permeabilities of the upper 300 m, lowermost 210 m, and lowermost 80 m are orders of magnitude higher than the extremely low value measured in the deepest 25 m during Leg 78B.

The only tools on board during Leg 109 that time did not allow to be run were the borehole televiewer and Schlumberger dual laterolog. Overall, Leg 109 was very successful in establishing Hole 395A as a geophysical reference section, complementing results at Holes 418A and 504B.

Site 670A

Site 670A (23°10'N,45°01.93'W, depth 3600 m) is located on the sloping west wall of the median valley, about 5 km west of a line connecting Sites 648 and 649. It lies within an anomalous region in the median valley, characterized by deeper than average seafloor, and a distinct westward offset in the central magnetic anomaly. The hole was placed in the center of an area of several square kilometers of serpentinized peridotite discovered by scientists in the submersible ALVIN.

This site was selected for drilling because the peridotite was poorly exposed at the surface and deeper sampling might determine if it is a rootless fault slice and might provide other clues to its mode of emplacement. This also appeared to be an ideal site in which to further test unsupported spud-in and the effectiveness of the positive displacement coring motor.

A sonar reflector was placed on bottom prior to spud-in at 11.15 on June 12. The coring motor quickly washed in about 4 m in loose sediment and easily established position. Core barrel #1 was recovered without any mechanical problems associated with the core barrel assembly, but at 14.30 on June 13 when the second core barrel was retrieved, two latch fingers were found to be broken off and the lower half of the core barrel assembly remained in the motor. Consequently, it was necessary to trip pipe to recover the rest of the barrel and samples from the coring motor. Because this core barrel design was evidently unreliable, the coring motor was replaced with a standard rotarycoring assembly. Pipe was lowered and the sonar reflector and the mud pit above the hole were spotted about 14.00 on June 14.The 4' x 8' pit was re-entered on the first pass at about 14.30, re-entry into the hole was confirmed by a "no-weight loss" state in the pit with pipe at 3637 m. Although the pipe descended toone side of the center of the pit, it was guided into place as itslid down the side of the pit. The pit was nearly full of drilling mud that had been pumped down just before pulling out of the hole, and this may have helped to prevent slumping and also may have helped lubricate the re-entry.

Core recovery was not notably different with the rotary drive than with the coring motor. Jamming of loose rubble in the catcher and lower end of the barrel was a problem with both systems. Our best recovery in a 9.5 m run was in Core #5R, with 1.60 m of rubbly serpentinized peridotite. Recovery of 0.25 -0.50 m was more typical; although we made several approximately 18 m runs to establish depth in the hole, this did not increase the amount of core recovered. Some potentially serious sticking was encountered near the end of the drilling period. Drilling terminated with recovery of Core #10W at 10.30 on June 16 in order to permit a timely departure for Barbados. We consider the hole could have been continued if we had time for proper casing and conditioning.

Total penetration was 92.5 m below sea floor; approximately 6.5 m of this was loose rubble and sediment. Although core recovery ranged from 3 to no more than 12 percent, some valuable samples containing unserpentinized mantle minerals were recovered. Magnetic property studies are limited by rarity of orientable core, but still may indicate whether the serpentinite could contribute to the offset in the magnetic anomaly pattern. Many samples have excellent deformation textures that may provide clues to the mode of emplacement. The geologic setting, almost at the axis of the median valley, defies all conventional notions about oceanic stratigraphy and spreading mechanisms.

SCIENCE SERVICES

Publications

On December 10, 1985, the ODP Publications Group sent requests for proposals (RFPs) to some 20 prospective bidders for production of the Proceedings of the Ocean Drilling Program. The requested proposals were for two principal phases of our publishing program: (1) typesetting and page makeup, and (2) printing,binding, and distribution.

Five firms interested in submitting proposals sent representatives to a bidders' conference that was held at ODP headquarters in College Station on January 13, 1986. Seven firms submitted proposals by the due date, February 3. Six proposals were for typesetting and page makeup, and two were for printing, binding, and distribution. Later in February, an evaluation team -- consisting of Russ Merrill, Curator and Manager of Science Services; Bill Rose, Supervisor of Publications; and Lynn Holst, Manager of Contracts -- set out on a 10-day tour to assess the plants and related facilities of the responsive bidders.

Following receipt of these bidders' best and final offers, contracts were executed with Consultants & Designers, Inc., of Anaheim, California, for typesetting and page makeup, and with Edwards Brothers of Ann Arbor, Michigan, for printing, binding, and distribution. Both firms are thoroughly experienced in their respective phases of the contract provisions, and both are accustomed to upholding high standards in production. (Consultants & Designers has been the Deep Sea Drilling Project's typesetting and page-makeup subcontractor for the past several years.) In addition, both subcontractors were the low bidders in their respective areas.

In a related matter, the JOIDES Planning Committee last fall requested ODP to assess possible economic benefits of publishing the Part B portion of the Proceedings volume (mostly the in-depth, peer-reviewed papers) independent of ODP's Publications Group. Accordingly, we sent an additional RFP to 15 leading science publishers to elicit their bids. Of these publishers, 2 are professional geoscience societies, 5 are university presses and 8 are commercial publishers.

To ensure that the costs we would be comparing would be truly comparable, both RFPs mentioned previously, as well as the one that went to the science publishers, described a Part B volume that meets the design criteria and quality standards that were defined by the JOIDES Information Handling Panel and Planning Committee. Further, we assumed that peer review would be conducted under ODP's supervision in either case, so that the role of an outside publisher would not include selection of manuscripts. Thus, in essence, the published works would be the same, whether published in-house by ODP or by an outside publisher.

As it happened, we received no bids from publishers in response to this publishers' RFP; therefore, we are unable to make a rigorous comparison of costs in the preferred way. The bids we received for typesetting and page makeup and for printing, binding, and distribution, as outlined earlier, did, however, offer prices well below those assumed in making preliminary estimates of ODP publication costs.

A copy of a typical Part B volume (modeled on DSDP Vol. XC, Pt. 2) will cost the scientific community about $63.00 (8.1 cents per page) including delivery to the reader. To put this price into perspective relative to costs of other technical publications, we compared it to institutional subscription prices for 18 reputable geoscience journals. The cost of publishing Part B volumesin-house compares favorably to current market prices for similar publications produced elsewhere: at $0.081 per page, this part B volume would cost slightly less than half the average price of $0.167 per journal page, undercutting all of the commercial and many of the society publications surveyed.

ODP ENGINEERING

Drill String Studies

ODP is making major modifications to TAMU's Heave Motion Computer Program. An option in the program for computing the real and complex Eigenvalues and mode shapes for a realistic vessel/drillstring configuration has been tested. Some work remains on developing a procedure to take full computational advantage of the tridiagonal form of the matrices in the complex Eigenanalysis.

The TAMU Heave Motion Software Package is being tested using example problems selected from appropriate technical articles in the open literature. We are just beginning this effort but the initial results are quite promising and some modifications to the software have been implemented to facilitate the comparisons. At the completion of this task, a recommendation for additional information and the level of confidence in the numerical predictions will be discussed with the ODP Operations and Engineering staff.

Efforts have also been focused on developing the capability to utilize the new NCAR and DI-3000 software package for displaying the numerical results generated using the heave motion program.

An analytical closed form solution for predicting Eigen values and displacements, based upon a simplified drill string model, was examined. When completed, this will provide another means of checking the validity of the heave motion computer model.

Recently, we have focused our attention on two aspects of the drill string analysis. The first aspect has been the completion of the graphics and plotting capabilities of the Heave Motion Program. The second aspect has been the development of an analytical solution for the heave response, a promising development that may provide a simpler and more compact computer code for a shipboard system, as well as a reliable means to check the more detailed heave motion software.

Hard Sea Floor Spudding System

The first Hard Rock Base (HRB) was successfully deployed and cemented last November on the Mid-Atlantic Ridge at Site 648 during Leg 106. A total depth of 34 meters was drilled, with 16-inch casing being set 8 m below the sea floor. The highly fractured young pillow basalt presented a real challenge.

Hole 648B was abandoned earlier than anticipated on Leg 106 due to hole instability, lack of working drilling jars, and to regroup and tackle the problems on Leg 109 in April-June 1986.Leg 109, which departed Dakar in late April, has a revised drilling game plan for Hole 648B. Smaller hole sizes will be drilled using larger drill collars. Also, several different types of bit cutting structures will be tried. The upper 250 feet of hole will be drilled until a flush joint string of 10-3/4" casing has been set and cemented. From that point, a 9-7/8" hole will be drilled and cored. Additional sets of drilling jars will be on hand for avoiding stuck bottomhole assemblies. A positive displacement coring motor will be aboard to drill the hole if needed.

New 12-1/4" hard formation tricone bits built by Smith Tool Company will be used for opening up the existing 9-7/8" hole in preparation for running the 10-3/4" casing. The new bit has wear pad lugs located on the upper bit body to provide protection to the legs and shirt tails in abrasive formations. The wear pads, coupled with hard facing and wear buttons on the legs of the bits, are designed to prolong cone bearing life.

Two new 9-7/8" core bit types have been designed and built. An extended conical (type 7) and short chisel (type 75) cutting structure will be employed. Additional hard facing and carbide wear buttons will be located on the legs and shirt tails of the bits to increase the life of the bearings in the core bit cones. The cutting structures being developed are designed to extend bit life in fractured abrasive basalt formations.

TV Running Sleeve

Design work and fabrication is complete on a modified "TV running sleeve." The sleeve, rather than being a separate package, adapts to the standard TV frame. The new sleeve and centralizer allow the VIT frame to be run on the 10-3/4" casing string. The frame is required for use on both Leg 109 and Leg 110.

Sediment Coring Systems

Design improvements to the Extended Core Barrel (XCB) have been completed. Circulation to the cutting shoe has been enhanced and now is adjustable by changing a "flow restriction ring" inside the shoe. If necessary the flow can be diverted internally rather than to "face discharge." This technique is successfully used in many mining-type core barrel designs.

A multiple core catcher capability has been added and now the use of the Acker collet-type core lifter can be supplemented with the ODP spring loaded dog-type core catchers.

The new, longer throat and adjustable nozzle XCB bit design allows better control and more variability in cutting shoe flow-rates. Design of the new "Venturi" vent assembly is complete.

It is anticipated that these modifications will result in improved XCB performance. Reduced incidence of core jamming and washing should result in higher recovery rates and less core disturbance.

Navidrill Core Barrel (3.75 NCB)

A design review meeting was held in College Station in February with representatives from Norton Christensen's Mining and Petroleum Research and Development groups. Ways to enhance corehead circulation and control bit weight on the diamond core headwere discussed. Norton will develop a proposal for the required design changes and present it to ODP engineering. No schedule has been set for the second round of design modifications and sea trials of the slimline wireline retrievable mud coring system.

Core Bit Development

Rock Bit Industries (RBI) has completed the design and fabrication of a new "hard rock" XCB bit. The final design reflects a re-entry compatible, 10-1/2" outside diameter (O.D.) bit. The 3.8" inside diameter (I.D.) core guide will be retained but with a much longer throat to provide a more effective "choking" or flow diversion to the XCB cutting shoes. Five TCI cones (6-1/2" bearing size) will be offset 1/8" to increase the gouging action of the bit. This should result in increased penetration rates. The additional offset can be tolerated since the XCB bit does not have to trim a core as does the conventional ODP core bits. The new bits will have adjustable jets for more optimized bit hydraulics.

Two types of TCI inserts will be evaluated, a medium length chisel type and a medium length conical type. These bits must be able to drill soft and medium formations at an acceptable rates of penetration (ROP) and still hold up while drilling indurated and basement-type rocks.

