JOIDES Journal

Vol VI No 2 June 1980

Hydrothermal/Pelagic Contact, Site 506C

HYDROTHERMAL/PELAGIC CONTACT

Site 506C was cored to 31.3 m sub-bottom in a mounds area with the hydraulic piston corer (see Figure 9 for site location). The photograph on the cover shows a sharp contact between an upper layer of green clay "hydrothermal" sediments and foraminifera nannofossil ooze which is continuous to the base of the hole. Other contacts in this cored section are gradational.

The core to the left shows a gradational contact between green clay and pelagic sediments taken at Site 506D in an area between the mounds.

- NOTICE -

ON JULY 1, 1980, THE JOIDES OFFICE ROTATES FROM WOODS HOLE OCEANOGRAPHIC INSTITUTION TO SCRIPPS INSTITUTION OF OCEANOGRAPHY.

TABLE OF CONTENTS
VOL. VI, No. 11, June, 1980

PUBLICATION INFORMATION

Cover Information	Front
Statement, History, Back Issues	Back

DRILLING OPERATIONS

GLOMAR CHALLENGER Schedule	1
Summary of Deep Sea Drilling Project	2
Leg 69 - Costa Rica Rift	
Leg 70 - Galapagos Spreading Center	18
Site Reports - Legs 71 and 72 Sites 511-518	31
Shipboard Scientific Staffing	34

IPOD AVAILABLE DATA	36
SITE SURVEY MANAGEMENT DATA BANK	39

REPORTS

Executive Committee	40
Planning Committee	42
Information Handling Panel	56
Ocean Paleoenvironment Panel	57
Passive Margin Panel	58
Pollution Prevention and Safety Panel	58
Site Survey Panel	60

JOIDES MEETING SCHEDULE	64

DIRECTORY

Committees	65
Panels	67
Working Groups	80
Alphabetic/Telephone Listing	85

FIGURES

Figure 1	Heat Flow Profile, Costa Rica Rift	3
Figure 2	Site Locations - Leg 69	5
Figure 3	Lithologic Summary of Basement Holes 501, 504A, and 504B	7
Figure 4	Lithologic Summary of Sediments, Holes 501, 504, 504A, and 504B	9
Figure 5	Sediment accumulation rates Sites 501/504 and 505	11
Figure 6	Ca concentrations in Sediment Pore Water, Sites 501 and 504	13
Figure 7	Lithologic Summary of Sediments Site 505	15
Figure 8	Lithologic Summary of Basement Site 505	17
Figure 9	Site Locations for Leg 70	19
Figure 10	Lithologic Summary of Site 506	23
Figure 11	Lithologic Summary of Site 507	25
Figure 12	Stratigraphic Summary of Site 508	27
Figure 13	Stratigraphic Summary of Site 509	27
Figure 14	Stratigraphic Summary of Site 510	30

LEGS 73-82-Tentative GLOMAR CHALLENGER Schedule*

Leg	Port of Departure	Leg Begins	Leg Ends	Days At Sea	Purpose
73	Santos	14 April	01 June	48	Mid-Atlantic Ridge Paleoenvironment
74	Cape Town	06 June	20 July	44	Walvis Ridge, Cape Basin-Paleoenvironment
75	Walvis Bay	23 July	02 Sept	41	Walvis Ridge, Angola Basin-Paleoenvironment
TRANSIT—Ascension Is. to San Juan-16 days					
76	San Juan	23 Sept	12 Nov	50	Blake-Bahama-Passive Margin
77	Ft. Lauderdale	17 Nov	03 Jan 1981	47	Florida Straits-Passive Margin
78	Mobile	13 Jan	02 Mar	48	Caribbean
TRANSIT—San Juan to Las Palmas-13 days					
79	Las Palmas	20 March	06 May	46	Off W. Africa/ Portugal-Passive Margin
80	Brest	11 May	25 June	45	Bay of Biscay Passive Margin
81	Plymouth	30 June	21 Aug	52	Rockall-Passive Margin
82	St. Johns	24 Aug	11 Oct	49	Newfoundland Ridge, Continental Rise off Delaware-Passive Margin
83	Norfolk				

*This schedule is only approximate and is subject to change.

DEEP SEA DRILLING PROJECT

LEG 69

COSTA RICA RIFT

(Co-Chiefs: J. Cann and M. Langseth)

The first part of Leg 68, July 5 to July 19, 1979, and Leg 69, September 18 to October 29, 1979, were devoted to studying the geothermal regime on the southern flank of the Costa Rica Rift. The area of study is enclosed entirely between latitudes 1°N and 2°N and longitudes 83° 40'W and 84° 00'W. There the age of the crust is 4 to 6 million years old so that relatively high heat flow (200-240 mW/m^2) could be expected. The southern and older part of the region has a basement with very low relief that has been completely covered by pelagic sediments about 250 m thick. This sedimentary blanket completely covers basement over a large area and should trap any geothermally driven circulation in basement beneath it. Numerous sea floor heat flow measurements taken during the site survey over the area gave uniform heat flow values of about 200 mW/m^2 very close to the theoretically expected value suggesting that the sedimentary layer at least was in conductive equilibrium with the terrestrial heat (Figure 1).

In the northern end of the area, the basement exhibits considerably more relief, being cut by numerous normal faults with 100 or more meters of offset. Here there are many possible outcroppings of basement rock, and sea floor measurements of heat flow gave highly variably values from 15 to 100 mW/m^2, much lower than that theoretically expected (240 mW/m^2). Basement in this region is being chilled by rather free circulation of water between outcrops through the basement beneath the sediments. Consequently, the temperatures near the top of basement must be low.

To study these contrasting geothermal regimes effectively it was necessary to make as many observations of the in situ state and properties of rocks and of the sub-bottom sediments as possible. Consequently, one of the major objectives of these sites was a broad range of downhole measurements, experiments and in situ samples of interstitial waters. Logging of temperature, and porosity-related properties were very important. In addition a downhole packer was used to seal off the hole in order to make flow tests to determine basement permeability, possibly to achieve fracture and measure stress, and to draw a large volume for water samples. A downhole ultrasonic televiewer was run in the hole to map cracks, voids and low downhole magne... the holes and measured vector field ... and magnetic susceptibility. The Barnes-Uyeda in situ pore water sampler and bottom hole temperature probe was also used in the sedimentary layer at each site.

Two sites (501 and 504 (Figure 2) were occupied in the area of high uniform heat flow and in effect are a single site. The two numbers arise from the fact that Sites 501 and 504 were occupied on different legs separated by an intervening hydraulic piston coring leg which drilled at Sites 502 and 503. Five holes lying roughly in an east-west line about .5 km long were drilled at Sites 501 and 504: 501 was a pilot hole penetrating 337m sub-bottom in which logging and downhole experiments were carried out, 504 was solely for hydraulic piston coring of the upper 337m of sediment, Hole 504A was started as a re-entry site but had to be abandoned because portions of the bit broke off in the hole. Hole 504B was a second and more successful re-entry site where 214 m of basement were drilled and all downhole experiments plus logs were run. Hole 504C was washed down through the sediment to 220 m to obtain in situ temperatures and pore water samples at four levels sub-bottom. No cores were taken.

At Site 505 (Figure 2) in the low heat flow zone area, three single bit holes were drilled. At Hole 505 the sedimentary section was drilled and rotary cored but basement was undrillable. Holes 505A and 505B were drilled in a search for more drillable basement and no sedimentary cores were taken. In the end, basement was penetrated to 42 m at Hole 505B and logging and some downhole experiments run.

The ambitious program of experiments and downhole observations led to many technical difficulties and misadventures. Most of these problems were overcome and ultimately the drilling on the Costa Rica Rift provided the most comprehensive and profound look at processes and consequences of geothermal circulation in the oceanic crust yet made.

Site 501 (CR-1)

Site 501 was drilled at 1°13.63'N, 83°44.06'W, in the middle of an area several kilometers across, over which heat flow and basement topography are both very uniform, and heat flow is close to that expected for a cooling lithospheric slab. This area was selected after site surveys, as the highest priority target in the Costa Rica Rift area. Site 501 was spudded in water 3466.9 m deep, and was spot cored

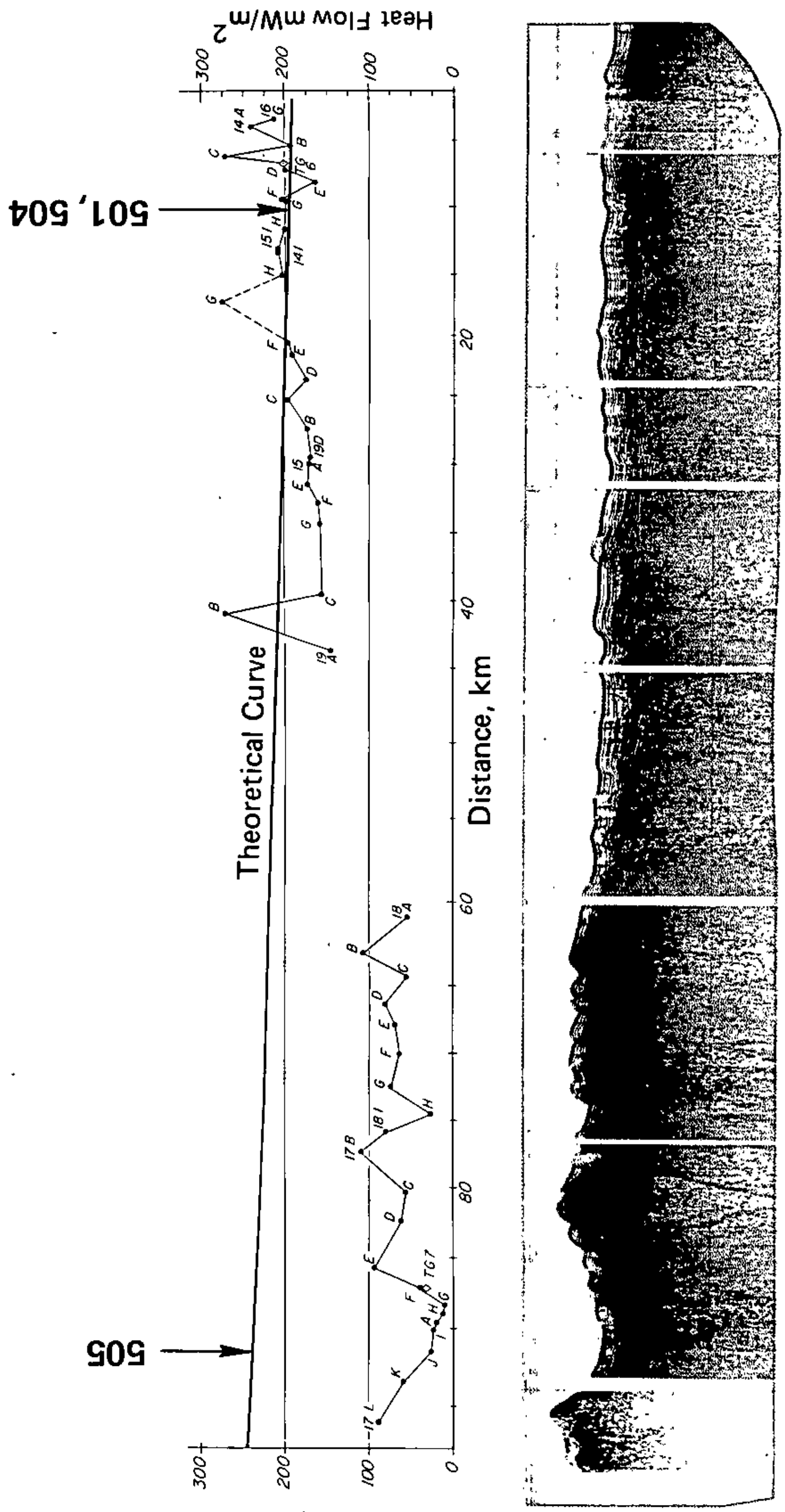

Figure 1

N-S profile of heat flow (mW/m^2) plotted as function of distance from the Costa Rica Rift axis (off figure to left) above a similarly scaled profiler record showing basement topography and sediment thickness. Projected locations of Sites 501/504 and 505 are shown.

through the sediments to basement at 264 m sub-bottom. Basement drilling continued until 73 m of basement penetration had been achieved. Subsequently four days were used for experiments in the hole and for logging before the ship set sail for Panama. The packer was included in the drill string, but failed during basement drilling, with the appearance of fragments of rubber in the cores. On its return to the surface, the element was seen to have stripped completely away, though some preliminary results were obtained before total failure.

The sedimentary section at Hole 501 was only spot-cored in its upper part, and these cores are similar to, though more disturbed than, the cores obtained by piston coring in Hole 504. (The section is described fully under Hole 504). Below 226 m sub-bottom, the hole was continuously cored. This section starts just above the base of the chalk unit seen at 504 and continues into the unit of interbedded chert and limestone. Logging of the sediment section began at 136 m sub-bottom, and the upper part of the logged section corresponds to Unit II of the sedimentary section established in Hole 504. Within the interval of Unit II, the compensated density log shows a general increase in density from about 1.5 Mgm^{-3} at the top to about 1.65 Mgm^{-3} at the base. These densities are about 0.15 Mgm^{-3} higher than those measured on samples from Hole 504, but the shape of the curve closely follows that obtained from the samples. The natural gamma log shows two spikes, at 188 and 200 m sub-bottom, probably corresponding to ash layers. At Hole 504 ashes were found at 183.5 and 187.5 m, but not in the neighborhood of 200 m. Within this unit, the caliper is consistently beyond its maximum extension of 22 inches, indicating that the hole had washed to a large size.

The section corresponding to Unit III of Hole 504 was logged and cored continuously. It runs from 232 to 263 meters sub-bottom, and the rocks recovered are chalks, limestones, and cherts. The stratigraphy of this unit showed up well on the records of the borehole televiewer, where the cherts appeared as horizontal bright bands, a few centimeters thick, and the intervening chert bands can be seen to be concentrated at the top (233-241 m) and bottom (253-263 m) of the unit, becoming less abundant towards the middle. The cherts and limestones are very similar to those of Site 504, containing clear bedding, with evidence of vertical compaction from the narrowness of horizontal zoophycus burrows compared with those higher in the section.

One successful in situ temperature measurement was made during the drilling of this hole. The temperature of 32.4°C at 121.6 m extrapolates, assuming a uniform heat flow and a thermal conductivity structure like that at 504, to a basement temperature of 59°C.

Pore waters were extracted from cores and by squeezing small lumps of chalk at a number of horizons in the hole. They showed extreme depletion of Mg^{++} from about 50 mm to about 7 mm and a corresponding increase in Ca^{++}. The extent of this change is much greater than was seen in other holes in the area.

Logs of this interval showed an increased average density when compared with Unit II, and a more spiky character, corresponding to alterations of chert, limestone and chalk. The temperature at the top of Unit III is about 55°C, and it is likely that the chert is actively forming there. The top of Unit III is thus apparently a diagenetic front.

Immediately above the basalt is a sedimentary unit from which a high natural gamma count was obtained. This is possibly a layer of metalliferous sediment overlying basalt, but no material of this kind was recovered.

In the basaltic section, a number of independent observations were made, giving a particularly clear view of the composition and structure of the basement at Site 501. Recovery of basalt from the 73 m of basaltic section was good, at 37.63 m, for a site on young crust. Visual and petrographic observations allowed subdivision into three principle units. Basalts of Unit I (Figure 3), between 265 and 287 m sub-bottom, show a very uniform petrography, with rare megacrysts of plagioclase, abundant microphenocrysts of plagioclase and clinopyroxene, often arranged in glomerophyric clusters, and common isolated microphenocrusts of olivine (now replaced by clay). Alteration varies from weak to moderate, and varies from a generally more oxidizing style of alteration at the top of the unit to a reducing style, accompanied by carbonate veining, at the base of the unit. Within the unit, the logs pick up alterations of high-density, low-porosity massive flow units and low-density more rubbly zones. The borehole televiewer also distinguishes clearly between the two kinds of unit. Particularly prominent on the logs and the televiewer record is a flow that forms the lower part of this unit. It is 8 to 9 m thick, and has a uniform high density and low porosity, and shows a generally smooth wall with fine cracks on the televiewer. The whole unit is normally magnetized, based on downhole magnetometer measurements, and may either have formed by off axis/volcanism or in a small normal interval in the reversely magnetized block in which the hole is placed.

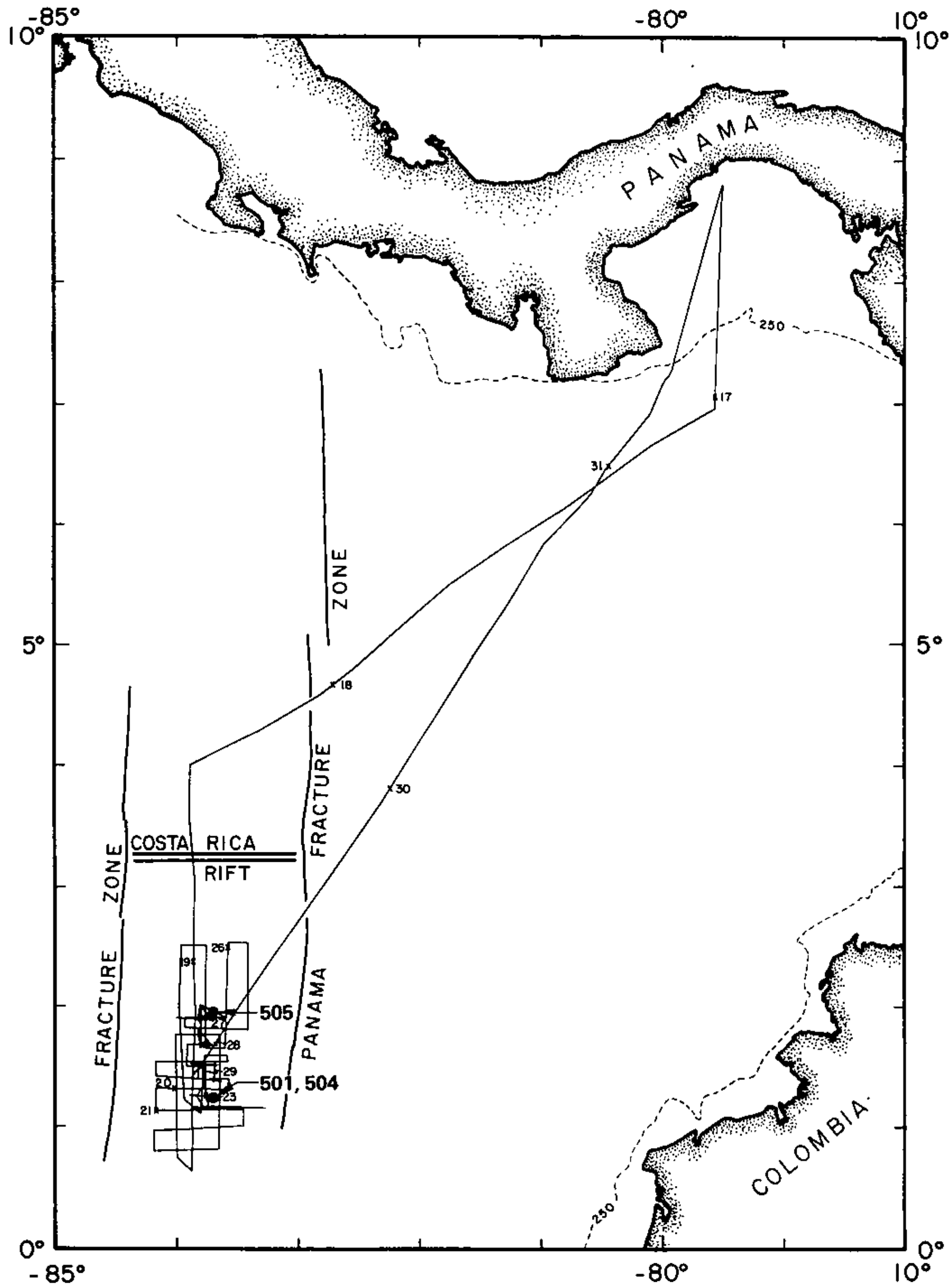

Figure 2

Location of Sites 501/504 and 505 in the Panama Basin, showing their relationship to the Costa Rica Rift, neighboring fracture zones, and the site survey grid of track lines.

Unit 2, between 287 and 311 m sub-bottom, is petrographically quite distinct from Unit I. It contained abundant megacrysts of calcic plagioclase, less common megacrysts of olivine (usually altered) and small phenocrysts of brown chrome spinel. The logs show the top of this unit to be of rather low density and high porosity, but to gradually increase in density downwards. The borehole televiewer only examined the top of this unit, and clearly revealed pillow lavas, in cross sectional images. Lower down the cored recovery indicates the presence of a massive flow about 6 m thick. The downhole magnetometer showed this unit of basalt, and the rest of the hole examined, to be reversely magnetized. The top part of the section was apparently erupted during a period of transition towards a normally magnetized interval, suggesting that is is made up of a series of individual flows erupted at different times in the transition period.

Unit 3, between 311 and 337 m sub-bottom has a still different petrographic character. Plagioclase and olivine megacrysts still persist, but chromite is absent and large emerald green clinopyroxene megacrysts occur instead. Within the unit is a small section totally lacking in megacrysts. The borehole televiewer did not reach this unit, and the other logs only penetrated its top. Their character, and the nature of the cored material, suggests that the unit is made up predominantly of pillow basalts, with one or two thin flows toward the base.

The downhole magnetometer showed that Unit I is normally magnetized, and Units 2 and 3 are reversely magnetized. The borehole televiewer ran very successfully, showing individual pillows in pillowed units, and meandering cracks in massive flows. The density/porosity related logs also brought out the distinction very clearly. Uniform porosities of 5-10% were indicated in massive flow units, while porosities reached about 50% in some of the more rubbly parts of the hole. The packer gave some results, even though it was not in very good condition after drilling in basement. One flow test indicated a permeability of about $10^{-9}cm^{-2}$. The large-scale resistivity experiment was run, but the results await interpretation.

