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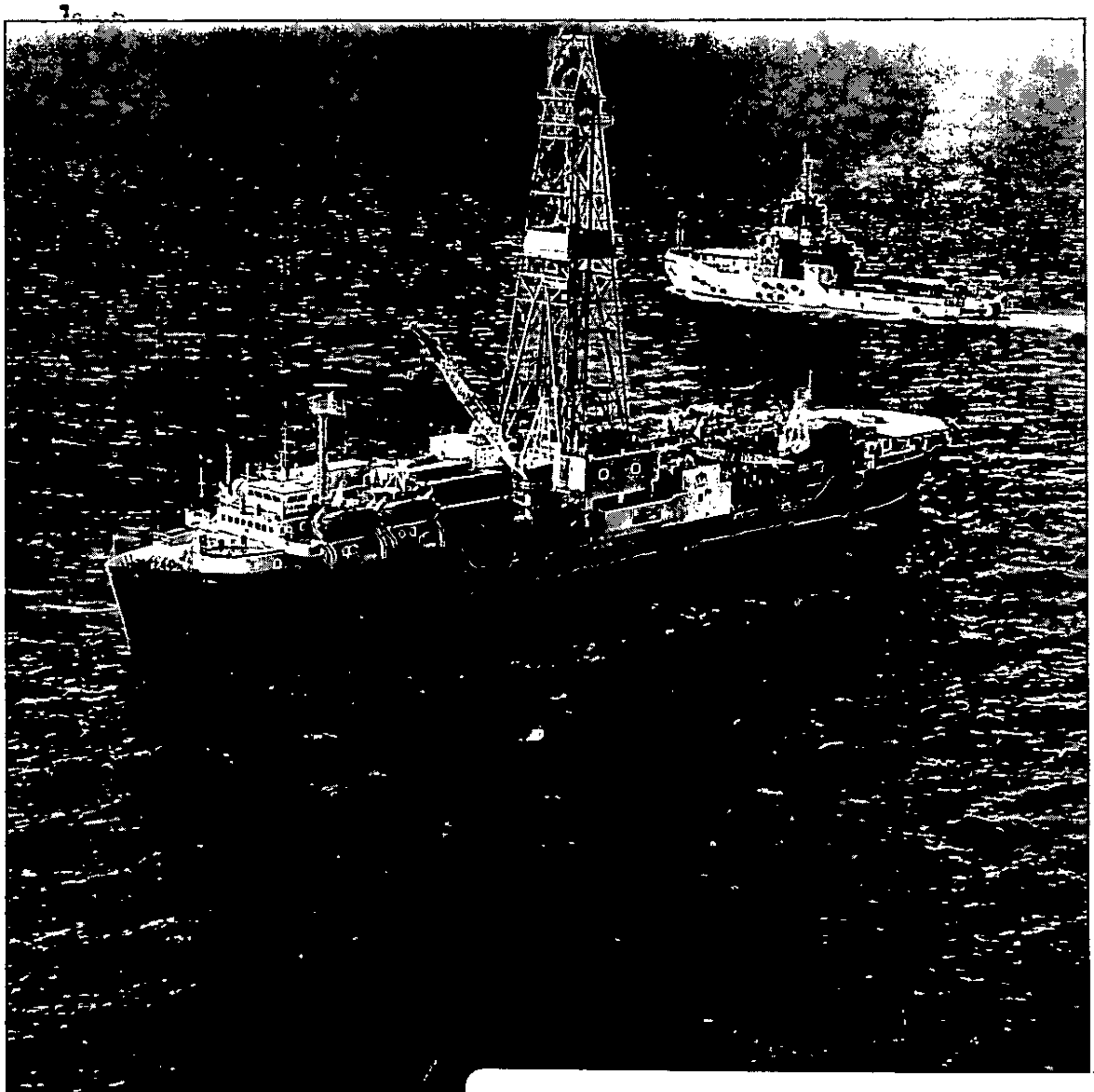

JOIDES Journal

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FOCUS

In the last FOCUS, I addressed the question of a thematically driven drilling program versus the global wandering of a very expensive scientific facility. The question to now ask is: Will we ever become the scientific ideal program which addresses fundamental questions of earth science? With the events since the last JOIDES Journal, the answer to this question is, hopefully, yes: if logistics, budgets and politics don't get in the way.

Unfortunately, as we start the Indian Ocean Program, logistics and political decisions have had major impacts. Last minute clearance problems have again occured, first with site surveys off Pakistan and drilling in the Red Sea, and now with clearance problems for the Mascarene Plateau. Clearly, the most frustrating political decision was the disinvitation of the U.S.S.R. Academy of Science membership in the ODP. This has had important budgetary impact, but also affects possible drilling programs in high latitudes of the North Pacific.

April and May brought not only these disappointing events, but also the formulation of the FY88 Program Plan. Out of this process came, I think, important decisions that will help us better plan a thematically driven program:

* EXCOM has endorsed the requirement that 4% of each fiscal year's base budget be set aside for special operations and purchases.

* PCOM has budgeted contingency times of up to 10% per leg for many of the Indian Ocean programs.

* PCOM has critically evaluated the times for logging and downhole experiments in planning for upcoming legs.

* TAMU and LDGO have effected procedural changes to maximize the success of downhole programs, including logging through pipe.

* An excellent prospectus, including realistic drilling times and contingency programs, was submitted by WPAC for PCOM evaluation.

* PCOM determined that the science program detailed in the WPAC prospectus warranted a 22-month program; the Central Pacific program will be treated with the same careful consideration.

* The PCOM mandate was changed to provide for one-and-a-half years of firm planning in advance of the drillship.

The first is by far the most significant. Many objectives set out by COSOD and the thematic panels (e.g. high latitude drilling, drilling in young crustal rocks) are costly operations requiring extra logistical support. As we move into the Pacific, where ridge crest drilling, Bering Sea drilling, and in-situ physical properties and geophysical experiments are receiving much attention, it is imperative that the base operating budget not represent the total allocation for ODP, and that funds are available to complete important COSOD programs.

A 22-month drilling program is being considered for the Western Pacific. This shows the strong thematic support for programs in this area, as well as the excellent documentation provided by proposals, site surveys and the regional panel. We are still using 18 months as a timetable for the Central and Eastern Pacific, but clearly, the mandate for the proponents, thematic panels and CEPAC is to provide PCOM with similarly well-documented, thematic programs. I did not intentionally exclude the Atlantic from this discussion but unfortunately am faced with the reality that we have only one moderately slow drill ship possibly something to be discussed at COSOD II.

Nick Pisias

Nicklas G. Pisias
Planning Committee Chairman

JOIDES RESOLUTION OPERATIONS SCHEDULE

Legs 115 - 123

LEG	AREA	DEPARTS LOCATION	DEPARTS DATE	ARRIVES DESTINATION	ARRIVES DATE	IN PORT
115	Mascarene Plateau Carbonate Dissolution Profile	Mauritius	19 May	Colombo	29 June	29 June-3 July
116	Intraplate Deformation	Colombo	4 July	Karachi	21 August	21-25 August
117	Neogene Package	Karachi	26 August	Mauritius	16 October	16-20 October
118	Southwest Indian Ridge	Mauritius	21 October	Mauritius	2 December	2-6 December
119	Kerguelen (north)	Mauritius	7 December	Mauritius	6 February	6-10 February
120	Kerguelen (south)	Mauritius	11 February	Freemantle	11 April	11-15 April
121	Broken Ridge and N90^{o}E Ridge	Freemantle	29 April	Jakarta	21 June	21-25 June
122	Exmouth Plateau	Jakarta	26 June	Darwin (?)	19 August	19-23 August
123	Argo Abyssal Plain	Darwin (?)	24 August	???	19 October	19-23 October

Revised 5/15/87

LEG 115 SCIENTIFIC PROSPECTUS

INTRODUCTION

The Indian Ocean was formed by a complex series of seafloor spreading events, starting with the rifting of Madagascar from Africa and continuing today with the asymmetric spreading on the Southeast Indian Ridge and the peculiarities of extremely slow spreading on the Southwest Indian Ridge. The origin and evolution of the major aseismic ridges, the Ninetyeast Ridge, the Chagos-Laccadive-Mascarene Ridge system, and the Kerguelen-Gaussberg Ridge, are integral parts of Indian Ocean development (Fisher et al, 1967 and 1971).

The Chagos-Laccadive-Mascarene volcanic lineament is a major aseismic ridge system in the Central Indian Ocean basin. It connects young volcanic activity in the vicinity of Reunion Island with the massive, Cretaceous-Tertiary continental flood lavas in the Deccan Traps of India. This lineament parallels the remarkable Ninetyeast Ridge and the two together record the northward motion of the Indian subcontinent away from mantle- fixed hotspots near Reunion and Kerguelen Islands, respectively (Fig. 1).

The importance of aseismic ridges in understanding the structure, evolution, and paleoceanography of the Indian Ocean cannot be overestimated. These mainly volcanic features appear to record the fragmentation and dispersion of Gondwanaland away from mantle-fixed hotspots (Morgan, 1981; Duncan, 1981). Some aseismic ridges (Seychelles bank, Gaussberg Ridge?) may be continental remnants left behind during the rifting process, while others (Chagos-Laccadive-Mascarene and Ninetyeast Ridge) appear to connect hotspots to continental flood basalt activity (Mahoney et al, 1982, 1983). Geochemical analyses of basalts recovered from these ridges provide constraints on mantle composition and variability, and the melting processes which produce magmas in the ocean basins. These extremely long and topographically high features, which have sunk below sea level, have influenced oceanic circulation and reflect the physical properties of the oceanic lithosphere in the Indian Ocean during the Cenozoic. Carbonate sediments on their margins also provide a complete record of vertical dissolution gradients.

Analysis of sediments and basalts recovered by drilling during Leg 115 will address the following scientific objectives:

(1) Determine basement crystallization ages along the Chagos-Laccadive-Mascarene Ridge system to document the proposed age-progressive nature of the volcanism for use in plate velocity and reconstruction studies.

(2) Determine the geochemical character of the basaltic rocks for comparison with basalts from the Deccan traps and Reunion/Mauritius/Rodrigues Islands, and to examine mantle melting processes and source variability through time.

(3) Measure paleolatitudes from sediments and basalts for comparison with the hotspot reference frame and to examine the timing and magnitude of proposed polar wander.

(4) Collect APC (advanced hydraulic piston coring) cores from widely varying bathymetric depths which record the Neogene history of equatorial surface productivity and vertical dissolution gradients.

Basement drilling objectives on the Mascarene Plateau are discussed below first, followed by a discussion of the paleoceanographic objectives.

JOIDES RESOLUTION is scheduled to depart from Port Louis, Mauritius on May 21, 1987. The cruise will end in Colombo, Sri Lanka on July 2, 1987.

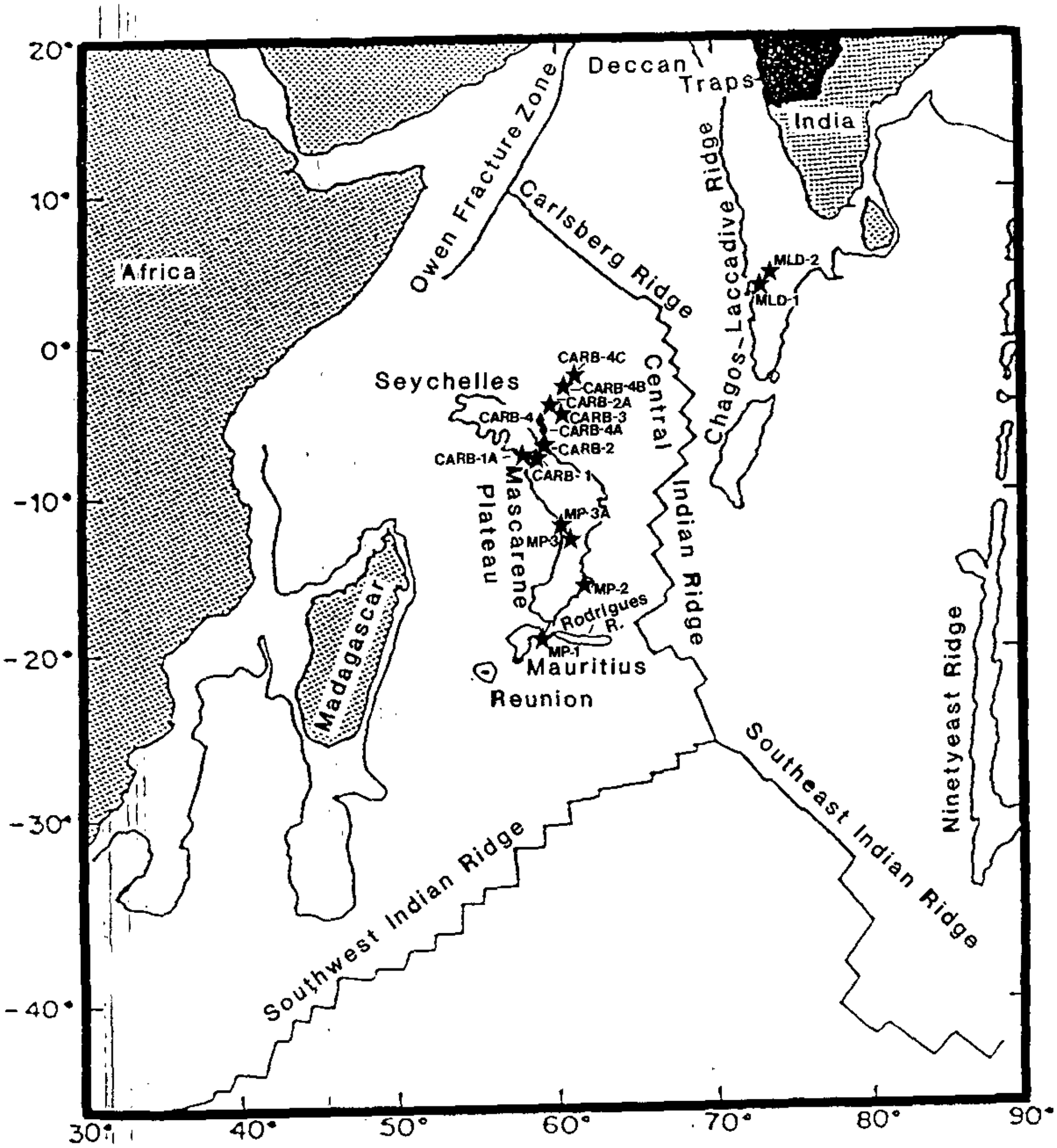

Figure 1. Chagos-Laccadive-Mascarene Ridge system in the western Indian Ocean.

MASCARENE PLATEAU DRILLING

Previous drilling at two DSDP sites on aseismic ridges in this region (Sites 219 and 237, Fig. 1) did not reach basement and thus did not address any of the questions related to the age, origin, and character of the volcanic rocks. These sites produced, however, valuable information about drilling conditions in the sedimentary section. Drilling at a third DSDP site (Site 238, Fig. 1) at the northeastern end of the Argo Fracture Zone and 300 km south of the Chagos-Laccadive Ridge did penetrate basement rocks. The typical ocean floor basalts that were recovered are not related geochemically to volcanism on the Chagos-Laccadive Ridge, and therefore are not useful in constraining plate velocities. Texaco, Inc. drilled two holes on top of the Mascarene Plateau in the Saya de Malha and Nazareth Banks which penetrated thick (>1000m) coral carbonate platforms before recovering basalts. Both of these holes were dry. The basalts are available for radiometric and geochemical studies (Texaco, pers. comm., 1987). The oldest sediments at the Saya de Malha Bank hole are late Paleocene; at the Nazareth Bank hole they are Eocene.

The vessel is scheduled to drill three single-bit, rotary-cored sites (MP-1 through MP-3) into basement along the Mascarene Plateau, between Mauritius and Saya de Malha Bank (Table 1). Sediment thickness varies between 200 and 300 m and water depths range from 2200 to 2800 m at these sites (Table 1).

Age-Progressive Volcanism and Plate Reconstructions:

The trend of the Ninetyeast and Chagos-Laccadive-Mascarene Ridges mark the path along which India has ridden north from the Southern Ocean to collide with Asia during Late Cretaceous and Tertiary times. The Chagos-Laccadive-Mascarene Ridge system is the western lineament which stretches from the volcanically active island of Reunion to Mauritius, where it intersects the Rodrigues Ridge at a right angle, and finally to the Mascarene Plateau (Fig. 1). Active spreading on the Central Indian Ridge has separated this southern portion of the C-L-M Ridge system from the Chagos Plateau, Laccadive and Maldive Island chains and Deccan basalts of India to the north (McKenzie and Sclater, 1971).

Except for the young islands of Reunion (≤2 Ma; McDougall, 1971) and Mauritius (7-8 Ma; McDougall and Chamalaun, 1969) in the south and the extensive Deccan Traps (60-65 Ma; Kaneoka, 1980) in the north, we have no age control on eruption times along this major linear volcanic province. Age studies along the Ninetyeast Ridge show a clear age progression (Duncan, 1978), but for plate reconstructions we must have at least two dated lineaments to precisely define rotation poles for the Indian/ Australian plate relative to the hotspot reference frame. Dating of basement from the Mascarene Plateau and Chagos-Laccadive Ridge is thus critical. Drilling on the Mascarene Plateau will not duplicate information gained from the planned drilling on the Ninetyeast Ridge as this ridge system is composed of 38 Ma volcanic rocks at its southern end, while the Mascarene Plateau apparently consists of basalts ranging from 35 Ma to the present (Reunion Island). Sampling and dating of both lineaments is required to determine plate motions over the mantle during Tertiary time. Given the geometry of these two lineaments and ages along them we can assess the data for use in plate reconstruction models based on fixed hotspots. The timing of the India-Asia collision can be predicted and compared with increasingly detailed models of Himalayan uplift and development of the Indus and Bengal Fans.