The prototype bits will be available for shipboard evaluation (sea trials) in April 1986, but no ship time is scheduled at present.

Hydraulic Bit Release

The new HBR-107 model hydraulic bit release was evaluated twice in rotary core barrel holes by the ODP development engineer on Leg 107. The unit successfully released one of two times. The failure to release apparently was caused by detritus infiltration into the mechanism. Leg 107 tests showed that the HBR-107 model will require further refinements to improve reliability, especially in exclusion of detritus from the moving parts.

Drill Pipe Inspection

Dr. Roderic Stanley, a highly recommended NDE consultant, has been retained to evaluate the ODP drill string inspection problem. He has examined the current situation, visited the ship to inspect the drill string and shipboard layout, surveyed the current state of the art in drill pipe non-destructive testing, and made recommendations on the best methods for ODP drill string inspection. Both new developments and adaptations of current inspection equipment were considered. Dr. Stanley completed the task of selecting the best available technique (i.e. external flux leakage buggy with cross-sectional area determination) and vendor (Baker Tubular Services) to inspect our pipe in the 12-18 month interim while a more state-of-the-art inspection system specifically adapted to our situation is explored/developed. Baker has submitted a proposal for a full pipe inspection service to be performed at the first Barbados port call in June. Dr. Stanley's final report was received by ODP in early April.

Dr. Stanley also coordinated a concurrent study by Cortest Laboratories of Cypress, Texas, to examine the entire drillstring from a fracture mechanics point of view. The result of that effort was to identify critical components, establish critical flaw sizes and crack growth rates, and determine inspection frequency and required flaw-detection resolution. Cortest Laboratories completed a fracture mechanics study to identify the fatigue and/or corrosion-fatigue propagation parameters of given crack sizes in ODP operations and on ODP drill pipe (5" and 5-1/2"). This will lead to rational selections of minimum flaw sizes required to be found by a pipe inspection system versus necessary frequency of pipe inspection.

TAM "Drilling" Packer

A primary objective of Leg 110 is to conduct permeability injection tests in a series of single-bit holes penetrating an overpressured thrust zone or "decollement." To accomplish this task, an open hole packer is required that is capable of being deployed as part of the bottomhole assembly during drilling. ODP is working with TAM International on the design and development of an open hole drilling packer. A preliminary design was approved and machine drawings were completed. Prototype fabrication began in January 1986, and prototype testing was accomplished in April. The hardware will be sent to Barbados for use on Leg 110 (July-August 1986). An ODP Special Tools Engineer will be aboard to assist in the operation of the equipment.

Drill-In Liner

Efforts are underway to provide an 11-3/4" drill-in liner capability for Leg 110 operations. The system will be re-entry compatible and will allow the drilling-in of an 11-3/4" casing string utilizing a mud motor powered underreamer. The 11-3/4"string can be hung off at any point in the 16" casing string with a modified off-the-shelf liner hanger giving maximum flexibility to the casing program.

Drill-In Casing

Design review of the DSDP drill-in casing system has been completed. Several potential problem areas capable of preventing downhole release of the system were identified. Most probable cause of failure on Leg 78 was excessive clearance and inadequate material hardness in the lower dog mechanism, leading to brinelling of the shifting sleeve and subsequent lock-up.Retrofit drawings have been prepared and all identified deficiencies will be corrected. This system remains scheduled for Leg 110 as a backup to the 11-3/4" liner hanger system.

Lockable Flapper Float Valve

Design work has begun on a new model of the Float Valve that will have the ability to lock in the open position and later be unlocked back to its normal spring-shut mode. The new float valve will be used in the XCB bottomhole assembly to enable logging tools and other open hole instruments (packers, geophones, water samplers, etc.) to pass out of and re-enter the pipe unobstructed, without either releasing the bit or drilling without a float valve (as is now required). The new model lockable flapper is targeted for sea trials on Leg 112.

WIRELINE LOGGING SERVICES OPERATOR REPORT

The following report includes excerpts from Leg 107 Preliminary Report and an update of log analysis being currently performed at the Borehole Research Group at Lamont-Doherty Geological Observatory (L-DGO). Further information may be obtained by contacting Dr. Roger Anderson, Director of Operations or Cristina Broglia, L-DGO Logging Scientist during Leg 107, at the Borehole Research Group (BRG), Lamont-Doherty Geological Observatory, Palisades, N.Y. 10964.

SUMMARY OF LOGGING RESULTS FROM LEG 107 (TYRRHENIAN SEA)

Logging operations, with Schlumberger and BRG-specialty tools, were planned at four sites: 650, 651, 652 and 654. Of these sites, only holes 651A (Vavilov Basin) and 652A (Sardinian continental margin) were logged. Logging was not conducted at Site 650 (Marsili Basin) or Site 654 (Sardinian continental margin) because operations at these locations were terminated prematurely due to jamming of the drillstring. An additional hole, 655B (magnetic ridge; Vavilov Basin) was logged with the resistivity-sonic velocity-gamma ray-caliper combination. However, while an initial run with the borehole televiewer was successful, a second run was aborted when the tool cablehead flooded as it was lowered into the drillpipe.

Site 651

The following suite of standard downhole measurements were successfully performed at Site 651: the resistivity-sonic velocity-gamma ray-caliper combination was operated from 339 to 119 meters subbottom and the density-porosity-natural spectral gamma ray was operated from 273 to 119 meters subbottom. An impassable bridge at 339 meters subbottom prevented logging the lower part of the sedimentary sequence and the basement during the first run. Also, attempts to clear a severe hole constriction during the second run, at 273 meters subbottom, failed when the drillstring became stuck at that depth.

Overall, the quality of the logging data at Site 651 was very good. However, the density log exhibited values that weresystematically lower than the core results. This difference was attributed to the rugose nature of the borehole wall which allowed drilling fluid to infiltrate into the gaps between the detector skid and the borehole wall and which decreased the reading of the measured sample.

Another problem that plagued Site 651 logging was the thorium and potassium contributions to the total gamma ray response was underestimated because a constant in the software of the spectral gamma ray tool was set incorrectly during the log recording. The curves have been reprocessed from the total count rates and the values are now correct.

Because the average core recovery in the logged interval was approximately 28%, logging data was used to supplement the qualitative and quantitative lithologic information in order to develop a more accurate sediment lithostratigraphy, particularly in the interval from 265 to 310 meters subbottom where core recovery drops to 6%. Lithologically, the coring data suggested that the logged interval primarily consisted of marly nannofossil ooze and chalk interbedded with volcanogenic sediments which were dated to be 150,000 to 1.6 m.y. old. However, the gamma ray and velocity logging data indicated that the volcanic sedimentary component of the section accounted for approximately 55% of the total sediment thickness in the logged interval and that the importance of volcanic sedimentation was seriously being underestimated.

At Site 651, the volcanogenic intervals were marked by high radioactivity values (up to 240 GAPI units), especially a high contribution of thorium (up to 40 ppm) and uranium (up to 11 ppm). These values, as observed in the carbonate intervals (see unit 2 of Fig.1, for instance), seemed to indicate that the input of volcanogenic material was quite constant even during periods of normal pelagic sedimentation, possibly by aeolian transportation. Further, the Th/U ratios suggest that these sediments owe their source to the continental Roman volcanic province (Locardi, 1967). If this information is confirmed by laboratory analysis, attempts will be made to relate the volcanic intervals in the cores, which cover a timespan of 1.5 m.y., to the different volcanic events in the Roman province.

Site 652

At Site 652, the resistivity-sonic velocity-gamma ray-caliper combination and porosity-natural and induced spectral gamma ray combination were operated in an area that would be troubled by bad hole conditions. During the first run the sonic velocity-resistivity-gamma ray string would not pass below 371.5 meters subbottom and the hole was logged up from that depth. On the second run, the induced spectral gamma ray tool replaced the density tool in the nuclear combination because its additional weight and other factors were needed to operate in the less than ideal hole conditions. However, the tool string was stopped by a bridge at 269.5 meters subbottom and logs were run from that depth. After running the drillpipe down to 429.5 meters subbottom to reopen the hole and after circulating sea water for 30 minutes, the same nuclear combination would not pass a hole constriction at 371.5 meters subbottom and logs were recorded from that depth up to 269.5 meters below the seafloor.

Site 652 results clearly show that the quality of log data was affected by either conditions in the borehole (particularly, the Pliocene section of the hole) or by very rapid changes in the hole size. Overall, the resistivity and velocity measurements seemed less sensitive to the borehole effects and the natural and induced spectral gamma ray results were better in the Messinian section of the hole (189 to 369 meters subbottom) where hole conditions slightly improved. On the other hand, problems did occur as the gamma ray spectrum data included large contributions from the borehole fluid, due to the same problem that occurred during recording at Site 651. These data as well as the induced spectral gamma ray data are being reprocessed at the Schlumberger computing center in New Orleans in an attempt to reduce the borehole effects. The experience of the logging crew at Site 652 showed that operating the neutron porosity tool without excentralizer does not give quantitatively reliable results, particularly when the hole is badly enlarged. Results from this operations suggested that contamination by the borehole fluid to the total count rates produced an overestimate of the sediment porosity in the logged interval.

Log analysis of 652A is currently being focussed on the interpretation of the induced spectral gamma ray data in the Messinian interval. This investigation has three objectives: 1) the development of a detailed lithology in the low recovery intervals (core recovery in the upper Messinian is about 29%); this has been accomplished by using the elemental yield ratios to detect high carbonate gypsiferous siltstones/sandstones and low carbonate claystones/mudstones, 2) the calibration of spectral gamma ray data on selected samples and quantitative computation of mineral volumes; this has been tentatively achieved using smear slide results as core data, since no XRD/XRF data is available and 3) the determination of the relationship between the cyclicity in sediment deposition observed on logs and the synrift evolution of the basin; the hypothesis that cycle frequency might be tectonically or climatically controlled is now being studied.

Site 655B

At Site 655B, the resistivity-sonic velocity-gamma ray- caliper combination was run from 195 up to 71 meters subbottom. The objectives at this site were to check the hole conditions before operating the borehole televiewer and to use sonic velocity, radioactivity and resistivity curves to characterize the different basalt flows in the section. Note that core recovery at the site was 43%. However, troubles plagued the operation as the first arrival picking software for velocity did not work properly and even after reprocessing were unable to provide good velocity measurements. Results indicated, however, that the logged interval included 115 m of basaltic flows, along with the sediment-basalt interface and 10 m of the overlying sediments. The logs showed that two distinct units in the basalts, an upper unit that is highly fractured and a lower unit that is less fractured but more altered. Moreover, the data indicated that there was an increase in natural radioactivity in the lower unit. It has been speculated that this increase could be due to either the precipation of uranium from the seawater circulating within the fractures and pillow margins or the presence of alteration products. In addition, a fine scale cyclicity on the order of 2-5m in the resistivity data allowed for the identification of individual lava flows.