Two temperature logs were run, one 16 hours after circulation in the hole had stopped and the other 29 hours later. Temperature gradients in sediments were low but increased appreciably between runs. The gradients in basement were much larger. Temperatures of 26°C and 41°C were measured at the bottom of the hole for runs 1 and 2 respectively. The temperature profiles appear to be equilibrating less slowly then conductive theory would predict suggesting a flow of water downhole at slower rates than at Hole 504B.

The alteration of the basalt is moderate in extensive. Fresh olivine is present in places, but is usually altered to clay minerals. Smectites and related clays are common in the basalts, and are accompanied by aragonite and calcite, pyrite, and zeolites. All of these indicate low to moderate alteration temperatures.

Chemical analyses were made of the basalts after the leg. All of the basalts are moderately basic in character. None are as basic as those from Hole 505B, but none are ferrobasalts either. All of the basalts share a Ca-rich, Na-poor character, and have rather low Ti levels relative to other ocean floor basalts. K and P are low, suggesting derivation from normal depleted mid-ocean ridge mantle. Much of this difference however may be caused by presence of phenocryst phases, and liquid petrogenesis will have to await glass analyses.

Site 504

Site 504 was a complex site at which four holes, including two re-entry holes, were drilled over two periods of time, separated by a period during which Site 505 was drilled. In addition, Site 501 lay within a few hundred meters of Site 504 having been drilled as a pilot hole on the initial part of Leg 68. This group of holes resulted in a wealth of information about a small and interesting area of the ocean floor, through the deployment of several new techniques and the integration of old ones.

Site 504 had been selected as the place for the main effort in drilling on Leg 69, in an area of the Costa Rica Rift, with a crustal age of 6.2 Myr., where heat flow is very uniform, and, at 200 mWm^{-2}, very close to the expected level for conductivity cooling of the lithosphere slab. Sediment cover is about 250 m and is made up of pelagic oozes thickly covering the smooth basement, where relief is only a few tens of meters. It was expected that, because of the sediment capping, hydrothermal circulation in the basement beneath would be sealed from contact with the ocean water, and would be developed in a very different way from that in open systems, such as in the mounds area of the Galapagos Spreading Center.

The beacon for Site 504 was dropped in 3473 m of water at 1°13.6'N, 83°43.6'W, after some complicated maneuvering to arrive as close as possible to Site 501, where the beacon

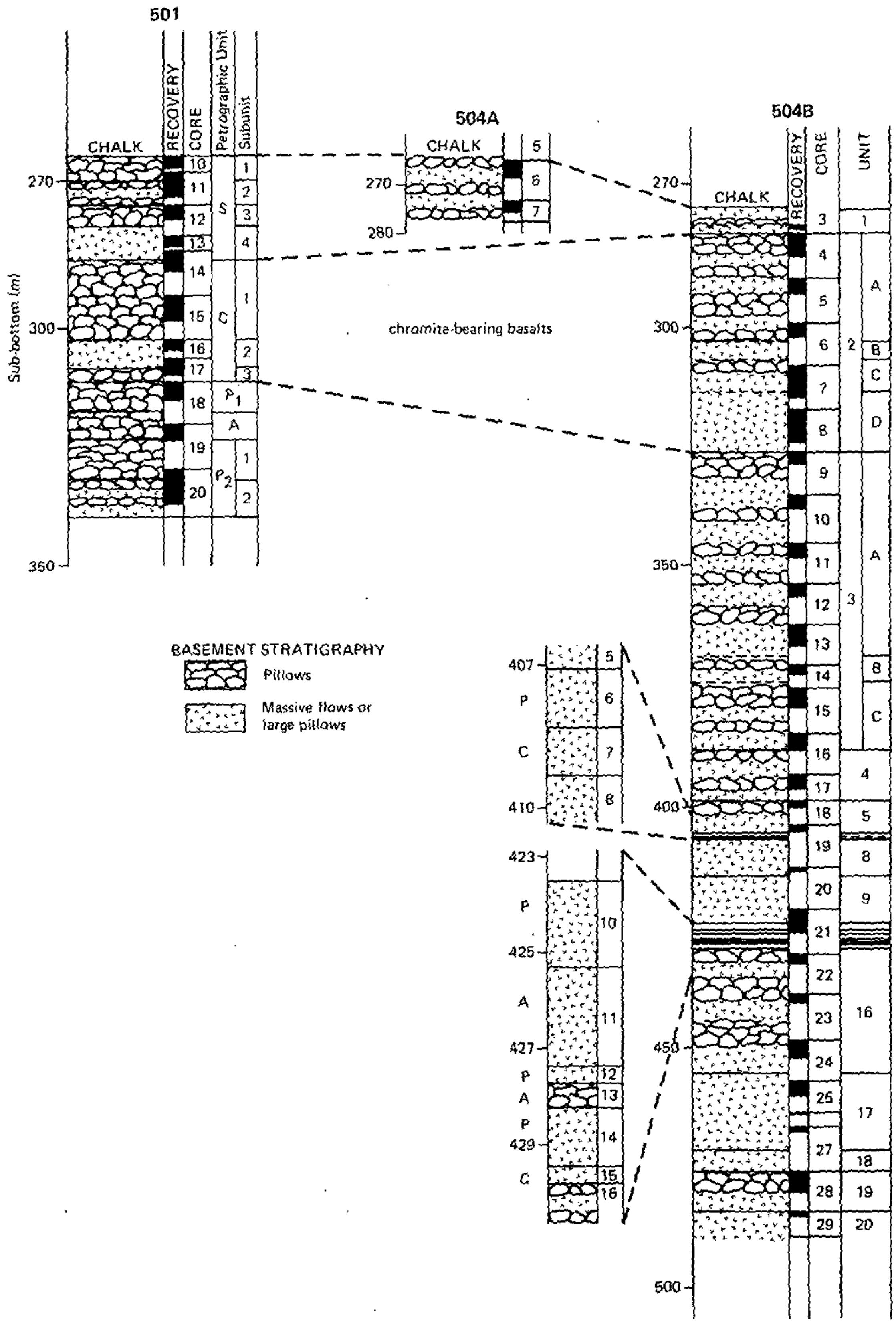

Figure 3

Lithologic summary of basement Holes 501, 504A and 504B.

had stopped operating. Satellite fixes showed that the beacon was about 1 km east of Site 501, so the drilling was done with offsets of several hundred meters west of the beacon. The first hole to be drilled, Hole 504, was piston-cored down to the top of the cherts discovered at Site 501. Recovery was excellent, as was preservation of sedimentary structures. A detailed program of interstitial water analysis was carried out here. Hole 504A, 67 m NW of Hole 504 and 200 m east of Hole 501, was intended as a re-entry site, but the large diameter bit being used to drill the hole for the casing disintegrated in the top of the basalt leaving bit portions in the hole, and the hole was abandoned. A month later, at the end of the leg, a logging run was made in the hole to measure temperature after equilibrium. Hole 504B was the second re-entry hole, drilled after returning from Site 505, and placed 250 m east of Hole 504A. This hole was successful in penetrating 214.5 m into basement. A suite of logs was run, including the Soviet downhole magnetometer and the borehole televiewer. Packer experiments were attempted and, in large part, succeeded. Hole 504C, 60 m west of Hole 504B, was drilled during a bit change. No cores were taken, but four runs of the temperature probe/pore water sampling tool were made at different depths.

The sedimentary section at Site 504 is 264 m thick in Hole 504A and 274.5 m thick in Hole 504B. The sediments are of pelagic biogenous nature. Major components are calcareous and siliceous microfossil debris. Volcanic ash forms a minor but significant part of the sediment, and terrigenous, windblown clay minerals are present in variable amounts. Pyrite is an important authigenic component. Intense bioturbation characterizes all of the sediment, and the complex burrow structures are well seen in the cores taken by the hydraulic piston corer.

There are three lithostratigraphic units, based on increasing degrees of diagenesis with depth (Figure 4).

Unit 1 (Holocene to early Pliocene in age) runs from the sea floor to 143.5 m sub-bottom. It consists mainly of siliceous nannofossil ooze which passes into the siliceous nannofossil chalk of Unit 2 at a sharp boundary marked by a sudden increase in wet bulk density, shear strength and thermal conductivity, and a rapid increase in porosity. Sediment colors within Unit 1 are usually shades of grayish green and olive green, but between 65 and 99 m a subunit is found in which distinctly brown colors are found. Here the proportion of clay is greatest and of carbonate lowest. XRF analysis of the sediments in this interval gave manganese contents (as MnO) of up to 1.15%. We attributed this to the interplay of changing climate and subsidence of the site during crustal spreading.

Unit 2 lies between 143.5 and 227.2 m sub-bottom, and covers the age span of late Miocene to early Pliocene. It consists of siliceous nannofossil chalks with generally higher carbonate content than in Unit 1 (up to 84%), and hence paler colors. Its base is defined as being at the first of the beds of siliceous limestones in the section.

Unit 3, of late Miocene age, runs from 227.2 m sub-bottom to the basalt contact at 264 to 274.5 m. It consists of interbedded limestones, cherts, and chalks. Whereas in Unit 2 the degree of compaction does not differ markedly from that in Unit 1, it is drastically increased in Unit 3, even in the chalk beds of this unit. Within the limestones compactions of 80% could be recognized from compressed burrows. Opal CT (cristobolite) and chalcedony occur within the silicified limestones and cherts of this unit, filling pores or replacing calcite fossils. Idiomorphic calcite crystals were also found. The chert from this site is among the youngest ever recovered from DSDP holes. The young age of chert formation is probably related to the high temperatures which are found in the sedimentary section. All the sediments were deposited rapidly with accumulation rates decreasing through the Pliocene, but increasing again in the Pleistocene (Figure 5).

The temperature gradient in the sediment at this site was measured at discrete points throughout the section using the Uyeda-Barnes temperature probe/water sampler, and over the lower part of the section during the logging of Hole 504A. All measurements agreed, giving a linear temperature profile when allowance was made for variation in thermal conductivity. Thus there appears to be no thermally significant advection within the sediment pile.

A detailed series of analyses of interstitial water from Hole 504 showed a similar pattern of Ca enrichment and Mg depletion to that observed at Site 501, but the degree of enrichment and depletion was markedly less, even though the two holes are only about two hundred meters apart (Figure 6). A less complete series of pore water samples collected at Hole 504C, coupled with interstitial water squeezed from sediments near the bottom of the sedimentary section in Hole 504B, gave even smaller degres of enrichment of Ca and depletion of Mg. This complex spatial pattern of pore water compositions may be related to very slow advection within the sediment section at rates comparable to those of ionic diffusion, and thus insignificant thermally.

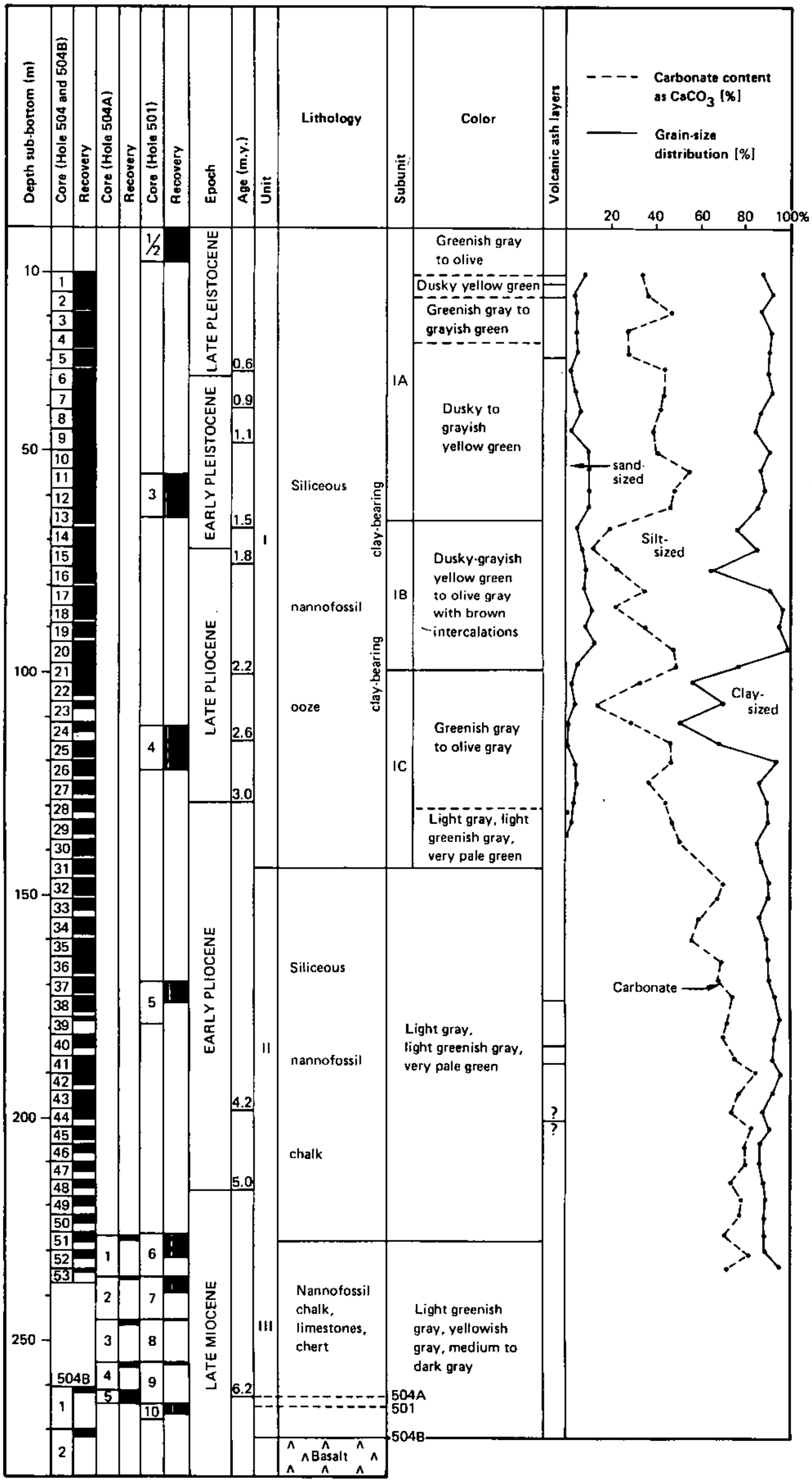

Figure 4

Lithologic summary of sediment Holes 501, 504, 504A and 504B.

The basement section at Site 504 was mainly drilled in Hole 504B, though 13 m was cored in Hole 504A (Figure 3). In the upper part of the section, the same petrographic units could be recognized as at Site 501, though with varying thicknesses. Three main types of basalt were distinguished. Type C contained phenocrysts of plagioclase, lesser olivine and minor amounts of chrome spinel, either as microphenocrysts or as minute octahedron in the groundmass. This type contained members that were more basic than the average for the hole, and also the more evolved basalts, which contained up to 95 ppm Zr, compared with a mean for the basalts of close to 50 ppm. Type P contained phenocrysts of plagioclase, olivine and clinopyroixene, visible as emerald green prisms in hand specimens. Accumulation of phenocrysts gives some of these rocks a basic character which is not a property of the liquids from which they were produced. The third type, type V, varied from sparsely phyric to aphyric. When present, the phenocrysts consisted of plagioclase, olivine and glomerocrystic clumps of plagioclase and augite.

All three types are complexly interbedded in the hole. Some of the lithostratigraphic units are tens of meters thick, but others are only a few tens of centimeters thick. Some of these thin units may be intrusive, but others, occurring as rapidly alternating sections of different lithology, and apparently associated with increased brecciation of the core, may be slices repeated by complex faulting. The breccias are polymict, with angular clasts and clay-rich matrices, suggesting a tectonic origin.

Alteration is moderately intense through most of the core, but is more intense in the zones of brecciation. Alteration is predominantly reducing, with saponitic clays replacing olivine and filling vesicles and veins, associated with zeolites and carbonate. No greenschist alteration was observed. Zones of oxidative alteration border some veins, and are associated with introduction of K and Fe into the rocks.

Numerous XRF analyses of basalts allowed limits to be placed on their origin. Batch processes seem precluded by trace element relations, and some control by open system processes in a ridge crest magma chamber seems likely. Generally the basalts show a great uniformity in chemical character, with only the evolved Type C lavas and the phenocryst-rich Type P lavas disturbing a simple pattern.

Paleomagnetic measurements give a consistent pattern of reversed magnetization of the basement units, though the intensity of magnetization and the inclination change from unit to unit with depth within basement. The upper unit of normally magnetized rock recognized at Site 501 is not found here: however, only a few samples could be taken from the petrographically equivalent part of the section. The uniformly reversed magnetization is confirmed by the downhole magnetometer, which appears to recognize within the uniform sequence intervals that might represent zones of brecciation, sedimentary interbeds, or equivalent non-magnetic layers. Further analysis of the results from this experiment will be needed onshore before firm conclusions can be drawn.

The Lynes packer was set in Hole 504B successfully three times, twice for flow tests and once for a sampler run. The flow tests, one about 50 m below the top of basement and the other in the bottom of the hole, both gave preliminary mean values of permeability for the hole beneath the packer of about 1 darcy. Such a permeability is very high compared with most terrestrial igneous formations and should insure that heat transfer in the crust would be by convection provided the pores are filled with water. The flow test at the bottom of the hole was able to generate sufficient pressure to open fractures in the rock and allow water to be pumped in. The critical pressure at which this happened was about 60 bars.

One run was conducted at the bottom of the hole with the sampler go-devil. Many gallons of water were collected, representing several stages in the dilution of formation water by surface seawater filling the bottom of the hole. Preliminary analysis suggests that the least dilute sample contained at least 20% of formation water. During the test, negative pressures of about 250 bars were developed which not only destroyed the packer element, but may have disintegrated some of the porous basalt at the bottom of the hole. Shore-based analysis should enable the composition of the formation water to be established, and hence aid in the analysis of the sediment pore water data.

Two temperature logs were conducted within the basement of Hole 504B. The first was run 70 hours after drilling finished and 34 hours after circulation had been stopped in the hole. The second log was run 36 hours afterwards, with no circulation in the hole during this interval. Both logs gave very similar results. The upper part of the hole, down to 3838 m below the rig floor or 86 m into the basement, showed very low temperatures, climbing slowly to 10° at 3838 m below the seafloor. Below this the temperature climbed very rapidly to reach bottom hole values of about 70°C. The main difference between the runs was that the bottom hole temperature had increased by about 5°C in the second run.

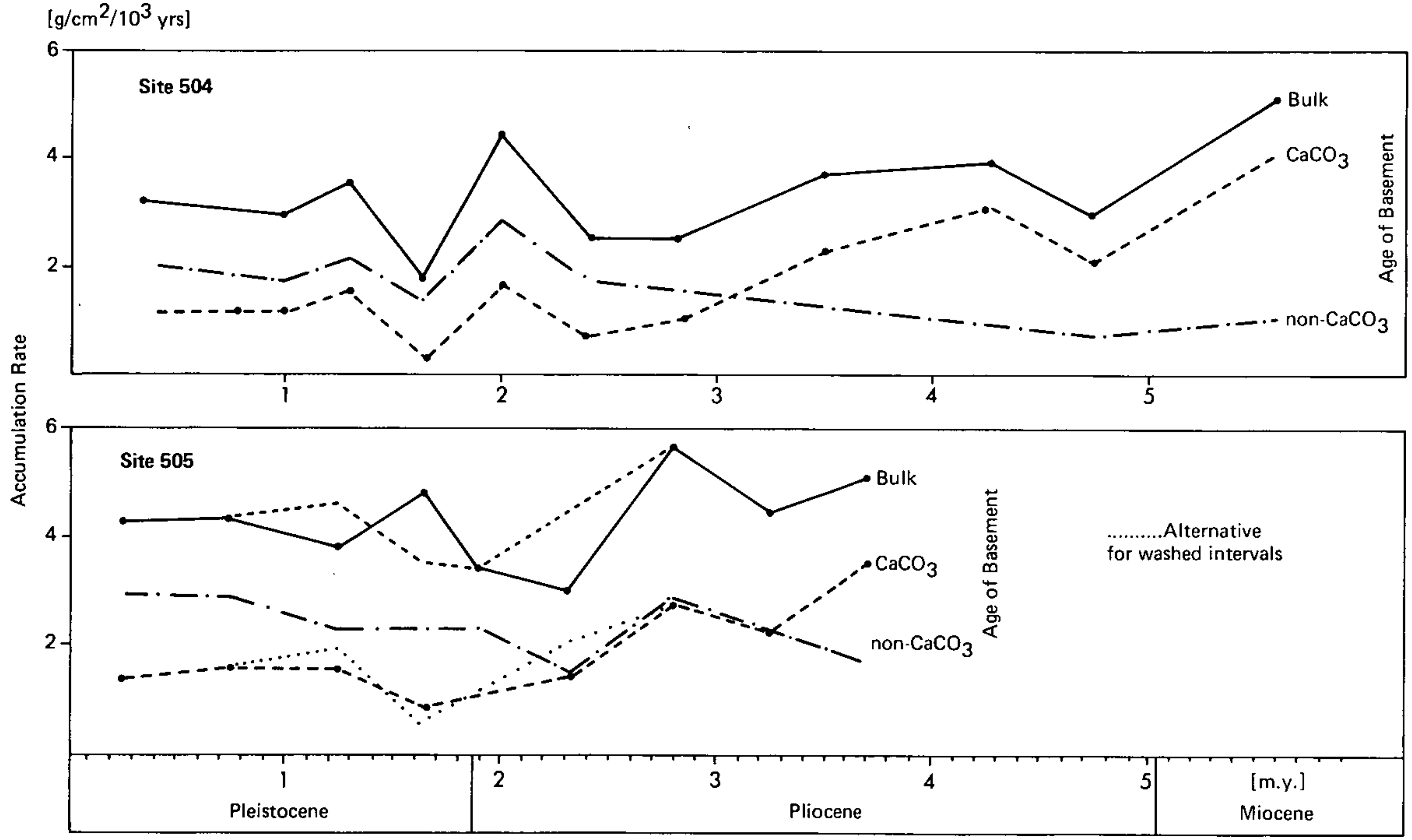

Figure 5

Sediment accumulation rates, Sites 501/504 and 505.