One very exciting development in the study of hotspot-generated volcanic lineaments (particularly in the Pacific Ocean) is the determination of "true polar wander." This is an old idea proposed originally to explain the apparent motion of the earth's surface with respect to the spin axis (e.g., glacial tillites in equatorial regions; coal deposits near the poles). The term now signifies any motion of the entire earth with respect to the rotational axis, presumably in response to changes in the principal moment of inertia (Goldreich and Toomre, 1969). A comparative study of paleomagnetically and hotspot-determined latitudes (e.g., Gordon and Cape, 1981) suggests that Pacific hotspots, and the mantle with them, have moved as much as 12° south during Cenozoic time. In this model, the whole earth moves with respect to its spin axis and the hotspots merely provide reference points. Thus if Pacific hotspots move south, those in the Indian Ocean move north. The best test of this model is at hotspot lineaments aligned north-south on a fast-moving plate, such as occurs in the Indian Ocean. Given the position of Gordon and Cape's (1981) true polar wander Euler pole (0°N, 115°E), the amount of northward motion of the Kerguelen and Reunion hotspots has been 10° to 15° in the last 60 to 70 million years. This should be easily resolvable through paleomagnetic measurements on both sediments and basalts recovered during drilling along either lineament. What is critical, however, is precisely dated locations along the Chagos-Laccadive-Mascarene volcanic system to allow plate reconstructions, in the hotspot reference frame, of the Indian Ocean through Late Cretaceous and Tertiary time.

<u>Upper Mantle Heterogeneity and Melting Processes</u>:

The earliest analyses of oceanic rocks showed that island and seamount chains and associated aseismic ridges are geochemically distinct from MORB's and were formed from different parts of the upper mantle and/or by different melting processes (Gast, 1968).

A variety of new geochemical models of upper mantle structure and mantle-lithosphere interaction have been proposed to explain the differences in bulk-rock geochemistry. The Chagos-Laccadive-Mascarene lineament offers an especially attractive volcanic province for examining upper mantle variability and melting processes. At the southern end, the islands of Reunion and Mauritius are built on oceanic lithosphere; at the northern end the Deccan flood basalts erupted through continental lithosphere. These endpoints are well characterized isotopically (White and Dupre, 1984; Mahoney et al., 1982; Fisk et al, 1987). It appears from these studies that the Deccan magmas formed by melting a mixture of MORB-type mantle and sub-continental lithosphere, while the basaltic rocks of Reunion and Mauritius are similar geochemically to magmas associated with hotspots.

Geochemical analyses (Sr, Nb, Pb and trace elements) of basalt samples recovered from intermediate sections of this lineament during Leg 115 at Sites MP-1, MP-2 and MP-3 (or MP-3A) will increase our understanding of the variability of the upper mantle magma source regions through time. This would allow a more quantitative assessment of the question of whether Deccan flood basalts were derived principally from a hotspot (mantle-plume) source, as is the case for Reunion, or whether this hotspot served largely as a source of heat to melt a chemically distinct subcontinental lithosphere from which the basalts were derived.

An interesting feature of this lineament is the Rodrigues Ridge which forms a perpendicular appendage on the Mascarene Plateau at its southern end near Mauritius (Fig. 1). Morgan (1978) suggested that this short east-west ridge formed along a transform fault by asthenospheric flow from the Reunion hotspot to the Central Indian Ridge. The Rodrigues Ridge should therefore be the same age as the island of Mauritius (i.e., >8 Ma). However, Rodrigues Island is much younger (about 1-2 Ma; McDougall, 1971), indicating that the whole ridge may actually be a young feature. In addition, it does not appear to be connected to the Central Indian Ridge towards the east. Sr and Nd isotopic systematics suggest that Rodrigues Island magmas were derived from a source very similar to that of Reunion Island (Baxter et al., 1985). The composition and the origin of the ridge and island remain a puzzle (Baxter et al, 1985; Fisk, 1983) which may be solved by drilling near its intersection with the Chagos-Laccadive-Mascarene lineament (Site MP-1).

Of considerable interest to plate tectonic studies of the northwestern

Indian Ocean is the southeastern limit of the Precambrian continental rocks forming the Seychelles Bank with the Saya de Malha Bank at the northern end of the Mascarene Plateau. Drilling on the center of this ridge at Site CARB-1 will identify its origin and examine the possible transition from continental to oceanic rocks. As mentioned earlier, the Chagos-Laccadive Ridge and the Mascarene Plateau were once a continuous volcanic lineament until seafloor spreading on the Central Indian Ridge separated them about 36 million years ago (McKenzie and Sclater, 1971). Drilling on the northeast flank of Nazareth Bank (Site MP-3) will penetrate the western side of this rifted margin and provide information on the timing of rifting, sedimentary history, and petrologic character of this structure.

PALEOCEANOGRAPHIC (CARBONATE DISSOLUTION) STUDIES

The construction of well constrained models of the deep-sea sediment budget and its changes through time and space are of critical importance if we are to understand the history of both global climate and ocean circulation. Such models can be established only by quantifying the processes which control the sediment budget. In the Indian Ocean, biogenically produced calcium carbonate has been the dominant component of sediments on the seafloor since the Mesozoic.

The accumulation of pelagic carbonate sediments in open ocean environments is primarily dependent on the rate of production and dissolution of foraminifers and calcareous nannoplankton. The productivity is determined by the availability of nutrients which, in turn, depends on the rate of supply of these elements from continental runoff and ocean circulation (e.g., vertical mixing, upwelling). In general, the rate of dissolution of calcium carbonate sediment is a function of the degree of calcite saturation in sea water at the sediment/water interface. Averaged globally, the degree of calcite saturation varies in order to balance the total carbonate budget. The oceanic circulation, and the underlying causes for its development and change, is therefore a key factor among the dissolution-related parameters. Deep-sea drilling has already established that fluctuations in dissolution rates in the Cenozoic are controlled by changes in productivity and carbonate concentration gradients (e.g., Heath et al, 1977).

The principal objective of the "carbonate dissolution profile" to be drilled during Leg 115 is the study of the interplay between the flux in carbonate production and the dissolution of this material as a function of water depth, as the shallow and deep water circulation and the climatic systems evolved during Neogene and Quaternary times. Drilling in the tropical Indian Ocean is aimed at significantly increasing our knowledge of the sediment-circulation-climate system on both a regional and global scale. It will ultimately form part of a network of depth transects that will enable us to examine the earth's carbonate budget through the Cenozoic.

The key to achieving this objective is to obtain a tightly spaced transect of continuous Neogene and Quaternary sediments from sites spanning a wide range of water depths. The requirements for such a transect also include the following:

(1) The sites should be located in a small geographic area to ensure that the pelagic rain to all sites is similar.

(2) The shallowest site should be located well above the depth of the calcite saturation horizon to ensure that little or no carbonate dissolution has occurred.

(3) The sites should cover a wide depth range so that a wide range of calcite saturation levels are represented. Depth intervals between sites should be similar, and the sites should be located both above and within present and past lysoclines and span present and past deep water mass boundaries.

(4) The sites should be located in an area with reasonably high sediment accumulation rates to ensure that high resolution studies are possible (e.g., detection of precessional cycles).

The northeastern flank of the Seychelles-Saya de Malha platform fulfills these requirements within the tropical Indian Ocean. Moreover, this drilling package is likely to produce the only high-resolution tropical stratigraphic sections from the Indian Ocean program. The four sites (CARB-1 through CARB-4) proposed will address a number of questions related to the evolution of the Neogene and Quaternary carbonate system: How has the carbonate system of the tropical Indian Ocean varied in response to changing climatic boundary conditions, changing glaciation levels and changing deep ocean circulation? Related questions include: How has surface productivity varied in response to climate and to the evolving physical geometry of the northern Indian Ocean? How do the sediments reflect the variation and interaction between surface production of biogenic carbonate and its dissolution at depth? The four sites will be double APC cored along a depth transect starting at a water depth of 1500 m between the Seychelles Bank and Saya de Malha Bank and deepening to 4600 m in the NW Indian Ocean Basin (Table 1).

Evolution of Shallow and Deep Water Circulation in the Northwestern Indian Ocean:

Because the Indian Ocean has a unique geometry (no northern ocean) and a strong monsoonal circulation in the tropical atmosphere and ocean, some of the water masses and circulation patterns are distinctly different from those in the Atlantic and the Pacific. The complex system of submarine ridges divides the modern deep flow into separate circulation systems in the Wharton-Cocos Basins, Central Indian Basin, and the connected Madagascar, Mascarene and Somali Basins (see also Reid and Lynn, 1971; Jacobs and Georgi, 1977). The evolution of this system can be traced through the study of its benthic faunas, which reflect deep water circulation changes, and planktonic faunas and floras, reflecting surface water changes. By studying gradients in $\delta^{18}O$ and $\delta^{13}C$ values, vertical and horizontal circulation patterns can be compared to other oceanic basin sites.

In terms of "deep" water mass changes, it is particularly important to establish how the intermediate and deep water masses responded to:

(1) The formation of a permanent ice cap in Antarctica during middle Miocene times.

(2) The onset of northern hemisphere glacial/interglacial cycles during late Pliocene times.

(3) The Miocene tectonic closing of the Tethyan seaway which connected the low-latitude Indo-Pacific and Atlantic regions.

In terms of shallow water mass changes, it is desirable to learn how the boundary between the Equatorial Water and the Central Water masses has fluctuated through time. Today, this boundary is located between the four CARB sites and the three MP sites. The retrieval of APC cores from the upper 200-250 m of the sedimentary column at Sites MP-1 through MP-3 will guarantee:

(1) That sufficient latitudinal distance is covered in order to be able to monitor such surface water fluctuations;

(2) That these reconstructions can be based on equally good, high-quality material across the entire latitudinal span covered by Leg 115.

Aragonite Dissolution (Maldive Islands):

Periplatform sediments deposited exclusively within the vicinity of shallow carbonate banks are unique environments in which to study climatically induced fluctuations of carbonate saturation levels within intermediate water masses. Besides coccoliths, planktonic/benthic foraminifers and pteropods, the periplatform carbonate ooze contains large amounts of needle-like, fine aragonite and some magnesium calcite in the form of skeletal fragments and micrite; both of which are produced in shallow carbonate environments. Because of their special mineralogy (aragonite and Mg-calcite), bank-derived sediments are susceptible to more rapid and shallower dissolution than the calcitic components (i.e., coccoliths and foraminifers).

Late Pleistocene aragonite cycles that occur within the fine (<62 micron) fraction of the ooze appear to be related to climatic changes because of their high degree of correlation with the oxygen isotope record obtained from planktonic foraminifers. The variation through time in the preservation of bank-derived metastable aragonite can therefore be used to explain the observed aragonite cycles, and hence, fluctuations through time in carbonate saturation levels in intermediate water masses.

The following objectives will be addressed by drilling the Neogene carbonate sections at sites MLD-1 and MLD-2 near the Maldive Islands:

(1) To derive a detailed oxygen and carbon isotope stratigraphy for the Neogene, given the expected high rates of accumulation of periplatform ooze, and to test the integrity of correlations with the Pleistocene isotope record.

(2) To determine the interaction between sea level fluctuations and carbonate off-bank transport, and to test the highstand carbonate theory (interglacial high sedimentation rates and turbidite high occurrence) established in the Bahamas.

(3) To determine the effects of monsoonal circulation in Northern Indian Ocean on carbonate dissolution and production.

(4) To estimate the influx of terrigenous components at different water depths.

(5) To decipher the effects of diagenesis on metastable aragonite and Mg-calcite.

Stratigraphy:

The collection of Neogene and Quaternary APC material from MP-1, MP-2, MP-3 and the four CARB sites will make possible the development of a high-resolution biostratigraphy (based on calcareous and siliceous microfossils) for the low-latitude Indian Ocean. There is still room for much improvement regarding the precise sequencing of, or relative distance between, biostratigraphic species events, both within and between microfossil groups. Once adequate magnetostratigraphic sequences are established, we can then transform the biostratigraphic information into an accurate biochronology.

Despite the fact that much effort has been made in establishing high-quality magnetostratigraphic records from deep-sea sediments, we still do not possess a single continuous Miocene record from a low latitude environment. This lack of an adequate biochronologic record makes it difficult to assess the rates of many of the important processes which characterized the development of the Miocene deep-sea environment. This magneto-biochronologic problem will be addressed at the MP-1, MP-2, MP-3 and CARB sites. The recovery of a number of APC cored sections from a relatively small area is ideal for this purpose because it should assure the recovery of the complete stratigraphic section.

Moreover, APC coring of the MP sites will allow magnetostratigraphic studies which are based on inclination and are therefore not critically dependent on core orientation.

DRILLING PLAN AND PRIORITIES

The current drilling plan includes two main programs: penetration and recovery of volcanic basement rocks on the Mascarene Plateau (Sites MP-1 through MP-3) and recovery of complete and undisturbed sediments by APC coring along a paleoceanographic depth transect consisting of four sites (CARB-1 to CARB-4). The drilling objectives described above will be addressed during 42 days of operations. The estimated drilling time will be divided between the basement and the paleoceanographic objectives.

Sites MP-1, MP-2 and MP-3 will penetrate 50 m into the basement using the rotary coring system (RCB) and provide basaltic rocks for radiometric age measurements, geochemical analyses and paleolatitude determinations. The timing of volcanism along the Rodrigues Ridge may be observed in the recovered sediments.

Sediments should also reveal the subsidence history and environment of deposition. Basaltic rocks at MP-3 (or MP-3A) will be dated and analyzed to determine mantle source compositions for magmas. The subsidence history and rifting of the Mascarene Plateau from the Chagos Bank should be recorded in the sediments.

Sites CARB-1, -2, -3, and -4 (or 1A, 2A, and 4A, B, C) will be located within the narrowest possible latitudinal range and spaced at nearly equal depth increments between 1500 m and 4000 m water depth. These sites will be double cored using the APC and XCB coring systems (Table 1).

If time permits, the first addition to the drilling program will be to deepen site CARB-1 to determine the nature and age of the basement. This will increase our understanding of the origin and past position of the Seychelles Bank. Sediments will reveal the Cenozoic subsidence history and paleoenvironment of deposition.

Finally, if time remains at the end of the program, an intermediate depth site in the Maldive Islands (MLD-2 as the first priority) will be APC-cored to examine the history of aragonite dissolution.

Logging with standard Schlumberger tools will take place at the three deepest sites (MP-2, MP-3, and CARB-1).

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LEG 115 PROPOSED DRILLING SITES

SITE	LOCATION	WATER DEPTH (M)	PENETRATION (M) SEDIMENT	BASEMENT	OPERATIONS
MP-1	18° 25.5'S 59° 09.0'E	2714	170	50	APC/RCB
MP-2	15° 36.5'S 61° 45.5'E	2650	250	50	APC/RCB Logging
MP-3	13° 10.0'S 61° 23.0'E	2240	280	50	APC/RCB Logging
MP-3A	12° 54.0'S 61° 17.0'E	2350	300	50	APC/RCB Logging
CARB-1	07° 36.0'S 58° 58.5'E	1496	280	50	double APC/XCB RCB; Logging
CARB-1A	07° 37.0'S 58° 47.0'E	1410	250	50	double APC/XCB RCB; Logging
CARB-2	07° 16.5'S 59° 18.0'E	2400	250	--	double APC/XCB
CARB-2A	04° 00.0'S 60° 31.0'E	3180	250	--	double APC/XCB
CARB-3	04° 19.0'S 60° 49.0'E	3800	250	--	double APC/XCB
CARB-4	05° 25.2'S 59° 56.4'E	4075	250	--	double APC/XCB
CARB-4A	05° 43.2'S 59° 56.5'E	4060	250	--	double APC/XCB
CARB-4B	02° 39.6'S 61° 10.8'E	4350	250	--	double APC/XCB
CARB-4C	02° 09.0'S 61° 21.6'E	4630	250	--	double APC/XCB
MLD-1	04° 56.0'S 73° 17.0'E	520	250	--	double APC/XCB
MLD-2	05° 12.5'N 73° 44.0'E	1500	250	--	double APC/XCB

Table 1.

SUMMARY OF LEG 113 RESULTS

SITES 689 - 697

Leg 113 was designed to address a number of major questions:

* When did the Antarctic ice sheets first form, and have they been permanent since their formation?

* When did marine glacial conditions develop sufficiently for initiating formation of cold Antarctic Bottom Water in the Antarctic region, particularly in the Weddell Sea? How have bottom and intermediate water temperatures changed in response to Antarctic glacial development?

* What has been the history of oceanic planktonic productivity in the Weddell Sea sector of the Southern Ocean? How is this development linked to the evolution of Antarctic climates and the oceanic environment, particularly the Polar Front?

* What has been the evolution of the Antarctic planktonic and benthic biota and their biogeographic patterns? How is this linked with the environmental changes?

To assist in answering these questions, nine sites were drilled in the Weddell Sea (Figure 1). These sites form a depth transect for studies of vertical water mass stratification, climatic evolution, and oceanographic history of Antarctica and the surrounding ocean during the late Mesozoic and Cenozoic.

The following site summaries were received from Drs. Peter Barker and James Kennett, Co-Chief Scientists aboard JOIDES RESOLUTION, Leg 113, during the period 5 January to 11 March, 1987.

Site Summary, Site 689
Latitude: 64°31.01′ S
Longitude: 03°05.99′ E
Water Depth: 2080 m

Site 689 (W1A) lies near the crest of Maud Rise, 700 km off east Antarctica. The primary objective of this site was to obtain a Cenozoic to Late Mesozoic calcareous-siliceous biogenic sequence beneath the Antarctic water mass and to monitor long-term changes in $CaCO_3$ and siliceous biogenic sediments in response to paleoceanographic development around Antarctica.

Four holes were drilled at Site 689: Hole 689A consists of a single APC core to 11.8 mbsf; Hole 689B consists of 21 APC cores and 12 XCB cores to a depth of 297.3 mbsf with 77% recovery. Holes 689A and 689B were occupied between 16 and 18 January. Hole 689C consists of 3 APC cores to 27.6 mbsf, with 76% recovery. Hole 689D consists of 12 APC cores from 19.5 to 133.8 mbsf with 101.4% core recovery. Holes 689C and 689D were occupied between 18 and 19 January. Drilling conditions were excellent. Drilling terminated an estimated 30 m above basement because of slow XCB coring progress in cherts.