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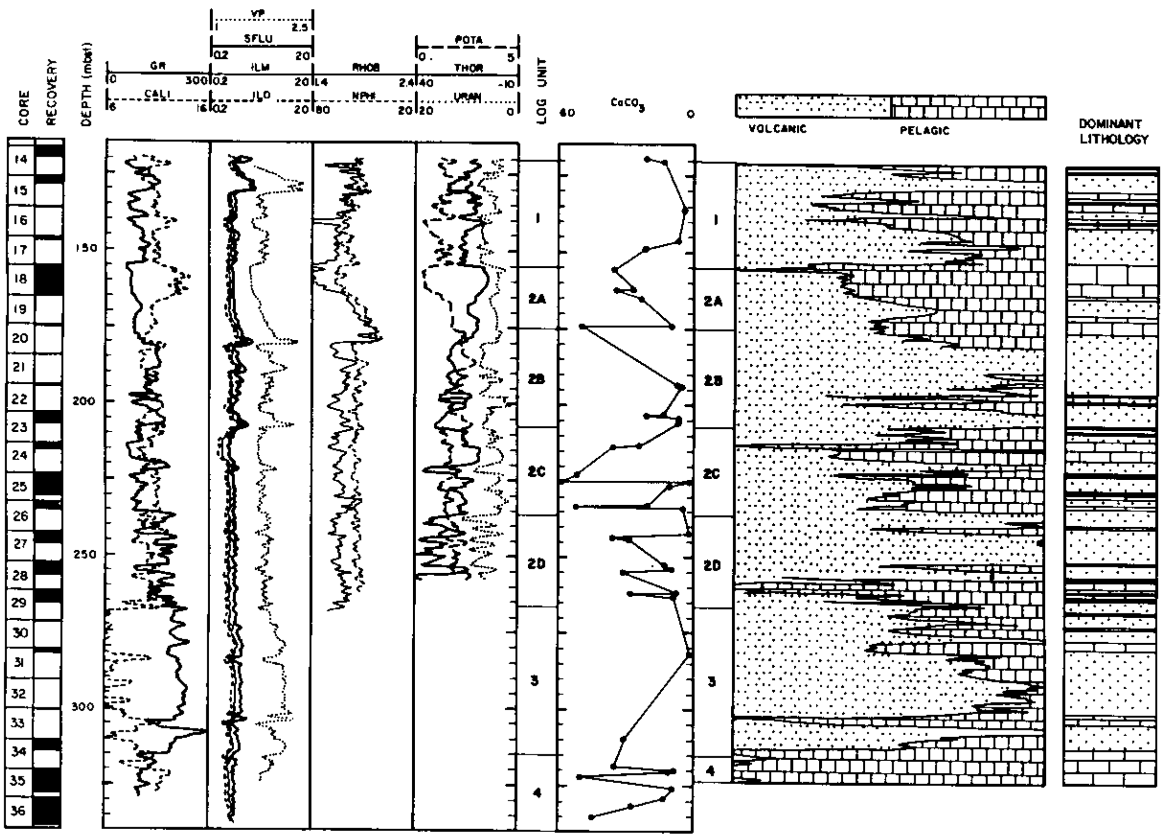


Figure 1

Figure 1 shows the original logging data as well as the quantitative interpretation of the lithologic components as determined by the Terralog analysis software. The abbreviations and their units of measure are GR (Gamma Ray, GAPI units), CALI (Caliper, in.), ILD, ILM (Deep and Medium Resistivity, ohm*m), SFLU (Spherically Focused Resistivity, ohm*m), VP (Compressional Sonic Velocity, km/s), Neutron Porosity (%), Bulk Density (g/cc), URAN & THOR (uranium and thorium, ppm), POTA (potassium, %). The figure also shows the division of the logging data into log-stratigraphic units that are based on the relative percentages of volcanic and pelagic sediments calculated from gamma ray and velocity input logs.

SPECIAL REPORT: DEVELOPMENT AND USE OF PACKERS IN ODP

by Keir Becker

The following special report to the JOIDES Journal was written by Dr. Keir Becker of the Division of Marine Geology and Geophysics at the University of Miami, Coral Gables, Florida

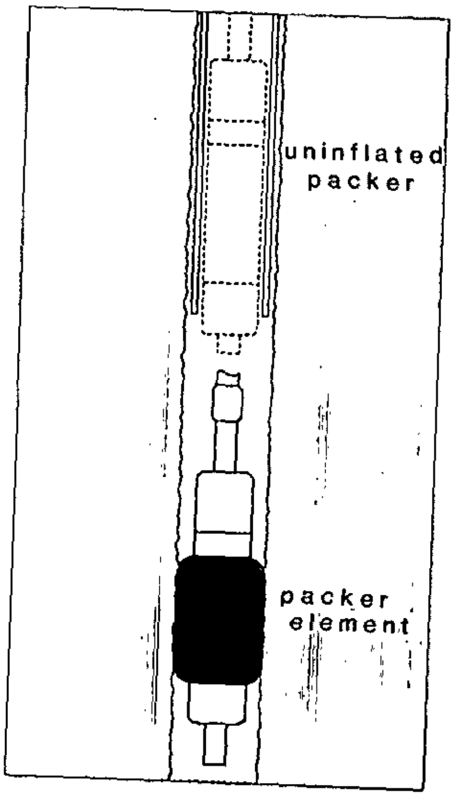
INTRODUCTION

A packer, simply defined, is a device that produces a hydraulic seal in a borehole. If this seal is properly maintained, then the hydrologic properties of a geological formation, such as pore pressure, transmissivity (which is related to permeability) and storage coefficient (which is related to porosity) can be tested by the application of differential fluid pressures to the isolated section. In addition, if the formation is permeable enough then fluid samples from the isolated area can be drawn for testing. Packers are designed to either be a weight-bearing part of the drillstring (i.e. a drillstring packer) or as a separate tool to be lowered on a wireline (i.e. a wireline packer). Furthermore, a drillstring or wireline packer can be designed to be a single-element packer (Fig. 1) which isolates the area between the packer seal and the bottom of the borehole or as a straddle packer (Fig. 1) which produces two hydraulic seals in a borehole and allows for the testing of formation properties in the zone between the seals.

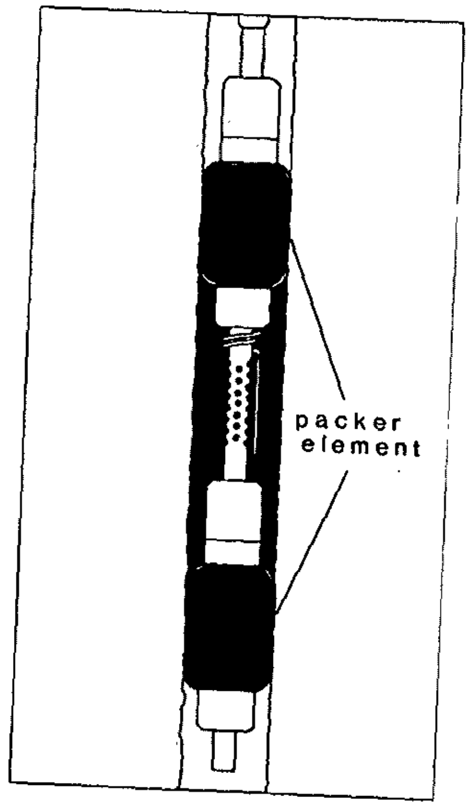
The packers associated with the Deep Sea Drilling Project (DSDP) and those to be used in the Ocean Drilling Program (ODP) produce the hydraulic seals necessary for operation in the borehole by inflating rubber/steel elements with drilling fluids. The elements found in this type of packer (known as an inflatable packer) are generally constructed of an internal rubber bladder (covered with an expandable steel member for strength) which is coated with an outer rubber cover (Fig. 2). The outer rubber and steel coverings both serve to grip the borehole wall during operations and to protect the inner bladder, which must remain unpunctured in order to maintain the hydraulic seal.

Inflation of the elements is accomplished either by pumping fluids from the drillship down to a packer (such is the case with a drillstring packer) or by means of an electrically powered downhole pump which is located within the packer (such is the case for a wireline packer). During the inflation operation, typical rubber/steel elements can be inflated to twice their uninflated diameters. However, it should be noted that a greater degree of inflation does not guarantee a stronger hydraulic seal but instead has been found to produce a weaker seal that can withstand only limited formation testing pressures. In controlling the amount of inflation and the packer formation pressure it is necessary to evaluate anticipated hole conditions and formation properties and the planned testing pressures. The packer inflation pressure is defined as the pressure (measured at the surface pumps) relative to hydrostatic pressure at which fluid is pumped into the elements when they are inflated. Given good hole conditions, the elements should be inflated to either approximately half the planned test pressures (if higher pressures are expected) or to at least 500-1000 p.s.i. However, care must be taken not to inflate the elements to pressures which will fracture the formation and thereby invalidate any testing.

In the case of the drillstring packer, the inflation mechanism is enabled by initially dropping a retrievable go-devil down the bore-



(a)



(b)

Figure 1. Sketches of TAM inflatable drillstring packers.
(a) A single-element packer, which isolates the formation between the element and the bottom of the hole.
(b) A straddle packer, which separately isolates the zone between the elements and the zone between the lower element and the bottom of the hole.

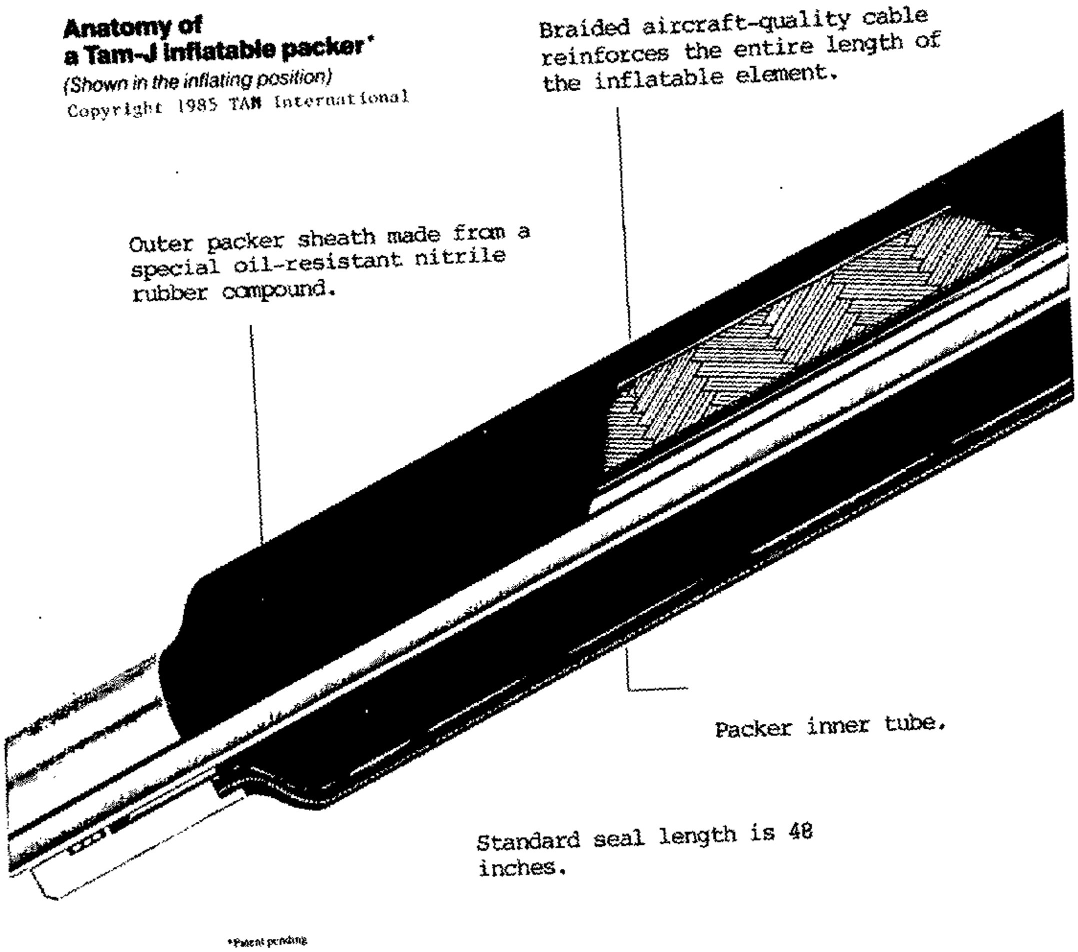

Anatomy of
a Tam-J inflatable packer*
(Shown in the inflating position)
Copyright 1985 TAM International
Braided aircraft-quality cable reinforces the entire length of the inflatable element.
Outer packer sheath made from a special oil-resistant nitrile rubber compound.
Packer inner tube.
Standard seal length is 48 inches.
*Patent pending

Figure 2

hole which keys into the plumbing system of the packer. Once properly seated, a go-devil can perform several functions such as establishing the hydraulic seal within the borehole, directing fluids pumped down from the drillship to either the rubber elements during inflation or into the formation for testing, carrying pressure recorders that monitor data for pore pressure and permeability determinations and possibly carrying a sample chamber. Moreover, using a go-devil that is retrievable with a sandline allows multiple sets to be taken as long as the elements maintain their structural integrity.