Preliminary calculations show unequivocally that such a profile must be related to inflow of cold ocean bottom water into the hole, entering the formation at the depth where the temperature begins suddenly to rise. Below this depth, the hole appears not to be receiving water, and the thermal rebound is essentially conductive. The hole is to be relogged two months after drilling on Leg 70, when a clearer picture of the flow of water in the area may be determined. However, already the thermal regime seems to be decidedly upset by the drilling of the hole. The other logs run successfully in the hole were compensated density, neutron density, resistivity, caliper and natural gamma. These indicated a complex porosity structure in the hole, which can only partly be related to the stratigraphic section compiled during drilling. The massive flow at the base of Unit 2 shows up clearly, but, though the porosity structure is very well defined, with all three porosity logs in good agreement with each other, the interpretation in terms of pillow lavas, massive flows, breccia zones and the like is not always clear. This correlation should be greatly aided by examination of the borehole televiewer records.

After many technical vicissitudes, the borehole televiewer ran successfully in Hole 504B. The records are noisier than in Hole 501, but massive flow units and pillow lava units can be readily recognized in places where initial image quality is good. Preliminary examination of televiewer records suggests that most of the basement section is made up of pillow lavas, but that there are some massive flows apart from the large one recognized on all the logs and in drilling. Many fractures can be seen, but so far it has not been possible to discriminate zones of intense fracturing and, perhaps, faulting from zones in which the normal joint pattern and pillow margin pattern is developed.

In summary, Site 504 was extremely successful, particularly in relation to the geothermal problems which it was planned to explore.

Site 505 (CR-2)

Site 505 was placed in an area of low heat flow to complement the high heat flow site at Site 504 (CR1). The site is in the floor of a valley within an area of more rugged topography than at Site 504. Measurements of conductive heat flow reached a broad minimum of 13-16 mWm^{-2} across the valley, compared with the level of about 240 mWm^{-2} predicted by a conductive cooling model. Here the crust was expected to be cooled by convecting sea water, and provide a controlled contrast with 504, since the nature of the crust and sediments are expected to be similar, but in a different thermal regime. The magnetic anomaly age of the site here is 3.9 Myr, based on well-defined magnetic anomalies mapped during the site survey. The CHALLENGER had no difficulty in identifying the site, and the beacon was dropped at 1°54.8'N, 83°47.4'W in 3538 m of water. Hole 505 was spudded in with no offset from the beacon, and with the packer included in the string. 233 m of sediment were continuously rotary cored above 9.5 m of basalt. The sedimentary section was divided into four lithostratigraphic units based essentially on color changes (Figure 7). The distinctness of these units and the position of their boundaries are supported by lithological observations and by changes in the values of some of the physical properties measured. Unit 1 (0-10m), late Pleistocene in age, is composed of dark olive gray to grayish olive green siliceous nannofossil ooze. It is distinguished in smear slides by a high ratio of total siliceous to carbonate components, a consequently lower carbonate percentage from carbonate bomb analyses, a high proportion of clay-sized material, a high porosity (in excess of 80% and a low wet bulk density. The transition in density and porosity are at a slightly greater depth than for color, but the difference is no more than 10 m. The surface sediments were brown in color, and contained 1.43% of manganese analyzed as MnO.

Unit 2 (10-72m), early to late Pleistocene in age, consists of grayish olive green to grayish green siliceous nannofossil ooze. It exhibits a higher density and carbonate content from Unit 1 as well as lowered porosity and silica to carbonate ratios. The content of clay-sized material is generally less than 10%.

Unit 3 (72-133m), formed between late Pliocene and early Pleistocene, has many affinities with Unit 1. It is generally darker than Unit 2, with colors ranging from dusky yellow green to dark olive green. Within it, wet bulk density decreases to levels close to those of Unit 1, and porosity increases correspondingly, reaching over 80%. The content of clay-sized material increases, and carbonate content decreases. All of these changes are reversed as the base of the unit is approached. Unit 4 (133-232m), of early to late Pliocene age, is paler again, and is composed of grayish yellow green to very pale green siliceous nannofossil ooze. Throughout, there is a gradual increase in bulk density and carbonate content accompanied by a decrease in porosity and low contents of clay-sized material. At about 20 m above the basalt, there is a transition from ooze to chalk accompanied by a distinct increase in density and decrease in porosity. However this transition is partly washed by drilling disturbance.

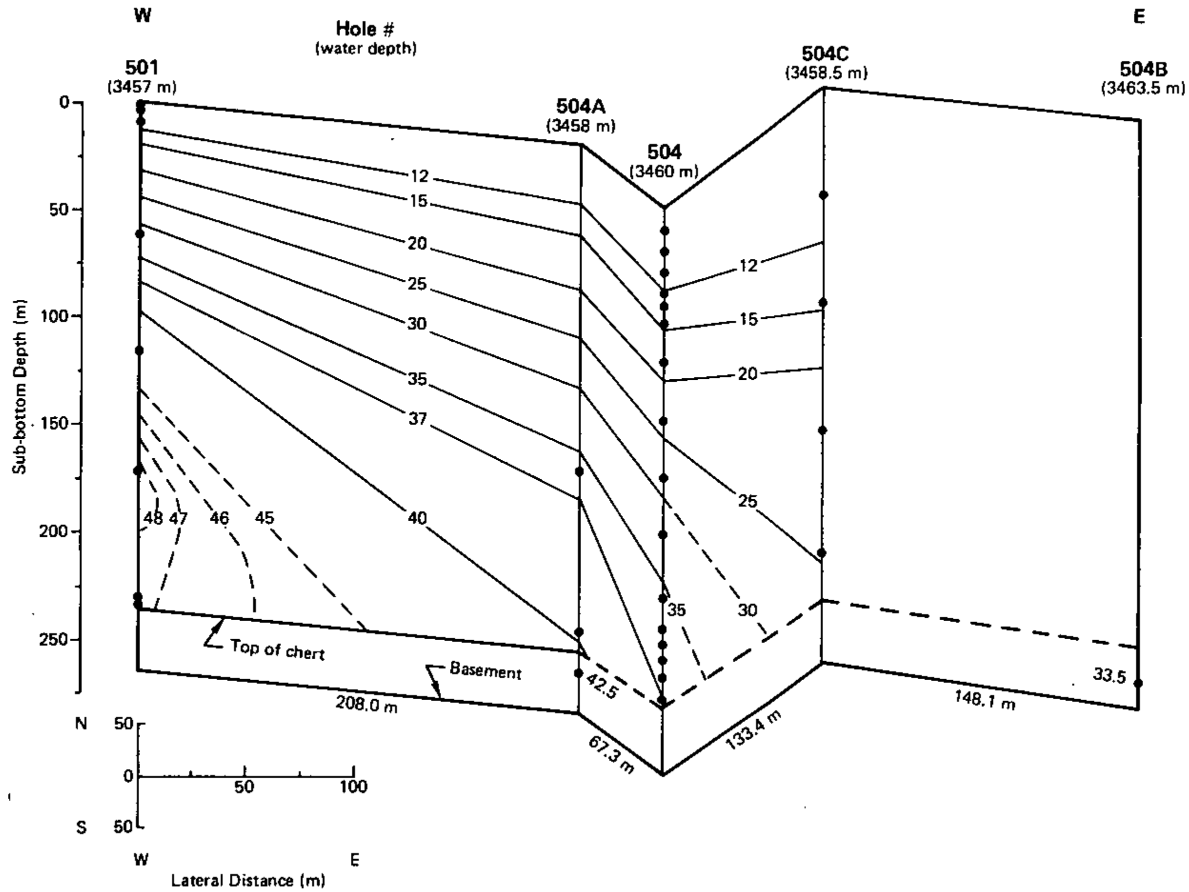

Figure 6

Contours of the Ca^{2+} concentration, in mmoles/liter, in sediment pore water at Sites 501 and 504. Contours are based on samples, shown as closed circles, from five holes situated approximately along an E-W line over a distance of 464 m. View is straight N: horizontal and vertical scales are equal, except that the diagram is foreshortened N-S by a factor of two.

Three prominent ash bands are seen in the section at 3.9, 18.6 and 26.4m. No discrete ash layers are seen in the lower part of the section. The layer at 18.6 m was chemically analyzed, and proved to be rhyolitic, containing normative anorthite and diopside.

The sedimentation rate, based on diatom events and upon the magnetic anomaly date of the basement (3.9 Myr), was apparently constant at 60 m/Myr. Diatoms are common and well-preserved except in the middle of Unit 2 and in the clay-rich Unit 3. Calcareous nannofossils are common and are only moderately well preserved. Within Unit 3 nannofossils become rate and are only poorly preserved. Fossils show no significant affects of diagenesis. Ages were assigned on the basis primarily of diatoms, and can be regarded as well defined, except for two intervals over which the heat flow probe was allowed to sink through the sediments while a measurement was being made, and within which two important events occurred.

Four heat flow and pore water runs were made using the contained sampling tool between 100 and 200 m and all four measurements were successful both in measuring temperature and in collecting water. The four temperature measurements, three of which had to be collected while allowing the bit to fall through the sediment because of its low strength, gave a linear thermal gradient of 2^{0} per 100m, indicating a basement temperature of $9^{0}C$. The linear gradient does not intersect the ocean floor at the bottom water temperature, but about 1^{0} above it, suggesting a curvature in the upper part of the section. This curvature may be due to heat generated within the sediment by biological activity, with perhaps 30 mWm^{-2} of heat flow from that source and 15 mWm^{-2} originating from beneath the sediments.

The pore water samples were analyzed with the interstitial waters squeezed from the sediments, and gave a pattern in marked contrast to that at Site 504. Ca^{++} decreases from its sea water values of 10 mWm^{-1} to about 3 mWm^{-1} while alkalinity increases from 3 to 17 meq l^{-1}. Mg stays constant, and H_2S is abundant. The maximum deviation from sea water values is at about 100 m. Below that gradients are reversed, and values close to those of sea water are reached again as basement is approached. This pattern of chemical variation is related to the activity of sulphate-reducing bacteria in the sediments, and is not related to reactions in the basement, which gave rise to the pattern found at Site 504.

No cherts were found in the sedimentary section, and the ooze-chalk transition is much deeber in the section than at Site 504. The bottom part of the sediment section was logged ... where compensated density measurements agreed well with bulk density measured at the base of the sediment section at Hole 505. The natural gamma log showed a peak in the sediments immediately above basalt at Hole 505B, perhaps indicating the presence of metalliferous sediments, but none were recovered in any hole at Site 505.

Only 0.43 m of basalt was recovered from Hole 505 after 9.5 m of penetration, and drilling had to be terminated because of severe torquing. The basalt was uniform, a strongly prophyritic rock containing 25 to 30% of large phenocrysts of plagioclase (An_{75}-An_{82}), olivine and clinopyroxene, with smaller phenocrysts of chrome-spinel. Plagioclase forms over 50% of the phenocrysts. Clinopyroxene phenocrysts are rare, with only two or three visible in each thin section. The matrix in which these phenocrysts are set is clearly a basic basalt, but attempts to match it with the magma that gave rise to the basement at 505A and 505B were not conclusive.

Because of the severe problems of the basement drilling at Hole 505, the drill string was pulled above the mudline, the ship was offset 1600 ft (about 500 m) due north of the beacon, and Hole 505A was started. This was on the flank of a small ridge running parallel to the axis of the valley, raised above the valley floor. Water depth was 3525 m and the hole was washed to basement at 196.5 m sub-bottom. Again drilling was difficult, with severe torquing. After 12 m of penetration, during which 0.75 m of basalt was recovered, suspicions that the bit might have failed induced us to pull the string. When the bit was recovered, it was in good condition, but the stabilizer pads were worn and it had clearly been working hard. The packer was completely shredded, probably through having become inflated downhole.

The basalt from Hole 505A is a sparsely phyric plagioclase, olivine, chrome spinel basalt, identical within the limits of determination with that from Hole 505B.

In an attempt to find better drilling conditions, the ship was offset 800 feet (about 250 m) further north and the drill string was run to the bottom again in 3517 m of water nearly at the top of the ridge running along the floor of the valley. We washed through 146 m of sediment to reach basement and then cored 43 m of basement with great difficulty (Figure 8). Eventually drilling was making no headway, and was stopped to allow logging and experiments.

The 6.85m of basalt recovered belonged to a single petrological unit

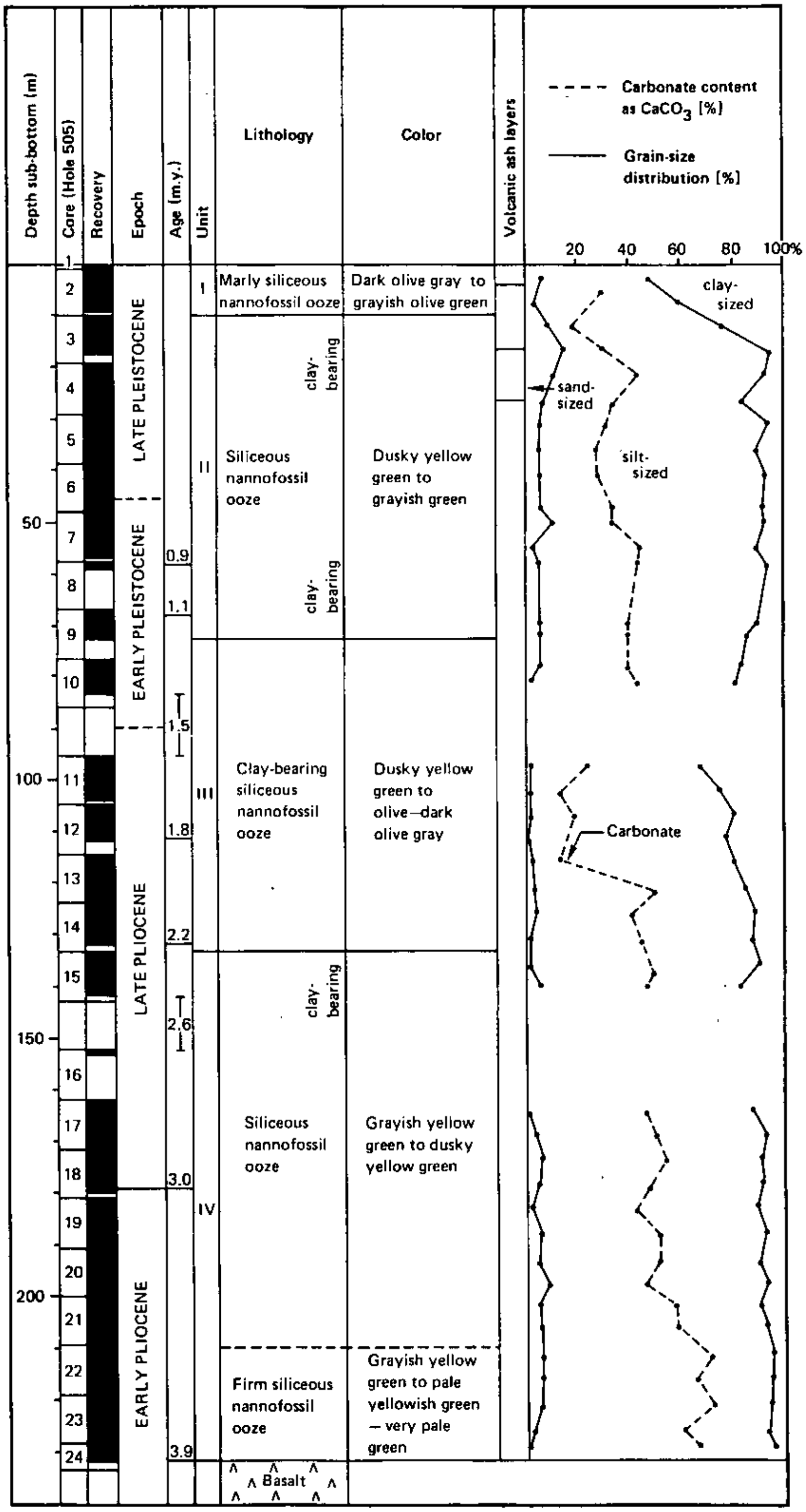

Figure 7

Lithologic summary of sediments, Site 505.

plagioclase, olivine, and chrome spinel phyric lava, identical in petrography and chemistry with that at Hole 505A. The basalt is rather basic with a Mg/Mg+Fe averaging 0.655, and mean TiO_2 0.96, CaO 12.68, and Al_2O_3 16.08. Ni is rather high at 159 and Zr low at 0.56, corresponding to Ti/Zr of about 100. The basalt is chemically and petrologically uniform within the limits of determination. Alteration is slight, and olivine is never completely altered. Alteration minerals include clay minerals, pyrite, phillipsite and calcite. An earlier reducing phase of alteration is overprinted with a later oxidizing phase in the vicinity of cracks. The oxidative phase of alteration increases K_2O, Sr and loss of ignition, and decreases MgO, suggesting the formation of a K and Fe-rich clay. The lavas recovered appear from their joint patterns and the attitude of their chilled margins to have been mainly part of thin sheet flows, with some small pillows.

Three attempts were made to run the borehold televiewer, but all were unsuccessful.

The downhole magnetometer was run successfully for the most part. Unfortunately, both at the top and the bottom of the logged section the hole was too near the vertical for the horizontal components to be meaningful. The vertical component showed that the basalt is uniformly reversely magnetized. Paleomagnetic measurements in the shipboard laboratory agreed with this conclusion, and showed that the intensity of magnetization is high (over 1 x 10^{-2}emu/cc) while susceptibility is low (about 10^{-4}emu/cc). Thus Qn ratios are high and the basalts are highly stable magnetically.

Three sets of logs were run: (1) compensated density, caliper, natural gamma and temperature, (2) neutron porosity, resistivity and natural gamma (3) water sampler and temperature. Of these, the porosity-related logs all agreed qualitatively and (except in the more porous regions) quantitatively. They showed a complex structure in which three logging facies could be identified: (a) a facies of low porosity with some thin porous bands, probably corresponding to pillow lava flows with some rubbly zones, (b) a facies of moderate porosity (0.25-0.30) perhaps corresponding to thicker rubbly tops of flow units and (c) a highly porous facies, usually accompanied by a natural gamma peak, which may correspond to sedimentary interlayers. The water sampler worked, but no formation water was detectable in the sample it returned.

Several comparisons may be made between Site 505, and Sites 501 and 504. The sedimentary column at 505 shows no cherts or limestones and only a smal. thickness of chalks. Pore-water chemistry showed a marked contrast, with the dominance at 505 of bacterially induced reactions in the sediments. The basement showed differences, too. The basalts are basic and very uniform and there is a lack of thick flow units. Alteration is much less intense than at 501 or 504. Though many of these differences can be related to the differences in temperature, not all of them can be related directly. However, since the conditions giving rise to the difference in basement temperature are primarily tectonic, and since it may be possible to relate basalt chemistry, for example, to tectonic differences, the distinction between the sites may prove in the end to be essentially one of tectonic environment.

Conclusions

The three sites drilled in two contrasting areas allowed most of the observations that we had planned, to be made despite loss of time through breakdown and failure of equipment. The two areas show a number of contrasts which seem to be related principally to geothermal conditions, since most other variables were constant. Sediment thickness and sediment type were very similar at both places, and basalt chemistry showed only small differences. Intensity of primary fracturing of the crust may have been different, but this is not necessarily the case.

Within the sediments the main contrast is in the degree of diagenesis. No limestones or cherts were found at the cold Site 505 while they were consistently present in the hot area at Sites 501 and 504. The marked differences in pore-water chemistry is probably also related to temperature, with conditions in the hot area dominated by interaction with the underlying basement, and in the cold area by bacterial processes within the sediment.

Within the crust, the degree of alteration was much less in the cold area, and this was apparently the cause of the much worse drilling conditions at Site 505. Logging results also suggested greater variability in basement physical properties at Site 505 than at Site 504, though penetration at Site 505 was not very great.