Site 689 sampled 297 m of almost pure siliceous and calcareous oozes to chalk with chert layers at the top and bottom of the sequence, and little terrigenous component. The dominant lithologies in the stratigraphic sequence and their ages are as follows:

0-31 mbsf: Radiolarian-bearing and radiolarian diatom oozes of late Miocene to Pleistocene (3 Ma) age;

31-68 mbsf: Diatom ooze with interbeds of calcareous nannofossil ooze of early and middle Miocene age; 68-150 mbsf: Calcareous nannofossil ooze with diatomaceous horizons of late Eocene to late Oligocene age;

150-205 mbsf: Foraminifer-nannofossil ooze of late Paleocene to late Eocene age;

205-237 mbsf: Foraminifer-nannofossil chalk of early to late Paleocene age;

237-297 mbsf: Foraminifer-nannofossil chalk, with interbedded chert layers near the base, of middle Campanian to latest Maestrichtian age.

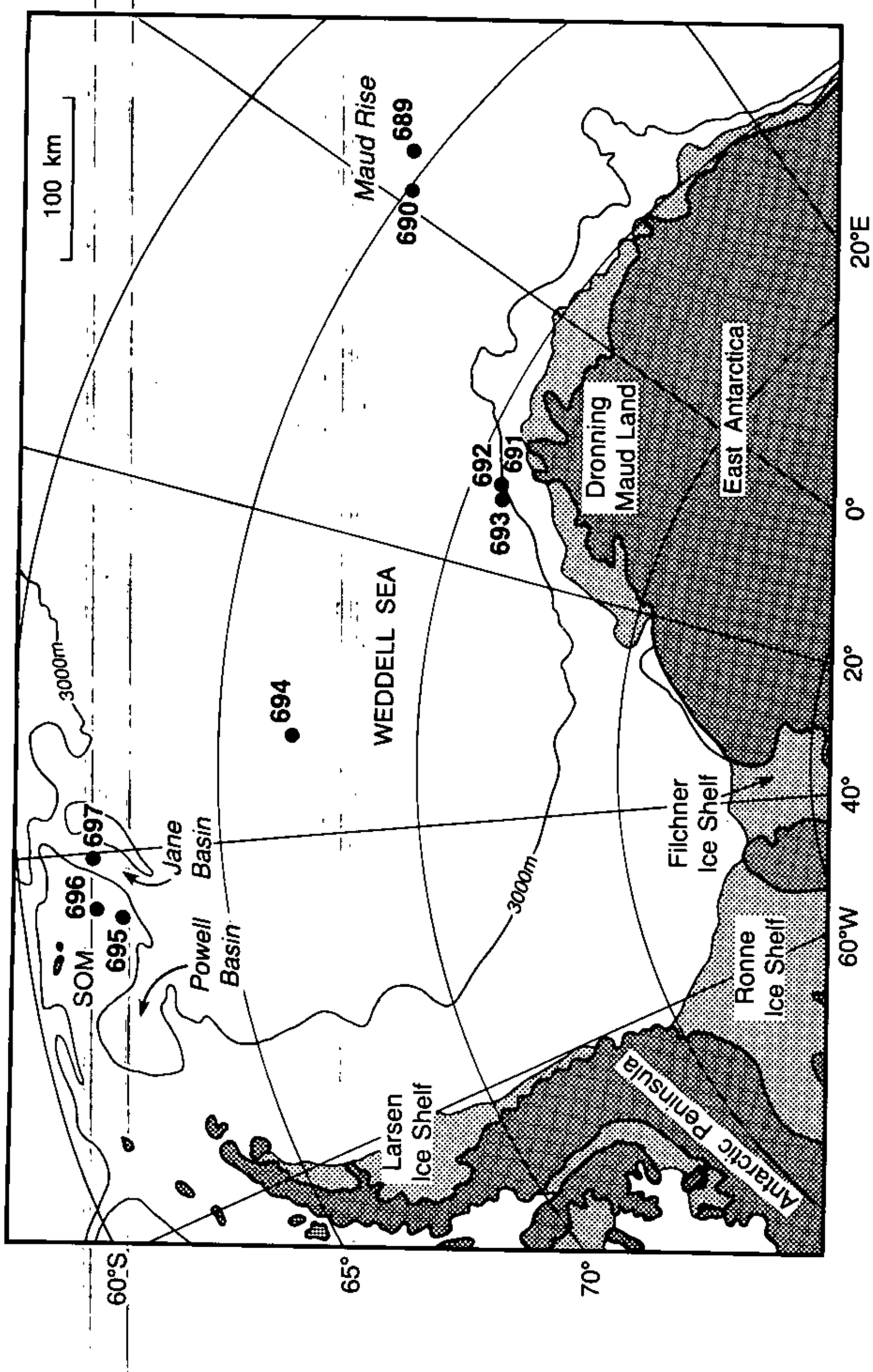

Figure 1. Location of Leg 113 Sites (689-697) in the Weddell Sea. All sites lie in the present-day Antarctic water mass, south of the Polar Front. SOM = South Orkney Microcontinent.

There is evidence of brief sedimentary hiatuses or highly condensed sequences during the early Paleocene (late Danian), late Paleocene-early Eocene, latest Oligocene-earliest Miocene, latest Miocene, and late Pliocene-Pleistocene. The hiatuses correspond to seismic reflectors.

The chert layer at the top of the sequence of late Pliocene age (3 Ma) is among the youngest ever obtained. The magnetostratigraphy for the late Neogene is well established, with excellent prospects for all of the recovered Cenozoic sediments. Sedimentation rates for the late Neogene are 9-10 m/m.y. In this section, we have recovered a fine, pioneering biostratigraphic sequence that will form the southernmost anchor for Atlantic biostratigraphy, biogeography, and isotopic stratigraphy. We obtained the first Cenozoic-Late Mesozoic calcareous nannofossil and planktonic foraminiferal biostratigraphy for Antarctic waters.

The high-quality biosiliceous record for the Neogene indicates a marked lack of sediment and microfossil reworking by bottom currents. It contains a useful record of benthic foraminifers. Intercalibration of siliceous and calcareous microfossil zonations from late Paleocene through Neogene time is possible for the first time in the Antarctic. Calibration of early Neogene biosiliceous stratigraphy to the chronostratigraphic scale is also possible for the first time. We obtained an apparently continuous Eocene/Oligocene boundary section with a normal associated siliceous-rich interval. In addition, we obtained an apparently continuous Cretaceous/Tertiary boundary and captured a planktonic crisis interval in the boundary between well-preserved assemblages. The boundary is associated with apparently altered volcanic clay and vitric ash (40 cm). The recovered late Maestrichtian and early Paleocene intervals are firsts for the Southern Ocean.

Sediments and microfossil diversity and assemblages clearly reflect a sequential cooling of the Antarctic water mass, inferred to be related to Antarctic glacial development. The siliceous biogenic facies have progressively replaced the carbonate facies during the Cenozoic, with initial siliceous sedimentation occurring during the latest Eocene-earliest Oligocene, a major increase in siliceous sedimentation beginning near the base of the Neogene, and exclusively siliceous sedimentation from the late Miocene. Ice-rafted dropstones are very rare, and have been seen only in the Neogene section.

A warm Paleogene is suggested by high planktonic microfossil diversities and the presence of discoasters that disappeared by the Eocene as surface waters cooled. Further decreases in planktonic diversity occurred at the Eocene/Oligocene boundary, during the middle Oligocene, and near the base of the Neogene when calcareous planktonic assemblages effectively became truly polar.

Sedimentation rates seem to be relatively uniform and low (ca. 4 m/m.y.) through much of the Cenozoic, reflecting uniform biogenic productivity; this should simplify intercalibration of magneto- and biostratigraphic time scales. Low organic content and oxidized sediments through the entire sequence reflect low sedimentation rates and well oxygenated intermediate waters during the Cenozoic and perhaps the Late Mesozoic. Site 689, located just south of the Antarctic divergence, has always lain well to the south of the high productivity biogenic belt of the Polar Front. During the Cenozoic this has been an oceanic backwater.

Site Summary, Site 690
Latitude: 65°09.63′ S
Longitude: 01°12.30′ E
Water Depth: 2914 m

Site 690 (W2A) lies on the southwestern flank of Maud Rise. Site 690 is the deeper of two sites on Maud Rise that form part of a depth transect for studies of vertical water mass stratification and biogenic sedimentation during the Late Mesozoic and Cenozoic around Antarctica. Objectives are similar to those at Site 689 located only 116 km to the northeast: to obtain a Cenozoic-Upper

Mesozoic calcareous-siliceous biogenic sequence beneath the Antarctic water mass and to monitor long-term changes in major biogenic components resulting from paleoceanographic developments.

Three holes were drilled at Site 690: Hole 690A consists of a single APC core to 7.7 mbsf; Hole 690B consists of 25 APC cores to a depth of 213.4 mbsf. These holes were occupied between 19 and 21 January. Hole 690C, occupied between 21 and 23 January, consists of 9 APC cores to a depth of 83.6 mbsf; a washed interval from 83.6 to 204.2 mbsf and 14 XCB cores from 204.2 to 321.2 mbsf. Sediments immediately overlying basement are lower Maestrichtian. Drilling conditions and core recovery were excellent.

Site 690 sampled 317 m of almost pure siliceous and calcareous oozes in the upper half of the sequence and mixed calcareous ooze/chalk and terrigenous sediments in the lower half. Minor chert layers occurred in the basal sediments. We sampled 1.71 m of amygdaloidal pyroxene-olivine basalt that is considered to be basement. The dominant lithologies in the stratigraphic sequence and their ages are as follows:

0-2.1 mbsf: foraminiferal ooze of Pleistocene age;

2.1-24.4 mbsf: biosiliceous ooze of late Miocene-Pliocene age;

24.4-53.4 mbsf: interbeds of diatom and calcareous nannofossil ooze of early Miocene-latest Oligocene age;

53.4-92.9 mbsf: nannofossil ooze of late Oligocene age;

92.9-137.8 mbsf: foraminifer-bearing nannofossil ooze of late Paleocene to early Oligocene age;

137.8-281.1 mbsf: nannofossil ooze-chalk with varying amounts of terrigenous sediments (quartz, clay, mica) of late Maestrichtian to late Paleocene age;

281.1-317.0 mbsf: muddy chalk, calcareous mudstone and nannofossil-bearing mudstone of Campanian to late Maestrichtian age;

317.0-321.2 mbsf: basalt.

The sequence has fewer hiatuses and better preservation than Site 689. A major hiatus spans the late Eocene and part of the early Oligocene. A late Pliocene to early-middle Pleistocene hiatus is present much as at Site 689.

The magnetostratigraphy for the late Neogene is well established, with excellent prospects for all the Cenozoic sections recovered. An increase in NRM intensity in the lower part of the sequence correlates with increased terrigenous sediment deposition. Magnetostratigraphic studies have been strengthened by coring the two nearby sites. The basalts are normally magnetized.

As at Site 689, the sediment sequence and biotic changes reflect a sequential cooling of the Antarctic water mass with biosiliceous facies progressively replacing carbonates during the Late Cenozoic. The sediment sequence at Site 690 differs from that at Site 689 in having an important terrigenous component (fine-grained quartz, clay, mica) in the lower Paleogene and Upper Cretaceous. This material is most abundant in the lower Eocene to upper Paleocene interval (an interval missing at Site 689) and the Maestrichtian. During the Paleocene, these clays impart rich reds and browns to the sediments. Color cycles are present. This clay is either eolian material derived from East Antarctica that was winnowed by bottom currents away from the crest of Maud Rise and deposited in the flank area of Site 690, or less likely, the terrigenous material was deposited from a nepheloid layer at depths greater than 2000 m (depth of Site 689) that originated in East Antarctica to the south. In either case, East Antarctica provided a rich source of fine-grained terrigenous sediments for Maud Rise during the Paleocene and Late Cretaceous. The clay is rich in chlorite-kaolinite, indicating that conditions were warm and humid in this sector of Antarctica during the Paleocene, and probably totally unglaciated. The rich reddish colors of the Paleocene clays perhaps also indicate some laterite formation.

The evidence from the clays and their mineralogy supports the relative warmth of the Paleocene from marinebiogeographic evidence. Eocene clays are dominantly smectite suggesting warm climatic conditions. In the early Oligocene, illite first appeared as a major clay, while smectite decreased. This change suggests that hydrolysis strongly decreased on Antarctica, due to a major cooling and/or increase in aridity. This supports previous isotopic and biogeographic data.

Results from Site 690 reinforce the biostratigraphic results of Site 689. Site 690 provides a superb Paleogene calcareous biostratigraphic sequence, apparently complete except for the upper Eocene to lower Oligocene. However, this interval is preserved in Site 689, and hence together the two sites provide a complete Paleogene sequence. The Maestrichtian through Paleocene is highly expanded because of the addition of the clays, permitting high resolution biostratigraphic and isotopic work. Preservation of the calcareous microfossils is superb. Because of the greater depth of deposition at Site 690, the Neogene has less carbonate due to increased dissolution. Siliceous microfossils are better preserved because of the reduction in carbonate.

There are greater differences in the benthic foraminiferal assemblages between the two sites in the Cretaceous and early Tertiary than in the Oligocene. This perhaps suggests a reduced vertical temperature gradient in the Oligocene as the Antarctic cooled.

We obtained another apparently continuous Cretaceous/Tertiary boundary section. Of great potential interest is that the biotic crisis seems to coincide precisely with the base of a 67 cm volcanic clay and vitric tuff layer that also occurs at Site 689.

The following two site summaries were combined:

Site 691
Latitude: 70°44.64′ S
Longitude: 13°48.68′ W
Water Depth: 3025 m

Site 692
Latitude: 70°43.43′ S
Longitude: 13°49.20′ W
Water Depth: 2875 m

Sites 691 (W4/1) and 692 lie on a mid-slope bench on the Weddell Sea margin of East Antarctica. Drilling on this margin aimed to examine the Cenozoic record of cooling and ice-sheet formation on the continent, to complement investigations of circum-Antarctic water mass development at other Leg 113 sites. At Site 691, in the axis of Wegener Canyon, three rotary holes were attempted during the period 25-26 January. One core was drilled at each hole, with a total recovery of 0.05 m. At Site 692, on the canyon shoulder, two holes were rotary drilled during 26-30 January. One core was recovered from Hole 692A (6.7 m penetration; 0.65 m recovery). Hole 692B penetrated 97.9 m and recovered 28.6 m (29%) in 13 cores. The three units recovered at this site include:

0-30.4 mbsf: Silty and clayey mud with likely unsampled coarse fraction, of Miocene to late Pleistocene age;

30.4-53.2 mbsf: "Boulder bed," pebbles and cobbles of several hard-rock lithologies with likely unsampled fine fraction, age unknown;

53.2-97.9 mbsf: Nannofossil claystone with macrofossils, volcanic ash lenses and laminae, and organic-rich claystone interbeds, of Early Cretaceous (probably Aptian) age.

Hole 692B was abandoned because the main aim of drilling was inaccessible and because of "boulder bed" caving downhole (also the likely cause of failure to spud in the four other holes attempted).

Diatoms date the canyon-cutting at Site 692 as early late Miocene or older; physical properties suggest 250-300 m have been eroded, implying a simple original continuity of layer-cake reflectors at the canyon walls. Wegener Canyon has now cut through the outer high of the "Explora Wedge" seaward-dipping reflector province, creating a narrow inner canyon inshore (Site 691) and permitting slow deposition (glauconite) on its flanks (Site 692). The relation to Antarctic ice-sheet growth should emerge from later sites.

The recovered Lower Cretaceous claystones resemble sediments of the same age from the Falkland Plateau, then nearby. The claystones were deposited in 500-1000 m water depth at the mid-latitude site in anoxic or weakly aerobic conditions, with likely fluctuating surface water salinity. By analogy with the Falkland Plateau section, a similar facies probably extends all or most of the 1200 m to the seaward-dipping reflector basement, considered mid-Jurassic in age.

<u>Site Summary, Site 693</u>
Latitude: 70°49.89′ S
Longitude: 14°34.41′ W
Water Depth: 2359 m

Site 693 lies on a mid-slope bench on the Weddell Sea margin of East Antarctica, 10 km southwest of the rim of Wegener Canyon and 30 km from Sites 691 and 692. Like those sites, it aimed to examine the Cenozoic record of Antarctic continental cooling and ice-sheet formation, to complement the objective of studying the development of circum-Antarctic water masses at other Leg 113 sites.

Two holes were drilled at Site 693 in 7 days 20 hours, from 30 January to 6 February 1987. Hole 693A (rotary drilled in anticipation of possible widespread boulder beds that had been observed at Sites 691 and 692) penetrated 483.9 m in 51 cores, and recovered 213.6 m (44%). The hole was terminated in Lower Cretaceous (Albian) claystones, and one logging run (gamma, resistivity, sonic) was made to 446 mbsf. Hole 693B was washed to 233.8 mbsf and cored continuously (16 XCB, 2 APC) to 401.2 mbsf, recovering 92.2 m (55%) to improve core recovery and quality in crucial intervals. Coring was terminated when the XCB shoe broke off in the hole. The seven units recovered at this site include:

0-12.2 mbsf: Foraminifer-bearing clayey mud, middle-late Pleistocene;

12.2-31.4 mbsf: Barren clayey mud, likely late Pliocene to early Pleistocene;

31.4-325.0 mbsf: Diatom mud and silty to clayey diatom-bearing mud, late Oligocene to late Pliocene, with lone thin late Miocene clayey/calcareous nannofossil-diatom ooze sub-unit; 325.0-345.1 mbsf: Alternating diatom mud, silt and muddy nannofossil-bearing clayey mud, late Oligocene;

345.1-397.8 mbsf: Diatom mud, silt, partly slumped, late early Oligocene;

397.8-409.0 mbsf: Radiolarian diatomite, middle Cretaceous?;

409.0-483.9 mbsf: Dark organic-rich, terrigenous claystones and mudstones, Albian.

Sedimentation rates were about 10 m/m.y. during the Pleistocene, 20-70 m/m.y. during the Pliocene and late Miocene, and 5 m/m.y. during the early Miocene and Oligocene. Hiatuses of regional extent occurred in the middle Miocene (8 m.y. duration; 265 mbsf) and the Late Cretaceous, Paleocene, Eocene and earliest Oligocene (ca. 60 m.y. duration; 398 mbsf). Glacial dropstones are abundant down to the middle Miocene hiatus, and are present but less common and somewhat weathered to the Oligocene hiatus at 398 mbsf.