FORMATION TESTING USING DRILLSTRING PACKERS

During formation testing several parameters can be determined from the isolated zone in the borehole. The most critical of these parameters and the one from which formation properties are determined is the fluid pressure in the isolated section of the borehole and at the surface pumps. During testing, it is also important to measure the rate at which fluid is pumped from the surface.

It is necessary to measure and distinguish between three different pressure values in the isolated section of the borehole since they determine the overall sequence in the testing procedure at each tested zone and the estimation of formation permeability. These are the hydrostatic pressure, the in situ pore pressure and the test pressure. Hydrostatic pressure is initially measured (before packer inflation) in order to check recorder calibrations and to provide a reference baseline for the in situ and test pressures. Once the packer is inflated and the formation isolated, fluid pressure in the borehole will slowly approach the in situ pore pressure. The time that it takes to reach equilibrium is dependent on the formation permeability and may take as much as 2-3 hours of passive monitoring. During active testing, permeability is estimated from the behavior of pressure in the borehole as measured in response to controlled pumping from the surface through the go-devil and into the formation.

Pressure measurements are made by several kinds of downhole pressure recorders (e.g. self-contained mechanical recorders, self-contained electronic recorders and electronic recorders on a conducting cable). Presently, the ODP uses four self-contained mechanical recorders that are housed in a special carrier that attaches to the packer. These packer recorders, which are manufactured by the Kuster Co., are calibrated for four different maximum pressures (9950, 11900, 12000 and 15275 p.s.i.) be set to record for 3, 6 or 12 hours.

Other parameters, such as permeability, can be determined using either pulse or constant flow tests. In a pulse test, downhole recorders monitor the decay of a short, instantaneous pressure pulse. In a relatively impermeable geologic formation, the period of decay will be long in comparison to the duration of the pulse. In a relatively permeable formation, the pressure pulse will decay too rapidly to allow for the resolution of permeability and therefore a constant flow test must be conducted. The decay of the pulse is described by an integral which is dependent on transmissivity (a function of permeability) and storage coefficient (a function of formation porosity). Fitting the pulse test pressure data to the integral results in a more accurate determination of permeability than of porosity as transmissivity is better resolved than storage coefficient.

During a constant flow test, fluids are pumped from the surface at a known constant rate while the downhole pressure is monitored until it reaches a steady-state volume. In theory, when steady-state is reached then permeability can be estimated by using a form of Darcy's Law. In practice, it may take too long for true steady-state conditions to be reached and therefore, permeability is usually estimated from the results of several flow tests at differing rates. It is also important to note that the ranges of permeability values over which pulse tests and flow tests yield results greatly overlap and it is often not possible to determine, before testing, which type of test will be more appropriate. In practice, it is advisable to attempt pulse tests before flow tests since flow tests disturb the pressure field around the borehole to a greater degree. Also, it should be noted that the time required for pulse testing increases with decreasing permeability and that, conversely, time increases with increasing permeability for flow tests.

A BRIEF REVIEW OF PACKER USE DURING DSDP AND ODP WITH IMPLICATIONS FOR THE FUTURE

During the Deep Sea Drilling Project, the only packer used was a single-element drillstring packer that was made by Lynes International. Termed the Lynes packer, this packer was intended as a rotatable safety tool (i.e. a blowout preventer) and was considerably more complicated than that required for formation testing only. Although successfully tested on DSDP Leg 38, the rotational capability of the packer was never quite perfected as it was prone to inflate during drilling which seriously damaged the rubber elements. However, the Lynes packer was successfully used in a non-rotating mode to measure formation pressure and permeability in DSDP Holes 501 and 504B during Legs 68, 69, 83 and 92 (Anderson and Zoback, 1982; Anderson et al., 1985), in Hole 395A during Leg 78B (Hickman et al., 1984) and Hole 597C during Leg 92. Also during DSDP, there were only 5 in situ measurements of permeability in holes which penetrated oceanic basement (Anderson and Zoback, 1982; Becker et al., 1983; Anderson et al., 1985), of which 4 were in Hole 504B.

Further the Lynes packer was also successfully used to collect large volume (up to 51 liters) samples of borehole fluids. Though successfully collected, it was unfortunate that most of these samples were seriously contaminated with drilling fluids, drilling muds and grease from within the sampler. Further, because of its complicated design, the fact that its elements were not designed for collecting multiple sets and possibly because it was a perfectly good tool that was being used in a mode for which it was not intended, the Lynes packer proved difficult to use for scientific purposes.

In 1984, during the interim between DSDP and ODP, the National Science Foundation provided funds for the refurbishment of the Lynes packer to better its performance and increase its use by the scientific community. However, several factors such as the costs of refurbishing the Lynes packer versus purchasing a new packer, its history of use during DSDP and the reluctance of the manufacturer to undertake the refurbishing operation, indicated that the ODP and the scientific community would probably be best served if a packer was purchased elsewhere. Investigations indicated that a new, resettable drillstring straddle packer could be purchased from TAM International at a price comparable to that of refurbishing the often-plagued Lynes packer.

Further investigation showed that, from the standpoint of safety, a straddle packer performed much better than a single-element packer at handling the forces placed on the drillstring. Also, an excellent feature was that a hydraulic failure anywhere within the system did not result in one or both elements being locked in undeflatable positions but resulted in the deflation of both elements, thereby limiting potential damage. In addition, from an operational standpoint, the TAM straddle design could be operated as a single-element packer, a double-element double strength single packer, a straddle packer and as a straddle packer which could test either the straddled interval or the interval below the lower element. The most serious limitation was it could only be used in a non-rotation mode.

The TAM straddle packer was deployed once during the first year of ODP in Hole 418A on Leg 102. This initial trial was only a partial success as the packer did not fully inflate while in the borehole. The problem was subsequently solved by increasing the diameters of the flow ports and by establishing a required waiting period for full inflation and deflation of the packer.

During initial preparation for Leg 110 (Barbados), it became apparent that the hydrogeologic measurements critical for the success of the cruise could not be efficiently and safely accomplished using the non-rotatable TAM straddle packer and that a wireline packer, which would have accomplished these measurements, would not be developed in time. Therefore, ODP engineers negotiated with TAM International for the construction of a rotatable, single-element drillstring packer. In comparison, neither packer has parts that are interchangeable but both can be used for the same kinds of tests and can use the same set of go-devils. Further, the TAM rotatable packer has the minimum inside diameter (3.84 in.) to be fully compatible with ODP logging tools. Therefore, planning indicates that each TAM packer will be used during Leg 110 operations. The rotatable packer will be used to conduct permeability/pore pressure tests in stable, open hole conditions and the straddle packer will be used, through perforated casing in unstable conditions, for pore pressure measurements and possibly outside the casing in stable formations.

For Leg 111, excellent hole conditions and temperatures approaching 200 deg C. are expected for Hole 504B. However, the temperature range over which the TAM drillstring packers can be used will be restricted by the temperature ratings of the rubber compounds of the elements and seals. Although commercially available rubber O-ring seals, made of special elastomers, are effective to temperatures as high as 300 deg C., the combination of elasticity, strength and resettability (which are necessary if the packers are to operate properly) may be difficult to achieve. Further, even if the packer elements constructed of the high temperature rubber compounds are effective to 200-250 deg C. questions remain over the range of test pressures that can be used as well as the life expectancy of the elements.

REFERENCES

Anderson, R.N. and Zoback, M.D., 1982. Permeability, underpressures and convection in the oceanic crust near the Costa Rica Rift, eastern equatorial Pacific. J. Geophys. Res., 2860-2868.

Anderson, R.N., Zoback, M.D., Hickman, S.H. and Newmark, R.L., 1985. Permeability versus depth in the upper oceanic crust: in situ measurements in Deep Sea Drilling Project Hole 504B, eastern equatorial Pacific. In Anderson, R.N., Honnorez, J., et al., Init. Repts, DSDP, 83: Washington (US Govt. Printing Office), 429-442.

Becker, K., Langseth, M.G., von Herzen, R.P. and Anderson, R.N., 1983. Deep crustal geothermal measurements, Hole 504B, Costa Rica Rift. J. Geophys. Res., 88, 3447-3457.

Hickman, S.H., Langseth, M.G. and Svitek, J.F., 1984. In situ permeability and pore-pressure measurements near the Mid-Atlantic Ridge, Deep Sea Drilling Project Hole 395A. In Hyndman, R.D., Salisbury, M.H., et al., Init. Repts. DSDP, 78B: Washington (US Govt. Printing Office), 699-708.

ODP DATABANK REPORT

The JOIDES/ODP Databank received the following data between February 1986 and May 1986. For more information concerning the ODP Databank, please contact Carl Brenner at the Lamont-Doherty Geological Observatory, Palisades, N.Y.

From D. Hayes (L-DGO): Two unpublished geophysical maps, "Bathymetry of the North Atlantic off Northwest Africa" and "Microphysiography and Bottom Reflectivity Characteristics of the North Atlantic off Northwest Africa", to aid in Leg 108 drilling.

From H. Stagg (Australia, via J. Kennett-URI): Preliminary copies of MCS lines documenting proposed Prydz Bay drillsites. Also, BMR MCS lines 21 and 31, in the Prydz Bay area.

From A. Mascle (France): MCS lines 107A and 212A, with navigation, to document Leg 110 site LAF-6; navigation for MCS line 128. Also, final navigation of French MCS lines with shot points and site locations, No. Barbados area.

From D. Hussong (HIG): Reproducible copies of the MCS lines collected aboard R/V MOANA WAVE, ODP Site Survey of the Peru Margin, along with dredge and heatflow data and digital tape of navigation with underway geophysics. Also, CDP navigation for MCS lines Peru 2, Yaquina Basin area; navigation with line identification for HIG MCS survey.

From K. Lighty (ODP/TAMU): Digital tape of navigation merged with underway geophysics for JOIDES RESOLUTION Leg 101, microfilm of seismic profiles collected and a copy of the underway report.

From M. Langseth (L-DGO): Heatflow profile over the Barbados Rise, at location of Leg 110 back-up sites LAF-4 and LAF-5.

From R. von Huene (USGS): Copies of Peru Margin MCS lines 2 and 3. Also, re-processed versions of Peru Margin lines CDP-2 and CDP-3.

From B. Taylor (HIG): Migrated section of MCS lines 13, 14 and 5 collected by R/V MOANA WAVE on the ODP Peru Margin site survey. Also, microfilm of the 3.5 kHz data and mixed frequency seismic reflection records.

International Phase of Ocean Drilling

JOIDES COMMITTEE REPORTS

EXECUTIVE COMMITTEE REPORT

29-30 APRIL 1986

The following paragraphs are highlights of the April meeting of the JOIDES Executive Committee which was held in Annapolis, Maryland.