The downhole experiments proved extremely valuable at all three sites in supplementing the information obtained from the cores. The borehole televiewer provided a much more precise method of determining lithological changes downhole than is available through coring or conventional logs, as well as giving information on fracturing of the hole walls. The packer despite

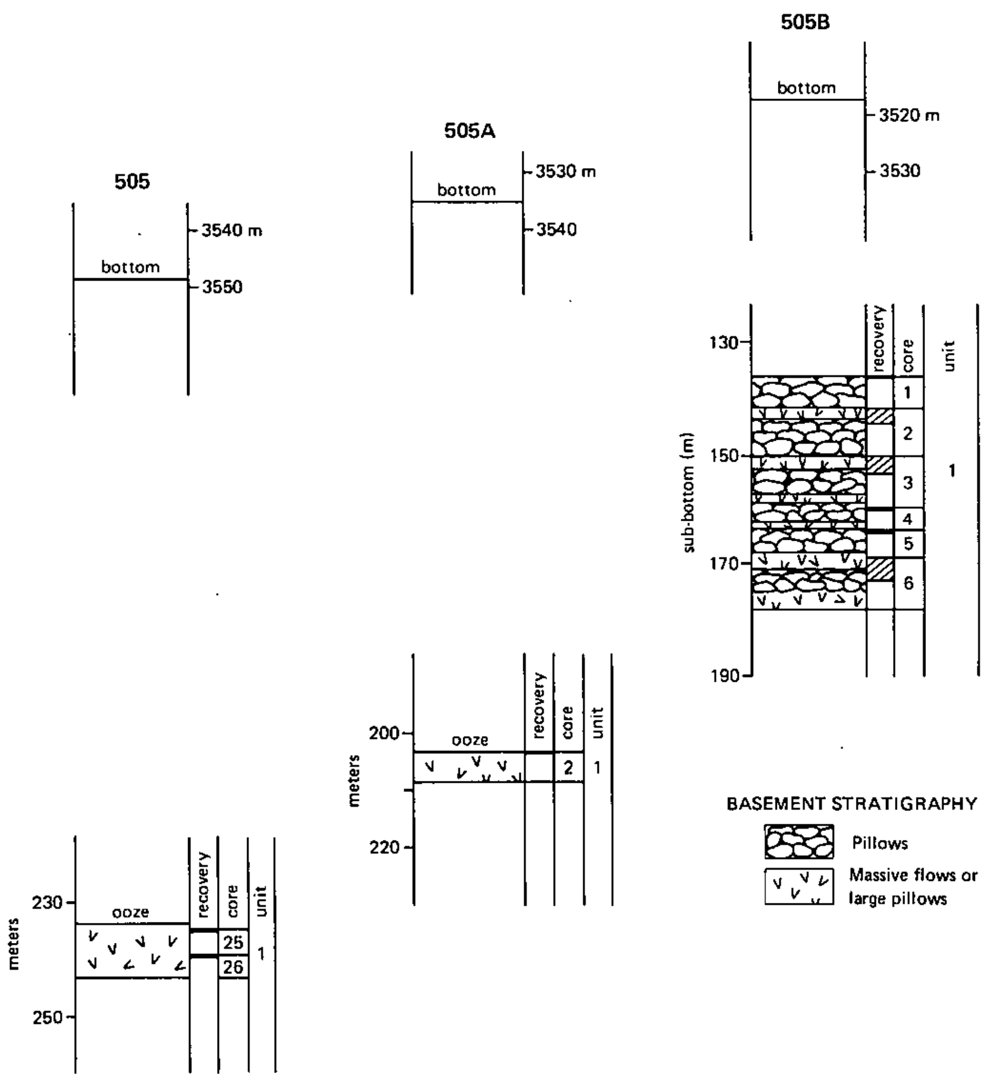

Figure 8

Lithologic summary of basement, Site 505.

continuing problems, provided vital information about the permeability of oceanic crust, hitherto unknown, and also drew a sample of formation water from the rocks at the bottom of the hole. The Soviet magnetometer ran successfully and reliably. Interpretation of results from it must await shorebased calculation, as is also the case with the resistivity experiment. The temperature/pore water sampler was a valuable tool that performed very well. The standard logs provided an important dimension in understanding the holes, and, since experience in interpreting them within basaltic formations is growing, they are beginning to be used increasingly quantitatively.

Finally, there is the question of further work in the area. Site 504 will be revisited during Leg 70 for logging and perhaps other experiments. With a whole in a geothermal area as active as this, there is clearly an advantage in further logging in the future, partly to discover how our interference with the natural geothermal system develops with time, and partly to deploy new experiments. The capacity to re-enter the hole without using CHALLENGER would clearly be a useful one. There is still important further drilling to be done in the area. In particular, the excellence of the drilling conditions, the shallowness of the ocean and the prevalence of good weather all combine to suggest this as the best site for the hole to Layer 3 proposed by the Ocean Crust Panel. The refraction results on the site survey showed that Layer 3 is at normal depths here, and Hole 504B could act a the CHALLENGER-style multiple re-entry hole required as part of the preparation for such a large task. We recommend that it be considered seriously.

LEG 70
GALAPAGOS SPREADING CENTER
(Co-Chiefs: J. Honnorez and R. Von Herzen)

Introduction

The first part of Leg 70, Sites 506 to 510 (Figure 9), was dedicated to studying and sampling the "open" hydrothermal regime of a young, oceanic crust, namely, the region adjacent to the Galapagos Spreading Center (GSC). The second part of the leg was devoted to further work on Hole 504B, started on Leg 69, i.e., the study and sampling of a conductive "closed" geothermal system in older crust of the Costa Rica Rift. Both Legs 70 and 69 were concerned with the overall study of the hydrothermal interaction among oceanic crust, seawater and the overlying sediments from geophysical, geochemical and petrological points of view. The initial objective of Leg 70 was to collect information pertaining to energy and mass transfers which occur during, or in response to, hydrothermal activity at a young mid-oceanic spreading center.

In situ measurements and representative material samplings were carried out at four sites (506-509) in a series of environments ranging from high heat-flow (335-963mW/m^2 or 8-23 HFU) areas with and without "mounds", to a relatively low heat-flow area (126-209 mW/m^2 or 3-5 HFU), in a region south of the GSC. Based on a 3.5 cm/yr half-spreading rate, the crustal age varied from 440 to 7290 x 10^{3}yrs. A fifth site, 510, was selected in an area of relatively high heat flow (184.2 mW/m^2 or 4.4 HFU), even though heat flow was less than expected for the crustal age estimated to be about 2.7 Myr. The sediment thickness was 115 m at Site 510 whereas it varied from 31 to 52 m at the other sites, south of the GSC.

One of our objectives was to collect evidence concerning the origin of the hydrothermal mounds found on the sea floor south of the GSC (Lonsdale, 1977; Corliss et al., 1978), and to define the extent of their regional influence. It was, therefore, necessary to compare undisturbed and continuous stratigraphic sequences from several mounds and off-mounds areas, at various distances from the former. Data and samples from low heat-flow areas lacking mounds were also required.

Another objective was the identification of the nature of the two sub-bottom reflectors observed in the "deep-tow" surveys (Lonsdale, 1977) verifying, therefore, the suggestion from Leg 54 that these reflectors are to be ascribed to the regional extension of a hydrothermal sediment layer originating in the mounds (Natland et al., 1979).

In the various types of areas, pore waters had to be collected and analyzed immediately, heat-flow measured and in situ physical properties logged. Finally, sample physical properties, including magnetics, sonic velocities, thermal conductivity, vane shear, and density, also had to be measured.

These various objectives could only be fulfilled by using, together with the conventional hard rock drilling, the HPC. This novel tool allowed largely undisturbed and almost continuous sediment sequences to be recovered from the mounds and the surrounding areas.

The area of investigation for Leg 70 is one of the best surveyed regions of the world sea-floor. Detailed bathymetric maps made from multibeam echo sounding surveys, ALVIN dive observations and surveys, and recent "deep-tow" surveys were available. However, we were somewhat handicapped by

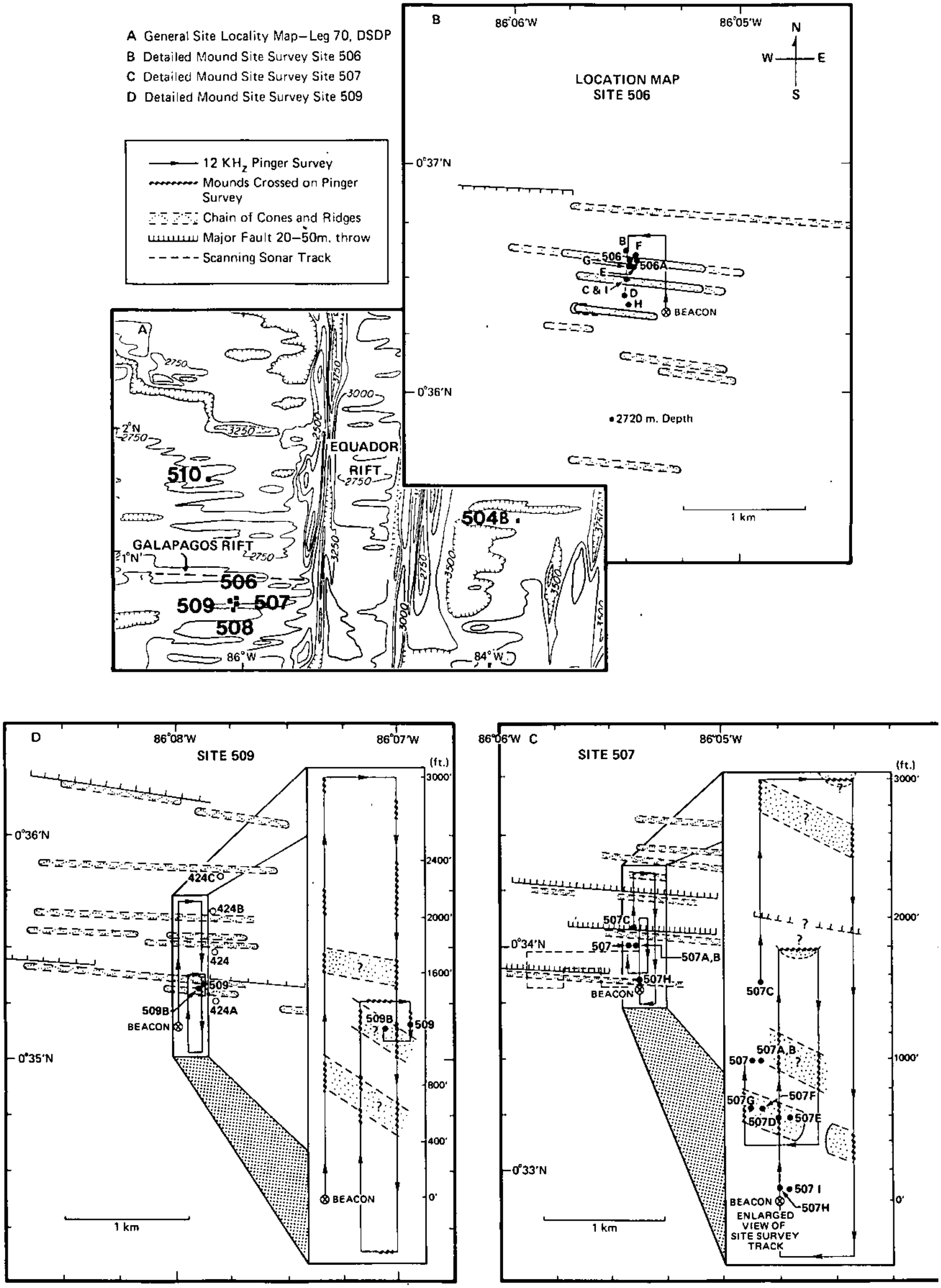

Figure 9

Site Locations for Leg 70.

the lack of detailed seismic data on the thickness of the sediment cover in the region south of the GSC. The regularity of the sea-floor spreading, smooth topography, and dense heat-flow data coverage of this region allowed the investigation of the mounds to be placed within the framework of dense geophysical data.

The second part of the Leg extended the work begun by Leg 69 at Site 504B on 6.2 Myr. old crust south of the Costa Rica Rift. Our main objective here was to extend the knowledge of young crust with samples and in situ measurements as deeply as the drill would allow. The physical nature of deeper portions of the crust and the petrology of basalts and their alteration with depth were investigated by deeper drilling at the re-entry site. A full suite of geophysical logs, and special downhole experiments to measure the large-scale electrical and seismic properties of the crust were carried out.

Site 506

Seven holes were drilled or cored, and three heat flow measurements were attempted at Site 506, a high heat flow area with mounds, about 19.5 km south of the Galapagos Spreading Center.

Two holes were drilled in the mounds sediments using the HPC: Hole 506 which was 37 m deep with 63% recovery (In reality, Hole 506 was very probably 32.3 m deep, as the final HPC core did not penetrate due to basement impact. This makes the recovery 70%), and Hole 504C which was 31 m deep with 93% recovery. Two holes were cored by the HPC in the sediment cover off the mounds: Hole 506B which was 21 m deep with 96% recovery, and Hole 506D which was 32 m deep with 87% recovery. All of the four holes are thought to have hit the basement.

Two holes were drilled into the mounds basement: Holes 506G and 506I which penetrated 5 and 3.5 m of hard rocks, respectively, with 20 and 6% recoveries. One hole, 506H, was drilled into the off-mounds basement which was 8 m deep with a 2% recovery. Heat flow measurements and pore water samples were collected in Holes 506A, 506E and 506F which were washed through the sediments.

Sediments

The most remarkable observations about the sediment stratigraphy (Figure 10) are the following:

1. The mud-line was at almost the same depth within a few meters at all four holes in the sediments.

2. In the mounds, below 1-4 m of pelagic oozes, Mn-hydrated oxides (mainly todorokite) form a layer up to 30-cm thick resting on an alternating sequence of thin pelagic sediment layers and green smectite layers, the latter up to 5-m thick. X-ray diffraction was used for the first time on the GLOMAR CHALLENGER, allowing the todorokite and smectite identifications. Both minerals are thought to be of hydrothermal origin on the basis of their similarity with Leg 54 equivalent and their restricted occurrence to the mounds. These "hydrothermal"(?) units are separated from the basaltic basement at Holes 506 and 506C by a 10 to 14 m thick basal unit consisting mainly of foraminifer nannofossil oozes, and they are overlain by a 1.7 to 3.9 m thick unit of foraminifer siliceous nannofossil oozes. No detailed stratigraphic correlation exists between the "hydrothermal"(?) units of Holes 506 and 506C.

3. Off the mounds, the "hydrothermal"(?) components are either completely missing (Hole 506B), or their presence is reduced to an 80-cm thick layer of green smectite-rich sediment (506D). This indicates that, contrary to Leg 54 scientific party's conclusion, the lateral extension of the "hydrothermal"(?) sediments is limited to the mounds themselves. In the off-mounds holes, the sedimentary column is made up to siliceous foraminifer nannofossil oozes, 20.5 m and 31 m thick in Holes 506B or 506D, respectively.

The reduced thickness of the pelagic sections in the mounds themselves compared to those of the off-mound holes indicates either that the "hydrothermal"(?) deposits are, at least partly, a product of replacement and/or dissolution of pre-existing pelagic sediments, or that the pelagic sediments have been removed from the mounds by slumping into the off-mounds area. No clear evidence for or against either of these hypotheses was found at this site.

Preliminary NRM measurements on the long spinner magnetometer show no apparent difference between the direction and intensity of the remanence of the off-mounds sediments and the Mn-hydrated oxide or green smectite rich sediments from the mounds.

The significant density change in the sediments from Holes 506 and 506C corresponds to lithological changes from the pelagic oozes (= 1.3 g/cc) to the "hydrothermal"(?) material (= 1.3 to 1.7 g/cc). All the physical properties in both Holes 506B and 506D continuously vary with depth. The depth gradient of the physical properties in Holes 506, 506B, and 506C are significantly larger than those of Sites 504 and 505, but are compatible to those of Site 424 (Leg 54). The only sample of basalt from the basement which was studied shows typical values of physical properties for Layer 2 rocks.

Two successful heat flow measurements to depths of about 30 m sub-bottom at Sites 506E and 506F gave about 1005 and 586 mW/m^2 (24 and 14 HFU), located respectively on and off mounds. The non-linear temperature gradient measured at the former suggests significant upward movement of pore waters.

Pore water chemistry is complex, reflecting the influences of biogenic debris diagenesis, convection, and reactions with the basement. The dominant features are: 1) the low concentrations of elements produced by biogenic degradation indicating that, both on and off the mounds, the sediments are flushed out by convecting waters: 2) the 10-20% calcium enrichment, believed to be due to seawater-basalt reaction.

Basement

The basement samples retrieved in the various holes of Site 506 appear to be mostly fresh, finely crystalline, plagioclase, sparsely phyric to aphyric basalts. Fresh glassy rinds are observed. No alteration minerals of unequivocally hydrothermal origin are present. These basalts appear similar to that observed in Leg 54 or ALVIN dives.

Site 507

Site 507, centered at 0°34.0'N, 86°05.4'W, is located within a concentrated grouping of mounds and mound ridges. It is about 4 km south of Site 506 and 23.5 km south of the Galapagos Spreading Center. Mounds occur on the north flank of a relatively broad elevation, the slope of which appears interrupted by small faults. Six holes were cored or drilled, four heat flow measurements and in situ pore water samples were collected.

Hole 507D was cored in the mound sediment (penetration: 38.7 m and 94% recovery). Hole 507F was cored at the end of the same mound (penetration was 31.3 m with 99% recovery) and Holes 507 and 507H were cored north and south of the same mound, respectively (penetrations were 3 and 33 m, respectively, with 98% recoveries). We attempted drilling two holes into basement off the mounds with little success. Hole 507B penetrated 7 m with a 9% recovery, whereas Hole 507C penetrated 29.5 m with a 96% recovery in sediments and 6% recovery in the basement. Holes 507E and 507G had heat flow measurements and pore water samples near the center and edge of the same mound, respectively. Holes 507A and 507I are the same measurements and samples located north and south of this mound, respectively.

Sediments

Hole 507D (Figure 11), cored into a mound, penetrated 26 m of interbedded green "hydrothermal"(?) clays and pelagic sediments, separated from the basement by 10 m of pelagic ooze. The "hydrothermal"(?) products extend almost up to the mound surface where thin manganese oxide crust fragments are present, suggesting that some "hydrothermal"(?) materials are recent deposits. At Hole 507F, apparently on a mound flank, 2 m of green "hydrothermal"(?) clays were found interbedded in the upper portion of a 31 m thick section of pelagic calcareous oozes. Smectite, todorokite and clinoptilolite were identified by X-ray diffraction in the green clays, the Mn-oxides and the pelagic oozes, respectively.

The fossil assemblages at Site 507 were essentially the same as those of Site 506. Radiolaria and diatoms are less abundant and more poorly preserved, especially below 12 m sub-bottom depth. An age of 0.27 to 0.44 Myr is inferred for the basalt sediments from the paleontological data, leaving a hiatus of at least 0.25 Myr with the age of the basement, estimated to be 0.69 Myr from the spreading rate.

There appears to be better evidence at this site for the formation of the green clays by coating and partial replacement of the siliceous organisms. But the possibility of sediment slumping from the mounds down to off-mounds areas still exists.

Pore water chemistry, as at Site 506, is characterized by slight Ca excess and Mg deficiency relative to bottom water, reflecting reaction with basement. Low ammonia concentrations and constant calcium concentrations indicate rapid convection.

Physical and thermal properties are basically the same as in the sediments of Site 506. Heat flow measurements agree with previous short probe determinations, with values of 335 to 502 mW/m^2 (8 to 12 HFU). Nearly linear temperature gradients suggest a present conductive thermal regime.

Basement

The basalts recovered in the various holes of Site 507 are either fine grained aphyric to sparsely plagioclase phyric, or coarse grained subophitic. The latter appear to be fresh where the former display black aureoles indicating a low temperature alteration with filling of pore spaces by green smectites and iron hydroxides. No sign of hydrothermal alteration has been observed. The shape of the alteration bands indicate that the basalt pieces belonged to a fragmented basement which has been further broken during drilling.

The basalts of Site 507, like those of Site 506, have high magnetization intensities (average NRM intensity of 22 mGauss), high ratios of remanence to induced magnetization (average Q of 33), and shallow inclinations (both positive and negative, less than 15%), consistent with the high amplitude magnetic anomalies and equatorial location of the site.

Site 508

Site 508 is located around 0°32'N, 86°06'W, about 28 km south of the Galapagos Spreading Center and 4 km south of Site 507.

One hole, 508, was continuously cored through 34.8 m of pelagic sediment. Average sediment recovery was 99%. In Hole 508B only a mudline core was recovered after which the bit was washed down to the basement. Basement drilling was attempted with only 8 m penetration and 6.5% recovery. After slow penetration and torquing, the hole was abandoned after jamming of the drill bit. Hole 508C was drilled within 15 m of Hole 508B with the purpose of recovering sediments directly overlying the basement. Heat flow measurements were carried out at Holes 508A, 508D and 508E.

Sediments

Hole 508 cored 35 m into the sediment cover which is made up of siliceous foraminifera nannofossil oozes (Figure 12). It is not certain that the basement was reached. No basaltic fragment was found in the core etcher of the lowest core of this hole. Holes 508B and 508C were drilled through 51.5 m of sediments similar to those of Hole 508. The recovery of a 10-cm thick interval of semi-lithified sediments about 0.5 m above the bottom of Hole 508, the presence of an indurated chalk pebble in the last core above basement of Hole 508B, and of partly indurated sediment in the only core of Hole 508C, indicate that several meters of at least partly lithified sediments directly overlie the basement.

Compared to the sediments from the other sites of this leg, the sediments at Site 508 show the following main differences:

1. The presence of semi-lithified pelagic oozes in the lowermost portion of the sediment column. Diagenesis related to compaction is unlikely to explain the formation of such sediment.

2. The sediments do not show a decrease in the amount of siliceous organisms towards the bottom of the sedimentary column. Site 508 sediments display the best microfossil preservation of all the sites drilled thus far.

3. The presence of H_2S and traces of pyrite indicate that reducing conditions are present throughout much of the sedimentary cover of Site 508.

The fossil assemblages were essentially identical to those of Holes 506 and 507. Similarly, all of the physical properties were approximately the same as those of the pelagic sediments of Hole 507, in spite of the large difference between the thermal regimes of the two sites.

Three heat flow measurements yielded relatively low values ranging from 134 to 197 m/W/m^2 (3.2 to 4.7 HFU) in agreement with the previous short probe measurements from research vessels. Each measurement shows an increasing temperature gradient with depth, possibly due to a hydrothermal recharge at rates on the order of 10^{-6}cm/s.

Pore water magnesium and calcium concentrations are close to bottom water values suggesting that there is little input of formation waters in this area of presumed recharge. The relatively high ammonia concentrations found at this site are compatible with such conclusions.

Basement

Basement drilling was attempted at one hole (508B), with relatively poor results. Due to the same drilling characteristics as at the previous mound sites, both penetration (8 m) and recovery (6.5%) were poor. The basalts are fine to medium grained aphyric to sparsely phyric plagioclase. They are often partly surrounded by a dark alteration rim and a few samples are slightly altered throughout. The alteration consists of the deposition of smectites, unidentified zeolites and Fe-oxyhydroxides in vesicles and pore spaces. No sign of unequivocal hydrothermal alteration could be found.