Illite is the dominant clay mineral through the Cenozoic section sampled, reflecting the physical nature of erosion. Smectite from retreating volcanic sources occurs in the Cretaceous section.

The biogenic component is almost entirely siliceous. It is common to abundant and well-preserved in the lower Pliocene, upper Miocene, and Cretaceous sections, but few and poorly preserved elsewhere. Foraminifers are found in the upper Pleistocene section, are well-preserved with nannofossils in the thin upper Oligocene interbeds, and occur in part of the Albian section. Foraminifers are absent elsewhere, including the Oligocene and lower Miocene, which is in contrast with sections recovered on Maud Rise. Magnetostratigraphy is good in the top 140 m and in the Cretaceous, but needs onshore work elsewhere.

Seismic profiles confirm speculations made at Site 692 that 90% of the sediments around Site 693 are pre-Late Cretaceous. Maximum erosion at Site 692 was 300 m, which implies sedimentation of eroded sediment at a mean rate of 5 m/m.y. through the hiatus period, assuming erosion was caused by Weddell Sea Bottom Water at the Eocene/Oligocene boundary. Rates were similar to the Oligocene/Miocene boundary, but much less before or since that time; between 100 and 12 Ma this was a starved margin.

Benthic diatoms in the lower Miocene and Oligocene sediments indicate a shallow, partly ice-free shelf, but rare ice-rafted debris indicates some glaciation. WE conclude that the East Antarctic ice sheet formed in the middle Miocene, increasing sediment supply to the margin and starting canyon-cutting after an initial early middle Miocene cooling. High Pliocene siliceous productivity was as seen at the Maud Rise sites and parallels coeval high calcareous productivity in lower latitudes. There is no evidence of major East Antarctic deglaciation since the middle Miocene, including a high-resolution lower Pliocene record. Lower sedimentation rates and diatom abundance and poor preservation over the last 2.4 Ma may reflect glacial intensification and increased sea-ice extent.

Site Summary, Site 694
Latitude: 66°50.82′ S
Longitude: 33°26.76′ W
Water Depth: 4653 m

Site 694 (W5) lies on the northern part of the abyssal plain of the Weddell Basin, 900 km north of East Antarctica and 900 km east of the Antarctic Peninsula. This site, the deepest of 7 sites forming a depth transect in the Weddell Sea, was selected to obtain a continuously cored, largely terrigenous sequence of hemipelagic clays and turbidites to provide a record of continental erosion during the glacial and preglacial climatic regimes of Antarctica, and data related to the history of bottom-water production in the Weddell Sea.

Three holes were drilled at Site 694 in 8 days, 15 hours, from 9 to 18 February. Hole 694A recovered a single APC core from 0 to 9.8 mbsf. Hole 694B consisted of 15 APC cores, 8 XCB cores, and 2 wash cores from 0 to 188.9 mbsf, providing 34% recovery. Hole 694C consisted of 1 wash core from 0 to 179.2 mbsf and 22 XCB cores from 179.2 to 391.3 mbsf, well above target depth, when the XCB became stuck at the bottom of the drill string, requiring a drill pipe trip, and it was decided to spend no more time at the site.

Drilling at Site 694 had to be postponed on two occasions because of closely approaching icebergs, but this did not require abandonment of the hole. Quality of the cores is good only in the uppermost part of the sequence; otherwise, the cores are moderately to highly disturbed.

The recovered sequence ranges in age from middle Miocene to Pleistocene. A paleomagnetic polarity stratigraphy in the uppermost 20 m of Hole 694B extends from the early Gilbert to the Brunhes Chron; paleomagnetic polarities are difficult to interpret below that depth. Biostratigraphic ages are based on diatoms and radiolarians, and are broadly constrained.

The sedimentary sequence is mostly terrigenous with a minor biosiliceous component. The abundance of ice-rafted debris fluctuates throughout the cored interval. Almost all of the recovered sediments are interpreted as hemipelagic silts and clays and turbidites. The four units drilled at the site are:

0-21.2 mbsf: Lower Pliocene to Pleistocene clay and clayey mud with minor silt, sand and diatom-bearing clayey mud interpreted as cyclic distal turbidites and hemipelagic sediments;

21.1-111.7 mbsf: Lower Pliocene, sorted, lithic quartz sands, interpreted as sandy turbidites;

111.7-304.3 mbsf: Middle Miocene to lower Pliocene sediments of hemipelagic and turbiditic origin including graded silts (with or without diatoms), diatom-bearing silty and clayey muds with interbedded silts and sandy muds, and at the base, a homogeneous gravel-bearing sandy and silty mud of glacial-marine origin;

304.3-391.3 mbsf: Middle Miocene diatom-bearing and diatom claystones and graded silts representing distal turbidites and hemipelagics. The base of this unit is marked by a hard silicified claystone layer that probably caused the loss of the XCB.

The sequence recovered at Site 694 is similar to the middle and upper part of Site 323 in the Bellingshausen Basin, west of the Antarctic Peninsula.

Lithic material in the coarse turbidite layers is dominated by sedimentary rocks suggesting derivation from West Antarctica and the Filchner continental shelf areas. Ice-rafted debris in a wide range of sizes occurs discontinuously throughout the sequence in varying abundances suggesting changes in intensity of Antarctic glaciation since the middle Miocene. The main source of the turbidites and the glacial material at Site 694 seems to be from the Antarctic Peninsula rather than from East Antarctica; thus, this site provides information about the development of glaciation on West Antarctica.

Several criteria based on sediments, neritic diatoms and clay mineralogy suggest development of major West Antarctic glaciation and ice-sheet formation during the late Miocene. The most rapid deposition of turbidites (180 m/m.y. or greater) occurred within an interval of only 0.5 m.y. or less during the early Gilbert Chron (Chron 3R4) before 4.8 Ma. This rapid turbidite deposition occurred during an interval marked elsewhere by major climatic cooling, increased and highly variable delta-018 values and low sea level and appears to correlate with the latest miocene to the earliest Pliocene. High rates of turbidite sedimentation in this interval probably resulted from an expanding, yet unstable, West Antarctic ice-sheet at this time. The sedimentary sequence recovered at Site 694 suggests inherent instability of the West Antarctic ice-sheet during the late Miocene. From 4.8 Ma (earliest Pliocene) to the present day, turbidite deposition virtually ceased at Site 694 indicating that the West Antarctic ice-sheet has been a permanent and stable feature since earliest Pliocene time.

The following site summary was prepared from information in the Hole Summary, written by the Leg 113 shipboard scientific party:

<u>Site Summary, Site 695</u>
Latitude: 62°23.48′ S
Longitude: 43°27.10′ W
Water Depth: 1305 m

Site 695 (W7) is the intermediate site of three which form a paleodepth transect through the circum-Antarctic water masses on the edge of the Weddell gyre, and was the first of the three drilled. It lies on the southeastern edge of the South Orkney microcontinent (SOM) on the northern margin of the Weddell Sea. The SOM separated from the Antarctic Peninsula at about 30 to 35 Ma. The microcontinent was pervasively block-faulted by this event, providing an effective older limit to the period for which the SOM can be used as a passive "dip-stick" into the paleo-ocean. Reflection profiles over the site show a bottom-simulating seismic reflector (BSR) at about 600 mbsf, interpreted as being a methane gas hydrate.

Site 695 consists of a single hole (Hole 695A), drilled in 3 days from February 20 to 23, consisting of 15 APC cores, 5 interstitial water cores, and 22 XCB cores. Recovery averaged 72%. The section recovered at Site 695 consists of 338.5 m of Pleistocene to uppermost Miocene or lowest Pliocene sediment, essentially of mixed siliceous biogenic, hemipelagic, ice-rafted terrigenous, and air-fall volcanic origin. Core disturbance is minor. Three lithostratigraphic units are recognized, the first of which is divided into four subunits:

<u>Unit I</u>: 0 to 190.7 mbsf, comprises a range of diatom-rich sediments (up to 80%). Subunit IA is 19.9 m thick, contains mainly diatom-bearing silty and clayey muds with minor foraminifers above 4 mbsf, and is of Pleistocene to middle Pliocene age. This is the only certain, in situ

occurrence of calcareous microfossils in Hole 695A. Subunit IB is 31.4 m thick, and includes muddy diatom oozes of middle to early Pliocene age. Subunit IC is 42.4 m thick, and includes mainly silty and muddy diatom oozes of late early Pliocene age. Subunit ID is 97.0 thick, and contains diatom oozes to diatom silty muds of early Pliocene age.

Unit II: 190.7 to 306.9 mbsf, with a much smaller biosiliceous component (10 to 25%) than Unit I, comprises diatom-bearing silty and clayey muds of early Pliocene age.

Unit III: 306.9 to 338.5 mbsf, consists of silty mud of early Pliocene and possibly latest Miocene age, with 0 to 10% diatoms.

Ice-rafted detritus occurs throughout the section, but is most abundant above 20 mbsf and in Unit II. Volcanic ash beds and glass also occur throughout, but are most common between 50 and 250 mbsf. Illite and chlorite dominate the clay mineral assemblages. Graded beds are rare and the terrigenous component is largely hemipelagic or ice-rafted.

The biogenic component is mainly siliceous; the carbonate component consists of foraminifers, which are confined to the upper 4 meters of the cored section (the limit of the Pleistocene). Diatoms dominate the siliceous component, and are common to abundant, moderately to well preserved between 5 and 293 mbsf, but less so elsewhere. Radiolarians and silicoflagellates occur as a minor biogenic component. Good recovery and low disturbance bode well for magnetostratigraphic studies, but low remanent intensities defer conclusive determinations to post-cruise analyses. Sedimentation rates were moderate (<30 m/m.y.) in the latest Miocene and earliest Pliocene (early Gilbert), very high (about 200 m/m.y.) in the late Gilbert, and decreased through the Gauss to low rates (2.5 to 8 m/m.y.) in the Matuyama and the Brunhes.

High biosiliceous productivity in the early Pliocene was also documented at other Leg 113 sites and in the Subantarctic (DSDP Site 514). A parallel increase in calcareous productivity is also seen in the subtropical SW Pacific (DSDP Sites 586-593). The expanded section should permit high resolution magneto- and siliceous biostratigraphic correlations, as well as detailed paleoceanographic and evolutionary studies. Volcanic ash layers will also support chronostratigraphic correlations between the three South Orkney transect sites.
A well-constrained heat flow measurement of 1.5 HFU is too high for the BSR at 600 mbsf to be the base of a methane hydrate. No BSR is visible within the 310 to 360 mbsf depth range predicted by the heat flow data as being the depth range of a methane hydrate base. A sharp methane increase at 250 mbsf is related to depletion of pore water sulphate, and indicates an in situ biogenic origin, presumably related to the high biosiliceous accumulation rates. The origin of the 600 mbsf inverse-polarity BSR remains uncertain.

Site Summary, Site 696
Latitude: 61°50.95′ S
Longitude: 42°55.98′ W
Water Depth: 650 m

Site 696 (W8) lies on the southeast margin of the South Orkney microcontinent (SOM), South Scotia Ridge. It is the shallowest site in the Weddell Sea depth transect for studies of Late Mesozoic and Cenozoic water mass stratification and Antarctic climatic history. Two holes were drilled during the period 23 February to 2 March. Hole 696A includes ten APC cores to 89 mbsf and two XCB cores from 89 to 103 mbsf (55% recovery). Hole 696B includes a washed interval to 76.6 mbsf, and 59 rotary cores and interstitial water cores from 76.6 to 645.6 mbsf (27.5% recovery). The site was abandoned at the maximum penetration allowed by safety restrictions.

The sedimentary sequence is middle or late Eocene to Pleistocene in age, and consists of terrigenous, hemipelagic and pelagic material with ice-rafted debris (IRD) and a minor volcanogenic component. IRD of all sizes is common from the middle upper Miocene (330 mbsf; ca. 8 Ma) to the present. Otherwise, only rare coarse-grained

IRD occurs at two levels between 530 and 570 mbsf in likely Oligocene or lower Miocene sediments. Calcareous material is present only as a planktonic foraminiferal component in the uppermost 4 m of the Pleistocene sequence and as benthic foraminifers and nannofossils in the basal few meters of the Eocene sequence. The pelagic component is almost totally biosiliceous, particularly diatoms. The Site 696 sequence consists of three parts: an upper hemipelagic part to 212 mbsf, a middle diatomaceous part to 530 mbsf, and a lower terrigenous and authigenic part to the base of the hole. The sequence consists of condensed Pleistocene to upper Pliocene, expanded lower Pliocene and upper to middle Miocene, and condensed Oligocene(?) to Eocene sections. Preliminary stratigraphy indicates a brief hiatus or condensed sequence during the uppermost Pliocene to lowest Pleistocene, and a possible brief hiatus during the middle Pliocene. Another condensed barren interval separates the Neogene and Paleogene sequences and hinders understanding of the transition. Magnetic polarity stratigraphy was identified for the early Pliocene to the present. Prospects for identifying a polarity stratigraphy are poor for the Miocene due to poor recovery, but good for Paleogene sediments. Biostratigraphic ages for the Neogene are based almost entirely on diatoms and radiolarians. The Paleogene sediments are barren of siliceous microfossils; age assignments are based upon calcareous nannofossils and palynomorphs. Sediments from this site document the first recovery of pollen and spores in sediments of the deep Weddell Sea. Benthic foraminifers are persistent but rare through most of Site 696, and comprise almost exclusively low-diversity assemblages of agglutinated forms.

The seven units drilled at this site are as follows:

0-64.5 mbsf: Pleistocene to lower upper Pliocene diatomaceous muds and oozes;

64.5-124.8 mbsf: Lower upper to lower Pliocene diatom-bearing silty and clayey mud;

124.8-211.8 mbsf: Lower Pliocene to upper Miocene silty and clayey mud, with minor diatom-bearing clayey mud;

211.8-260.1 mbsf: Upper Miocene diatom ooze and muddy diatom ooze;

260.1-269.7 mbsf: Upper Miocene coarse turbidite sand;

269.7-529.8 mbsf: Diatom ooze and

mud-bearing diatom ooze passing down to diatomite and mud-bearing diatomite;

529.8-645.6 mbsf: ?Middle Miocene to Eocene, dominantly terrigenous sediments subdivided into four subunits: sandy mudstone (possibly middle Miocene); claystone, clayey mudstone and silty mudstone (undifferentiated upper Paleogene to lower Miocene); glauconitic silty mudstone and claystone (undifferentiated upper Paleogene to lower Miocene); and sandy mudstone (Eocene).

Eocene mudstones reflect the dominant terrigenous regime of SOM while it was still contiguous with the West Antarctic continental margin. Benthic foraminiferal assemblages indicate deposition in an inner neritic environment under slightly hyposaline and hypoxic conditions. Abundant assemblages of Mollusca and Cnidaria are present. Diverse calcareous nannofossil assemblages attest to the warmth of the Southern Ocean during the Eocene. Palynoflora indicates the presence of temperate beech forests with an undergrowth of ferns on West Antarctica. The warm climate interpretation is also supported by a clay association dominated by smectite, as in the Eocene sediments of Maud Rise, resulting from the predominance of chemical weathering over physical processes.

A condensed neritic sequence of about 77 m of poorly dated terrigenous glauconitic sediments separates sediments of Eocene and middle Miocene age. Rare, reworked freshwater diatoms indicate freshwater lakes in West Antarctica. Nearly all of the overlying section contains only agglutinated benthic foraminifers and virtually no calcareous planktonic microfossils, indicating a change to highly undersaturated bottom waters, even at these shallow depths. The paucity of fossils makes it difficult to interpret climatic conditions in this interval, but rare agglutinated benthic foraminifers suggest cool bottom waters. IRD is almost totally absent. The clay mineral associations consist of abundant to exclusive smectite and common to abundant illite.

This condensed sequence passes (perhaps disconformably) up into a 300-m sequence of poorly recovered but dominantly biosiliceous (90% diatoms) sediments of middle to latest Miocene age. Lack of terrigenous sediment deposition in the middle Miocene reflects the isolation of SOM from West Antarctica due to formation of the Powell Basin. Sedimentation rates are fairly constant and moderately high from about 14 to 5 Ma, with an average of 35 to 41 m/m.y. High productivity, excellent preservation and the taxonomic composition of the diatoms suggest that the Antarctic Convergence was located just to the north of the SOM during much of Miocene and that there was little sea-ice in the area. The continued absence of calcareous microfossils throughout most of Miocene indicates that the CCD was exceedingly shallow, less than (the present-day depth of) 650 m. The lack of IRD in the middle and lower upper Miocene sediments suggests major glaciation had not yet commenced on West Antarctica, in concordance with trends observed at other Leg 113 sites. A major change in the climate of West Antarctica during the middle Miocene is indicated by changes in clay mineral assemblages. At this time, smectite, the dominant clay mineral in the earlier middle Miocene, is replaced by illite and chlorite. This indicates a strong decrease in chemical relative to physical weathering, which may have resulted from a major cooling of West Antarctica. A similar change in clay associations occurred in early Oligocene time at sites adjacent to East Antarctica and Maud Rise, indicating that major cooling occurred earlier in East Antarctica than West Antarctica.

In the early late Miocene, diatomaceous sediments continued to dominate. An increase in hemipelagic sedimentation, the appearance of an important ice-rafted component and the further increase in illite and chlorite, all resulted from development of a West Antarctic ice-sheet during the late Miocene. At the Miocene/Pliocene boundary, diatomaceous sediments are largely replaced by diatom-bearing silty and clayey muds. This resulted from the development, during the latest Miocene, of a major and probably permanent West Antarctic ice-sheet, the major supplier of fine terrigenous sediments to the West Antarctic continental margin. At the same time, a general regional decrease occurred in biosiliceous productivity. Site 696 also exhibits a characteristic regional decrease in sedimentation rates from the early Pliocene to the late Pliocene and Pleistocene. The Pleistocene is marked by abundant *Neogloboquadrina pachyderma* and a low-diversity benthic foraminiferal assemblage, as found throughout the Weddell Sea.