The meeting was divided into two sessions, a joint session with the ODP Council and a separate business session. The joint session was co-chaired by D. Heinrichs (NSF) and J. Knauss (EXCOM) and included the signing of a Memorandum of Understanding by the European Science Foundation Consortium. The business session was chaired by J. Knauss.

MEMORANDUM OF UNDERSTANDING SIGNING CEREMONY

The ceremony was presided over by W. Merrell (NSF) and E. Seibold (ESF). During the opening remarks, Merrell noted that the European Science Foundation (ESF) Consortium was last of the candidate members to join the ODP and commended those people responsible for their diligence in coordinating the 12 countries of the consortium into an organized body. It was stated that the ESF Consortium consists of Belgium, Denmark, Finland, Greece, Iceland, Italy, the Netherlands, Norway, Spain, Sweden, Switzerland and Turkey. Seibold responded that the signing of the MOU will hopefully aid in the building of bridges between nations, eventually including the eastern bloc nations, through the development of personal relations between scientists. The ceremony was concluded by the signing of the MOU and the passing of a resolution by EXCOM which welcomed the ESF Consortium to the Ocean Drilling Program.

FY87 PROGRAM PLAN AND FY87 BUDGET

JOI stated that the FY87 Program Plan was a managerial and scientific plan that would achieve both COSOD and JOIDES objectives. JOI also stated that the FY87 budget was based on advice from NSF and covered a range of possible budget levels between $34 - 36M (TABLE 1). The budget, developed in concert with the ODP subcontractors, consists of three categories: a target budget of $36 M (with justifications), a lower budget of $34.3 M (with a program of impact if the target was not achieved) and an increased budget of $38.1 M, if additional funds became available.

It was the consensus of EXCOM, after reviewing the operations budget of TAMU, that due to the critical role that publications plays in the success of the program, that this operation be fully implemented at this time. EXCOM also requested that TAMU revise their budget to include a more detailed explanation of the low budget program. After reviewing the L-DGO budget, the EXCOM agreed that the budget for Wireline Logging Services should remain at levels no lower than $2.75 M and endorsed the suggestion by L-DGO that they approach the Office of Naval Research (ONR) for funds to purchase a dipmeter for use in the logging program. EXCOM also approved the expenditure of funds by Wireline Logging Services to develop the Sidewall Entry Sub. After reviewing the JOI budget, EXCOM agreed that the Site Survey Databank should be budgeted at the levels considered acceptable by the Databank Review Panel, however, the remainder of the budget was in need of re-evaluation and revision. It was the consensus of EXCOM that JOI develop a revised program plan by August 1986 which reflected a potential long-term reduction in the US contribution and which emphasized the low budget figures.

In considering the impact that potential reductions in US Federal spending may have on the ODP, as a result of the Gramm-Rudman-Hollings legislation, the EXCOM advised JOI and the subcontractors that the low budget figures may indeed be the long-term reality of the program.

PARTICIPATION OF THIRD WORLD SCIENTISTS

In a continuing effort to involve geoscientists from the Third World community in the ODP, the JOIDES Office reported that positive responses had been received from the Intergovernmental Oceanographic Committee (IOC), the Scientific Committee on Oceanic Research (SCOR) and the International Union of Geological Sciences (IUGS) in terms of providing funds for travel and establishing better communications with the worldwide scientific community.

TABLE 1 - TARGET BUDGETS

(in millions)

	FY86 operations	FY87 low budget	FY87 target	FY87 high budget
JOI	1.43	1.47	1.56	1.66
L-DGO	2.50	2.60	2.75	2.89
TAMU	32.00	30.20	31.70	33.60
Totals	35.90	34.30	36.00	38.10

PLANNING COMMITTEE REPORT

28-30 May 1986

The following paragraphs are highlights from the May 1986 meeting of the JOIDES Planning Committee.

SHORT-TERM PLANNING

Leg 109 (MARK-II)

At its January meeting, PCOM recommended that the deepening of Hole 648B, established on Leg 106, is the highest priority of Leg 109. A logging program is also to be conducted during this cruise, barring exceptional drilling and recovery rates at Site 648B. JOIDES RESOLUTION should go to DSDP Hole 395A after 30 days at 648B and proceed with the logging program which will include the FRG differential thermometer, the Becker packer and the nuclear combination tool.

Leg 110 (Barbados)

No problems are anticipated for Leg 110 as all safety reviews are completed and the science program has been approved. However, the inclusion of the casing perforation program into the overall drilling plan was unclear. The issue will be clarified by TAMU and reported on at the August 1986 PCOM meeting.

Leg 111 (504B)

The PCOM reaffirmed that the deepening of DSDP Hole 504B is the prime objective of Leg 111. PCOM recommended that up to five days be reserved, early in the cruise, to conduct advanced piston coring (APC) at a downwelling site near 504B and for APC and extended core barrel (XCB) coring to basement at 504B. This latter operation is designed to study alteration processes at the upwelling area. PCOM approved the inclusion into the scientific plan of the logging experiment, endorsed by DMP, with time devoted for vertical seismic profiling (VSP) operations. PCOM recommended that the Los Alamos Water Sampler be placed on RESOLUTION for use during the leg.

It was the consensus of PCOM that the back-up program for 504B would be the Mottl proposal to drill several single bit holes within 3 km of Site 501/504 to further define the nature and pattern of hydrothermal flow through the sediments and underlying shallow basement. It was agreed that the decision to abandon operations at 504B and institute the back-up program would be left to Leg 111 co-chief scientists. The PCOM also recommended that, as a further back-up to the Mottl proposal, unsupported bare rock drilling be conducted at the Galapagos spreading center.

Leg 112 (Peru Margin)

PCOM recommended that Leg 112 be extended 5 days and that a total of 52 days be allotted for drilling. Of that time, thirty-six days are to be devoted to TECP objectives, twelve days for SOHP objectives and the remaining four days are to be shared between TECP and SOHP objectives at Site 3 in the Lima Basin.

The Science Operator indicated that clearances have been requested from the Peruvian government and that no problems are anticipated.

Leg 113 (Weddell Sea)/Leg 114 (Sub-Antarctic South Atlantic)

PCOM recommended that Legs 113 and 114 be jointly briefed. However, it was generally agreed that Leg 114 is scientifically strong on its own merits and should not be considered as a back-up program to Leg 113. PCOM agreed that the first priority sites on Leg 113 should be W1 (Maud Rise), W2 (Maud Rise) and W4 (Caird Coast). Sites W5 (Weddell Sea), W6-8 (South Orkneys) and W10 (Bransfield Strait) will be attempted after the prime program. The PCOM recommended that the primary scientific objectives for Leg 114 be Sites SA8 (Agulhas Basin), SA3 (DSDP Site 513) and SA 5W (NE Georgia Rise).

MEDIUM-RANGE PLANNING

Site Surveys

NSF reported that all US site survey proposals for the eastern Indian Ocean will be funded. Also NSF noted that site surveys by other nations have been funded and all relevant work should be completed by Spring 1987.

Drilling Program (TABLE 1)

At its April meeting, the EXCOM requested that PCOM re-examine the Red Sea drilling program with a view towards the potentially volatile political situation in the region and on the basis of problems recently experienced by France and the FRG during survey work in the Gulf of Suez. PCOM accomplished this request through the development of two sets of drilling schedules, one with the Red sea program (Option 1) and another with the Red Sea replaced by another objective (Option 2). After extensive discussion, it was the consensus of PCOM that Option 1 be adopted as the prime Indian Ocean drilling plan with Option 2 the alternate program should the Red Sea program be eliminated from the schedule. IOP and SOHP were asked to comment on an extended Exmouth program to accomplish deep stratigraphic objectives.

LONG-RANGE PLANNING

For the Western Pacific drilling program, PCOM accepted the proposal by WPAC, for a 9 leg drilling program, as the basis for planning noting that this schedule is tentative and subject to modification by iterations of the schedule. The 9-leg program is listed in Table 2.

TABLE 2

WESTERN PACIFIC DRILLING
(not in priority or chronological order)

Lau Basin
Bonin, Mariana 1
Bonin, Mariana 2
Vanuatu
Sulu, Banda
Great Barrier Reef
Japan Sea
South China Sea
Nankai Trough

PROPOSALS RECEIVED BY THE JOIDES OFFICE BETWEEN 1 FEBRUARY - 31 MAY 1986

NEW AND REVISED PROPOSALS

Ref. No.	Date Rec'd.	Title	Investigator(s)	Inst.	Site Survey Avail' Data	Site Survey Future Need	Panel Reference	PCOM Reference	Remarks
				ATLANTIC OCEAN					
				INDIAN OCEAN					
89/B	10/1/84	Mantle heterogeneity leg-drilling on S.W.Indian Ridge Fracture Zones	Dick, H.J.B. Natland, J.	WHOI SIO	Some		SOP 3/85 LITHP;IOP; & TECP 3/85 & 5/86 DMP 5/86		US Indian Ocean W'shop:1st rev.3/85 Further rev'd 5/86 incorp.162/F,186/F & 208/B. Also see 112/B & 223/B
215/B	2/10/86	Pliocene-Holocene sedimentary & palaeoceanographic history of a young rifted margin, Red Sea	Richardson, M. Arthur, M.A.	URI	Some	Yes	IOP 2/86 SOHP 2/86 TECP 2/86		
219/B	3/03/86	Evolution of the Gulf of Aden	Simpson,P.R.K.	Newcastle U. U.K.	No	Yes	LITHP 3/86 IOP 3/86 TECP 3/86		Related to Props. 119/B & 134/B
223/B	4/14/86	Drilling a fracture zone in the Central Indian Ocean	Natland,J. Fisher,R.L.	SIO	Yes	No	IOP 4/86 LITHP 4/86 TECP 4/86		Related to Props. 89/B & 208/B
226/B	5/1/86	Neogene evolution of the pelagic carbonate system & deep circulation of the equatorial Indian Ocean	Prell,W.	Brown U.	Some	Yes	IOP 5/86 SOHP 5/86		Rel. to 77/B & 97/B
				SOUTHERN OCEANS					
129/C	01/21/85	ODP opportunities in the Bounty Trough	Davy, B.W.	D.S.I.R. N.Zealand	Some	Yes	WPAC 1/85 SOHP 1/85 TECP 1/85 SOP 1/85 CEPAC 5/86		Revised 5/86
228/C	5/5/86	Drilling in the Weddell Sea (East Antarctic continental margin)	Hinz,K. Oostmann,H. Fuetterer,D.	BGR,FRG AWI,FRG	Yes	No	SOP 5/86 TECP 5/86 SOHP 5/86		Rel. to 54/C Leg 113
230/C	5/8/86	Drilling the Wilkes Land margin, Eastern Antarctica	Eittreim,S. Hampton, M.A. Tanahashi,M.	USGS Geol.Surv. Japan	Some	Yes	SOP 5/86 TECP 5/86		USSAC South Pacific Workshop
				WEST PACIFIC					
46/D	3/5/84	Processes of continental rifting & evolution of passive continental margins; South China Sea	Hayes, D.E. Lewis, S.D. Ladd, J. Diebold,J.	LDGO	Yes	Some	WPAC 2/86 TECP 2/86 SOHP 2/86 LITHP 2/86		Related to Props. 147/D,194/D,216/D & 218/D.Revised 2/86.Mature Prop.
83/D	9/5/84	Izu-Ogasawara(Bonin) Arc transect	Okada, H. Takayanagi,Y.	Shizuoka Univ.Japan Tohuku U., Japan	Yes		WPAC 9/84 TECP 9/84 LITHP 9/84		Revised 7/85 & 4/86 Japanese Workshop Rel. to Prop.171/D
171/D	08/13/85	Bonin Region;problems of intra-oceanic arc-trench development	Taylor,B.	HIG	Yes	Some	WPAC 8/85 LITHP 8/85 TECP 8/85		USSAC West Pacific Workshop. Rel.to Prop.83/D.Rev.4/86
206/D	12/30/85	Great Barrier Reef:slope sedimentation adjacent to a mixed reefal-carbonate/ epiclastic shelf	Davies,P.J. Symonds,P.A. Feary,D.	BMR, Australia	Some	Yes	SOHP 12/85 WPAC 1/86 TECP 3/86		USSAC Carbonate Platforms Workshop Formerly included in Prop.126/D: COGS-2 super-prop. Rev.3/86
216/D	2/13/86	Drilling in the South China Sea	Rangin,C. Pautot,G. Briais,A. Tapponnier,P.	U.P&MCurie Paris IFREMER IPG Paris France	Yes	No	LITHP 2/86 TECP 2/86 WPAC 2/86		Related to Props. 46/D,147/D,194/D & 218/D
217/D	2/13/86	Drilling on the Lord Howe Rise	Mauffret,A. Mignot,A.	Univ.P&M Curie, France	Some	Yes	SOHP 2/86 WPAC 2/86 TECP 2/86		See Prop.67/D
218/D	2/13/86	Manila Trench & Taiwan Collision Zone, South China Sea	Lewis,S. Hayes,D.E. Lundberg,N. Suppe,J. Dorsey,R.	LDGO Princeton U.	Some	Yes	TECP 2/86 LITHP 2/86 WPAC 2/86		Related to Props. 46/D,147/D,194/D & 216/D
220/D	3/20/86	Three drilling sites in the Lau Basin	Hawkins,J.W.	SIO	Some	Yes	TECP 3/86 LITHP 3/86 WPAC 3/86		USSAC West Pacific Workshop See Prop. 189/D