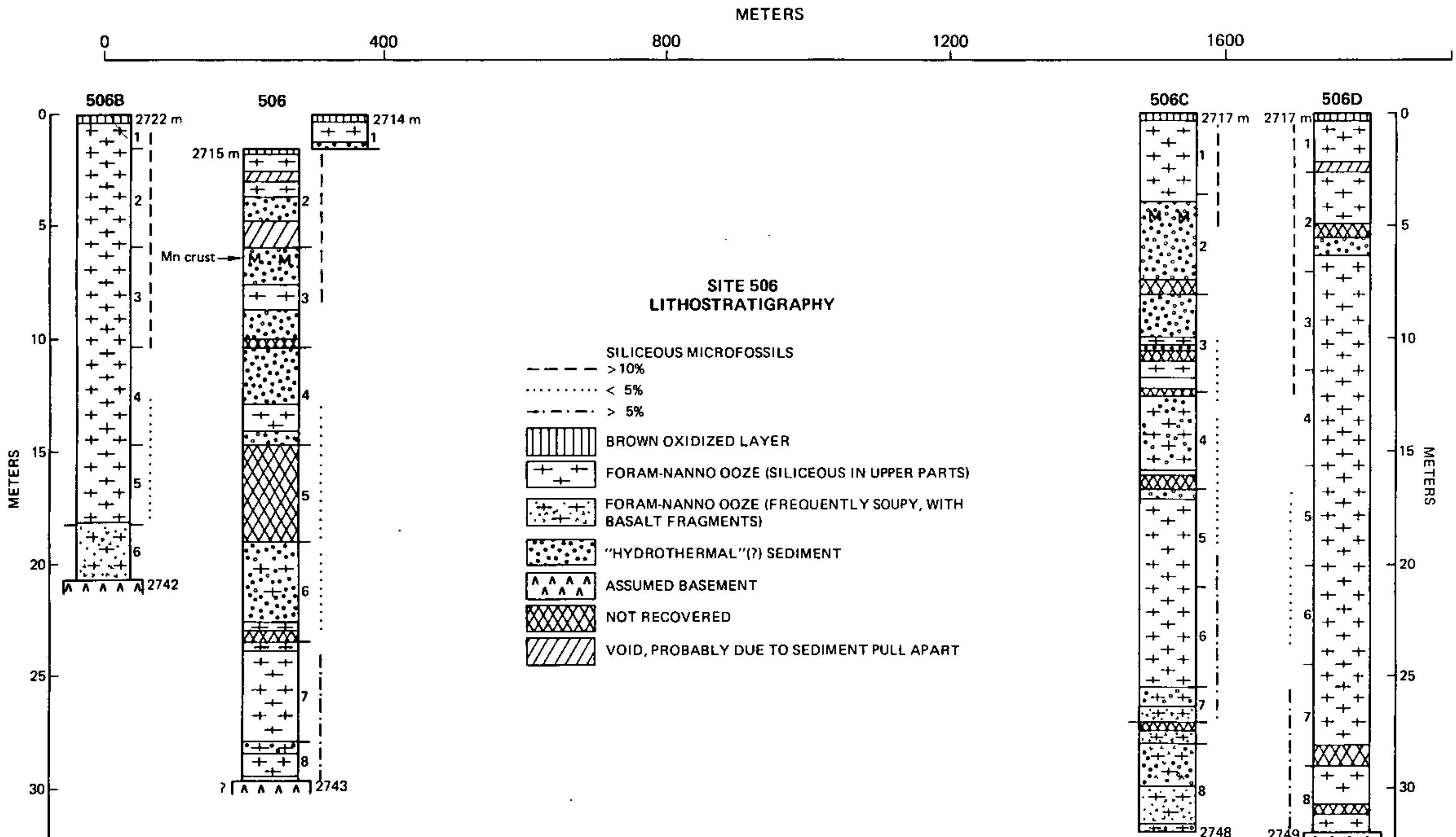

Figure 10

Lithologic Summary of Site 506.

Site 509 is centered on a mound field, located at 0°35.34'N, 86°07.90'W, 21 to 22 km south of the Galapagos Spreading Center, and 4 km west of the north-south line passing through Sites 506 and 507. Site 509 coincides with IPOD Leg 54, Site 424: Holes 509 and 509B are located respectively off and on a mound about 120 m and 180 m west and slightly north of Hole 424A. Three heat flow measurements were carried out at the same locations. The sediment cover is about 32 to 34 m thick and the underlying basement is assumed to be 0.60 to 0.63 Myr old on the basis of the 3.5 cm/yr half-spreading rate inferred from the magnetic anomalies.

Sediments

The overall thickness and lithological sequence of the mound sedimentary column of Hole 509B (Figure 13) is very similar to those of the other two mound sites, i.e., 506 and 507. The stratigraphy observed in the 33.4 m of sediments cored in Hole 509B consists, from top to bottom, of the following units:

1. About 4 m of various interbedded lithologies, including manganese oxhydroxide crust fragments (up to 2.5 cm thick and mainly in one 1.4 m thick layer), pelagic oozes, smectite granular clay, and Mn-Fe oxide ooze:

2. about 12 m of smectite green clays interbedded with pelagic oozes.

3. 17.4 m of mainly non-siliceous foraminifer-nannofossil ooze overlying the basaltic basement.

The sedimentary column cored in Hole 509, located probably on the edge of a mound, is exclusively made up of 31.9 m of siliceous foraminifer-nannofossil oozes. This observation demonstrates that the "hydrothermal" (?) material has no regional extent at this site either, and therefore, could not explain the sub-bottom reflectors observed by Lonsdale (1977). The fossil assemblages present at Site 509 were essentially identical to those of the previous sites.

Small pore water calcium enrichments and magnesium depletions again imply a flow of formation waters through mound area sediments. Ammonia concentrations are also low, especially in Hole 509B, suggesting rapid flushing by upward convection.

Heat flows were quite high in each hole of this site: about 419 and 775 mW/m² (10 and 18.5 HFU) at Holes 509 and 509B respectively. Thermal gradients at 509B decreased with depth suggesting hydrothermal discharge through the mound at a rate of 1.9 10^{-6}cm/s. Gradients were almost linear in Hole 509 suggesting that a conductive thermal regime exists in the off mound area.

Manganese oxide crusts have the highest density and sonic velocity and lowest porosity of all the sediments of this leg: wet bulk density = 1.98 g/cm^3, grain density = 3.75 g/cm^3, porosity = 58.1%, sonic velocity = 2.22 km/s. The green clays have slightly higher density, sonic velocity and lower porosity than those of the previous sites: wet bulk density = 1.66 g/cm^3, grain density = 3.12 g/cm^3, porosity = 70.1%, sonic velocity = 1.72 km/s. On the other hand, all of the physical properties of the pelagic sediments are similar to those of the previous sites.

The preliminary results of the magnetic properties measurements on the sediments are very similar to those of Sites 506 and 507. However, the Mn-oxide crusts exhibit surprisingly coherent NRM directions despite their very low intensities which are consistent with their presumably low Fe-content.

In summary, the major differences between Site 509 sediments and those from the other sites are:

1. The manganese crust fragments are more numerous and they form a thick layer in Hole 509B. Moreover, the oxidized "mudline" layer is thin (0.5 m) and only 0.7 m of pelagic sediment overlays the hydrothermal material. These observations may indicate that Hole 509B was cored closer to the top of the mound than the other holes, and/or that the hydrothermal activity was more recent (or still active?) at this hole than at any other previous sites.

2. Contrary to sediment section from other off-mound holes, the lower halves of which are almost devoid of siliceous microfossils, Hole 509 contains siliceous remains down to the bottom of the sedimentary column.

No basement drilling was attempted at this site.

Site 510

The main objective of Site 510 was to test the basement drilling capacity of a region of the Galapagos Spreading

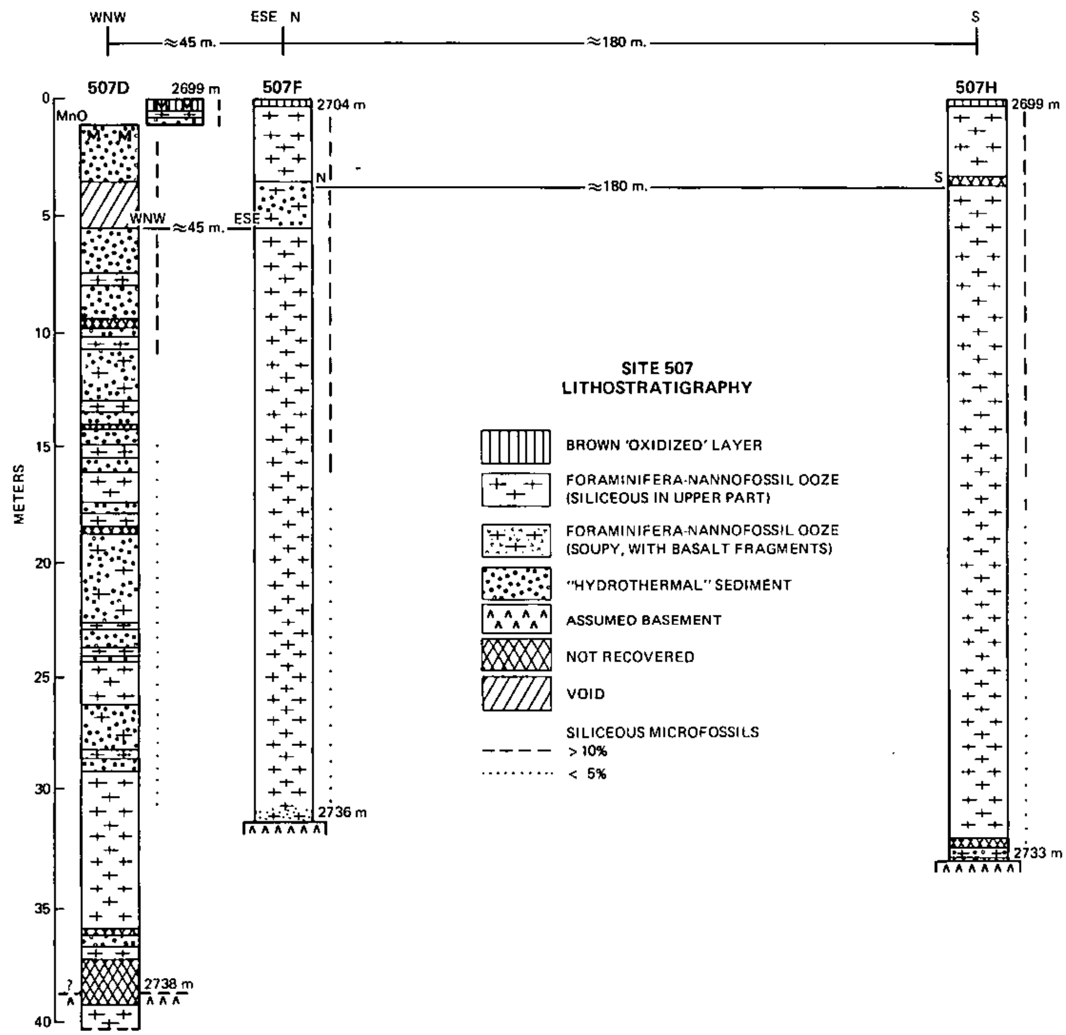

Figure 11

Lithologic Summary of Site 507.

Center which was older than that of the three mound fields previously studied.

Site 510 is located at 1°36.79'N, 86°24.60'W, in a moderately high heat flow region (167-209 mW/m^2 or 4-5 HFU). The site is about 90 km north of the Galapagos Spreading Center and 38 km west-north-west of Leg 54, Site 425. The sediment cover is about 115 m thick. The site is near magnetic anomaly 2' and, assuming a 3.25 cm/yr half-spreading rate, the crust should be 2.7 Myr old.

One hole was cored by washing the drill bit down to 38.5 m sub-bottom depth, then "punch-cored" down to the basement, at 144.5 m sub-bottom depth. Sediment recovery varied between 93 and 100%. Eighteen meters of basement rocks were drilled, with about 27% recovery, until the drill bit became jammed and the hole had to be abandoned for fear of losing the bottom hole assembly.

Sediments

The sedimentary column (Figure 14) appears to be uniformly made up of foraminifer diatom nannofossil oozes, according to the recovered cores. The diatoms are particularly abundant and the biogenic silica content is therefore higher than in any of the other pelagic sediments studied during this leg. There appears to be no decrease in siliceous organism content with depth. reducing conditions prevailed in the sediments as evidenced by the traces of pyrite and the H_2S odor, as well as the distinctive olive green color.

Both calcareous nannofossil and planktonic foraminifers indicate a basal sediment age of 3.0 to 2.6 Myr. The planktonic foraminifer assemblages are dominated by warm water species. The Pliocene-Pleistocene boundary is located at about 90 m sub-bottom depth. The abundance of benthic foraminifers and the presence of poorly preserved planktonic foraminifer tests at intervals 6CC and 7CC (105 and 112 m depths, respectively) indicate dissolution.

Depth gradients of physical properties of these sediments is very small compared to those of the other sites, except near the basement. The lowermost 20 m of the sedimentary column exhibit larger depth gradients, as found at other sites. This trend could be explained by some interaction between the sediments and the basement, but there was no other evidence of such a process.

In situ temperatures measured at 39.5, 67 and 95.5 m sub-bottom depths, yielded a linear gradient of 0.22°C/m. An average thermal conductivity of 2.1 mcal/cm°C s give a conductive heat flow of 190 mW/m^2 (4.6 HFU), about two-thirds of the value precicted by the cooling plate model for a 2.7 Myr old crust.

Site 510 pore waters have Ca enrichments and Mg depletions up to 15%, extremely high SiO_2 concentrations (up to 1100 m) reflecting biogenic silica dissolution, and NH_3 and H_2S concentrations indicating the production of about 400 m of CO_2 by ulfate reduction.

Basement

The basalts retrieved during the 18 m penetration at Site 510 are significantly different from those of the other Galapagos Spreading Center sites.

The main differences are the following:

1. The basalt is more phyric with 15-40% plagioclase phenocrysts.

2. The 1.5 x 1 mm average size of these phenocrysts is large.

3. The presence of olivine phenocrysts.

4. The primary Fe-Ti oxides are only about half as abundant.

The basalts are surrounded by a thicker alteration rim than those of Sites 506 and 508; the dark rim ranges in thickness from 5 to 40 mm. In addition to the variously colored smectites, calcite is present in the vesicles and other pore spaces of these alteration rims. The more pronounced alteration may be due to a longer interaction of the crust with seawater, or to the higher permeability of the basalts.

The average magnetization intensity at Site 510 is 6 x 10^{-3} Gauss, i.e., less than one-third of that observed at Sites 506 and 507. The remanence is dominant over induced magnetization with a mean Q ratio of 22. The remanence is stable to AF demagnetization with average NRM inclination of -13° and average stable inclination of -16°

The basalts have higher sonic velocities and lower grain densities than those of the previous sites. The latter is probably due to alteration.

Site 504B

On December 3, Hole 504B, drilled during Leg 69, was re-entered at 1343 hours. During the fourteen consecutive days on site, the hole was re-entered three more times and 347 m of basement were cored. Final depth of 836 m sub-bottom was reached on December 13. Penetration rates varied from about 2 to

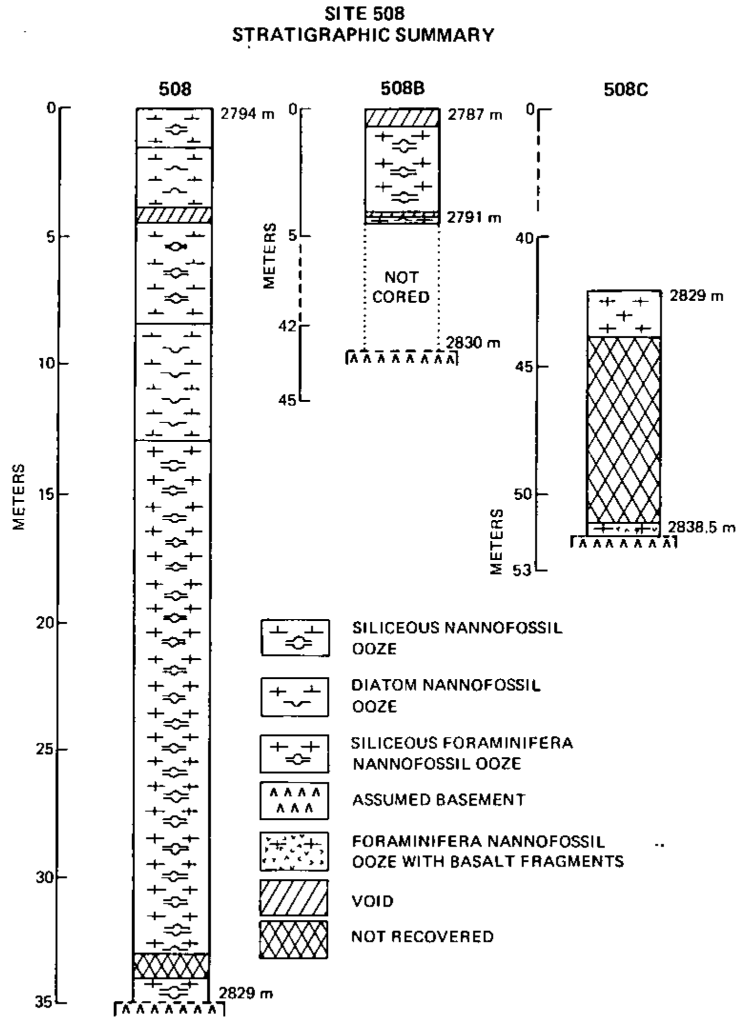

Figure 12

Stratigraphic Summary of Site 508.

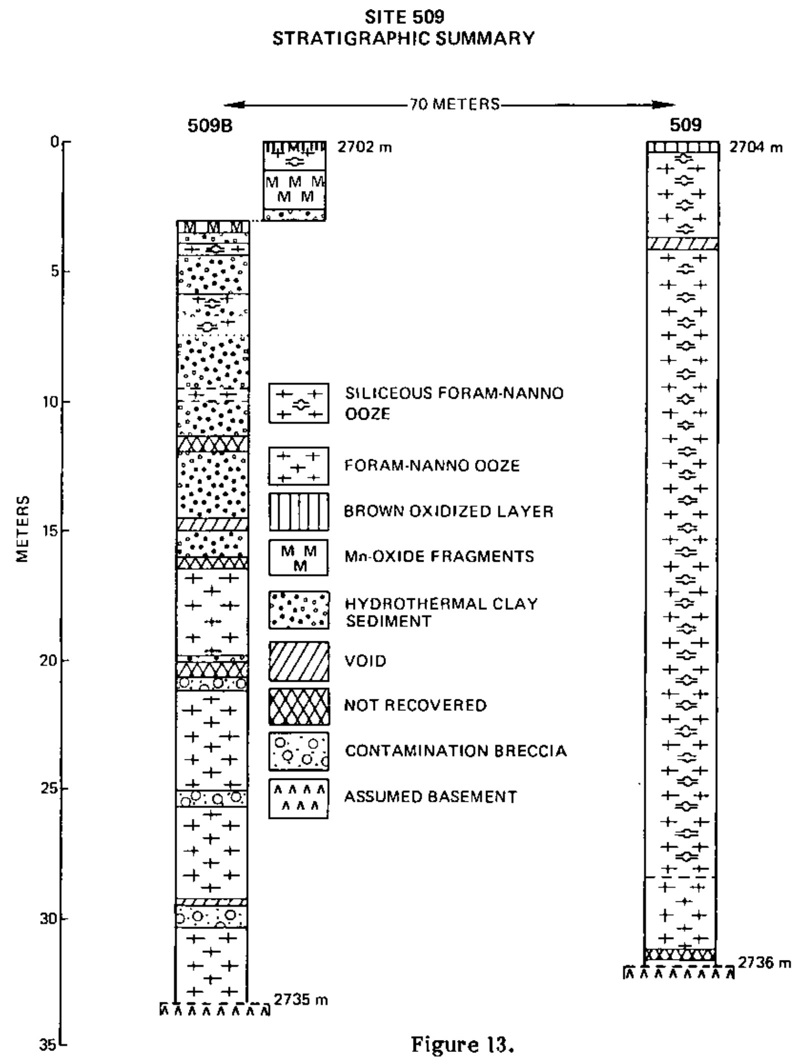

Figure 13.

Stratigraphic Summary of Site 509.

6 m/hr, with an average close to 4 m/hr. Recovery varied from 0 to 100% with an average of 26.4%.

The basement cored during Leg 70 at Hole 504B is comprised of 26 petrographic units corresponding to 15 paleomagnetic units. Unfortunately, the unavailability of XRF chemical analysis prevented correlation of the petrographic or the paleomagnetic units to magmatological variations. Three major kinds of lava were encountered: massive flows (at least 23 m thick), flow breccias and highly fractured sequences of pillow lavas, and/or thin flows. The basalt ranges from aphyric to sparsely to highly olivine-plagioclase-clinopyroxene phyric. The association of the first two phenocryst minerals is the most common. Spinel microphenocrysts have been observed in a few units. Five petrographic types of basalts were distinguished on the basis of the occurrence of the various phenocryst minerals.

The lowermost 347 m of basalts drilled in Hole 504B, during Leg 70 exhibit a slightly different alteration from that of the upper 214 m of basalts drilled during Leg 69. The main differences are as follows:

1. No calcite was observed below 660 m sub-bottom depth.

2. Fe-oxhydroxides are not common between 600 and 760 m and below 800 m sub-bottom depths.

3. Vein pyrite was not observed above 540 m sub-bottom depth, and becomes progressively more abundant with depth. As in the Leg 69 portion of the hole, various types of smectite form the most abundant alteration products, and it was accompanied by minor amounts of zeolites (analcite and nontrolite were identified by XRD). A mixed layer mineral was tentatively identified as saponite-talc by XRD. Olivine phenocrysts are frequently replaced by various combinations of talc, smectite and red iddingsite (probably a Fe-oxhydroxide rich smectite-mixture). Preliminary reflected light observations indicate that the igneous Fe-Ti oxides are severely altered into mainly non-opaque secondary products (Fe and/or Ti oxhydroxides and silicates?) filling up the large cracks with separated rather small Ti-magnetite relics. It appears that the basement alteration probably took place in mainly suboxic conditions in the upper portion of the hole (i.e., down to 540 m sub-bottom depth), and in suboxic to anoxic conditions in the lowermost 296 m, or at least as far as the basement was drilled. The alteration process and the resulting products do not differ, as far as our shipboard observations indicate, from those of basalt seawater reactions at low temperature.