This site summary was prepared from information in the Hole Summary, written by the Leg 113 shipboard scientific party:

Site Summary, Site 697
Latitude: 61°48.63′ S
Longitude: 40°17.73′ W
Water Depth: 3483 m

Site 697 (W6) lies in Jane Basin and is the deepest member of a 3-site paleodepth transect on the northern margin of the Weddell gyre. Jane Basin formed 25 to 30 million years ago as a back-arc basin separating the then-active island arc of Jane Bank from the South Orkney microcontinent. Antarctic Bottom Water flows northward through Jane Basin and the hemipelagic sediments deposited in the basin promised a high-resolution record of bottom water production and sediment transport in the past.

Two holes were drilled at Site 697, from 3 to 7 March. Hole 697A consisted of 3 APC cores from 0 to 20.9 mbsf, providing 95% recovery. Hole 697B consisted of 11 APC cores and 21 XCB cores, from 18.0 to 322.9 mbsf, providing 62% recovery. Hole 697B was abandoned above target depth when time for coring on Leg 113 ran out.

The sedimentary sequence at Site 697 is mainly of hemipelagic origin, with a minor siliceous biogenic component and numerous thin, altered volcanic ash layers. Ice-rafted detritus (IRD) is abundant only near the base of the sequence. Two lithologic units are recognized, the first being divided into three subunits:

<u>Unit I</u>: 0 to 293.0 mbsf, includes silty and clayey mud, diatom- bearing silty and clayey mud, clay and diatom clayey mud, and is of Pliocene to Pleistocene age. Subunit Ia (0 to 15.5 mbsf) consists of silty mud and diatom-bearing silty mud of late Pleistocene age. The diatom content fluctuates over 2-m cycles. Subunit Ib (15.5 to 85.7 mbsf) is clayey mud and clay of late Pliocene to Pleistocene age. Diatoms are rare to absent except in one core. Subunit Ic (85.7 to 293.0 mbsf) is mainly diatom-bearing clayey mud, of Pliocene age, but includes intervals of clayey mud and diatom clayey mud. Diatoms occur both in thin laminae and disseminated throughout the section. Three thin turbidites occur near 161 mbsf. At the base, an ungraded, burrowed silt with dropstones may reflect an episode of stronger bottom currents.

<u>Unit II</u>: 293.0 to 320.1 mbsf, includes silty and clayey mud of early Pliocene age. It is coarser-grained than Unit I, with abundant IRD and very rare diatoms, and one possible thin silt turbidite.

Volcanic material occurs as dark gray and green fine-grained ash laminae altered to clay, as disseminated glass and as coarse vitric ash in a few beds. Dropstones are mostly of sedimentary origin, rounded or subrounded and less than 2 cm in diameter. Bioturbation is minor. Authigenic minerals include fine-grained carbonates near 200 mbsf, common pyrite below 90 mbsf and possible zeolite occurring irregularly between 20 and 90 mbsf. Illite and chlorite are the dominate clay minerals. The biogenic component is siliceous: diatoms dominate, fluctuating in abundance and preservation and including a few thin ooze interbeds.

The expanded section at Site 697 provides a high-resolution magnetostratigraphic record with opportunities for calibration with high-latitude biosiliceous zonations and for paleoceanographic studies. The Blake Event occurs as a doublet at 4 mbsf, confirming its global range and reversed nature. Whole-core susceptibilities may reflect orbitally-induced changes in sediment composition. Volcanic ash beds may provide additional correlation between sites drilled on the South Orkney transect (Sites 695-697), and should prove particularly useful for high-resolution studies of bottom-water variability. Magnetostratigraphic zonation indicates high and smoothly-varying sedimentation rates of up to 135 m/m.y. for the Gilbert, to 78 m/m.y. until mid-Gauss and 43 m/m.y. to the late Brunhes; sedimentation rates determined from biostratigraphy are in general agreement with these values. Pleistocene sedimentation rates are more than 5 times greater than at any other Leg 113 site, and indicate continued sediment supply and bottom-water nepheloid transport in the Weddell gyre despite contrary indications elsewhere. This suggests changes in the distribution and mode of formation of turbidity currents along the West Antarctic and Antarctic Peninsula margins of the Weddell Sea.

The absence of a calcareous layer in the Pleistocene section at Site 697 (but present on Maud Rise, the Dronning Maud Land margin and the other South Orkney microcontinent sites) indicates that the CCD did not descend to 3500 m in Jane Basin. This layer is accessible to piston cores in most places, and is of potential value as a paleoceanographic indicator within the Antarctic water mass.

ODP ENGINEERING REPORT

LOCKABLE FLAPPER FLOAT VALVE (LFV)

A prototype model of the Lockable Float Valve was deployed on Leg 113 at six different sites. Through-the-bit logging was not attempted at any of these sites for a variety of reasons unassociated with the LFV itself. All deployments were deemed successful. The LFV functioned as well as a normal float valve and had no adverse effects on coring operations. On two occasions, a lock-open go-devil was dropped at the end of a site to check proper actuation capability of the LFV after coring. In both cases, the LFV was retrieved with the flapper locked open as intended. The unit deployed on 113 suffered some wear and erosion from sand and turbidites but was still serviceable with adjustment. Both it and an unused prototype were left aboard for further deployment and evaluation during Leg 114.

The used LFV inadvertently remained locked open when an XCB core barrel was retrieved from 518 mbsf at Hole 699A on Leg 114. This apparently led to a backflow of cuttings which jarred the LFV mechanism and prevented the next core barrel from seating properly. The hole was subsequently lost when the XCB barrel became stuck downhole.

Plans are to continue deployment and evaluation during Leg 114 to determine if the failure was related to a design shortcoming or excessive wear on the unit in use. Development will continue with the goal of making the LFV fully reliable for use in all APC/XCB bottomhole assemblies.

HARD ROCK DRILLING (LEG 118)

Preparation is well underway for the Southwest Indian Ridge bare rock drilling/coring scheduled for Leg 118. Plans are to set a guide base in an area that is predominantly serpentinized peridotite in approximately 15,500 feet of water.

Modifications are currently being made to the existing guide base by Subsea Ventures in Houston. Modifications include installation of additional guides and brackets to allow the legs to telescope from the guide base. The legs will act as an integral part of the guide base rather than having to be bolted on separately aboard ship, resulting in considerable time savings. The guide base will be reassembled at Subsea Ventures' facility and the cable release system will be tested to verify proper operation. During Leg 106 the guide base at Site 648 was inadvertently shifted on the sea floor while attempting to actuate a pull release type shear sub to free the kelly hose. A new hydraulically actuated release sub has been built and tested that will allow the kelly hose to separate from the guide base using pump pressure rather then drill pipe pull. The guide base modifications, renovations and testing will be completed by the end of April.

Significant design changes have been made to the Christensen positive displacement motors to overcome weaknesses in the core barrel and latch systems noted during Legs 106 and 109. Internal clearances in the motor section were increased allowing the use of longer and stronger core barrels which approach the ruggedness of the proven ODP rotary core barrel system.

A new, high-strength latch system made from 15-5 PH stainless is being built. Completion of manufacturing, assembly and space-out tests is scheduled for June 1, 1987.
A new, high-strength drilling jar for unsupported drilling and coring is in fabrication and scheduled for completion by June 1, 1987.

DIAMOND CORING SYSTEM (DCS)

A request for proposal for the development of a wireline retrievable, high speed, narrow kerf Diamond Coring System (DCS) was released to industry on April 3, 1987. Proposals are due at the Ocean Drilling Program June 12, 1987. Contract award is anticipated about mid-July, 1987.

The objective of this RFP is to improve core recovery and drilling rates in both heavily fractured young basalts and older, more massive seafloor basalts using a mining type, wireline retrievable diamond coring system.

HIGH TEMPERATURE DRILLING

Enertech Engineering and Research Company was awarded a contract to assess the magnitude of the steam flash hazard in a series of "worst case" analyses which may be encountered during drilling in hydrothermal discharge areas. Six cases were studied and included two water depths (6560 and 9020 feet) and three bottom hole temperatures (300oC, 400oC and 500oC). Two flow mechanisms were modeled: one represented a highly geopressured zone and the other a swabbed in normal pressure zone. Simplifying assumptions included a sealed drill pipe/hole annulus, unlimited flow capacity reservoir and unrestricted flow through the drill pipe.

Conclusions and Recommendations:

1. The most encouraging conclusions that can be reached from the analysis are that the maximum flow rates up the drillstring are not excessive and should be controllable with an inside blowout preventer.

2. A considerable time is required before the surface flowing temperature reaches levels that would be hazardous to personnel. The minimum allowable flow period was found to be 6 minutes.

3. Hazardous temperatures only occur on wellflows from geopressured reservoirs. These flows can be detected by testing the drill string for flow before releasing the top drive unit.

4. The results of this investigation apply to the assumed conditions analyzed. Since the key parameters shown by this study appear to be water depth and geopressures, additional calculations should be made if worse conditions might be expected. Specifically, shallower water depths and deeper hydro-thermal reservoirs below the seafloor (that can sustain higher geopressures) will generate higher flow rates and higher surface temperatures.

DEEPWATER WELL CONTROL FOR ODP

WORKSHOP REPORT

To address the feasibility of riser drilling on board the JOIDES RESOLUTION, ODP Engineering and Operations sponsored a workshop on 30 April 1987, in College Station, Texas. The workshop was held in conjunction with the JOIDES Technology and Engineering Development Committee (TEDCOM) meeting at TAMU. Forty-one representatives from TEDCOM, ODP, universities, agencies and the oil industry gathered to discuss deepwater well control.

BACKGROUND ON RISER DRILLING

When the JOIDES RESOLUTION was converted, the riser system was removed to make room for the lab stack and other modifications. The main equipment for a marine-riser system is a large-diameter pipe through which the drill string is deployed. A riser is comparable to extending the casing up through the water column. The size and length of the riser pipe required to drill at ODP's water depths obviously demand an enormous outlay of space on board and substantial maintenance costs, a choice that was not feasible at the time.

Riser drilling allows fluids to be pumped continuously, keeping the hole clear of cuttings. Its advantages for drilling in difficult remote, deep-water sites are numerous.

WORKSHOP PROCEEDINGS

Frank J. Schuh, of Enertech and TEDCOM, served as Chairman and moderator for the workshop. Nicklas Pisias, ODP Planning Committee Chairman, introduced the session with background on the engineering needs of future drilling programs. He emphasized some long-standing problems, identified by PCOM and the advisory panels, which need to be addressed by the engineering group in order to ensure continued success of many upcoming legs. These issues included drilling alternating hard-soft lithologies and unconsolidated sediments, maintaining stable hole conditions, and drilling with good recovery in young basement rocks. Pisias identified deep stratigraphic test holes, such as the proposed Somali Deep Hole, as sites which could potentially be drilled more safely with well control technology.

Dr. Paul Stanton, of Exxon Production Research, discussed the theory and hardware of both conventional and modified marine riser systems. The record industry water depth for riser drilling is 6,952 feet; the JOIDES RESOLUTION typically drills in water depths of 12,000 to 15,000 feet without a riser.

Duke Zinkgraf and Vernon Greif of Sedco/Forex narrated a videotape on deployment of a marine riser and a blowout preventor stack. David Steere (Underseas Drilling Inc.) discussed the requirements and costs to reconvert the JOIDES RESOLUTION into a ship which could accommodate 6,000 feet of nearly 19-inch pipe. He estimated shipyard modifications and equipment costs of more than $11 million. Dan Reudelhuber, also from U.D.I., discussed the storage problems associated with reinstalling riser equipment.

The afternoon session was devoted to alternative solutions to marine-riser deployment. Joe Johnson, of AMOCO, discussed the drilling systems used in mining. The system uses small core heads connected to drill rods which retrieve cores by wireline. The drill rod has a dual function in that once the core bit has reached a desired depth, it then serves as a casing string and is cemented into place. Coring then continues with the next smaller core head and drill rod. The system is currently used on land but could be adapted to ODP use in conjunction with a slim-line (9 and 5/8 inch) riser.

Other presentations focussed on blowout prevention with slim-line riser drilling, engineering analyses for slim-line systems, and a theoretical concept using a dual drill-pipe system and subsea reservoir.

The session ended with a discussion of the benefits of well control and riser drilling to ODP research. Design engineers emphasized that they would need to know ODP requirements for penetration and maximum water depths for future development.

Barry Harding, of ODP Engineering and Operations, said that the mining system has the potential to address many ODP drilling problems and encouraged continuing development of this technology. Harding also remarked that the workshop provided a needed forum for engineers and ODP scientists to exchange ideas on riser drilling. As presentations are scheduled at COSOD II on alternate drilling platforms, such workshops are important opportunities to learn from industry experts and define ODP goals.

[Note: Portions of this article first appeared in the ODP Newsletter, Vol.III, No.7, from a report by A. Milton.]

UPCOMING LOGGING SHORT COURSES

The Borehole Research Group at Lamont-Doherty Geological Observatory is continuing their program of short courses in order to inform the ODP community of logging techniques and technological advances. Upcoming short courses will be held as follows:

September, 1987, Palisades, NY
This short course will be held in conjunction with the 9-11 September Information Handling Panel meeting.

October, 1987, Hannover, FRG
This course will be held in conjunction with a meeting of the German Geological Society.

For further information concerning dates and locations of the above short courses, please contact Rich Jarrard, Lamont-Doherty Geological Observatory, Palisades, NY 10964, (914) 359-2900.

WIRELINE SERVICES CONTRACTOR REPORT

The following report was compiled from ODP monthly technical progress reports from the Borehole Research Group at Lamont-Doherty Geological Observatory. For further information, contact either Roger Anderson or Rich Jarrard of the Borehole Research Group, LDGO, Palisades, NY 10964.

SUMMARY OF LOGGING RESULTS: LEG 113

Hole 693A

At hole 693A, on the Antarctic continental margin, nearly the entire hole was logged with the Schlumberger seismic stratigraphic combination. Beginning at pipe depth of 108 mbsf, 332 m of open-hole logs of excellent quality were obtained. In general, the logs showed a good correlation with lithologic boundaries from cores and with physical properties data. However, major changes in the logs at 259 mbsf appear to correlate with only a subtle lithologic change from a clayey nannofossil diatom ooze to a clayey diatom-bearing mud. Another distinct boundary was identified on the logs at 406.5 mbsf by a moderate increase in the gamma ray and a sharp increase in velocity. No corresponding lithologic boundary was identified, possibly because of low core recovery near this interval.

At Hole 693A, the sidewall entry sub (SES) was deployed for the first time. No technical problems were encountered, and logging proceeded routinely with the SES just beneath the ship. Hole conditions were excellent, so additional pipe did not need to be added from above the SES to clear bridges. The first deployment of the SES was about four hours slower than had been anticipated; future deployments will be somewhat more efficient.

The Planning Committee logging plans for Hole 693A had included two tool combinations, but only one was run due to time constraints. PCOM had also planned logging at Sites 694 and 695. Neither site was logged because of stuck core barrels.

Hole 696B

At Hole 696B, south of the South Orkney Islands, 60 m of open hole logs were obtained near bottom. A distinct boundary was identified on the logs at 595 mbsf, which is believed to correspond to the prominent reflector identified as the "break-up" unconformity on a regional seismic line.

At Hole 696B, the logging tools were originally rigged up without the sidewall entry sub (SES). A sediment bridge was encountered immediately below pipe (65.5 mbsf) forcing the tools to be pulled from the hole. The SES was installed and the drill pipe was run down to 12 meters from bottom (645 mbsf) and logging commenced from 630 mbsf to pipe (555 mbsf). The wireline tools were pulled into the pipe after logging the first open hole segment; poor hole conditions required trying to circulate before pulling up pipe. Debris around the tools in the pipe plugged up the drill pipe; pumping mud created a pressure pulse stronger than the weak point at the cable head, causing the loss of the logging tools. An attempt to retrieve the tools with the drill string failed.

Post-cruise Analysis

Preliminary analysis for Leg 113, Site 693, included: 1) reprocessing the sonic data using an in-house algorithm rather than the one used by Schlumberger to substantially improve the log quality, and 2) Milankovitch analysis using the gamma ray and resistivity logs. The upper portion of the logs (108-244 mbsf; Upper Miocene-Lower Pliocene) appears to show a strong obliquity signal (41,000 years) and a weaker 100K and 410K eccentricity signal.

Preliminary geochemical analyses of Hole 395A have been completed. Standard deviations are now being calculated to compare log to core data.

ODP DATABANK REPORT

The JOIDES/ODP Databank received the following data between January, 1987 and April, 1987. For additional information on the ODP Databank, please contact Carl Brenner at Lamont-Doherty Geological Observatory, Columbia University, Palisades, NY 10964.

- From R. White, Bullard Labs (UK): Cruise report from DARWIN site survey of the Makran area.
- From J. Leggett, Imperial College (UK): Marathon industry seismic lines landward of the proposed ODP sites, with corresponding navigation.
- From K. Lighty, ODP/TAMU: Digital tape of navigation merged with underway geophysics, microfilm of seismic profiles, and data report, all from RESOLUTION Leg 106 (Kane Fracture Zone Area).
- From J. Curray, SIO: Preliminary seabeam charts, navigation tracks and corresponding seismic profiles, with tentative site locations, from CONRAD survey of the proposed North Ninetyeast Ridge drillsites.
- From B. Taylor, HIG: Photographs of SEAMARC II sidescan sonar data and bathymetry of the Sumisu Rift, Bonin-Marianas area.
- From K. Lighty, ODP/TAMU: Digital tape of navigation merged with underway geophysics, and microfilm of seismic profiler data, for RESOLUTION Leg 107.
- From J. Weissel and G. Mountain, LDGO: Preliminary migrated processing of the digital single channel seismic profiles documenting the Bengal Fan "Intraplate Deformation" drillsites.
- From W.A. Huddy, Pritish Hydrographic Office: British bathymetric soundings along ship's track, Georgia Basin area.
- From J. Gill, USGS: USGS multichannel lines documenting Lau-Tonga sites LG3 and LG6.
- From G. Mountain, LDGO: Seabeam bathymetry maps for the Oman Margin and Owen Ridge areas (Neogene I program).
- From G. Mountain and J. Weissel, LDGO: Migrated digital single channel profile documenting the Intraplate Deformation (Leg 116) drillsites, with navigation.
- From A. Droxler, Rice U.: ELF-Aquitaine MCS lines and WILKES single channel profiles documenting revised proposed sites MLD-1 and MLD-2 on the Maldive Platform as part of Leg 115 Carbonate Dissolution Transect.
- From R. Schlich, IPG, France: Large copies of MARION DUFRESNE seismic profiles documenting the North Kerguelen drillsites.
- From D. Falvey, BMR, Australia: Copies of BMR lines I, 11, 19, 23 and 31, with navigation, in the Prydz Bay area.
- From R. Duncan, OSU: Copies of single channel seismic lines documenting Leg 115 sites MP-1, 2, 3 and 3A, and CARB-1, 1A and 2, with navigation.