CENTRAL & EASTERN PACIFIC

214/E	1/31/86	Drilling the trench-slope break:Central Aleutian Forearc	Ryan,H.F. Scholl,D.W.	USGS	Yes	Some	TECP CEPAC	1/86 1/86		USSAC NORPAC W'shop Rel. to 213/E
221/E	3/24/86	Late Cenozoic palaeoenvironments:APC/XCB drilling in the Equatorial Pacific	Pisias,N.G. Mix,A.C. Lyle,M.	OSU	Some	Yes	SOHP CEPAC TECP LITHP	3/86 3/86 3/86 3/86		
222/E	3/28/86	Ontong-Java Plateau: origin, sedimentation history and tectonic processes	Kroenke,L.W. Coulbourn,W. Mahoney,J. Resig,J.	HIG	Yes	Yes	SOHP LITHP TECP CEPAC WPAC	3/86 3/86 3/86 3/86 3/86		See Prop.142/E
224/E	4/23/86	Drilling in the Escanaba Trough:the sediment filled axial valley of the Gorda Ridge,N.E.Pacific	Fisk,M. et al Karlin,R.et al Holmes,M. Morton,J.	OSU U. Washington USGS	Yes	No	LITHP TECP CEPAC	4/86 4/86 4/86		U.S.INPAC Workshop
225/E	4/30/86	Drilling in the Aleutian Basin,Bering Sea	Cooper,A.K. Marlow, M.S.	USGS	Some	Yes	TECP SOHP CPEAC	4/86 4/86 4/86		USSAC NORPAC W'shop Rel. to Props.182/E 195/E,207/E,211/B & 229/E
227/E	5/2/86	Subsidence & fragmentation of the Aleutian Ridge and formation of summit basins	Vallier,T.L. Geist,E.	USGS	Some	Yes	TECP CEPAC LITHP	5/86 5/86 5/86		USSAC NORPAC W'shop Rel. to 207/E
229/E	5/8/86	Drilling on the Beringian continental slope & rise, Bering Sea	Cooper,A.K. Marlow,M.S. Armentrout,J.	USGS Mobil	Yes	Some	CEPAC SOHP TECP	5/86 5/86 5/86		USSAC NORPAC W'shop Rel. to 195/E,207/E & 225/E
231/E	5/8/86	Drilling in the North Pacific magnetic quiet zone	Mammerickx,J. et al	SIO	Some	Yes	TECP CEPAC LITHP	5/86 5/86 5/86		USSAC NORPAC W'shop
232/E	5/16/86	Drilling in high temperature zero-age crust on northern Juan de Fuca Ridge	Davis,E. et al	PGC, Canada	Yes	Some	LITHP CEPAC TECP	5/86 5/86 5/86		INPAC W'shop
233/E	5/21/86	Fluid processes & structural evolution of the central Oregon accretionary complex	Kulm,L.D. et al	OSU	Yes	Some	SOHP TECP CEPAC	5/86 5/86 5/86		INPAC W'shop

JOIDES/ODP BULLETIN BOARD

1986/1987 MEETINGS SCHEDULE

Date	Place	Committee/Panel
4-8 July	Strasbourg	IOP
10-12 July	La Jolla	IHP
22-23 July	Woods Hole	DMP
28-29 July	Corvallis	LITHP
6-7 August	Denver	PPSP
11-15 August	Cornerbrook, Newfoundland	PCOM
17-18 September	College Station	TEDCOM
15-16 October	Vancouver	EXCOM
20-21 October*	Ann Arbor	CEPAC & SOHP
late October*		TECP
4-6 November*	Villefranche	SSP
7-8 November*	Tokyo	DMP
19-21 November*	Houston	SOP
early December*	San Francisco	WPAC
8-10 January*	U.K.	LITHP
28-30 April	Washington, DC	EXCOM (& ODP Council)

*Meeting dates are tentative.

ODP/TAMU JOIDES PANEL LIAISONS

The following ODP/TAMU staff scientists have been assigned to liaise with JOIDES panels for planning purposes:

LITHOSPHERE PANEL- Andrew Adamson

SEDIMENTS & OCEAN HISTORY PANEL- Amanda Palmer

TECTONICS PANEL- Christian Auroux

DOWNHOLE MEASUREMENTS PANEL- Suzanne O'Connell

INFORMATION HANDLING PANEL - Russ Merrill

POLLUTION PREVENTION AND SAFETY PANEL- Lou Garrison

SITE SURVEY PANEL- Robert Kidd

ATLANTIC REGIONAL PANEL- Jack Baldauf

CENTRAL & EASTERN PACIFIC REGIONAL PANEL- Elliot Taylor

INDIAN OCEAN PANEL- Brad Clement

SOUTHERN OCEANS REGIONAL PANEL- Lou Garrison

WESTERN PACIFIC REGIONAL PANEL- Audrey Meyer

TECHNOLOGY AND ENGINEERING DEVELOPMENT COMM.- Barry Harding

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MISSING THIN SECTIONS

Many thin sections that were loaned to investigators from DSDP Repositories are still missing from the collection. These thin sections are a unique representation of the material on which the descriptions of each core are based and are a part of the reference collection maintained at each Repository for visiting scientists and for future studies. Their absence diminishes the usefulness of the collection to the entire scientific community. All investigators who have borrowed thin sections are urged to return them as soon as possible to the repository where the corresponding cores are stored. Questions should be referred to:

The Curator
Ocean Drilling Program
P.O. Drawer GK
College Station, Texas 77841
(409) 845-6620

LEGS 101 and 102

ODP databases for Legs 101 and 102 are open to the public. Leg 103 will become available on June 19. Anyone who wishes to make a request can do so by writing or calling the ODP Data Base Group. Please contact Kathe Lighty, Data Librarian, Ocean Drilling Program, P.O. Drawer GK, College Station, Texas 77841, or call (409)845-6741.

Cores recovered during ODP's Leg 101 are now available for sampling, contingent upon approval by the Leg 101 co-chief scientists. In order to obtain samples, investigators need to fill out a Sample Request Form. To obtain this form, or other information regarding sampling, please contact the Curator, Ocean Drilling Program, P.O. Drawer GK, College Station, Texas 77841, or call (409)845-6620.

ANNOUNCEMENT:

The Leg 106 shrimp-like hydrothermal crusteans are a new species !

"Rimicaris Exoculata" & "Rimicaris Chayesal"

For information and/or samples, contact Dr. A. Williams, Smithsonian Institution, Natural Sciences, Washington, D.C.

MEMBERSHIP ANNOUNCEMENT

ESF

On 29 April 1986, the European Science Foundation Consortium signed a Memorandum of Understanding (MOU) with the National Science Foundation for full membership in the Ocean Drilling Program.

JOIDES JOURNAL MAILINGS

As of 1 July 1986, Joint Oceanographic Institutions Inc. (JOI) will be handling the mailings of the JOIDES Journal. Please notify JOI with any changes or additions to the mailing list or if you have not received your copy of the Journal:

JOI Inc.
1755 Massachusetts Ave., NW
Suite 800
Washington, DC 20036
Telephone: (202) 232-3900
Telex: RCA number 257828 (BAKE UR UD)
Telemail: J.Baker

*****

CHANGE OF ADDRESS

September 30, 1986 is moving day for the University of Rhode Island JOIDES Office. As of October 1, the JOIDES Office will be located at the College of Oceanography, Oregon State University under the direction of Dr. Nick Pisias and Dr. Douglas Caldwell. Consult the next issue of the JOIDES Journal for the telephone, telex, and telemail numbers of the new office.

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ODP WORKSHOP - PALEOMAGNETISM OBJECTIVES FOR THE ODP
September 5 - 7, 1986
Davis, California

The purpose of this workshop is to develop a coherent set of paleomagnetic objectives for future cruises during ODP. Areas of primary interest for this meeting are high-resolution behavior of the earth's magnetic field, details of the motions of plates and subplates, magnetostratigraphy, origin of marine magnetic anomalies and general shipboard procedures. For more information, contact K.L. Verosub at the University of California at Davis, Davis, California.

ANNOUNCEMENT

OF A WORKSHOP TO DEVELOP SCIENTIFIC DRILLING INITIATIVES IN THE

SOUTH ATLANTIC

(from the equatorial fracture zones to the Atlantic margin of the Antarctic)

Convener: James A. Austin, Jr.
University of Texas Institute for Geophysics
4920 North I.H. 35
Austin, Texas 78751-2789

Place: Woods Hole Oceanographic Institution
Woods Hole, Massachusetts

Time: first half of April, 1987 (exact time to be announced)

Written expressions of interest should be directed to the convener. Limited JOI/USSAC travel/subsistence support is available for U.S. participants.

CALL FOR PAPERS

DEEP STRUCTURE AND PAST KINEMATICS OF ACCRETED TERRAINS
IUGG General Assembly, August 9-12, 1987
Vancouver, B.C.

The object of this symposium is to consider the concept that large amounts of todays continents evolved as a result of the accretion of displaced terrains. This type of tectonics is particularly apparent in modern fold-mountain belts, but could also apply to older (even Precambrian) fold belts and hence may have been a general process by which continental crust is formed. For more information, contact:

E. Irving
Pacific Geoscience Ctr.
9860 W. Saanich Rd.
Sidney, B.C.
CANADA V8L 4B2

D.B. Stone
Geophysical Inst.
Univ. of Alaska
Fairbanks, Alaska
99775-0800 USA

GUIDELINES FOR THE SUBMISSION OF PROPOSALS/IDEAS

Editor's note: The Site Survey Panel (SSP) has revised the site survey standards matrix and added explanatory notes. The following are the revised standards.