Paleomagnetic data suggest 15 units with an overall mean stable inclination of -18°. Two of the units, each extending over 5 cores, have mean stable inclinations of -53° and -63°, respectively, steeper than would be expected due to geomagnetic secular variation. Tectonic tilt, geomagnetic excursions, stable secondary remanence, or a combination of these might be responsible for these anomalous inclinations. Overall mean intensity of magnetization is 7 mGauss and the overall mean Q ratio is 10.

The average sonic velocity of the basement rocks measured on-board is significantly higher than the wave velocities derived from site survey data: 5.71 km/s vs. 4 to 5 km/s, respectively. This difference can be attributed to the widespread occurrence of fractures on a scale larger than the cored samples which are probably responsible for the water flow.

Drilling was followed by an extensive logging and downhole measurements program. Successful logs over the entire basement section include sonic, resistivity, temperature, and caliper. Natural gamma and neutron density were partially successful, compensated density was unsuccessful. Successful logs show prominent massive basalts at about 325, 590, and 690 m below mudline, and otherwise generally fractured/altered basalt. Downhole experiments include large scale electrical resistivity and oblique seismic, the latter in cooperation with R/V GILLISS.

Four borehole temperature profiles and in situ water samples were made during the deepening of Hole 504B on Leg 70, including the first one before any disturbance of the re-entered hole. These confirm that the strong downward flow of water to about 350 m sub-bottom water depth, observed during Leg 69, is still occurring. The present flow rate down the cored hole was estimated at a few m/hr. The data also suggests that a conductive gradient of about 0.12°C/m exists below about 430 m sub-bottom depth, yielding roughly a 201 mW/m^2 (4.8 HFU) heat flow which is in good agreement with the Leg 69 result. Maximum temperature at bottom on last profile measured 111°C, estimated to reach equilibrium at about 120°C.

Conclusions

The hydrothermal mounds of the Galapagos Spreading Center are unique features of the world ocean floor. High recoveries of practically undisturbed sediments, allow us to reconstruct the following lithological stratigraphy, from top to bottom:

Unit 1 is pelagic sediment with occasional Mn-oxide crust, capped by the usual moderate brown oxidized "metalliferous" layer at or near the sediment-water interface. The contact between this uppermost unit and the underlying Unit 2 is generally very sharp.

Unit 2 represents the hydrothermal material, ranging from a Mn-oxide crust agglomerate to an ever present and thick green smectite layer. This hydrothermal material is frequently interstratified and mixed with pelagic sediments and usually grades into the lowermost unit, with frequent smectite-filled mottles occurring in the transition zone.

Unit 3 is essentially made up of pelagic sediment resting on the basaltic basement.

The basement rocks underlying the mounds seem to lack any unusual alteration features. As a matter of fact, these basalts display alteration patterns and mineralogy which are very similar to those of young crustal material from other localities.

The Galapagos Spreading Center basement rocks are ferrobasalts, the paleomagnetic properties of which are very consistent with an inversion of a negative anomaly source made up by a 500-m thick basalt pile. Site 510 basalts might be the first recovery of the youngest non-ferrobasalts directly adjacent to the oldest ferrobasalts which are particular to the Galapagos Spreading Center. These basalts have a very low velocity, which increases with age. Porosity, density and thermal conductivity have sidespread but strong depth gradients compared to other sites, even with some having similarly high heat-flows. Both these high gradients and the presence of the hydrothermal mounds seem to be related, the gradients corresponding to a large regional expression and the mounds localized, more restricted expressions of the same hydrothermal process.

Pore water and formation (i.e., basement) water samples could be analyzed on-board the GLOMAR CHALLENGER and more complete analyses will be carried out in shorebased laboratories. The shipboard analyses of water samples strongly suggest that these waters are the products of basement-convective discharge and conductive recharge in the high heat-flow and in the low heat-flow areas, respectively. This is in agreement with the expected theoretical models of seawater circulation through the oceanic crust.

Strong linear gradients with depth of the thermal conductivity show that water movement occurs on a larger scale than the mound dimensions.

The results of pore-water analyses and heat flow measurements in all of the Galapagos Spreading Center sites confirm the hypothesis that the mounds are the foci of localized hydrothermal discharge onto the seafloor. These discharges are responsible for the high heat flows (up to 963 mW/m^2 (23 HFU)) and unusual sediments encountered at the mounds. Both high heat flow and hydrothermal material are not found a short distance off the mounds. The sediment thickness at the mounds does not appear to be drastically different from that of sediment cover in the off-mound or non-mound sites of the same area.

Except at Site 509, a discrepancy (or hiatus?) exists between the basement age as derived from magnetic anomalies, and the paleontological age of the sediments in contact with the basement.

A significant drop in the content of siliceous organisms in the mound sediments was observed which contrasts with the amount of biogenic silica in the off-mound and non-mound sediments. On the other hand, preliminary calculations indicate that a major non-biogenic supply of silica is needed to form the hydrothermal smectite.

Hole 504B of the Costa Rica Rift was drilled to a total sub-bottom depth of 836 m. This is one of the deepest holes ever drilled into oceanic basement. The maximum temperature measured at the bottom of the hole was 111°C from which a probably equilibrium temperature of about 120°C is inferred. Unfortunately we had to stop short of the 150°C temperature limit at which the first unequivocally metamorphic minerals start forming. The basement at Hole 504B appears to be made of pillow basalts and/or thin flows with frequent, up to 23 m thick, massive lava flows. This latter observation contrasts with Leg 69 where only one (?) thick lava flow is encountered.

A few breccias were observed which were generally well cemented by alteration minerals. These breccias are thought to be due to the flow of the lava during its emplacement and does not correspond to talus or tectonic breccias related to fault scarps. The variability in the type of alteration changing from suboxic to almost anoxic with depth, the increasing trend in the amount of alteration product with depth, might explain the behavior of Hole 504B basement during drilling: average penetration rates of 26 m/hr (ranging from 2 to 6 m hr) and recoveries ranging from 0 to more than 100%, depending on the nature of the rock. The magnetic inclination of Hole 504B basalts appears to be systematically skewed and probably required a post-eruptive mechanism such as tectonic tilting or alteration.

Conductive heat-flow exists below the zone found by Leg 69 to be a recharge area of seawater into basement. Formation water silica concentrations increase with depth suggesting that water chemistry varies with depth as a result of reactions with warmer and warmer basement rocks.

The final picture looking back at both the Galapagos Spreading Center sites and the deep hole in the Costa Rica Rift is that of extremely dynamic systems in which the oceanic crust, its sedimentary cover and seawater intimately interact at almost visible rates.

REFERENCES

Corliss, J.B., Lyle, M., Dymond, J., Crane, K., 1978. The chemistry of hydrothermal sediment mound deposits near the Galapagos Rift. Earth and Planet. Sci. Lett. 40, 12-24.

Lonsdale, P., 1977. Deep-tow observations at the mounds abyssal hydrothermal field, Galapagos Rift. Earth Planet. Sci. Lett. 36, 92-110.

Natland, J.H. et al., 1979. Galapagos Hydrothermal Mounds: Stratigraphy and chemistry revealed by deep-sea drilling. Science 204, 11 May 1979, 613-616.

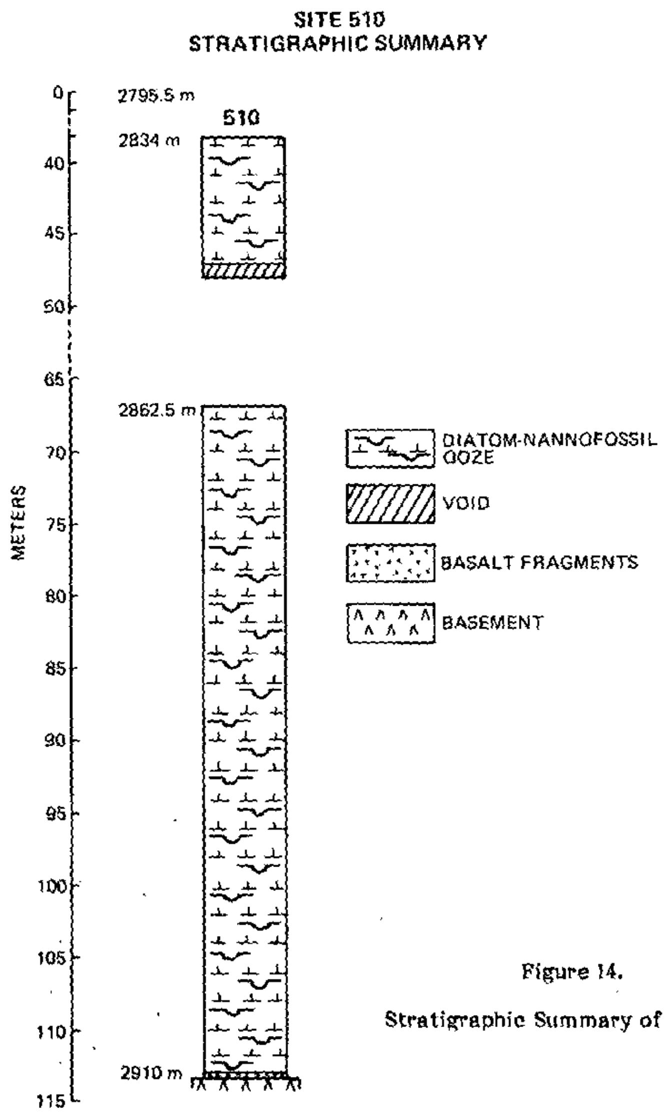

Figure 14.

Stratigraphic Summary of Site 510.

SITE REPORTS

Leg 71

Co-chief scientists W. Ludwig and V. Kashenianikov

Site 511 AB-1B) Lat: 51°00.28'S
Long: 46°58.3'W
Water Depth: 2602 m

Hole 511 was drilled to a depth of 632 meters sub-bottom on the Falkland Plateau. The section drilled consisted of the following six units:

1. 3 m of siliceous ooze and thin foraminiferal oozes of Pliocene to Recent age.

2. 192 m of diatomaceous ooze and nannofossil diatomaceous ooze spanning the Paleocene to Early Oligocene.

3. 14 m of calcareous ooze and zeolitic foraminiferal ooze of Late Campanian-Lower Maestrichtian age.

4. 203 m of zeolitic clay and claystone with intercalations of nannofossil claystone ranging from Coniacian to Campanian-Lower Maestrichtian in age.

5. 80 m of claystone, nannofossil claystone and nannofossil chalk of Early Albian to Middle Santonian age.

6. 134 m of petroliferous mudstone and nannofossil mudstone of Neocomian to Aptian age.

Drilling was terminated at the 4.1 s penetration limit imposed by the Safety Panel. Two lowerings of the downhole temperature probe gave an estimated heat flow value of 75.37 mW/m^2 (1.8 HFU). The drilling results confirm the continuity of the chronostratigraphic units of the Ewing Bank into the basin province of the Falkland Plateau. The microfossils in Unit 2 provide temporal control since they can be correlated with lower latitude zonations and the New Zealand stages.

Site 512 Lat: 49°52.19'S
Long: 40°50.71'W
Water Depth: 1843.9 m

Site 512A Lat: 49°52.17'S
Long: 40°50.71'W
Water Depth: 1844 m

Two holes were drilled at Site 512 on the Falkland Plateau. The first (512) was piston cored to 78 m sub-bottom while the second (512A) was washed to 78 m and then rotary-drilled to 90 m sub-bottom. Two units were recovered in Hole 512:

1. 930 cm of ice-rafted sand and gravel of Plio-Pleistocene age.

2. 77 m of diatomaceous ooze, diatomaceous and siliceous nannofossil ooze and siliceous nannofossil ooze of Middle to Late Eocene and Early Late Miocene age.

Only one core was obtained from Hole 512A and this had the same lithology as the lowermost interval cored in Hole 512. Drilling was terminated in Hole 512A due to sea conditions. The site was abandoned after five days of persistent current and long period swells which prohibited drilling followed by a forecast of worsening weather.

Site 513 (AB-4B) Lat: 47°34.99'S
Long: 24°38.4'W
Water Depth: 4381m

Hole 513 was cored to a sub-bottom depth of 104 m and Hole 513A was cored to basement at a sub-bottom depth of 387 m. We recovered a total of 47 cores and four lithologic units. Unit 1 consists of 180 m of muddy diatomaceous ooze of Middle Miocene to Recent age. Unit 2 is 53.9 m of Lower Miocene to Upper Oligocene muddy diatomaceous nannofossil ooze and diatomaceous nannofossil ooze. Unit 3 is 145.5 m of nannofossil ooze ranging in age from Upper to Lower Oligocene with a white chert bed at the base. Unit 4 consists of 6 m of fine-grained phyric basalt interpreted to be basement. Siliceous microfossils indicate recovery of a unique Quaternary to Late Oligocene sequence containing almost all biostratigraphic zones. Middle Miocene is found in only one core, and an apparently continuous Early Miocene-Early Oligocene sequence is observed in 21 cores.

Data from this site documents fluctuations in the position of the Polar Front. It provides an excellent opportunity to calibrate zonal schemes of different siliceous groups, to correlate temperate and subtropical zonations, and to investigate climatic changes and oceanic subsidence.

Site 514 (AB-4A) Lat: 46°02.8'S
Long: 26°51.3'W
Water Depth: 4322 m

Site 514 was cored with the hydraulic piston corer to 151 m sub-bottom through Pliocene to Quaternary diatomaceous clays and oozes. These were divided into three subunits:

1. 130.3 m of diatomaceous clay and muddy diatomaceous ooze.

2. 7.3 m of mud and nannofossils and ooze.

3. 13.2 m of diatomaceous mud.

Siliceous microfossils permit recognition of almost all diatom and radiolarian zones except in one gap in the Middle Pliocene. Paleomagnetic measurements detected almost all epochs and events and permit correlation with siliceous fossil zonations. Mixed siliceous and calcareous fossils trace the relative position of the polar front and its migration with time. Drilling was halted due to rough sea. We consider Leg 71 highly successful, despite time loss on sites due to weather and/or sea conditions.

Leg 72

Co-chief scientists P. Barker, R. Carlson and D. Johnson report:

Site 515 (AB-9) Lat: 6°14.3'S Long: 26°30.2'W Water Depth: 4265m

Hole 515 was rotary drilled and washed to 55m, then terminated when the pressure core barrel jammed in the bottom hole assembly. Hole 515A was HPC'd to 107.9m with a recovery of 89%. Hole 515B was washed to 94.9m, then rotary drilled to 636.4m with a 79% recovery. The following units were recovered:

Unit 1. 180m of gray-brown terrigenous mud of Quaternary to Early Pliocene to Lower Miocene age, with occasional nannofossil- and foraminifer-rich layers in the upper part.

Unit 2A. 351m of dark greenish gray biosiliceous mud and mudstone of Middle Miocene to Early Miocene or Late Oligocene age with occasional nannoplankton- and rare foraminifer-rich horizons.

Unit 2B. 84m of dark greenish gray terrigenous mudstone of Early Miocene and/or Late Oligocene age containing only traces of siliceous microfossils. This unit is locally altering to chert.

Unit 3. 21m (minimum) of Early Eocene greenish gray calcareous zeolitic mudstone.

Site 515 was chosen to study the onset and variability of the flow of Antarctic bottom water through the Vema channel into the Brazil Basin. The 20-25Myr hiatus at the base of the section straddles the conventionally assumed Eocene/Oligocene boundary onset of Antarctic bottom water production and corresponds precisely to a sharp and strongly discordant acoustic reflector which extends throughout the Brazil Basin. The overlying sediments are fine-grained and show a high average rate of sedimentation, but were all deposited under a high energy bottom current regime. The indications of variability are not the same throughout the section (for example, a significant carbonate variation may be present for only the past 2Myr.) and some criteria, such as grain size, radiolarian and diatom stratigraphy, ecology and magnetic fabric, await shore lab study. However, the site shows distinct promise for investigation of Antarctic bottom water history.

Site 516 (AB-6) Lat: 30°16.59'S Long: 35°17.11'W Water Depth: 1313m

We successfully completed HPC and rotary drilling operations at Site 516 (AB-6) on the upper flanks of the Rio Grande Rise and met essentially all objectives. Two HPC holes (516 and 516A) penetrated to 183m subbottom with high core recovery (85 percent) and replication of the section in the upper 70m. Holes 516B, 516C, 516D and 516E were drilled to conduct instrument development tests and heat-flow measurements and would have continued as rotary holes except for weather and bit loss problems. Rotary drilling in Hole 516F continued to 1270.6m subbottom and recovered a virtually complete sedimentary sequence down to basal sediments of Santonian/Coniacian age (approximately 80Myr BP). The total drilling time for this single-bit operation was 157.4 hours, extending by 35.8 hours the previous record for the lifetime of a DSDP drill bit.

The stratigraphic succession recovered was almost entirely calcareous and virtually complete from the recent to the basal sequence of Santonian/Coniacian age. Excellent continuity was obtained across the Cretaceous/Tertiary, Paleocene/Eocene and Eocene/Oligocene boundaries. The Paleocene sequence was remarkably complete. Shipboard paleomagnetic

...... on over 500 samples yielded sharp polarity transitions down to anomaly 33/34. The excellent paleomagnetic and biostratigraphic continuity will qualify Site 516 as an appropriate stratigraphic type section for the South Atlantic. Measurements of sediment physical properties, including P wave velocities, were made on over 400 samples. These, together with extensive multichannel seismic data around the site, allow a detailed comparison between the acoustic record and the lithostratigraphic succession at this site. The 3.5 kHz PDR provided subbottom penetration to 70m which will be of value in interpreting the shallow HPC section. The mid-section dome reflectors coincide with a zone of diagenesis and recrystallization in middle to late Eocene limestones interbedded with volcanogenic turbidites and ash layers absent elsewhere in the section. The base of Hole 516F included calcareous volcanogenic sediments, hydrothermally altered basalt and two or more relatively fresh basalt flow units. Excellent prospects exist for isotopic dating of the basalt and detailed geochemical analysis of the flows and associated alteration products. Fragments of bryozoans, coralline algae and mollusks are present in the interstices of a brecciated zone at the top of the flow units, suggesting submarine eruption near the photic zone, thus providing constraints on the early subsidence history of the rise.

Site 517 (AB-7) Lat: 30°56.81'S
Long: 38°02.47'W
Water Depth: 2963m

Site 517 (AB-7) was cored on the west flank of the Rio Grande Rise to a depth of 48.4m subbottom using the hydraulic piston corer before adverse weather caused drilling to be terminated. The core quality was poor in the upper 10 meters, but improved downward. The sediments consist of calcareous ooze which extends to mid-Pliocene in age with no hiatuses, slumping or reworking. Downhole fluctuations in planktonic foram dissolution and benthic foram assemblages show promise for high resolution oxygen isotope studies of water mass variability. The benthic forams also suggest Antarctic bottom water shallowing during the Pliocene.

Site 518 (AB-8C) Lat: 29°58.42'S
Long: 38°08.12'W
Water Depth: 3944m

One hole was drilled at Site 518 (AB-8C) on the east flank of the Vema Channel in the Antarctic bottom water-North Atlantic deep water transition zone. HPC coring reached 72m subbottom and terminated in stiff terrigenous muds and marly oozes of early Miocene age (18 to 19 Myr.). Four hiatuses comparable to those found at Sites 357 and 516 near the crest of the Rio Grande Rise were encountered. High amplitude carbonate fluctuations extend throughout the Pleistocene. Diverse benthic forams show potential as water mass indicators or may reflect selective dissolution.

SHIPBOARD SCIENTIFIC STAFFING

Leg 72

P. Barker	Co-Chief Scientists	UK	Univ. of Birmingham
D. Johnson		USA	W.H.O.I.
R. Carlson		USA	Texas A & M Univ.
W. Coulbourn	DSDP Staff Representative/ Sedimentologist	USA	S.I.O.
L. Gamboa	Sedimentologist	USA	L-DGO
U. Melo	Sedimentologist	Brazil	Cidade Universitaria
A. Shor	Sedimentologist	USA	L-DGO
C. Pujol	Paleontologist (forams)	France	University of Bordeaux
L. Tjalsma	Paleontologist (forams)	USA	Cities Service
P. Cepek	Paleontologist (nannos)	FRG	Bundesanstalt fur Geowissenschaften und Rohstoffe
N. Hamilton	Paleomagnetist	UK	University of Southampton
A. Suzyumov	Paleomagnetist	USSR	Inst. of Oceanology
W. Walton	Physical Properties Specialist	USA	Cornell University

Leg 73

K. Hsu	Co-Chief Scientists	Switz	Geologisches Institute der E.T.H.
J. LaBrecque		USA	L-DGO
K. Pisciotto	DSDP Staff Repesentative/ Sedimentologist	USA	SIO
A. Karpoff	Sedimentologist	France	Institut de Geologie
J. McKenzie	Sedimentologist	Switz	Geologisches Institut der E.T.H.
H. Weissert	Sedimentologist	USA	Univ. of S. California
A. Gombos, Jr.	Paleontologist (diatoms)	USA	Exxon Prod. Res. Co.
S. Percival	Paleontologist (nannos)	USA	Mobil Oil Corp.
R. Poore	Paleontologist (forams)	USA	USGS Menlo Park
R. Wright	Paleontologist (forams)	USA	Florida State Univ.
N. Peterson	Paleomagnetist	FRG	University of Munich
L. Tauxe	Paleomagnetist	USA	L-DGO
P. Tucker	Paleomagnetist	UK	Edinburgh University
M. Carman, Jr.	Igneous Petrologist	USA	University of Houston
E. Schreiber	Physical Properties	USA	Queens College (CUNY)

Leg 74

T. Moore	Co-Chief Scientists	USA	U.R.I.
P. Rabinowitz			L-DGO
P. Borella	Staff Representative/ Sedimentologist	USA	S.I.O.
D. Futterer	Sedimentologist	FRG	U.Kiel
A. Lever	Sedimentologist	U.K.	U. of East Anglia
G. Duee	Sedimentologist	France	Inst. of Sc. & Tech.U.
N. Shackleton	Isotope Specialist	U.K.	U. Cambridge
A. Chave	Paleomagnetist	USA	S.I.O.
G. Lohmann	Paleontologist (forams)	USA	W.H.O.I.
A. Boersma	Paleontologist (forams)	USA	L-DGO
H. Manivet	Paleontologist (nannos)	France	Lab. of Palynology BRGM
S. Richardson	Igneous Petrologist	USA	M.I.T.
S. O'Connell	Igneous Petrologist	USA	W.H.O.I.
K. Kleinert	Physical Properties Specialist	FRG	U. Of Tubingen

Leg 75

W. Hay	Co-Chief Scientists	USA	R.S.M.A.S.
J. Sibuet		France	C.N.E.X.O.

Leg 76

R. Sheridan	Co-Chief Scientists	USA	U. Delaware
Undecided			

Leg 77

R. Buffler	Co-Chief Scientists	USA	U.T.M.S.I.
W. Schlager		USA	R.S.M.A.S.

Leg 78

B.Biju-Duval	Co-Chief Scientists	France	Inst.Fran.du Petrole
C. Moore		USA	U.C. Santa Cruz

IPOD AVAILABLE DATA*

Introduction

The dissemination of geologic data gathered by deep-sea drilling is a primary function of the Deep Sea Drilling Project (DSDP). The Initial Reports of the Deep Sea Drilling Project, a series of volumes published by the U. S. Government Printing Office, is the primary publication of DSDP. Space limitations however prevent the Initial Reports from including all of the observational data. It has been necessary to develop other methods of making this data available to the scientific community. The Information Handling Group (IHG-DSDP) has taken the responsibility of developing a coordinated, automated Master Data file with associated computer software to process, store, and retrieve DSDP data in a useful form. A series of informal specific memoranda entitled "Data Data" contain more detailed descriptions of the procedures and capabilities of the IHG. They are obtainable by writing to the group at DSDP.