EXECUTIVE COMMITTEE REPORT

The JOIDES Executive Committee and the ODP Council met on 28-30 April 1987 in College Station, Texas. The EXCOM session was chaired by D.Caldwell (Oregon State University) and D.Heinrichs (NSF) chaired the ODP Council session. Highlights of the joint meeting (28-29 April) appear below:

INTERNATIONAL PARTICIPATION

D.Heinrichs, as National Science Foundation representative, reported that the invitation to the Soviet Union for membership in ODP had been delayed by an additional review by the U.S. President's Office of Science and Technology Policy.

On 29 April, Heinrichs gave the following statement, excerpted from material provided by the National Security Council, regarding Soviet participation:

"The President has determined that we should not cooperate in this particular field of science at the present time, but this in no way should be interpreted to mean that we are not interested in multilateral scientific cooperation with the Soviet Union. We currently have other agreements with the Soviets in the fields of space, housing, agriculture, health, environment, and atomic energy.

I am not prepared to comment on the specific elements that went into the President's decision. However, there was concern regarding Soviet access to sophisticated technology employed in the ODP."

The news from NSF was met with strong concern from EXCOM, and the following motion was unanimously adopted by the Committee:

EXCOM Motion:
The JOIDES Executive Committee is deeply disappointed to learn of the USA decision to exclude the USSR Academy of Sciences from membership of the Ocean Drilling Program.

The USSR Academy of Sciences has participated with considerable scientific benefit to all concerned in earlier phases of deep sea drilling. The future participation of the USSR Academy of Sciences is seen as a scientifically important contribution to international scientific endeavors in earth and marine sciences.

The JOIDES Executive Committee therefore expresses its deep concern about the U.S. President's decision to terminate negotiations with the USSR Academy of Sciences and urges immediate reconsideration of this decision.

Non-U.S. member countries agreed to raise objections to the U.S. decision through the U.S.Department of State. The U.S. members to ODP were equally concerned with the exclusion. The ODP Council members agreed to address the matter separately at their 30 April meeting.

FY 88 BUDGET DEVELOPMENT

With the new budget protocol in place, FY88 is a transition year for ODP. The NSF has guaranteed the $35.5M target base budget for FY88, assuming six international partners.

The recently formed Budget Committee (BCOM) met three times prior to this EXCOM meeting to provide advice to JOI during the development of the FY88 Program Plan.

Input from the Planning Committee on the FY88 Science Plan and from each of the subcontractors was reviewed by BCOM. A base budget of $35.792 (plus $6.046 in enhancements) was identified by the subcontractors (TAMU, LDGO and JOI/JOIDES). The identified base budget did not provide for specific needs of the FY88 Science Plan, however. These are: Prydz Bay ice vessel, a day rate increase and drilling supplies associated with guide base deployment, for an adjusted base budget of approximately $37.050M.

After considering the long-term scientific and engineering objectivesof the ODP, BCOM proposed cutting ofscience services rather than reducing the FY88 science program.

EXCOM determined that, in order to avoid lengthy budget negotiations in the future, a defined portion of the base budget should be identified and set aside for special operations such as high-latitude and bare rock drilling or essential operations needs such as drill string replacement. EXCOM unanimously endorsed the following two motions forwarded by the Planning Committee:

The Executive Committee affirms the proposition that the budget for standard operations should be approximately 96% of the base budget, with the remaining 4% reserved for those "special operations" necessary to meet the goals of the ODP program. This sum may be applied to special one-time purchases in years when "special operations" are not scheduled.

The standard operations budget must include the on-going development of systems essential for the achievement of the goals of COSOD I.

For the immediate fiscal year, EXCOM charged JOI with implementing reductions of approximately $1.150M to achieve the $35.5M target. These reductions included: cuts at TAMU headquarters, changes in publication of Part A and B ODP Proceedings, and reductions in science services. The reductions in publications call for author-prepared, camera-ready copy for the Part B contributions and for 1000 microfiche copies from the 2000 volume press run for both Part A and B Proceedings.

CHANGE OF PLANNING COMMITTEE TERMS OF REFERENCE

EXCOM formally amended the mandate for PCOM in the Planning Committee's Terms of Reference. PCOM must now plan the general track of the drilling vessel four years in advance of drilling (changed from three years). PCOM will also establish a scientific drilling program, to be included in the upcoming fiscal year's Program Plan, at each PCOM annual meeting.

POLICY FOR REENTRY OF DSDP/ODP BOREHOLES

At the request of the Downhole Measurement Panel and the Planning Committee, EXCOM unanimously adopted a resolution regarding reentry of ODP/DSDP boreholes for downhole experimentation:

The JOIDES Executive Committee actively encourages the use of the Deep Sea Drilling Project and Ocean Drilling Program boreholes for scientific purposes by both the D/V JOIDES RESOLUTION and independent vessels through wireline reentry. The drilling program has historically sought to maintain a catalog of hole conditions for those sites with installed reentry equipment in order to facilitate scientific planning. In order to maintain such a list and to protect JOIDES interests in future uses of these holes, the JOIDES Executive Committee requests that parties desiring to use any of these holes seek endorsement of the Executive Committee prior to their use. In addition, a written report to the Science Operator on the state of the holes used is requested following the conduct of these experiments. We trust that all member institutions and governments will adhere to this agreement and will ensure that those announcements and reports are made in a timely fashion.

EXCOM agreed to publicize the resolution through JOIDES associations with other international scientific organizations such as the International Council of Scientific Unions (ICSU) and the International Union for Geology and Geophysics (IUGG).

PLANNING COMMITTEE REPORT

The following report contains highlights from the Planning Committee Meeting held 10-12 April in Washington, DC.

BUDGET PLANNING

At its January, 1987 meeting in Hawaii, PCOM developed the science program for the 1988 fiscal year (Legs 118 to 123). This science plan was transmitted to JOI, Inc. for FY88 Program Plan development. In February and March, the newly formed Budget Committee (BCOM) then reviewed budgets submitted by JOI, Inc. (including the JOIDES Office), LDGO Borehole Research Group and TAMU. The submitted budgets included, as "enhancements", three important items needed for completion of the 1988 program: an ice boat for the Prydz Bay Program, drilling supplies for Leg 118 bare rock drilling, and increases in the day rate of the JOIDES RESOLUTION. The BCOM made recommendations on how to bring the total ODP budget in line with the $35.5 million (U.S.) base budget target figure provided by NSF. The BCOM recommendations were based on the premise that for $35.5M, the science program defined by PCOM could be accomplished and, that for the long-term, the base budget figure ($35.5M for FY88) should consist of standard operating expenses plus special operations (e.g., the Prydz Bay ice boat and Leg 118 bare-rock guide base).

PCOM endorsed the long-term budgeting concept formulated by BCOM by passing the following motion at the April meeting in Washington D.C.:

The Planning Committee affirms the proposition that the budget for standard operations should be approximately 96% of the base budget, with the remaining 4% reserved for those "special operations" necessary to meet the goals of the ODP program. This sum may be applied to special one-time purchases in years when "special operations" are not scheduled.

At its recent meeting EXCOM unanimously endorsed this motion.

For the long-term, it is critical that this budgeting process be established. During the next four years, PCOM may be considering programs which include high latitude drilling in both the North and South Pacific, and extensive drilling programs on the East Pacific Rise. Major equipment expenditures, such as replacement of drill string, must also be considered. Rough estimates for special operations anticipated over the next four years range from $6M to $8M (Table 1). More importantly, long-term engineering developments must be planned in order to accomplish drilling in hot, young crustal rocks, drilling deep holes in sedimentary sequences, and drilling and recovery in areas where alternating sequences of hard and soft sediments are anticipated.

During the development of the FY88 budget, BCOM, PCOM and EXCOM were faced with three options: 1) increase funds available to the program (recent decisions concerning U.S.S.R participation in ODP makes this option impossible for 1988); 2) reduce the science program for FY88 (which has significant long-term implications since any funding increases must come from existing members); 3) reduce some services provided by the program. In general, the latter option is being considered and important changes in the nature of publications and total services provided by the prime contractor, TAMU, will result from necessary changes in the budgeting of ODP.

INDIAN OCEAN PLANNING

The preliminary scientific objectives of Legs 115-120 were outlined in the February 1987 issue of the JOIDES Journal (Vol. XIII, No. 1). Below are updates on recent planning decisions affecting these legs. The preliminary objectives of Legs 121-123 are described below, along with PCOM recommendations for these legs.

EXTRA EXPENDITURES FOR UPCOMING YEARS

		Tentative Schedule
FY88 (Second Half of Indian Ocean Program)		
		119 Kerguelen
Bare rock guidebase (HRGB)	$ 0.4 M	120 Kerguelen
Ice boat (Kerguelen)	$ 0.85 M	121 Broken Ridge
		122 Exmouth Pl.
		123 Argo Plain
		(Begin October)
FY89 (First Six Legs in Western Pacific)		124 Banda
		125 Sunda
Nankai Geotech	$ 0.4 M	126 Sulu-SCS
Pressure Core Barrel (PCB)	unknown	127 Bonin I
Packers	$ 0.2 M	128 Nankai
Drillstring	$ 0.4 M	129 Japan I
Lau Basin (bare rock)	$ 0.4 M	(End September)
and high temperature	$ 0.5 M	
FY90/FY91/FY92 (Remainder of WPAC + 9 CEPAC Legs)		130 Japan II
		131 Bonin II
5 guidebases	$ 2.0 M	132 ? CEPAC
(mudmotors, bits etc.)		133 GBR
Deep Hole (Bering Sea)	unknown	? Vanuatu I
Ice boat (Ross Sea)	$ 0.90 M	? Vanuatu II
Reoccupation of site 504 B	unknown	? Lau Basin
		8? CEPAC Legs
ESTIMATED TOTAL	$ 6.05 M	
AVERAGE EXPENDITURE PER YEAR	$ 1.25 M	

Table 1. Rough estimates for special operations anticipated over the next four years.

Leg 115: Mascarene Plateau/Carbonate Dissolution Profile

In March and April 1987 HMS CHARLES DARWIN successfully conducted a site survey of the Mascarene Plateau sites. The previously defined time frame for this leg (42 days) allowed the inclusion of aragonite-cyclicity site MLD-2 in the Maldives. Logging will be done at the three deepest holes CARB-1, MP-3 and MP-2.

Leg 116: Intraplate Deformation

Intraplate Deformation will provide the entire program of this leg. PCOM adopted drilling of the following four sites: Sites 1, 2 or 3, 5 or 5A and 6 (in that order) for a total of 48.5 operational days (see Table 2). All sites should have standard logging, with borehole televiewer (BHTV), at Sites 1 and 5, and packer and heat flow measurements at Sites 5 and 6. At its recent meeting, PPSP approved all sites except Site 5. However, if hydrocarbon shows are detected at any site, approval of subsequent sites to be drilled would be in question.

Leg 117: Neogene Package

At the seven sites (NP 1-7) double APC/XCB will be done; site NP-2 will also serve as a geochemical reference site. Standard logging is planned at sites NP 2-7 and VSP at site NP-6. Total time for this leg is 48.5 days plus transit.

Leg 118: Southwest Indian Ridge

The first priority of this leg remains drilling of the median ridge site with deployment of the guide base. Camera surveying, setting of the guide base, casing and drilling to approximately 280 m depth will take 23 days (or more) of the previously planned 36 operational days. In addition to standard logging, the logging program for this site includes BHTV, multichannel sonic tool, gyro magnetometer, susceptibility tool, wireline packer(s), complex resistivity, dual laterolog and vertical seismic profiling (VSP). This will add about 10.5 days. Ten extra operational days have been added to this leg, gained by delaying the beginning of Kerguelen Leg 119. Within this additional time, pogoing of the gravel pit transect is optional to the co-chiefs.

Legs 119 & 120: Kerguelen and Prydz Bay

The beginning of Kerguelen/Prydz Bay drilling will be delayed by 10 days to better match the Prydz Bay weather window, resulting in a rearrangement of drill sites. The two legs have been redefined as shown in Table 3. Also see Table 4 for a description of Leg 119 & 120 sites and objectives.

If the Prydz Bay sites cannot be drilled, site SKP-6B acts as an alternative, exactly fitting the time frame (13.7 days, plus 0.3 for BHTV); a possible back-up site is KHP-4A.

Though the start of Kerguelen drilling has been delayed by 10 days the legs have been shortened, thus the effect on the Kerguelen weather window (mid-December to mid-March) is minimized.

Leg 121: Ninetyeast Ridge/Broken Ridge

Leg 121 is scheduled to drill target sites on both Ninetyeast Ridge and Broken Ridge (see Table 5). Ninetyeast Ridge, the longest aseismic ridge in the world, extends from at least 17°N beneath the Bengal Fan, to over 30°S at the intersection with Broken Ridge. Most current models suggest that it was formed by a hot spot now underlying Kerguelen and Heard Islands. Drilling at two sites on the Ridge is proposed to help understand the timing and velocities of the northward movement of the Indian plate, and its deceleration as it collided with Asia. It is also intended to complete a continuous north-south paleoceanographic transect. Recovery of a complete sediment section will help establish age relationships, subsidence and uplift history of the Ridge, and paleoceanography of this part of the Indian Ocean.

Broken Ridge is a relatively shallow water platform, isolated from land areas in the eastern Indian Ocean.

PROPOSED SITES LEG 116: INTRAPLATE DEFORMATION

Site	Location	WD[m]	Pen[m]	Time	Logging	Main Objective
1	0°55.725' S 81°24.000' E	4680	775	11.5	S.S. BHTV	Establish reference hole for seismic stratigraphy & physical properties
2	0°57.375' S 81°23.985' E	4680	620	7.7	S.S.	Compare sediment sequence with 1 to establish deformation history
3	0°57.875' S 81°23.985' E	4680	510			Same as 2
5	0°58.975' S 81°22.000' E	4680	630	9.9	PKR, TEMP BHTV	Date fault; measure P,T and fluids above, below & at fault zone
6	01°02.050' S 81°24.000' E	4680	230	6.1	PKR, TEMP	Measure P, T and fluid characteristics on heat flow anomaly

Note: It is recommended to drill Site 5 or Site 2 before Site 1 to better estimate the possibility of reaching 750 m with the XCB.

Note: Site 5 did not get safety approval.

Table 2. Some specifics of proposed Leg 116 drilling sites, as discussed at the April PCOM meeting. Due to safety problems at Site 5, modifications for some sites are presently under consideration.

PROPOSED SITES FOR LEGS 119 & 120

LEG 119:
Beginning 19 December 1987 (est.)

Site	Time (days)
KHP-1	8.5*
SKP-6A	5.7
PB-1	3.5
PB-2	3.5
PB-3	3.5
PB-4	3.5
Transit	24.8
10% contingency	5-6
Total (est.)	59.0

[* includes 1.2 days for televiewer and VSP]

LEG 120:
Beginning 21 February 1988 (est.)

Site	Time (days)
SKP-1	5.3
SKP-2	5.6
SKP-3	12.3*
SKP-4A	12.5
Transit	19
10% contingency	5-6
Total (est.)	60.0

[* includes 0.9 days for VSP]

Table 3. Proposed sites for Legs 119 & 120, as redefined at the April PCOM meeting.

PROPOSED SITES FOR LEGS 119 & 120: KERGUELEN AND PRYDZ BAY

Site	Lat(S)	Long(E)	WD[m]	Pen[m]	Main Objective
Leg 119					
KHP-1	49 22′	71 39′	600	910	High-res. Neogene strat. sect., N-Kerg.
SKP-6A	66 44′	83 05′	2300	500	Nature and Age of Plateau Basement
PB-1	67 00′	78 00′	800	500	) Obtain complete strat. sect. of
PB-2	67 15′	78 00′	800	500	) dipping reflector sequence, probably
PB-3	67 30′	78 00′	800	500	) Neogene, Paleogene & Cretaceous,
PB-4	67 45′	78 00′	800	500	) related to climate and glaciation of Antarctic continent
Alternate site to PB 1-4:					
SKP-6B	61 34′	81 55′	2250	1000	Expanded Neogene-Paleogene-Cretaceous sect.
Leg 120					
SKP-1	54 49′	76 47′	1700	450	Nature and Age of Basement of Plateau
SKP-2	57 55′	79 55′	1500	700	High-res. Neogene section, S-Kerg.
SKP-3	58 07′	78 11′	1500	1300	Basement, exp. Paleogene-Cretaceous sect.
SKP-4A	58 43′	76 24′	1200	550	Nature and Age of Basement of Plateau

Table 4. Site locations and objectives for Legs 119 & 120

PROPOSED SITES FOR LEG 121: BROKEN RIDGE & NINETYEAST RIDGE

Site	Lat	Long(E)	WD[m]	Penetr.[m] Sed.	/Bsmt	Time [d]
BR-1	30°56'S	93°34'	1200	450	-	3.8
BR-2	31°00'S	93°33'	1065	450	-	3.6
BR-3	31°06'S	93°32'	1050	450	-	3.1
BR-4	31°09'S	93°31'	1050	450	-	3.6
90ER-2	17°15'S	88°15'	1800	550	yes	5.5
90ER-5	27°18'S	87°30'	2300	500	yes	5.5
NNER-9	5°39'N	90°02'	2816	399	50	
NNER-10	5°22'N	90°23'	3045	628	yes	

Table 5. Location, depth and times for Leg 121 sites.

Its southern margin was rifted from the Kerguelen Plateau prior to middle Eocene time. Four primary sites are proposed for drilling on Broken Ridge to constrain the uplift/subsidence history of the Ridge since the Late Cretaceous, and the timing between uplift and rifting.