A. General Information

JOIDES accepts input by individuals or groups into the Ocean Drilling Program as:

1. Preliminary Proposals (ideas/suggestions) for scientific ocean drilling. Examples are objectives (a specific process), drilling targets, downhole and other experiments, etc. Such input generally lacks either geographic specificity, site survey data, or both.

2. Mature Drilling Proposals (Minimum requirements are detailed in Section C.)

Preliminary and mature proposals will be reviewed and prioritized by one or more JOIDES advisory panels. Only mature proposals are ultimately considered and prioritized by the Planning Committee, which plans the actual drilling. Thus ideas which become part of the drilling program do so either by evolving into a mature proposal, or by incorporation into an existing proposal with multiple objectives. Proposals are considered mature when accompanied by a specific set of minimum data listed in Section C and provided by the proponents or JOIDES (certain technical data may not be readily available to proponents). It follows that the time required for an idea or proposal to be processed by the JOIDES science advisory structure and become part of the drilling plan will depend on the completeness of the required data at the time of submission. Proponents are therefore urged to submit as complete a package as possible. Lead time requirements are given in section D. Preliminary proposals should be sent in triplicate to the JOIDES Office. Six copies of mature proposals should be submitted to the JOIDES Office.

B. Review Process

Proposals should be submitted to the JOIDES Office which forwards the material to the appropriate advisory panel(s) for review. The JOIDES panels review and prioritize the proposals and advise the Planning Committee of their recommendations. The panels may request additional information from the proponents and may suggest that the proposal be modified to enhance its scientific merit. Some proposals of limited scope may be incorporated by the advisory panels into a proposal of broader scope.

Thematic Panels are primarily concerned with the process aspects of the science. Regional Panels and Working Groups review the proposal within the context of a particular geographic regions (e.g. additional "sites of opportunity" may be recommended for drilling, to maximize the scientific payoff of drilling in that particular region). As the proposal matures and proceeds through the advisory system, service panels make recommendations regarding technical aspects of the proposed drilling (e.g. site survey review, safety review, engineering and technology review, downhole measurements review, etc.).

The Planning Committee monitors and directs the proposal review process, reviews the recommendations of the advisory panels, decides the fate of proposals, and ultimately integrates the approved proposals into a detailed drilling plan and ship track. Figure 1 is a diagrammatic representation of the review process.

C. <u>Minimum Requirements</u>

1. Minimum Requirements for Mature Proposals (6 copies):

The following items should be discussed in the proposal:

a) Specific scientific objectives with priorities

b) Proposed site locations and alternative sites

c) Background information, including regional and local geological setting and identification of existing geophysical/ geological data base

d) Drilling requirements for each objective (e.g. estimated drilling time, steaming time, water depth, drill string length, reentry, etc.)

e) Logging, downhole experiments and other supplementary programs (estimated time, specialized tools and requirements, etc.)

f) Known deficiencies in data required for:
1) location of drill sites (site surveys)
2) interpretation and extrapolation of drilling results (regional geophysics)

ODP has established standards for site survey data which are given in Annex A. This outlines the techniques to be used in the various environments which may be encountered.

g) Statement of potential safety problems in implementing proposed drilling.

h) Other potential problems (weather window, territorial jurisdiction, etc.).

i) The name and address of an individual assigned as a proponent for each site who will serve as a contact for JOIDES when additional information is required.

Proponents are also required to submit a Site Proposal Summary Form for each proposed drilling site.

2. Data Availability and Deposition:

Proponents are asked to identify available data in three categories:

a) The primary data necessary and sufficient to support the scientific proposal. The ODP Databank is authorized to duplicate and distribute these data as needed for ODP evaluation and planning procedure.

b) Other data relevant to the proposal which may be obtained from publicly accessible data bases in the U.S. and elsewhere.

c) Data which will eventually be available for public access but has release clauses imposed by the data holder (proponent). These data are not normally considered as part of the evaluation of the scientific merit of the related proposal.

It is emphasized that supporting data for a proposal in the above categories must be deposited with the ODP Databank to ensure that a proposal is considered mature. Please categorize data with a, b, or c in the site summary form. Annex B summarizes the guidelines for submission of data to the ODP Databank.

3. Submission of Preliminary Proposals (Ideas/Suggestions)-3 copies:

Preliminary proposals (ideas and suggestions) for ocean drilling should be submitted to the JOIDES Office in triplicate letter form, preferably with as much background information as possible.

4. Letters of Intent to Submit may be sent to the JOIDES Office at any time.

D. Lead Time

As a general rule a minimum of at least 36 months lead time is required from the time of proposal submission to actual drilling. Exceptionally, less lead time may be acceptable in some cases where site surveys are not required.

E. All submissions should be sent (with the appropriate number of copies) to the JOIDES Office.

The JOIDES Office is always available to discuss and advise proponents of proposal requirements.

JOIDES Office
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University of Rhode Island
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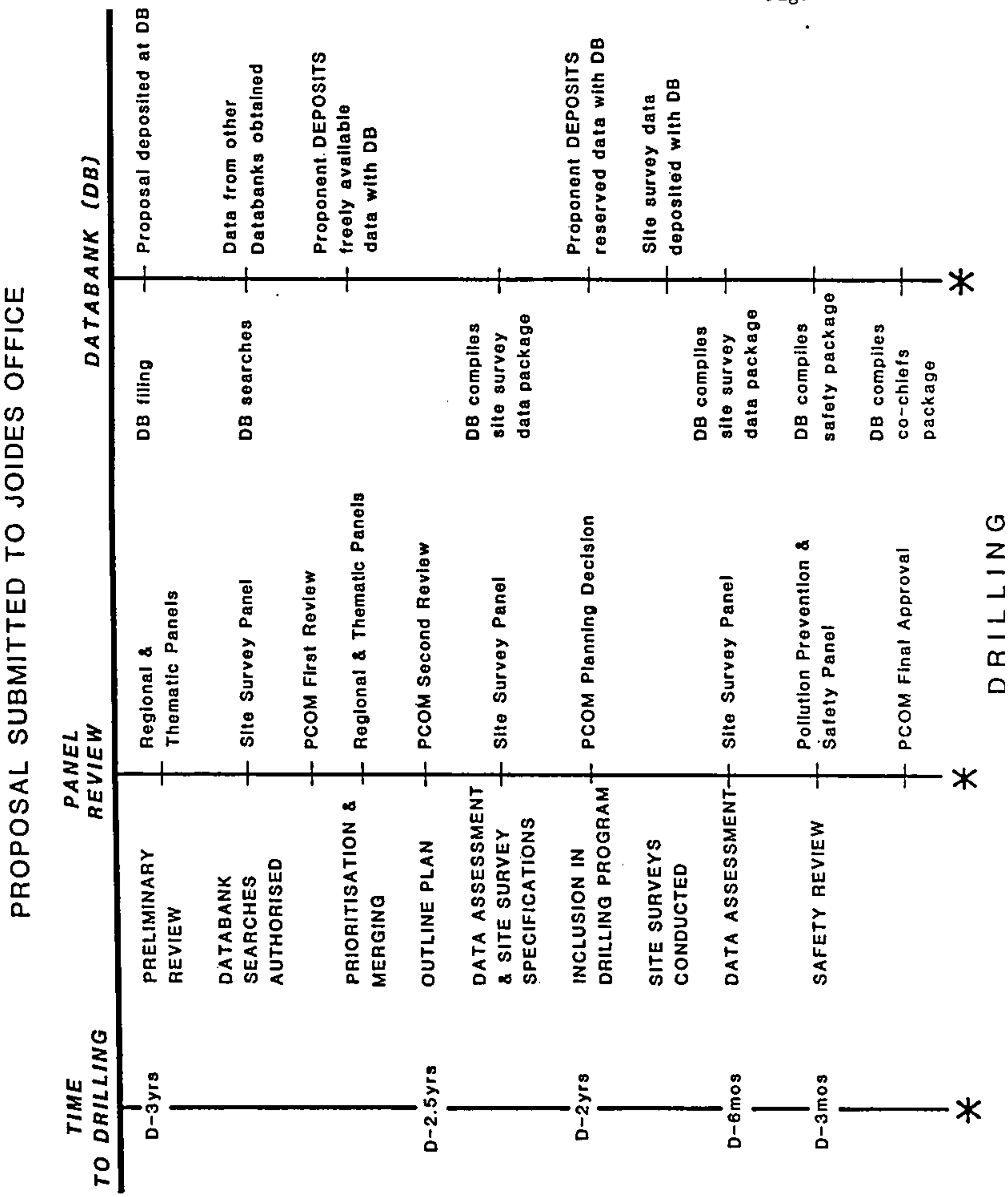
Telemail: JOIDES. URI

Figure 1


PROPOSAL SUBMITTED TO JOIDES OFFICE
TIME TO DRILLING
PANEL REVIEW
DATABANK (DB)
D-3yrs
PRELIMINARY REVIEW
Regional & Thematic Panels
DB filing
Proposal deposited at DB
DATABANK SEARCHES AUTHORISED
Site Survey Panel
DB searches
Data from other Databanks obtained
PCOM First Review
Proponent DEPOSITS freely available data with DB
PRIORITISATION & MERGING
Regional & Thematic Panels
D-2.5yrs
OUTLINE PLAN
PCOM Second Review
DATA ASSESSMENT & SITE SURVEY SPECIFICATIONS
Site Survey Panel
DB compiles site survey data package
D-2yrs
INCLUSION IN DRILLING PROGRAM
PCOM Planning Decision
Proponent DEPOSITS reserved data with DB
SITE SURVEYS CONDUCTED
Site survey data deposited with DB
D-6mos
DATA ASSESSMENT
Site Survey Panel
DB compiles site survey data package
D-3mos
SAFETY REVIEW
Pollution Prevention & Safety Panel
DB compiles safety package
PCOM Final Approval
DB compiles co-chiefs package
DRILLING

Revised 6/86

SITE SURVEY DATA STANDARDS ANNEX A

TARGETS / TECHNIQUES	A	B	C	D	E	F	G
X = Vital (X) = Desirable (X)*= Desirable but may be required in some cases R = Vital for re-entry sites H = Required for high temperature environments	PALAEOENVIRONMENT (shallow penetration)	PASSIVE MARGINS	ACTIVE MARGINS	OCEAN CRUST (thick sediment cover)	OCEAN CRUST (<approx.400m.sed.cover)	BARE-ROCK DRILLING	ASEISMIC RIDGES, PLATEAUS & SEAMOUNTS
1.Deep penetration SCS	(X)	(X)	(X)	X or 3			(X)*
2.High resolution SCS	X	(X)	(X)	(X)	X	X	(X)
3.MCS & velocity determinations		X	X	X or 1			(X)*
4.Seismic data on cross lines	(X)	X	X	X	(X)	(X)	(X)*
5.Seismic refraction		(X)	(X)*	X	(X)	(X)	(X)*
6.3.5 Khz	X	(X)*	(X)*	(X)	(X)*	X	(X)
7.Multi-beam bathymetry	(X)*	(X)*	X or 8A	(X)	X or 8B	X	(X)* or 8A
8.Sidescan sonar: A - shallow	(X)*	(X)*	X or 7	(X)		(X)	(X)* or 7
B - deep-towed					X or 7	X	
9.Heat flow		(X)*	(X)*	(X)	(X), H	(X), H	(X)
10.Magnetics & gravity		(X)	(X)	(X)	(X)	X	(X)
11.Coring information: A-palaeoenvironmental	X	(X)	(X)				
B-geotechnical		R	R	R	R,H	X	R
12.Dredging					(X)*	(X)*	(X)*
13.Photography					(X)*	X	(X)
14.Current meter (for bottom shear)	(X)*	(X)*	(X)*				

SITE SURVEY DATA STANDARDS: EXPLANATORY NOTES

The list of "TARGET" categories describes broad types of drilling objectives. Individual sites with multiple objectives may need to meet the requirements of two "TARGET" categories. Frequently, sites will have shallow APC objectives (TARGET A) and deeper sedimentary and basement objectives (TARGET D or E).