A Sample Distribution Policy has been adopted by DSDP (approved by the National Science Foundation, September, 1976) which restricts the release of scientific data gathered aboard D/V GLOMAR CHALLENGER to those immediate members of the respective shipboard scientific party for a 12-month period following completion of the cruise. This policy excludes the Preliminary Report on Underway Data, containing only track charts and data indexes which has immediate unlimited distribution. (If a data request costs more than $50.00, reimbursement for expenses only may be charged).

Physical Properties and Other Quantitative Core Data

All the quantitative data are processed through a series of data reduction programs. Before a file is declared clean (in an ALGOL-readable format), the data is scanned for points that are clearly in error. The data reduction programs also convert the standard DSDP labeling notation to a sub-bottom depth in meters in order to provide a more readily interpretable location for the sample.

MUDPAK is an extremely flexible graphics program which is most useful for displaying and comparing sets of coordinated data against a common depth axis. MUDPAK can make a composite plot of curves both from individual data files as well as the superimposition of like parameters measured by different methods. (Requests for quantitative data should be addressed to Barbara Long, Data Resource Coordinator.**

Aids to Research

In addition to the filling of requests for prime data, the IHG is developing secondary tools to assist researchers in finding materials relevant to their studies. Two of these are discussed below.

The Guide to DSDP Cores is a summary of (guide to) the core material and available information that is published in the Initial Reports. Thirty categories of data have been established in which to select relevant information. An online (computerized) search system to the Master Guide File, GUIDESEARCH, is available for formulating online searches. The guides are available in microfiche. Copies of GUIDESEARCH can also be obtained for individual use (on magnetic tape). Requests for a list of cores per specific criteria through use of GUIDESEARCH should be addressed to Lillian Musich, Geologist.** Inquiries for documentation describing the syntax used in GUIDESEARCH should be addressed to Peter Woodbury, Principal Programmer/Data Manager**.

Computer Keyword Searches of DSDP Subsequent Investigations and Related Publications

A computer-generated Keyword Index has been developed by the DSDP Information Handling Group to retrieve information relating to current research on core material after an initial shipboard description has been prepared. The Index aids in planning future investigations by enabling scientists to know what studies are currently in progress. This information will help in preventing duplication of research. The data base is constructed from the sample request and bibliography files of DSDP, and is updated once a year. The DSDP Information Handling Group maintains computer data files pertaining to investigations on DSDP core sample material and publications that result from these investigations. Once a year we update and produce on microfiche a keyword index of these investigations and publications. The current index contains data from 1400 investigations and 1100 publications.

We have recently completed a program which allows a search of our two Keyword Index data files (one file for subsequent investigations and one file for published papers) to find the occurrences of selected keywords linked to given site numbers.

This new search capability will allow us to answer questions such as a typical one we received from a visiting scientist:

"Who received ash samples from Site 173 to do trace element analyses or age dating work?"

An example of part of the results of the computer search on this request is listed below. We searched our subsequent investigation file for any occurrences of four keywords linked with Site 173, e.g.:

Keywords	Site Number
Sediment - volcanogenic	
Rock - pyroclastic	Site 173
Age - absolute	
Chemical composition	

KEYWORD SEARCH EXAMPLE

NINKOVICH, DRAGOSLAV, 1977A.
INVESTIGATION TITLE: MINERALOGICAL AND CHEMICAL ANALYSIS OF VOLCANIC ASH LAYERS IN THE NE PACIFIC DEEP-SEA SEDIMENTS, FOR A STUDY OF PROCESSES OF DIAGENESIS AND CHEMICAL ALTERATION OF THE ASH SINCE THE OLIGOCENE.
CHEMICAL COMPOS
SED-VOLCANOGENIC
ROCK-PYROCLASTIC
SITE 173

SACHNO, V. G., 1976.
INVESTIGATION TITLE: PETROLOGO-GEOCHEMICAL INVESTIGATIONS OF THE PACIFIC OCEAN EFFUSIVE FORMATIONS AND CORRELATION OF THE MAGMATIC ACTIVITY IN THE OCEAN AND MAINLAND. METHODS: ATOMIC ABSORPTION, X-RAY SPECTROSCOPSY, INFRA-RED SPECTROSCOPSY, GAS CHROMATOGRAPHY, OPTIC MICROSCOPSY.
CHEMICAL COMPOS
SITE 173

SARNA-WOJCIGKI, ANDREI M., MEYER, CHARLES E.
RUSSEL, PAUL C., 1978.
INVESTIGATION TITLE: CHEMICAL AND PETROGRAPHICAL ANALYSES TO ESTABLISH TEPHROCHRONOLOGICAL CORRELATIONS BETWEEN SAMPLES OF VOLCANIC ASH AND ON-LAND ASHES IN CALIFORNIA. SEPARATED GLASS WILL BE ANALYSED BY ELECTRON MICROPROBE, NEUTRON ACTIVATION, AND X-RAY FLUORESCENCE ANALYSES TO DETERMINE CONCENTRATIONS OF MAJOR, MINOR, AND TRACE ELEMENTS. PHYRIC MINERALS WILL BE IDENTIFIED AND ABUNDANCE COUNTS MADE. ASH CHARACTERISTICS WILL BE COMPARED WITH CHARACTERISTICS PREVIOUSLY DETERMINED FOR ON-LAND ASHES IN THE WESTERN BORDERLAND OF THE COTERMINUS U.S.
CHEMICAL COMPOS
ROCK-PYROCLASTIC
SED-VOLCANOGENIC
SITE 173

(Index requests should be addressed to Trudy Wood**, requests for core samples should be addressed to the Curator**.

DSDP Core Photographs

The west and east coast core repositories of DSDP each maintain a complete collection of black and white and color photographs of all cores retrieved by GLOMAR CHALLENGER. Legs 1 through 44 are archived as prints. Legs 45 onwards are archived as 35 mm slides. They are available for viewing at any time at the repositories.

Individual copies of prints or slides are available upon request to the Associate Chief Scientist, Science Services**.

---

*This contains information about the availability of DSDP data and how to obtain it. For a detailed discussion of the history and management of DSDP data, see Rosenfeld, M.A. and Davies, T.A., 1978, "Management of Deep Sea Drilling Information," JOIDES Journal, Vol. IV, No. 2, p. 67-84.

**Deep Sea Drilling Project, A-031
University of California at San Diego
La Jolla, CA 92093

DEEP SEA DRILLING PROJECT—DATA BASE STATUS

GENERIC DATA FILE	COMPLETE THROUGH LEG	STORAGE MEDIUM	COMMENTS
CARBON CARBONATE DSDP Shore Lab	1-65	FT	No carbonate for Leg 46: Leg 60 and Leg 62 are not complete.
CHEMISTRY Water content/ Shipboard Lab	1-70	FT	No chemistry for Leg 41, 69
DEPTHS From underway recording	1-70	FT	
GRAIN SIZE (Sand/Silt/Clay) DSDP Shore Lab	1-66	FT	No grain data for Leg 16. Legs 64 and 65 grain size are being processed.
G.R.A.P.E. (Gamma Ray Attenuation Porosity Evaluator) Points taken on board. Data processed and edited onshore.	1-44, 47-52, 58, 66-68, 70-71	FT	G.R.A.P.E. data were not collected on Leg 46:
SCREEN Output from JOIDESSCREEN. Computer-generated lithological classifications. Includes basic composition data, average density, and geologic age of classified layer.	1-44	T	
SMEAR SLIDES Shipboard observations	1-44	FT	
SONIC VELOCITY On board ship-Hamilton Frame method	2-70	FT	There are no SONIC data for Legs 1 and 13.
VISUAL Shipboard observation	1-44	FT	

UNDERWAY DATA: Recorded on board between drilling sites. The underway data is processed jointly by DSDP and the SIO Geologic Data Center.

Bathymetry	Legs 07-09 13-56 61-69	FT	
Magnetics	Legs 07-09 12-69	FT	
Navigation	Legs 03-69	FT	
Seismic	Legs 1-70	F	

T=magnetic tape
F=microfilm

REPORT FROM IPOD SITE SURVEY MANAGEMENT DATA BANK

The following data have been received:

I. "IPOD Drilling on the Continental Margin of Eastern North America," by R.Sheridan, J.Grow and J.Ewing.

II. Subsidence History, Shaping and Sedimentary Processes at Northwest African Passive Continental Margin - Drilling Proposal for Gibraltar-Cape Verde Transect during IPOD Leg 79, Feb-April 1981," by M.Sarnthein, K.Hinz, U.von Rad, G.Wissman and E.Seibold.

III. "Drilling in the Norwegian Sea during IPOD Extension Drilling Proposals - A Summary," by K. Hinz.

IV. "Drilling on Northeast Atlantic Margins during IPOD Extension," by D.Roberts and L.Montadert.

V. Computer tapes of FRED H. MOORE Cruise 01, Legs 2-7, South Atlantic and Caribbean: magnetics, navigation and topography. From UTMSI.

VI. 4 full-size multichannel profiles from Walvis Ridge, taken during BGR Site Survey, 1978. From K. Hinz.

VII. Sediment thickness maps and anomaly identifications: bathymetry maps of Leg 73 (Mid-Atlantic Ridge sites), from UTMSI.

VIII. Bathymetry maps, sediment thickness maps and depth-to-basement map of Leg 75 (Angola Basin sites), from UTMSI.

IX. Computer tape of navigation/bathymetry of FRED H. MOORE cruise 1, Legs 5 and 6, from UTMSI.

X. Detailed bathymetry, mosaics, core data: CHARCOT 1979 data in region of Leg 74 drilling, from H. D. Needham (CNEXO)

XI. Safety Panel sheets for additional Leg 75 sites: from J. C. Sibuet (CNEXO).

XII. Report "Status of Seismic Data from FRED H. MOORE Southwest Atlantic Legs," from UTMSI.

XIII. 3 charts: bathymetry, sediment isopach and acoustic basement of Cape Verde - Canary Basement. Draft versions, from A. Bullard, NORDA.

XIV. 2-part isopach map of sediments of Pacific Ocean Basin and Marginal Sea Basin, from W. Ludwig and R. Houtz, LDGO.

DRAFT REPORT
EXECUTIVE COMMITTEE
25-26 March, 1980-New Orleans

STATUS OF CHALLENGER OPERATIONS

I. CURRENT CHALLENGER OPERATIONS

The CHALLENGER was in the middle of Leg 72, in the Rio Grande Rise area. Leg 71, in the Falkland Plateau, in spite of bad weather conditions, drilled 3 of the 5 planned sites and was considered successful by the shipboard party.

The Port call included refurbishing the main propulsion system, drill pipe inspection and a dynamic conditioning maintenance program. Equipment is currently on board the CHALLENGER for drill string motion and strain studies. These will be conducted on an almost non-interfering basis with drilling operations.

II. FUEL

The CHALLENGER used about 1.2m. gals. of fuel last year, a year with relatively little transit.

Fuel saving programs have been initiated on board the CHALLENGER. These include taking as much fresh water as possible on board the ship and reducing fuel consumption while idling by using only one forward and one aft thruster.

The ship will top off with fuel in Santos after Leg 72. The CHALLENGER should be able to drill the next 3 Legs without having to refuel and pay the high South African prices. Port calls for later Legs have been adjusted to use U.S. ports as much as possible, since fuel costs are lowest there. In addition, a $600,000. request for supplemental fuel costs has been sent to NSF.

PCOM REPORT

I. SOUTH ATLANTIC PROGRAM

A. Leg 73 Logging Motion

Prior to the meeting, by a telex and telephone count, the EXCOM had agreed to the PCOM motion to cancel logging on Leg 73, because of the shallowness of the holes and the shortness of time.

B. Leg 74 Science Operations Plans

The EXCOM accepted the PCOM motion to log only the rotary drilled holes on Leg 74.

C. Leg 75, HPC Geotechnical Studies

The SP4 requested that a complete HPC section from one hole be made available, without being opened on the ship, for geotechnical studies. The PCOM was prepared to agree to this request provided that it was done in close consultation with the curator and co-chiefs, and that funding and sampling procedures could be worked out. This would be tried in the Angola Basin on Leg 75.

The EXCOM realized that approving such special sampling requests might bring about others. It was asked if it would be possible to put a complete geotechnical lab on board. The SP4 panel had considered this and didn't seem to think so. The EXCOM approved the PCOM motion for special handling of the Leg 75, Angola Basin Site, hydraulically piston cored material.

NORTH ATLANTIC PROGRAM

The EXCOM questioned the ambitiousness of the North Atlantic program, and the similarities of some of its objectives to EXPLORER objectives. CHALLENGER type drilling and the sites to be drilled during this program are different from those of the EXPLORER. The Passive Margin Panel has had a long standing objective to penetrate the deeper sediments on rifted margins. If these objectives are met in the current phase of drilling they will be enhanced by EXPLORER recovery.

ENA-1 is near Site 391 but with slightly shallower depth to basement. Because the sites are so close, it was asked if a drilling bit, rather than a coring bit could be used for the upper section of this site. This might increase the possibility of reaching the lower section where the primary objectives are. The current PMP plan is to HPC the upper section. The reports of Site 391 could be examined to determine which regions of the deeper section need to be cored in ENA-1.

III. OTHER BUSINESS

A. The Rock Eval

The Rock-Eval uses a pyrolysis technique to obtain information about the nature of hydrocarbons in the sample. The instrument is always on board the CHALLENGER, but the operator needs to have some proficiency in interpretation of the results. A good organic geochemist can learn how to operate the equipment fairly quickly. However, the operation is time consuming and if the instrument is to be used, two organic geochemists or, alternatively, an organic geochemist and a trained operator should be on board.

This instrument has been available for about 5 years and is widely used in the oil companies. Debyser was asked to give DSDP a list of companies that have a Rock-Eval. This might increase the chances of finding experienced people to operate the Rock-Eval on board the CHALLENGER.

B. Micro Paleo Reference Centers

Saunders in Basel had not been contacted to see how the motion to increase the number of micropaleo reference centers from 5 to 8 would affect the work that he has done. The status of the reference centers was not clear. The PCOM motion to ask JOI Inc. to submit a proposal to NSF for funds to prepare microfossil slides and establish a micropaleoreference center at the Smithsonian Institution was tabled.

OCEAN DRILLING IN THE 80's

I. 81-83 CHALLENGER PROPOSAL

A. Background

The final version of the 81-83 CHALLENGER proposal was compiled at the JOIDES PCOM meeting in late February and sent to DSDP for printing, submittal to NSF, and distribution. Copies of the proposal were distributed prior to, and during, the meeting.

The new proposal presents the program more coherently but contains basically the same science as the previous proposals. There is still a strong emphasis on the use of the hydraulic piston corer and the inclusion of a wide spectrum of scientific interests.

B. Program Interest

Each member was asked to state the general feeling of his country or institution toward the proposal. Everyone felt there was support for the proposal, particularly because of the strong community participation in planning the program.

C. Funding

With the uncertainties of the reviewer's response and cuts in the '81 budget, the possibility of funding the program is not very encouraging. Nevertheless, the strong international interest was thought to be of importance particularly, if the member countries could increase their annual contribution. The NSF will send an official letter to the IPOD countries asking for letters of intent to participate in the program.

Several U.S. government agencies other than the NSF have interests in the science proposed in the 81-83 CHALLENGER extension. These areas of interest include:

1) Paleoclimate studies, of interest to NOAA and other groups studying climatic change

2) Geotechnical studies, of interest to groups studying hazardous waste disposal

3) Downhole experiments, of interest to groups studying in situ and/or obtaining real time readouts of earth processes

It was suggested that these groups be contacted for funding support.

D. Discussion

A suggestion was made that the 81-83 program might be funded for 2 or 3 months per year over a period of several years. It was thought this might be helpful for the community utilizing the HPC cores, which could then build on their broadened base of knowledge over a longer time period.

The general response to this suggestion, however, was not favorable since more than HPC'ing is planned for the 81-83 program and the mechanics of running a part-time DSDP may be too difficult.

II. OCEAN MARGIN DRILLING

A. Background

The draft report of the Houston meeting was distributed prior to and during the EXCOM meeting. The final report should be ready in about a month and will be formally transmitted to the NSF to provide a basis for further planning.

At the IPOD-NSF meeting in Washington, several of the member countries expressed an interest in participating in the OMD program, including the planning and technical developments.

Discussion/Action

Many concerns for funding and planning both the 81-83 CHALLENGER and OMD programs were discussed. When the FUSOD plans were being proposed an overlapping CHALLENGER-EXPLORER program was presented, and this is still considered to be a desirable operational mode for the current plans. With a view toward possible implementation of the dual program, the EXCOM decided that JOIDES, in conjunction with NSF, should make contact with scientists from other countries which may be interested in joining an ocean drilling program for the 1980's. JOIDES should arrange meetings of those concerned to discuss the scientific objectives and conditions of collaboration.

In the discussion of new members, it was firmly reasserted that only full membership be allowed. If affiliate membership were permitted, the current IPOD members might opt for the lesser fee alternative and the available funds might actually decrease. However, small countries joining to form a unit, and entering as a single member, e.g., Scandinavia, Switzerland-Italy and Australia-New Zealand might be considered.

Two sub-committees were formed to encourage new country membership in JOIDES. One committee was charged with assembling scientific oceanic drilling information past, present and future, particularly for presentation at the IGC. The other committee was charged with determining who the likely new members might be and contacting key persons.

Scientists from many non-IPOD ountries have participated in the program, and global science has benefited. The program is now faced with the possibility of discontinuing because of the lack of funds and it is hoped that other countries might be able to support the program. Increased international participation will also increase the areas where drilling may be conducted. Because the trend of the Law of the Sea conferences has been to restrict access to territorial waters for scientific research, increased international participation in the drilling program might help to reverse this trend.

DRAFT REPORT
PLANNING COMMITTEE
25-28 February, 1980-Washington, D.C.

NORTH ATLANTIC PROGRAM

I. Introduction

The PCOM heard presentations from panel members about the North Atlantic Program. Extensive discussion developed. The information will be given in this section of the JOIDES Journal rather than under the appropriate panel report. Table I gives an abstracted listing of North Atlantic site information by Leg.

II. Leg 76 (Blake-Bahama Basin)

Leg 76 will be drilled in the Blake-Bahama Basin area. Three sites are proposed ENA 1, 5, and 7:

ENA-1 is located in the Blake-Bahama Basin east (seaward) of the Blake Spur Anomaly. The objective is to recover oldest sediment and sample basement in the Jurassic quiet zone. Discussion developed concerning the feasibility of successfully penetrating that depth of sediment at that water depth. Results of drilling nearby Hole 391 indicate a high probability of success.

ENA-5 is located on the Blake Plateau in 2200m of water. An unconformity, possibly associated with A_u, occurs at about 700m. The objective is to examine the sediments above and below the unconformity.

ENA-7 is located on the Blake outer ridge at 3150m water depth. The prime objective here is to use the Pressure Core Barrel to sample the gas hydrate. Safety approval of this site will depend on a rigorous science program and a working Pressure Core Barrel. The test will be conducted where there is no bright spot below the BSR. A summary of the proposed gas hydrate experiment was distributed prior to the PCOM meeting.

II. LEG 77 (Florida Straits)

Leg 77 will be drilled in the Florida Straits area. Two sites are proposed, ENA-12 and 13.

ENA-12, in the Florida Straits is planned to penetrate lower Cretaceous and upper Jurassic sediments (probably limestone) that are traceable over the entire Gulf of Mexico. Sampling this reflector will enable the precise age and paleoenvironment of this part of the seismic stratigraphy to be determined. This information is important in understanding the role of this area in the rifting of the Atlantic.

ENA-13 is located slightly northeast of ENA-12. It will be drilled to get continuous cores of the Tertiary and Cretaceous sediments, investigate the age and cause of hiatuses related to the origins of the Florida Current, and study the exchange of water between the Atlantic Ocean and Gulf of Mexico.

Political and environmental concerns about drilling ENA-12 and 13 were expressed. Apparently there are no political problems with drilling in this area. The stiff 1-2 knot currents may pose a problem. DSDP has said that strong currents shouldn't cause difficulty as long as they are steady or change gradually over a period of time. Not enough current data was available at the PCOM meeting to determine how extensive the current problem would be. Some current information will be collected during the site surveys.