Eight sites are considered for this leg; four on Broken Ridge (BR 1-4) have been chosen, each penetrating 450 m. Alternatively, one deep re-entry site is under consideration. Four sites are placed on Ninetyeast Ridge (90ER-1A, 90ER-1B, 90ER-2, 90ER-5) with the last three going for basement. The Indian Ocean Panel is now asked to review the science program of this leg, considering that Kerguelen Site KHP-3 has been dropped. A total of 53 days is scheduled.

Leg 122: Exmouth Plateau

The Exmouth Plateau, off northwest Australia, is a submerged marginal plateau representing a very wide, sediment-starved, stretched passive margin with transform boundaries and a well-defined breakup unconformity. Sites proposed for drilling on this plateau will address the following objectives:

* test the Late Jurassic to Neogene global sea-level curve in an almost hiatus-free continental margin section

* study early rifting history and test subsidence and stretching models for continental margin and marginal plateau evolution near the continent/ocean boundary

* study margin sedimentation, paleoclimate, and paleoenvironment from the Triassic to Cenozoic

* correlate unconformity-bound sequences with sedimentation, tectonics, and global sea-level fluctuations.

PCOM decided that Leg 122 will consist of the following four Exmouth Plateau sites: EP-2A, EP-6, EP-7, and EP-10A, with Site EP-6 as a possible re-entry site. Site EP-9B has been shifted to Leg 123. A total of 52 operational days is recommended for this leg (see Table 6).

Leg 123: Argo Abyssal Plain

The Argo Abyssal Plain is a sediment-starved remnant of the Cretaceous Eastern-Tethys Sea, located off northwest Australia and

PROPOSED SITES FOR LEG 122: EXMOUTH PLATEAU

Site	Lat(S)	Long(E)	WD[m]	Pen[m]	Main Objective
EP-2A	19°56′	110°27′	4050	800	Transitional crust, Triassic syn-rift fill
EP-6	21°17.8′	113°28.5′	1250	1200	Complement to EP-7
EP-7	20°36′	112°07′	1365	990	Neogene-U.Jurassic: Sea-level, paleoceangraphy & sed. history study
EP-10A	16°56.6′	115°33.1′	2050	980	Triassic pre- & syn-rift seds. break-up unconformity, young ocean development

(Site EP-9B will be drilled during Leg 123)

Table 6. Site locations and objectives for Leg 122.

PROPOSED SITES FOR LEG 123: ARGO ABYSSAL PLAIN & EXMOUTH PLATEAU

Site	Lat(S)	Long(E)	WD[m]	Penetration [m] Total	Penetration [m] Basm't	Main Objective
AAP-1B	15°59′	117°34′	5740	1200	300	U.Jurassic-L.Cretaceous E-Tethys paleo-circulation & -ecology, subsidence history, oldest Indian Ocean crust, geochemical ref. hole
EP-9B	17°12′	115°39′	3320	600	-	Complements EP-10A for post Neocomian-Quaternary hist. of margin

Table 7. Site locations and objectives for Leg 123.

underlain by the oldest (M25, Oxfordian or older) crust of the Indian Ocean. Drilling in the Argo Abyssal Plain will address the following objectives:

* study the composition and alteration style of the oldest Indian Ocean crust (geochemical reference hole)

* more accurately date anomaly M25

* provide more information about Mesozoic/Cenozoic paleoceanography and paleobiogeography

* provide a distal record of margin sedimentation and evolution

This leg will consist of two sites: re-entry Site AAP-1B will be the only Argo Abyssal Plain site; about 300 m of basement penetration are recommended, making this a "geochemical reference hole". Allotted time for this site is approximately 32 days. Additionally, Site EP-9B (8 days) at the Exmouth Plateau will be drilled during this leg. Total operational time is 40 days (see Table 7).

WESTERN PACIFIC PLANNING

For planning purposes PCOM set a time frame for drilling in the Western Pacific of approximately 22 months. Planning will be based on the top nine programs of the excellently prepared Third WPAC Prospectus. At the August meeting, PCOM will have a detailed discussion of this third prospectus and its recommended drilling schedule.

CENTRAL AND EASTERN PACIFIC PLANNING

PCOM recognized the first draft outline of a prospectus for drilling in this area, prepared by CEPAC at its March, 1987 meeting. PCOM will review the draft in detail at its August, 1987 meeting, allowing all thematic panels to provide their input. The guideline for planning in the CEPAC area is 18 months.

PROPOSALS RECEIVED BY THE JOIDES OFFICE

1 February - 30 April, 1987

Ref. No.	Date Rec'd.	Title	Investigator(s)	Inst.	Site Survey Avail. Data	Site Survey Future Need	Panel Reference	PCOM Ref.	Remarks
		ATLANTIC OCEAN							
276/A	4/2/87	Drilling the Equatorial Atlantic transform margins	J.Mascle	UP&MC, France	Yes	Some	SOHP 4/87 TECP 4/87 ARP 4/87		
		SOUTHERN OCEANS							
273/C	3/26/87	Drilling on the Southern Kerguelen Plateau	R.Schlich et al.	Inst.Phys. Strasbourg BMR, Canberra	Yes	No	TECP 3/87 SOHP 3/87 LITHP 3/87 SOP 3/87		Appr. Legs 119/120
		WESTERN PACIFIC OCEAN							
274/D	3/2/87	Preliminary proposal for drilling in the South China Sea	L.Zhaoshu Z.Yan	SCS Inst. Oceanol. China	Yes	Yes	WPAC 3/87 TECP 3/87 SOHP 3/87		Preliminary; rel. to 147/D, 194/D, see also 28/D, 46/D,
		CENTRAL AND EASTERN PACIFIC OCEAN							
271/E	2/23/87	Paleoceanographic transect of the California current	J.Barron et al.	USGS	Yes	Yes	SOHP 2/87 CEPAC 2/87		
275/E	3/27/87	Drilling the Gulf of California (ODP Gulf of California workshop)	B.Simoneit J.Dauphin, (eds.)	(OSU)			CEPAC 3/87 SOHP 4/87 LITHP 4/87 TECP 4/87		257/E included
277/E	4/10/87	Borehole monitoring of tilt and strain to detect aseismic slip at the Cascadia margin	M.T.Brandon	Yale U.			DMP 4/87 TECP 4/87 SOHP 4/87 CEPAC		Related to 237/E
		GENERAL AND INSTRUMENTAL							
272/F	2/20/87	Summary of long-term downhole measurements on seas around Japan	K.Kinoshita				WPAC 2/87 TECP 2/87 DMP 2/87		Incl. sites from 50/D, 51/D, 83/D, 171/D, 159/F, 177/D

ANALYSIS OF PROPOSALS RECEIVED BY THE JOIDES OFFICE

THROUGH 30 APRIL 1987

Total number of proposals received:	277

A. ATLANTIC OCEAN:	42
U.S.[JOIDES institutions]	13
U.S.[non-JOIDES institutions]	3
France	13
UK	4
FRG	3
ESF consortium	3
Canada	3
B. INDIAN OCEAN:	66
U.S.[JOIDES institutions]	29
U.S.[non-JOIDES institutions]	16
France	9
Canada	4
UK	3
ESF consortium	2
FRG	1
(Australia)	1
(Seychelles)	1
C. SOUTHERN OCEANS:	17
U.S.[JOIDES institutions]	6
U.S.[non-JOIDES institutions]	4
France	3
FRG	2
(Australia)	1
(New Zealand)	1
D. WESTERN PACIFIC:	72
U.S.[JOIDES institutions]	9
U.S.[non-JOIDES institutions]	11
Japan	25
France	11
FRG	2
UK	2
Canada	2
(Australia)	5
(Peoples Republic of China)	3
(New Zealand)	1
(Korea)	1
E. CENTRAL AND EASTERN PACIFIC:	57
U.S.[JOIDES institutions]	26
U.S.[non-JOIDES institutions]	22
Canada	6
France	2
Japan	1
F. GENERAL/INSTRUMENTAL:	23
U.S.[JOIDES institutions]	8
U.S.[non-JOIDES institutions]	2
Japan	5
FRG	3
Canada	2
France	1
UK	1
ESF Consortium	1

TOTAL BY COUNTRY:

USA	149
JOIDES institutions	91
non-JOIDES institutions	55
France	39
Japan	31
Canada	17
FRG	11
UK	10
ESF consortium	6

NON-JOIDES NATIONS:	14
Australia	7
Peoples Republic of China	3
New Zealand	2
Korea	1
Seychelles	1

In addition, 68 ideas or suggestions for drilling have been received. Several of these have now been resubmitted as full proposals.

JOIDES / ODP BULLETIN BOARD

1987 MEETING SCHEDULE

Date	Place	Committee/Panel
5 June	Los Angeles, CA	PPSP
15 June	Washington, DC	BCOM
30 June - 3 July	Copenhagen	SSP
6-10 July	Strasbourg	COSOD II
3-6 August	Palisades, NY	IHP
18-19 August*	Seattle, WA	DMP
25-29 August	Nikko	PCOM
31 Aug - 2 Sept	Tokyo	SOHP
September*	to be announced	PPSP
28-30 September*	St. Moritz	TECP
29 Sept - 2 Oct*	Paris	CEPAC/LITHP
6-9 October	Nikko	EXCOM/ODPCouncil
8-9 October	Columbus, OH	SOP
Oct - Nov*	Italy or U.K.	IOP
2-5 November*	London	WPAC
November*	Honolulu	SSP
30 Nov - 4 Dec	Bend, OR	PCOM/Panel Chairmen (Annual Meeting)

* Tentative meeting (not yet formally requested/approved)
(rev. 6/1/87)

ODP/TAMU PANEL LIAISONS

Atlantic Regional Panel - JACK BALDAUF
Central & Eastern Pacific Regional Panel - ELLIOT TAYLOR
Downhole Measurements Panel - SUZANNE O'CONNELL
Indian Ocean Regional Panel - BRAD CLEMENT
Information Handling Panel - RUSS MERRILL
Lithosphere Panel - ANDREW ADAMSON
Pollution Prevention & Safety Panel - LOU GARRISON
Sediments & Ocean History Panel - AMANDA PALMER
Site Survey Panel - AUDREY MEYER
Southern Oceans Regional Panel - LOU GARRISON
Technology & Engineering Development Committee - BARRY HARDING
Tectonics Panel - CHRISTIAN AUROUX
Western Pacific Regional Panel - AUDREY MEYER

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PCOM / PANEL LIAISONS

At the 10-12 April Meeting held in Washington, DC, the Planning Committee approved the following reassignment of PCOM members acting as panel liaisons. This new liaison scheme became effective on 1 May 1987.

LITHP:	Kastner / Robinson	WPAC:	Pisias / Taira
SOHP:	Brass / von Rad	DMP:	Langseth & McDuff
TECP:	Shipley / Eldholm	IHP:	Gartner / Cadet
ARP:	Ross / Cadet	PPSP:	Pisias
CEPAC:	Coulbourn & Larson	SSP:	Langseth / Francis
IOP:	Larson / von Rad	TEDCOM:	Francis
SOP:	McDuff & Pisias		

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PALEOMAGNETIC OBJECTIVES FOR THE OCEAN DRILLING PROGRAM

Copies of the report of a JOI/USSAC sponsored workshop on paleomagnetic objectives for ODP, held 4-7 September 1986, can be obtained by writing to:

Dr. Kenneth L. Verosub
Department of Geology
University of California, Davis
Davis, CA 95616

JOI / USSAC WORKSHOPS

Several JOI-USSAC Workshops are scheduled for the next several months. If you are interested in attending one of these workshops you should contact one of the convenors directly. These workshops are advertised in greater detail in EOS and other journals. The workshops are:

WELLBORE SAMPLING
27-28 May 1987 - Houston, TX
Dr. Barry Harding
Dr. Richard Traeger

CARRIBEAN REGION
17-21 November 1987 - Jamaica
Dr. Robert Speed

PRECISE DATING OF OCEANIC BASALTS
Fall 1987 - Northwestern University
Dr. Rodey Batiza
Dr. Robert A. Duncan
Dr. D.R. Janecky

U.S. Workshops in support of the Ocean Drilling Program are sponsored by the JOI-USSAC. If you are interested in proposing such a workshop, please contact Dr. Ellen Kappel at JOI, Inc. for proposal guidelines.

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PUBLICATIONS UPDATE

The Part A, or Initial Report, portion of Vol. 3 of the Proceedings of the Ocean Drilling Program was printed, bound, and distributed in April 1987. Vol. 104A is due in July, and Vol. 105A in August. Additional Part A volumes in press are those for Legs 106, 107, 108, 109, 110, and 111.

Owing to the lack of scuff resistance of the chrome-finish cover material used on Volume 101A/102A, we decided to switch to a cloth-based material for Vol. 103A and subsequent volumes because of its greater resistance to wear. Although we had originally selected the cloth fabric for our covers, we switched to the paper-based cover material because the printer recommended it for its durability and its guaranteed availability over the term of our printing subcontract.

The status of manuscripts we have received for the Part B portions of Vols. 101, 102, 103, and 104 is shown in the following table:

(Status as of 20 April 1987) Vols:	101B	102B	103B	104B
Total manuscripts received:	29	7	30	15
Manuscripts reviewed and sent for author revision:	8	3	7	2
Revised manuscripts received from authors:	3	2	1	2
Manuscripts accepted and sent to editorial processing:	3	2	-	-

SAMPLE DISTRIBUTION

The twelve-month moratorium on samples distributed after a cruise, is completed for Ocean Drilling Program Legs 101-109. Approved requests for materials from these cruises no longer require contribution to the ODP Initial Reports. These cruises include cores collected in the equatorial Atlantic off the coast of northwest Africa and on the Mid-Atlantic Ridge south of the Kane Fracture Zone (Leg 109).

Preliminary sample record inventories for ODP Legs 101 through 108 and 110 through 113 are now in searchable database structures. The sample investigation database searchable by keywords is now on line at ODP. The DSDP sample investigations database has been uploaded and keyboarding of the ODP sample requests is in progress. At present, the most efficient way to access this database is for investigators to request that a search be done by ODP staff.

Investigators requiring information about the distribution of samples and/or desiring samples, or who want information about the sample investigation or sample records databases, should address their requests to:

The Curator
Ocean Drilling Program
Texas A&M University Research Park
1000 Discovery Drive
College Station, Texas 77840
(409) 845-4819

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 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
Texas A&M University
P.O. Drawer GK
College Station, TX 77840
(409) 845-6620

LEGS 101 THROUGH 109 DATABASES

ODP databases for Legs 101 through 109 are available to the public as of the middle of June, 1987. Anyone who wishes to make a request can do so by calling or writing the ODP Data Base Group. Please contact Kathe Lighty at (409)845-8495 at the Ocean Drilling Program, 1000 Discovery Drive, College Station, Texas 77840.

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TELEMAIL LISTINGS WANTED

The JOIDES Journal will now list Telemail addresses as well as telephone and telex numbers. If you have a Telemail listing, please forward it to: Cherry Moss, JOIDES Office, College of Oceanography, Oregon State University, Corvallis, OR 97331 (Telemail: JOIDES.OSU).

JOI/USSAC ODP FELLOWSHIP

Joint Oceanographic Institutions, Inc., in cooperation with the U.S. Science Advisory Committee, has announced an Ocean Drilling Program graduate fellowship. The fellowship will provide an opportunity for scientists of unusual promise and ability who are in residence at U.S. institutions to conduct research compatible with the research interests of the ODP. The award for a doctoral candidate is $18,000, to be used for stipend, tuition, benefits, research costs and incidental travel, if any. Applications for participation as a shipboard scientist on the JOIDES RESOLUTION must be received by 1 September 1987. Applications that do not nvolve participation in an ODP cruise must be submitted by 1 January 1988. An application packet, with instructions and information on upcoming cruises, is available from:

JOI/USSAC Ocean Drilling Program Fellowship
Joint Oceanographic Institutions, Inc.
1755 Massachusetts Ave., NW, Suite 800
Washington, DC 20036

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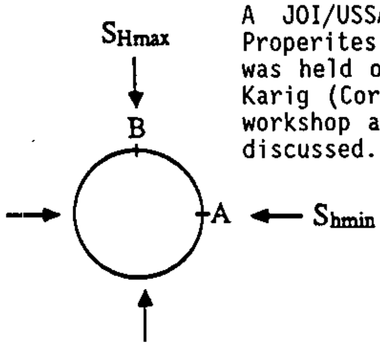
PHYSICAL PROPERTIES WORKSHOP REPORT AVAILABLE



A JOI/USSAC sponsored workshop on Measurement of Physical Properites and Mechanical State in the Ocean Drilling Program was held on 26-28 June 1986, at Cornell University. Daniel E. Karig (Cornell) and Matthew Salisbury (Dalhousie) convened this workshop at which directions for ODP downhole measurements were discussed. Copies of the report are available from:

Daniel E. Karig
Department of Geological Sciences
Cornell University
Ithaca, NY 14853-1504

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DSDP/ODP SITE SURVEY CATALOGUE

The revised and updated catalogue of DSDP and ODP site survey data will be available from the ODP Databank in the summer of 1987. Included will be track charts and descriptions of data available for each survey carried out in support of ocean drilling. For further information contact the Manager, ODP Databank, Lamont-Doherty Geological Observatory, Palisades, NY 10964.

SELECTION PROCESS FOR SHIPBOARD SCIENTISTS ON ODP CRUISES

We at ODP have received a number of questions about the process by which shipboard scientists are selected for ODP cruises. This selection process involves two contractual obligations. First, the Science Operator, Texas A&M University, has final responsibility for selecting all scientific staff who will participate on a specific leg. Second, the "Memorandum of Understanding" signed by all members states that, on average, each non-U.S. member should have two shipboard scientists on each ODP cruise.

Scientists interested in participating on an ODP cruise should contact ODP/TAMU for a "Cruise Participant Application Form." U.S. scientists and scientists from non-member countries should submit this form to the Manager of Science Operations at ODP/TAMU; scientists from non-U.S. member countries should submit the form to ODP/TAMU and give a copy of the application to the ODP office in their country. Though applications are accepted until the specific cruise leaves port, ideally they should be submitted by about ten months prior to the cruise to make sure they receive effective consideration.