TARGET A - Generally APC/XCB penetration.

TARGET B - Greater penetration than a few hundred meters on a passive margin.

TARGET C - Greater penetration than a few hundred meters on an accretionary wedge, pre-arc, or sheared margin.

TARGET D - Greater penetration than a few hundred meters in a deep ocean environment. Often includes basement penetration.

TARGET E - Sediment thicknesses of less than a few hundred meters in a deep ocean ridge crest or fracture zone environment. Often includes basement penetration.

TARGET F - Bare rock drilling, probably on zero age crust.

TARGET G - Elevated features above the ocean floor. Widely varying sediment thicknesses. Sediment slumping may be a problem on flanks. Basement often an objective.

The techniques include commonly used geophysical and sampling techniques.

1) DEEP PENETRATION SCS - Large source Single-Channel Seismic.

2) HIGH RESOLUTION SCS - Watergun Single-Channel Seismic or small chamber airgun in some situations. Digital acquisition preferred, but usually not necessary.

3) MCS and VELOCITY DETERMINATION - Multi-Channel Seismic including velocity determination (stacking velocities and semblance plots) when accurate depths are critical. Velocity analysis to determine sediment thickness over proposed sites.

4) CROSSING LINES - A seismic grid and/or crossing lines over the proposed site. The density of the seismic grid required depends on each particular situation.

5) REFRACTION - Sonobuoy or Ocean Bottom Seismometer refraction profiles. Expanding Spread Profiles or wide-angle refraction profiles.

6) 3.5 KHz - High frequency data for near-bottom high resolution to resolve small scale features and give some indication of sediment type.

7) MULTIBEAM BATHYMETRY - SEABEAM or SeaMARC II bathymetry or equivalent. In some cases the greater resolution of SEABEAM may be required. Areas where slumping may occur should have multibeam bathymetry and/or side scan sonar.

8) SIDE SCAN SONAR - The reflectivity of sidescan sonar is often needed to interpret multibeam bathymetric data

a. Shallow - side scan sonar sources towed near the surface; e.g. SeaMARC II, GLORIA.
b. Deep - Side scan sonar sources flown near the bottom; e.g. Scripps Deep Tow, French SAR, SeaMARC I.

9) HEAT FLOW - Pogo type profiles or piston core heat flow measurements in detail appropriate to the scientific problem.

10) MAGNETICS and GRAVITY - Regional magnetics should be available on any location for which the magnetic age of ocean crust is important. Gravity is seldom an absolute requirement, but should be obtained on any profiles for which subsidence studies are planned. SEASAT derived gravity information often complements the regional magnetic picture

11) CORING - Cores should be taken near all paleoenvironmental sites.

All re-entry sites should be supported by cores, core descriptions and geotechnical measurements (see below for specific list).The two limiting factors for re-entry operations are:

a. Sufficient sediment thickness
b. Ability to wash through the sediment section

The benefit of geotechnical information for re-entry operations is that wash-in capabilities are tied to the formation strength. The manner in which geotechnical information is to be used within ODP will most likely evolve as studies of that geotechnical database and re-entry operations take place.

At present (1986),the following measurements of geotechnical properties on fresh piston cores are recommended as part of the site survey package for a re-entry site.

a. Penetrometer strength
b. Vane shear strength (natural and remolded)
c. Bulk density
d. Water content
e. Atterberg limits (liquid and plastic limits)

Gradients and maximum and minimum values of the geotechnical properties listed above are also recommended.

For older piston cores, please provide any geotechnical measurements made when the core was fresh. Atterberg liquid and plastic limits should also be measured on old core material as this is one geotechnical observation which is still valid on partially dessicated material.

The above properties should be provided in conjunction with lithology and bedding.

Site proponents should contact the Science Operator (TAMU) for further clarification on the geotechnical requirements for their particular circumstances

12) DREDGING - May be required when basement drilling is included in the objectives.

13) PHOTOGRAPHY - May be required in TARGET E in the case of hydrothermal areas over sedimented spreading centers. Bare rock drilling sites will require extensive bottom photography, such as ANGUS coverage.

14) CURRENT METERS - Information on bottom currents will be required when bottom shear might be a problem. Shallow water sites may need tidal current information as well.

ANNEX B

ODP DATABANK GUIDELINES FOR THE SUBMISSION OF REGIONAL GEOPHYSICAL AND SITE SPECIFIC SURVEY DATA

Data should be submitted in the following forms:

1) Digital magnetic tapes of underway geophysical data values (topography, magnetics, gravity) merged with smoothed final navigation. The preferred format is MGD77, which expects a "header" record as well as data records.

2) Cruise report describing in detail the results of surveys.

3) Large copies, suitable for xeroxing, of single-channel seismic reflection profiles. The preferred format for 3.5 kHz records is on 35 mm film negative.

4) Large sepia copies (suitable for ozalid reproduction) of processed multi-channel seismic reflection profiles.

5) Large (page sized) photographic negatives of any side scan sonar data (GLORIA, SeaMARC I or II) collected.

6) Large sepia copies (suitable for ozalid reproduction) of any SEABEAM data, presented at a contour interval deemed appropriate.

7) Large sepia copies (suitable for ozalid reproduction) of any "specialized" data sets (such as sediment thickness maps, bathymetry/magnetic contour charts, velocity analyses, etc.) that have been developed in the course of a cruise report. The format and nature of the presentation of these data will be variable and will be dependent upon the nature of specific interest at each site.

Data should be deposited at:

ODP Databank
Lamont-Doherty Geological Observatory
Palisades, New York 10964
USA
Telephone: (914) 359-2900

ODP SITE PROPOSAL SUMMARY FORM

(Submit 6 copies of mature proposals, 3 copies of preliminary proposals)

Proposed Site: General Area: Position: Alternate Site:	General Objective: Thematic Panel interest: Regional Panel interest:

Specific Objectives:

Background Information (indicate status of data as outlined in the Guidelines):

Regional Geophysical Data:

Seismic profiles:

Other data:

Site Specific Survey Data:

Seismic profiles:

Other Data:

Operational Considerations:

Water Depth:(m)__________ Sed. Thickness:(m)_________ Tot. penetration:(m)________

HPC _____ Double HPC _____ Rotary Drill _____ Single Bit _____ Reentry _____

Nature of sediments/rock anticipated:

Weather conditions/window:

Territorial jurisdiction:

Other:

Special Requirements (staffing, instrumentation, etc.):

Proponent: Address & phone number:	FOR OFFICE USE: Date received: Classification no.: Panel allocation:

PUBLICATIONS

The Public Information Office at ODP/TAMU has published a brochure which describes ODP, the ship's capabilities, shipboard scientists' responsibilities and cruise participation. This publication has been supplemented by a newly designed application form. Interested parties should contact ODP/TAMU at College Station, TX 77843 for more information.

A new brochure which describes tha current and future projects of the Engineering and Drilling Operations Department is now available from the Office of Public Information. Contact ODP/TAMU, College Station, TX for more information.

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ANNOUNCEMENT:

Beginning in Fall 1986, Dr. Audrey Meyer will replace Dr. Robb Kidd as the Manager of Science Operations at ODP Headquarters, Texas A&M University, College Station, TX.

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Request for Notices

The editorial staff of the JOIDES Journal encourages members of the the scientific community to submit announcements, notices and other news items for publication in the JOIDES/ODP Bulletin Board section of the JOIDES Journal.

Interested parties should send items for publication to: JOIDES/ODP Bulletin Board, JOIDES Office, University of Rhode Island, Narragansett, R.I., 02882

OFFICIAL ODP PANEL ABBREVIATIONS

EXCOM	Executive Committee
PCOM	Planning Committee
TEDCOM	Technology and Engineering Development Committee

Thematic Panels

LITHP	Ocean Lithosphere Panel
SOHP	Sediments and Ocean History Panel
TECP	Tectonics Panel

Regional Panels

ARP	Atlantic Regional Panel
CEPAC	Central and Eastern Pacific Regional Panel
IOP	Indian Ocean Regional Panel
SOP	Southern Oceans Regional Panel
WPAC	Western Pacific Regional Panel

Service Panels

DMP	Downhole Measurements Panel
IHP	Information Handling Panel
PPSP	Pollution Prevention and Safety Panel
SSP	Site Survey Panel

Working Group

RS-WG	Red Sea Working Group

JOIDES Office

BIBLIOGRAPHY OF THE OCEAN DRILLING PROGRAM

The following publications are available from the ODP Subcontractors. Information from Texas A&M University can be obtained from ODP Headquarters, TAMU, College Station, Texas. Information from the Lamont-Doherty Geological Observatory can be obtained from R. Anderson or R. Jarrard at the Borehole Research Group, L-DGO, Palisades, N.Y.

A) TEXAS A&M UNIVERSITY

1. Technical Notes

Technical Note #1 (December 1984)
Preliminary time estimates for coring operations.

Technical Note #2 (June 1985)
Operational and laboratory capabilities of JOIDES RESOLUTION.

Technical Note #3 (September 1985)
Shipboard Scientist Handbook

Technical Note #4 (May 1986)
Five papers on the Ocean Drilling Program from "OCEANS' 85"

Technical Note #5 (May 1986)
Water Chemistry Procedures aboard JOIDES RESOLUTION

Technical Note #6 (May 1986)
Organic Geochemistry aboard JOIDES RESOLUTION - An Assay

Technical Note #7 (June 1986)
Shipboard Organic Geochemistry on JOIDES RESOLUTION

2. Scientific Prospectuses

No. 1 (January 1985)	Leg 101
No. 2 (February 1985)	Leg 102
No. 3 (March 1985)	Leg 103
No. 4 (April 1985)	Leg 104
No. 5 (June 1985)	Leg 105
No. 6 (September 1985)	Leg 106
No. 7 (October 1985)	Leg 107
No. 8 (December 1985)	Leg 108
No. 9 (March 1986)	Leg 109
No. 10 (April 1986)	Leg 110
No. 11 (July 1986)	Leg 111

3. Preliminary Reports

No. 0 (May 1986)	Leg 100*
No. 1 (April 1985)	Leg 101
No. 2 (June 1985)	Leg 102
No. 3 (July 1985)	Leg 103
No. 4 (September 1985)	Leg 104
No. 5 (December 1985)	Leg 105
No. 6 (March 1986)	Leg 106
No. 7 (May 1986)	Leg 107
No. 8 (June 1986)	Leg 108

* - with Prospectus

4. Other Items Available:

- Ocean Drilling Program (in English, French, Spanish and German)
- Onboard JOIDES RESOLUTION
- ODP Sample Distribution Policy (1 December 1984)
- Instructions for Contributors to the Proceedings of the Ocean Drilling Program
- ODP Engineering and Drilling Operations

B) LAMONT-DOHERTY GEOLOGICAL OBSERVATORY

Wireline Logging Manual (1st Edition, March 1985)

DIRECTORY OF JOIDES COMMITTEES, PANELS AND WORKING GROUPS

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****

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Special Issue No. 2: Initial Site Prospectus, Supplement One, April 1978 (Volume III)

Special Issue No. 3: Initial Site Prospectus, Supplement Two, June 1980 (Volume VI)

Special Issue No. 4: Guide to the Ocean Drilling Program, September 1985 (Volume XI)

Special Issue No. 5: Guidelines for Pollution Prevention and Safety, March 1986 (Volume XII)