ODP/TAMU works closely with the designated Co-Chief Scientists in staffing each cruise. Therefore, the staffing procedure does not begin until the Co-Chief Scientists have been identified, usually by one year prior to the start of the cruise. After the Co-Chief Scientists are invited, the ODP Manager of Science Operations discusses shipboard scientific staffing needs with them and solicits nominations for scientists from the non-U.S. member countries. This process takes several months, and invitations are mailed to most of the prospective shipboard scientists by about eight months prior to the cruise. Because inevitably a number of invitees cannot participate and must be replaced by other applicants, staffing is usually not completed until about four months prior to the cruise. Even then, last-minute changes in shipboard scientists' plans sometimes mean that other applicants may be invited to participate on a cruise on much shorter notice.

The shipboard staffing timetable outlined above is an ideal schedule, allowing most scientists adequate time to arrange to be absent from their offices for the duration of the cruise. However, this timetable cannot be maintained when cruise objectives or Co-Chief Scientist selections are not identified by one year prior to sailing. In such situations, staffing proceeds in an identical manner, but on an accelerated timetable so as to give shipboard scientific invitees as much time as possible before the cruise.

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DSDP/ODP SITE SURVEY CATALOGUE

The revised and updated catalogue of DSDP and ODP site survey data will be available from the ODP Databank in the summer of 1987. Included will be track charts and descriptions of data available for each survey carried out in support of ocean drilling. For further information contact the Manager, ODP Databank, Lamont-Doherty Geological Observatory, Palisades, NY 10964.

Ocean Drilling Program
Cruise Participant Application Form

Name (first, middle, last): ______

Institution (including address): ______ **Telephone** (work) ______

______ (home) ______

______ **Telex/Cable:** ______

Permanent Institution Address (if different from above): ______

Passport No./Exp. Date/Country: ______

Present Position: ______ Date of Birth: ______ Sex: ______

Geographic Region(s), Scientific Problem(s) of Interest (Leg number(s) if known): ______

Date(s) Available: ______

Reason(s) for Interest (if necessary, expand in letter): ______

Expertise (petrologist, sedimentologist, etc.): ______

Education (highest degree and date): ______

Experience (attach curriculum vitae): ______

Selected Publications Relevant to Requested Cruise: ______

Personal and/or Scientific References (name and address): ______

Previous DSDP/ODP Involvement and Nature of Involvement: (i.e. cruise participant, shore-based participant, contributor, reviewer, etc.): ______

Staffing decisions are made in consultation with the co-chief scientists and take into account nominations from partner countries; final responsibility for staffing rests with ODP at TAMU.

Please return this form to:

Manager of Science Operations
Ocean Drilling Program
Texas A&M University
College Station, TX 77843-3469

Applicants from JOIDES partner countries should ensure that they send a **copy** of their applications to their respective national ODP offices.

Facsimile of Cruise Participation Application form. Further information on cruise participation and application materials may be obtained from ODP/TAMU, 1000 Discovery Drive, College Station, TX 77840.

ODP DISPLAY AVAILABLE

A new portable ODP display is available for use at meetings and conventions. The display folds into two compact cylinders and may be put on board a plane as luggage or shipped. The display has been used at meetings in the U.K., Norway and the American Association of Petroleum Geologists meeting in Los Angeles. For more information and scheduling, contact Robin Smith, JOI, Inc., 1755 Massachusetts Ave., NW, Washington, DC 20036, Telephone: (202) 232-3900.

ODP BROCHURE

The general brochure for the Ocean Drilling Program has been updated. This edition features a color photo of the JOIDES RESOLUTION when she was in the Panama Canal. The section on research has been updated and includes a summary of cruises in the South Atlantic. Copies may be ordered from Karen Riedel, Ocean Drilling Program, 1000 Discovery Drive, College Station, TX 77840 USA.

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DRILLING BULLETIN BOARD

A new electronic bulletin board called DRILLING is now available on Omnet's Science Net. The board includes items of interest to both the Ocean Drilling and Continental Drilling Programs, coordinated by JOI, Inc. and DOSECC, Inc. respectively. Weekly summaries from the JOIDES RESOLUTION are posted to DRILLING, as well as ship schedules for forthcoming ODP legs and updated schedules of JOIDES committee meetings. Information on new programs, proposal deadlines and other matters are also posted regularly. Use of the DRILLING bulletin board is encouraged to announce appropriate meetings, workshops, results, etc.

If you have any questions about the DRILLING bulletin board, please contact the coordinator, Dr. Ellen Kappel (telemail E.Kappel, telephone 202-232-3900). Information about accessing Omnet can be obtained from: Omnet Inc., 70 Tonawanda St., Boston, MA 02124 (telephone 617-265-9230).

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REQUEST FOR NOTICES

The editorial staff of the JOIDES Journal encourages members of the scientific community to submit news items for publication in the JOIDES Journal. We would welcome updates on: upcoming meetings, workshops and symposia; availability of relevant publictions and workshop reports; or any other items of interest to the ODP community.

The Journal is published in February, June and October of each year; notices should be received no later than one month before press time to ensure their publication. Please send items to:

JOIDES Journal
c/o JOIDES Office
College of Oceanography
Oregon State University
Corvallis, OR 97331 USA
Telemail: JOIDES.OSU

BIBLIOGRAPHY OF THE OCEAN DRILLING PROGRAM

The following publications are available from the ODP Subcontractors. Information from TAMU be obtained from ODP Headquarters, 1000 Discovery Drive, College Station, TX 77843-3469. Information from the Lamont-Doherty Geological Observatory can be obtained from R. Jarrard, Borehole Research Group, L-DGO, Palisades, NY 10964.

TEXAS A&M UNIVERSITY

1. Proceedings of the Ocean Drilling Program, Part A (Initial Reports)

   Volumes 101/102 published together, December 1986
   Volume 103 published April 1987

2. Technical Notes

   #1 Preliminary time estimates for coring operations (REV. EDITION December 86)
   #2 Operational and laboratory capabilities of JOIDES RESOLUTION (June 85)
   #3 Shipboard scientist's handbook (September 85)
   #4 Five papers on the Ocean Drilling Program from "OCEANS '85" (May 86)
   #5 Water Chemistry Procedures aboard JOIDES RESOLUTION (September 86)
   #6 Organic Geochemistry aboard JOIDES RESOLUTION - An Assay (September 86)
   #7 Shipboard Organic Geochemistry on JOIDES RESOLUTION (September 86)

3. Scientific Prospectuses

   #0 (March 1986) Leg 100
   #1 (January 1985) Leg 101
   #2 (February 1985) Leg 102
   #3 (March 1985) Leg 103
   #4 (April 1985) Leg 104
   #5 (June 1985) Leg 105
   #6 (September 1985) Leg 106
   #7 (October 1985) Leg 107
   #8 (December 1985) Leg 108
   #9 (March 1986) Leg 109
   #10 (April 1986) Leg 110
   #11 (July 1986) Leg 111
   #12 (August 1986) Leg 112
   #13 (October 1986) Leg 113
   #14 (February 1987) Leg 114
   #15 (May 1987) Leg 115
   #16 (May 1987) Leg 116

4. Preliminary Reports

   #0 (May 1986) Leg 100
   #1 (April 1985) Leg 101
   #2 (June 1985) Leg 102
   #3 (July 1985) Leg 103
   #4 (September 1985) Leg 104
   #5 (December 1985) Leg 105
   #6 (March 1986) Leg 106
   #7 (May 1986) Leg 107
   #8 (June 1986) Leg 108 107
   #9 (August 1986) Leg 109 108
   #10 (September 1986) Leg 110
   #11 (November 1986) Leg 111
   #12 (February 1987) Leg 112
   #13 (May 1987) Leg 113
   #14 (June 1987) Leg 114

5. Other Items Available

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

LAMONT-DOHERTY GEOLOGICAL OBSERVATORY

Wireline Logging Manual (2nd Edition, December, 1986)

NATIONAL GEOPHYSICAL DATA CENTER

DSDP DATA REQUEST PROCEDURES

INTRODUCTION

The Information Handling Group of the Deep Sea Drilling Project was responsible for all scientific data collected on board the Glomar CHALLENGER and produced in the Deep Sea Drilling Shore laboratories during the program's 96 cruises. All DSDP data files have been transferred to the National Geophysical Data Center (NGDC) as of May, 1987. A summary of DSDP data available is given in the following pages. All prime data collected as part of the Deep Sea Drilling operations and some special files compiled by the DSDP Information Handling Group are available for distribution from NGDC.

DATA SERVICES

Data files can be provided in their entirety on magnetic tape according to user specifications. NGDC is also able to provide researchers with a full range of correlative marine geological and geophysical data from other sources. NGDC will provide a complimentary inventory of all data available on request. Inventory searches are custom tailored to each user's needs (ie. geographic area, parameter measured, etc.).

Information from the DSDP Site Summary file is fully searchable and distributable in PC-compatible form on floppy diskette, as well as in the form of computer listings and graphics, and magnetic tape. NGDC is working on making all of the DSDP data files fully searchable and available in PC-compatible form. Digital DSDP geophysical data are fully searchable and available on magnetic tape.

In addition to the DSDP data files described in the following table, NGDC can also provide analog geological and geophysical information from the DSDP on microfilm. One summary publication, "Sedimentology, Physical Properties, and Geochemistry in the Initial Reports of the Deep Sea Drilling Project volumes 1-44: An Overview", Report MGG-1, is also available.

DATA REQUEST PROCEDURES

Data requests may be made by telephone or by letter. Costs for services are as follows: $100 per magnetic tape, $50 per floppy diskette, $35 per reel of microfilm, $12.50 per copy of Report MGG-1. Costs for computer listings and custom graphics vary. Prepayment is required by check or money order (drawn on a U.S. bank), or by charge to Mastercard, VISA, or American Express. A $10 surcharge is added to all foreign shipments, and a $15 fee is added to all rush orders. Shipping and handling is included in the prices quoted.

FOR MORE INFORMATION

Data Announcements describing each DSDP data set in detail are available at no charge on request. For additional information on data availability, costs, ordering, etc., please contact:

Marine Geology and Geophysics Division
National Geophysical Data Center
NOAA E/GC 3 Dept. 334
325 Broadway
Boulder, CO 80303
303-497-6338 (FTS 320-6338)

For technical details, call 303-497-6339 (FTS 320-6339) or write to the address above.

AVAILABLE DSDP DATA

Data file: legs available	Data source	Description	Comments
Part 1. Lithologic and stratigraphic data			
Paleontology: 1-96	*Initial Reports*	Data for 26 fossil groups. Code names, abundance and preservation data for all Tertiary fossils found thus far in DSDP material. The fossil dictionary comprises more than 12,000 fossil names and codes.	Does not include Mesozoic fossils. No data for Leg 83. Legs 1-85 at NGDC.
Smear Slide: 1-96	Shipboard data	Information about the nature and abundance of sediment components.	No data for Leg 83 (hard rock cores only).
Thin Sections: 4-92	Shipboard Data *Initial Reports*	Petrographic descriptions of igneous and metamorphic rocks. Includes information on mineralogy, texture, alteration, vesicles, etc.	No data for Legs 1-3, 5, 8, 9, 15, 20-21, 24, 27, 40-41, 42B, 44, 47-48, 50, 56, 71-72, 75-76, 78, 80, 95, 96.
Visual Core Descriptions: 1-96	Shipboard data	Created from shipboard descriptions of the core sections. Information about core color, sedimentary structures, disturbance, etc.	
Visual Core Descriptions - igneous rocks: 4-94	Shipboard data	Igneous and metamorphic rock lithology, texture, structure, mineralogy, alteration, etc.	No data for Legs 40, 42B, 44, 47-48, 50, 56, 95, 96. Legs 22-94 available in digital form.
SCREEN: 1-96	Processed data	Computer generated lithologic classifications. Basic composition data, average density, and age of layer.	
Part 2. Physical properties and quantitative analytic core data			
Carbon-carbonate: 1-96	Shore Laboratory Shipboard, carbonate bomb data	Percent by weight of the total carbon, organic carbon and carbon carbonate content of a sample. Bomb data has carbonate only.	No data for Legs 46, 83, 88, 91, 92.
Grain Size: 1-79	Shore laboratory	Sand-silt-clay content of sample.	No data collected for Leg 16, 64 and 65.
GRAPE (gamma ray attenuation porosity evaluator): 1-96	Shipboard data	Continuous core density measurements.	No data for Leg 46.
Hard-rock major element analyses: 13-92	Shore-based and shipboard analyses	Major-element chemical analyses of igneous, metamorphic and some sedimentary rocks composed of volcanic material.	No data for Legs 20, 21, 31, 40, 42B, 44, 47, 48, 50, 56, 71, 93-96.
Hard-rock minor element analyses: 13-92	Shore-based and shipboard analyses	Minor-element chemical analyses of igneous, metamorphic and some sedimentary rocks composed of volcanic material.	No data for Legs 20, 21, 27, 35, 40, 42B, 44, 47, 48, 50, 56, 57, 66, 67, 71, 93-96.
Hard-rock paleomagnetics: 14-92	Shore-based and shipboard	Paleomagnetic and rock magnetic measurements of igneous and metamorphic rocks and a few sedimentary rocks composed of volcanic material.	No data for Legs 1-13, 17, 18, 20-22, 24, 30, 31, 35, 36, 39, 40, 47, 48, 50, 56, 57, 67, 68, 74, 93-96.
Intersitial Water Chemistry: 1-96	Shore-based and shipboard analyses	Quantitative ion and/or pH, salinity, alkalinity analyses of interstitial water and surface sea water samples.	No data for Legs 46, 83.
Long-core spinner magnetometer sediment paleomagnetics: 43, 68, 70-72, 75, 90	Shipboard analyses	Paleomagnetic measurements: declination and intensity of magnetization. Data from hydraulic piston cores only.	Should be used with reservation since the cores were later discovered to be rust-contaminated and disturbed. Quality of the data for each core clarified by documentation.
Discrete sediment sample magnetics: 1-94	Shipboard laboratory	Paleomagnetic measurements: declination, inclination, and intensity of magnetization. NRM measurements and AFD measurements when available.	Rotary cores: 1-76, 78 encoded. HPC cores: 71-75 encoded. No data for 95, 96.
Alternating field demagnetization: 4-96	Shipboard laboratory	Paleomagnetic measurements of sediments on which alternating field demagnetization is carried out.	Rotary cores: 4-73 encoded. HPC cores: 72-79 encoded.

Part 2. Physical properties and quantitative analytic core data. (Cont.)

Sonic velocity: 2-95	Shipboard analyses	Hamilton frame and 'ear muff' methods.	No data for Legs 1, 13, 96.
Vane Shear: 31-94	Shipboard data	Sediment shear strength measurements using Wykeham Farrance 2350 and Torvane instruments.	No data for Legs 32-37, 39-40, 45-46, 49, 52-56, 59-60, 62, 65-67, 70, 77, 79, 81-84, 86, 88-89, 92.
Analytic water content, porosity, and density: 1-96	Shipboard laboratory	Measurements by syringe method from known volumes of sediment.	No data for Leg 41.
Well Logs: 6-96	Shipboard data	Analog charts and magnetic tapes produced by Gearhart-Owen and Schlumberger.	Schlumberger LIS tapes: 48, 50, 51, 57, 80-84, 87, 89, 95, 96. Gearhart-Owen tapes: 60, 61, 63-65, 67, 68, 70, 71, 74-76, 78. Analog data only: 6, 8, 46, 66, 69.
X-ray mineralogy: 1-37	Shore laboratory	X-ray diffraction	Data for Legs after 37 not available in digital form.

Part 3. Underway geophysics

Bathymetry: 7-96	Shipboard data	Analog record of water-depth profile.	Available as digital data and 35mm continuous microfilm. No data for Legs 10-12, 57-60.
Magnetics: 7-96	Shipboard data	Analog record produced on the Varian magnetometer in gammas. Digitized at 5-min. intervals on an OSCAR X-Y digitizer.	No data for Legs 10, 11.
Navigation: 3-96	Shipboard data	Satellite fixes and course and speed changes that have been run through a navigation smoothing program, edited on the basis of reasonable ship and drift velocities and later merged with the depth and magnetic data.	
Seismic: 1-96	Shipboard data	Sub-bottom profiles recorded on Edo Western Graphic Model 550. Digital data for Legs 89-96 in SEG-Y tape format.	Both Bolt and Kronllite filters available on board. Fast and slow sweeps available on microfilm and photographs.

Part 4. Special reference files

Site Summary: 1-96	Initial Core Descriptions	Information on general hole characteristics (i.e., location, water depth, sediment nature, basement nature, etc.).	
AGEPROFILE: 1-96	*Initial Reports* Hole summaries	Definition of age layers downhole.	
COREDEPTH: 1-96	Shipboard summaries	Depth of each core. Allows determination of precise depth (in m) of a particular sample.	

Part 5. Aids to research

SAMPLE RECORDS	Inventory of all shipboard samples taken.

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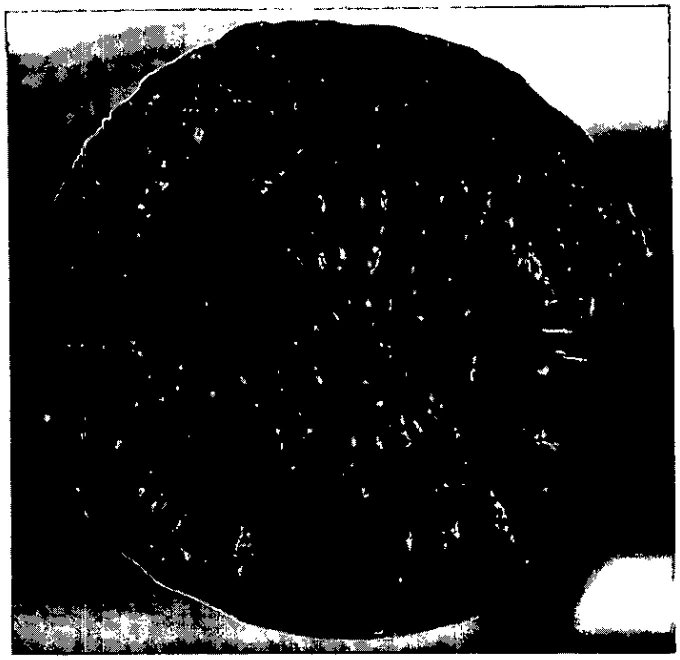

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