IV. LEG 78 (Caribbean)

Three sites of equal priority were proposed for the Caribbean Leg, CAR-1, 3, and 7.

CAR-7 is planned to be drilled on a basement high in the Yucatan basin, with the intention of dating the oldest sediments to provide information on Caribbean reconstructions. The validity of drilling basement highs to determine the age of the oldest sediment was questioned.

CAR-3 is located on a high fault block in the Venezuela Basin. A continuous NW-SE change in the basement reflectors occurs in the Venezuela Basin. The NW part shows a strong continuous reflector. In the SE, no reflector is present, and the basement is more characteristic of rough oceanic crust. The major objective at this site is to date the lowest sediments and penetrate the Venezuela Basin crust. Washing through the upper portion of the sediments was discussed as a time-saving tactic.

CAR-1 is located on the toe of the Barbados accretionary wedge, with the objective of penetrating through the subduction complex, the underlying megathrust, and into the lower plate along the Antilles arc. There is also a plan to place a recording seismometer in this hole.

The Caribbean Working Group proposed that Leg 78 begin in Belize (Honduras) and end in Barbados. This would decrease transit times and allow drilling of the three proposed sites.

The proposed sites were thought to fall into two categories, those of regional (CAR-1) and those of topical (CAR-3, 7) interest. On this leg active margin interests are in competition with passive margin interests, and therefore the prioritization of the sites was done by the PCOM.

It was stressed that sufficient time be allotted to achieve the first priority objectives. The PCOM felt that CAR-1, the Barbados toe drilling, be given higher priority than CAR-3, the Venezuela Basin site, and that both have higher priority than CAR-7, in the Yucatan Basin.

Nassau and Port of Spain had initially been proposed as possible ports. Fuel costs are less at U.S. ports so San Juan and Miami were also suggested. In addition, sometime between Legs 76 and 78, a 10 day mandatory dry dock will occur and this will be done in a U. S. port.

V. LEG 79. (Mazagan or Galacia)

The first choice of sites for this leg is on the Mazagan escarpment. If these are unacceptable for safety reasons, alternative Galacia sites are proposed. Three sites are proposed for the Mazagan escarpment, MAZ-1, 2, and 3.

The Mazagan escarpment consists of a series of fault blocks. An E-W transect is planned. MAZ-1 will penetrate a slump mass on the fault scarp and into Jurassic (Callovian) sediments. Oxfordian age rocks have been dredged from this scarp. MAZ-2 will be drilled in the thick sediment wedge on the down-dipping part of a rotated fault block, recovering syn and post-rift sediments. MAZ-3 will be drilled on the more thinly sedimented high of a fault block and penetrate basement.

VI. LEG 80 (Biscay or Goban Spur)

Leg 80 will be drilled on the Biscay Margin, with alternative sites on the Goban Spur. Three sites are proposed:

ARM-1 is planned to penetrate the thick sediment wedge in the down-tilted part of the fault block, somewhat similar to MAZ-2. In the preliminary safety review the PMP was asked to move this site more toward the tilted fault block. More surveys will be done in the area.

ARM-2 (west of ARM-1) is planned to penetrate through the sediment pile (including black shales) into the first ocean crust. ARM-3 is located on a fault block east of ARM-1 and will be drilled to compare the mid-slope development of the rifted margin with that further downslope (ARM-1) Black shales may also be encountered here.

Discussion developed concerning the importance of drilling at least two of the tilted fault blocks to examine the differential tilting and rates of tilting over time.

VII. LEG 81 (Rockall)

Three sites along an E-W transect are also proposed for Rockall, ROCK-1, 2, and 3. ROCK-3 will be a reentry site because of weather conditions and is planned to penetrate through the NW dipping reflectors and syn-rift clastic sediments. ROCK-2 is planned to penetrate a thinly sedimented basement high. ROCK-1 is proposed to penetrate NW dipping clastic subbottom dipping reflectors and possibly oceanic crust.

VIII. LEG 82

Two sites are planned for Leg 82, ENA-3 and 8.

ENA-3. The and underlying seismic reflections pinch out at Site 105, and therefore they are difficult to correlate. ENA-3 will be drilled on the continental rise off of Delaware, with the objective of continuously coring the prestratigraphy to basement, and possibly sampling the J_1 reflector which is probably pre-Oxfordian. This site is also part of the proposed Explorer transect, and the information will tie in with the COST B-3 well.

If full penetration isn't reached here, important information will be lost, but it was still thought to be worthwhile to attempt this drilling because the mid-late Cretaceous was poorly cored in this area. Site 105 did not continuously core the A_u reflector, and it is important to examine that horizon. HPC'ing the upper sediments will also allow studies of turbidites, mud waves, and other Tertiary/Pliocene material.

ENA-8 is on the Newfoundland ridge in relatively thin sediments. A single bit hole will be drilled to sample sediments above and below the mid-Cretaceous unconformity, determine the origin of the Newfoundland Ridge, and provide further paleoreconstruction information. It is not known if this is a continental fragment related to the Grand Banks (such as the Flemish Caps or Orphan Knoll) or if it is an oceanic volcanic edifice possibly similar to the Walvis Ridge. The OPP also has interest in this site since it is shallow enough for Tertiary carbonates, but it isn't high on their list of priorities.

Other Sites. ENA-4 and ENA-2 are contingency sites for this leg. At ENA-4 the A reflector section of the sedimentary column is expanded. This site would be drilled to improve our understanding of stratigraphic relationships. Because of the thickened sequence it will not be possible to drill much below here and certainly not to basement. ENA-2 would be drilled to examine the A_u unconformity. It may be possible to determine the ages of Tertiary erosional hiatuses on the slope and correlate them with sea level changes. This site is near one of highest priority to the SP4 Panel for investigating slope geotechnical properties.

Changing the priority of ENA-2 and ENA-8 was discussed. The objectives of 8 were not thought by some to be as clear as 2. However, ENA-5 is similar to ENA-2 so the unconformity question may already have been addressed. Three attempts are being made to drill the Jurassic and only one to drill the Tertiary. This is partly because application of Vail's sea level curves requires a good CDP record section. The geotechnical aspects of ENA-2 are included in the 81-83 proposal. In addition, work like this will probably be done by the USGS in conjunction with lease sales.

IX. North Atlantic Geochemical Heterogeneity Transect

The Ocean Crust Panel presented a plan to drill a series of holes in the Western North Atlantic to examine the temporal and spacial distribution of what appears to be two distinctly different basalt types, indicating an enriched or depleted rare-earth element mantle source. It was asked that some of these sites be drilled during transits in the 79-81 program.

A recent CHARCOT cruise dredged the MAR and placed the boundary at or near 33°N,

TABLE I

TENTATIVE NORTH ATLANTIC PROGRAM

Leg	Site	Penetration	Water Depth	Age At T.D.	Reentry	Time (days)	Priority	Objective
76	ENA-1	1800m	4900	Bathonian (?)	Yes	28	1	Oldest Sediment
	ENA-5	500m	2200	Early Tertiary	No	10	2	Unconformity
	ENA-7	400m	3150	Late Tertiary	No	4	3	Hydrates
77	ENA-12	1500m	3050	Oxfordian (?)	Yes	28	1	Old Gulf Sediments
	ENA-13	1000m	2475	Late Tertiary	No	14	2	Hiatuses
78	CAR-1	1200	5000		No	15		Subduction Tectonics
	CAR-3	1600	5000		No	20		Venezuela Basin age & Caribbean Reconstruction
	CAR-7	600	4100		No	7		Yucatan Basin age & Caribbean Reconstruction
79	MAZ-1	1000m	3375	Callovian (?)	No	14	1	Pre-rift sediments
	MAZ-2	1000m	3525	Bathonian (?)	No	14	1	Pre-rift sediments
	MAZ-3	1000m	3500	Bathonian (?)	No	14	1	Pre-rift sediments
80	ARM-1	1200m	4400	Jurassic (?)	Yes	20	1	Pre-rift sediments
	ARM-2	1000m	4650	Aptian	No	12	2	Ocean Crust
	ARM-3	1000m	3225	Late Cretaceous	No	12	3	Mid-slope Paleo-depth & shelf conditions during rifting
81	ROCK-1	600m	3000	Paleogene	No	13	1	Oceanic Crust
	ROCK-2	300m	2600	Paleogene	No	10	1	Outer high
	ROCK-3	800m	3000	Paleogene	Yes	20	1	Syn-rift sediments
82	ENA-3	1800m	4870	Callovian (?)	Yes	28	1	Reflect or J,
	ENA-8	1000m	3225	Jurassic (?)	No	12	2	Newfoundland Ridge

approximately coincident with the Hayes Transform Fault. One sample immediately to the north had a flat to enriched REE pattern. Samples 5-10 miles to the south had depleted REE patterns.

To further study this pattern the OCP proposed drilling:

1) AT-3 and AT-4, (on 81 & 38 Myr old crust, south of the Kane Fracture Zone) previously proposed and well surveyed sites.

2) AT-13, (on 38 Myr old crust) that was originally proposed for Leg 49. Drilling this site would also extend the FAMOUS transect, and

3) 1 or 2 holes in older crust around the extension of 33° to see the direction of the geochemical pattern away from the Ridge.

Several hypotheses have been proposed to explain the observed heterogeneity , but more data is needed to develop defendable models. Drilling is necessary to explain this problem because that is the only way older crust can be sampled. The minimum program to begin to attack this problem was considered to be 2 holes. Assuming single bit sites, with 100 m of basement penetration, approximately 4 days per hole were estimated to be necessary, with a minimum of 10 days for the 2 sites.

X. Geophysical Leg - Logging Site 395

There was a plan to return to Site 395 (550 m into basement, drilled during Leg 45) to conduct a wide variety of downhole experiments and measurements. It will not be possible to organize these efforts. Therefore, the request is to return to the site in transit from Leg 78 to 79, and spend 2-3 days running a full suite of logs in the hole, and possibly include the borehole televiewer.

XI. Discussion of North Atlantic Program

A. Geochemical Heterogeneity Transect.

The geochemical heterogeneity transect was first discussed at the March 1979 PCOM meeting. At that time, it received a positive response, but the PCOM felt more data was necessary to constrain the problem. The CHARCOT was scheduled to dredge the MAR in the spring to locate the present boundary. That data was to be presented at the July PCOM meeting. Unfortunately, the cruise was delayed so there was no additional information to present in July.

The CHARCOT data was also not available at the October meeting. However, a document about the geochemical heterogeneity prepared by members of the OCP was distributed. This document and the OCP's plans were discussed. In addition, Dimitriev gave a presentation about geochemical heterogeneity in the South Atlantic.

In the discussion about the geochemical heterogeneity several varied opinions were expressed. Although the problem was thought to be significant, several PCOM members were not convinced that it was well enough defined to justify the necessary time in an already very tightly scheduled program. In light of this, the PCOM did not adjust the schedule to include time to address the heterogeneity problem.

B. Logging Site 395

Only a logging engineer and a televiewer operator would be necessary to run this program. It was suggested that the 3-days might be taken from CAR-3. CAR-3 however, has basement objectives and these should not be jeopardized. It was decided that the decision should be made in real time. This might pose a problem for the availability of the televiewer. However, Anderson has a proposal to rebuild the equipment so it wouldn't have to be loaned from AMOCO. Televiewer pictures of the Mazagan sites would also be useful, especially beneath the Oxfordian where the limestone-chert interbeds have been difficult to core in the past and recovery has been about 20%. In light of this discussion, it was decided to log Site 395 if CAR-1 takes too much time and there is no chance of completing CAR-3 or if there is enough time after completing CAR-3.

C. Passive Margin Program

The original passive margin plans for the North Atlantic program consisted of 7 legs. That time has now been reduced to 6 legs, including the Caribbean which will be 2/3's active margin interests.

In support of the passive margin plans for deep penetration, it was pointed out that hole stability is influenced by the type of sediments and the downhole conditions. At Site 105, the limestone drilling was very successful. It was recognized that if severe problems were encountered in the early legs, e.g. 76, plans for the later legs could be altered accordingly. Overall, the potential of achieving the objectives were thought to be worth the risk. The PCOM accepted in principal the general program and priorities as outlined by the PMP in their presentation.

Extensive discussion developed about the feasibility of achieving the proposed objectives. Drilling in the Florida Straits, for example, will be considerably complicated by the fast currents in that area. Almost all of the deep sites, especially the ENA sites, have objectives at the very limit of Challenger capability.

If these holes are to be cased as far as possible, an additional week may be required before significant penetration can be begun, the longer the ship is required to be on station, the greater the risk of failure. It was also pointed out that some of the sites and objectives might change in response to the safety review.

The success rate of some of the previous deep holes was reviewed.

1. Site 391 (Leg 44) was the first attempted deep hole penetration with reentry. It failed because the early model cone and casing was not strengthened well enough, and the cone sheared from the casing.

2. Reentry cones worked well on Legs 45, 46, and 47. Leg 47 at Site 398 achieved the second deepest penetration. At 3000m water depth, 1750m of sediment was cored. The sediment had a high carbonate content.

3. Leg 50 drilled 2 holes. Hole 415 failed because of highly fractured rock. Hole 416 failed because brittle flysch was difficult to drill. There was lots of caving and the hole couldn't be cleaned. In addition, there was an engineering failure because the skirt was too small so the cone caved in.

4. Off of Japan several single bit holes achieved deep penetration, by washing to 800m and then coring.

5. Site 462A in the Nauru Basin was reentered 15 times, in 5189 m. water depth.

When a reentry cone is used the bit has to be changed every 50 hours. However, the rule is not rigid. If the objective were close, eg. 300m., the bit could probably be run to the end.

It was suggested that ENA-7 be drilled first, but this also poses problems. The PCB has not been successfully operated and the success of ENA-7 is dependent upon a successful PCB. Before clathrates are drilled, it was also thought to be important, if not essential, to have a realiable temperature probe, that would allow the scientists to know in real time if the cored material was in the hydrate stability field. Such a tool is also not available. It was not clear if the equipment to do a clathrate test would be ready in time for Leg 76. The PMP also maintained that determining the stratigraphy of the oldest sediments was its highest priority. The Safety Panel was asked to review the sites as early as possible and the PCOM will review the objectives again at the July meeting.

PANEL REPORTS

I. DMP

The Downhole Measurements Panel prepared an extensive report on downhole measurements and experiments. This report stressed the need for integrated physical properties studies, described the main standard logs and special logging tools used by industry, made recommendations for improving log quality and utilization, discussed the types of recording instrument packages and deployment procedures that are possible in a borehole, listed and described downhole experiments and recordings carried out from the GLOMAR CHALLENGER between Legs 45-69, and listed related shipboard and shorebased core measurements.

Recent downhole experiments were described, particularly those carried out during Leg 69. DMP plans for the North Atlantic were discussed. These were included with the North Atlantic Program plans.

II. SP4

An ad hoc working group of the SP4 prepared a report on long range plans of the panel. This was distributed at the meeting. Specific items of importance to the PCOM were addressed. Three recommendations were made regarding the HPC:

1. Use of sonic probes rather than x-rays for rapid indication of major structures or inclusions prior to splitting. The sonic probes are thought to be quicker and safer.

2. Color Photograph the cores as soon as possible. The current practice of photographing batch sections at one time introduces a delay that may result in significant color loss.

3. Cover the cores with plastic film as quickly as possible. This will prevent drying and the efflorescence and loss of detail that accompanies drying.

The SP4 also recommended a 3 or 4 arm Dipmeter be acquired, rented or designed for DSDP drill holes. This is a device that measures rock resistivities and enables the accurate measurement of in situ bedding and fracture orientation.

A list of SP4 recommendations regarding the sedimentary petrology procedures aboard the CHALLENGER was resubmitted. These recommendations are given in Table II, JOIDES Journal, Vol. VI, No. 1, p. 63. There are 3 categories of recommendations:

1) For DSDP immediate implementation on a routine basis (either on board the CHALLENGER or on shore).

2) For DSDP implementation as soon as possible or whenever possible.

3) For non-DSDP scientist or engineer, priority implementation as soon as possible.

Almost all of the #1 items are being done except the Atterberg limits and grain densities. Most of the #3 items are also being done. Recommendation D.1.2.2 was amended to read: report layer interval velocities from cross-correlation travel time measured to 0.001S. The only conflict with implementing these recommendations is one of time and money.

The SP4 requested that 4 complete sites in the Gulf of Mexico and Atlantic Ocean be drilled using the Hydraulic Piston Core and the resulting material recovered be used initially for geotechnical, acoustical and geochemical testing. These cores should not be opened on board the CHALLENGER, but shipped to a designated stateside laboratory. After the tests are finished, all remaining materials will be sent to either the IPOD repository.

The possibility of using less than the complete core, reassembling the scientific crew for sampling after the physical properties are completed, shipping the cores, curatorial support and funding were discussed. Sangery at Cornell is taking 30 cm lengths in a geometric progression (1, 3, 7, m, etc.) from Leg 72 HPC cores, for geotechnical tests. These samples are being cut on board and shipped in a vertical position to LDGO. They will be sent to Cornell and then returned to LDGO.

It was generally agreed that the two major advantages of the HPC were its applications in high resolution stratigraphy and studying near in situ physical properties. The former has received the majority of the attention. The SP4 would prefer to have a complete section of one hole rather than parts of the four requested holes. An Angola Basin site is the first location they requested. The OPP representatives agreed that they would back such a request. If time permitted, they would like to double HPC the site anyway to insure that a complete section was recovered.

The PCOM was prepared to endorse the SP4 request for special handling of the HPC samples from Leg 75, to be done in close consultation with the curator and co-chiefs. "Prepared" was included because of concern about funding both the geotechnical tests and the sampling procedures when the tests were completed. These details should be worked out between the SP4 and the curator and Leg 75 co-chiefs.

III. IHP

A summary of the IHP minutes was distributed in the pre-meeting package. Several recommendations were made in the summary, two of direct importance to the PCOM were discussed.

At the 1977 Mexico City meeting, the IHP proposed that by October 1979, that all data bases should be completely up to date and there should be no backlog. This recommendation was strongly supported by the PCOM. This goal has not been met. Last year, the way was paved to transfer the DSDP data base to the NGSDC for long term archiving. Some files were to be shared as soon as they were checked and validated. This effort has not started due to lack of resources at both DSDP and NGSDC.

Last year with the phase down budget, this year with increased fuel costs, and with the uncertainties for the continuation of the program beyond FY '81, there is considerable concern about what will happen to the data base preparation. The data base preparation is not considered to have a real time urgency and is therefore among the first activities to be cut back when funds are limited. Yet at present, there are no detailed plans, proposals, or budgets for carrying out the necessary work during a phase down period. The preparation of the data base is dependent upon the Information Handling Group, and there is nothing to insure its continuation. It was suggested by the IHP that possibly this group should be administered and funded separately from the rest of DSDP to insure a proper phase down, and sufficient funds. However, the PCOM was reluctant to become so involved in DSDP management affairs. The PCOM asked DSDP to prepare a long term phase down plan, specifically including data management and publication.

This plan should look at the long term, beyond 3 years, including funding that the NGSDC will need. It was suggested ...

on the data management aspect of the phase down could be obtained from the IHP.

IV. SAFETY PANEL

During the last year two full Safety Panel review meetings were held. All sites for the South Atlantic Program (Legs 71-75) have been reviewed.

Fifty-three sites were approved, 5 with special precautions, 6 disapproved and 3 moved to a nearby location. In conjunction with the November meeting, a one-day seminar on gas hydrates was held. Not enough is known about hydrates to establish clear guidelines, so each case will continue to be decided individually.

Last March, the Safety Panel held a meeting to discuss various ways in which the safety review process might be made more effective. Some of the changes that have been or will be put into effect include:

1. Safety Previews. These allow site proponents to be made aware of potential safety problems, in the early stages of planning.

2. Revised Safety Check sheets. The current check sheets are often treated casually by the site proponents. They are urged to consider their information more carefully.

3. Revised Safety Manual. The old manual is out of print. It will be updated and reprinted.

4. Membership. Three new members were added to the Panel to increase the available breadth of experience and knowledge.

V. AMP.

A. Synthesis Volume

The proposed active margin synthesis volume would not just be a compilation. It is hoped that the volume would include a reevaluation of previous DSDP results by some senior scientists. The volume would include petrological geophysical, structural, etc. aspects on active margins. A letter has been sent asking about interest in the

is
s.
al,
of
it
the

volume, but as yet no one has made a committment to write a proposal for the work. The PCOM was asked to endorse the volume in hopes that JOIDES endorsement would help the volume to be produced. AGU, and possibly SEG, are interested in publishing the volume.

The synthesis volume money is available for volumes that are essentially finished, but which need extra money for publishing costs. The monies are not for research. The PCOM encouraged interested scientists to procede with the volume, but were unable to recommend financial assistance at this stage of the undertaking.

B. Recent Drilling Results.

Leg 66 was drilled off of Oaxaca and Leg 67 off of Guatemala. The Leg 67 area received an extensive seismic survey during the cruise, while the HIG downhole seismometer was in place. It may also be surveyed with a seabeam, and the Navy is going to conduct submersible dives in the area.

A serious gas hydrate problem was encountered in 3 of the 4 Leg 67 forearc holes. Thin layers of vitric sand containing hydrates were recovered at 200-300m penetration. These were interlayered with sediments devoid of hydrates, which possibly accounts for the absence of a BSR. The sediments containing hydrate are rich in organic matter of a woody nature derived from terrigeneous sources.

Three recommendations were considered to be essential in dealing with future hydrate encounters:

1. Real time temperature measurements, e.g., the possibility of a temperature probe before the bit that is capable of penetrating stiff or hard sediments.

2. In situ pressure measurements are essential if pressure from expanding hydrate must be differentiated from geopressured gas.

3. A pressure core barrel that is capable of closing on very hard sediments such as hydrates is necessary. On Leg 67 the PCB couldn't operate on non-hydrated stiff sediments.

VI. OPP

A. HPC and High Resolution Stratigraphy

Leg 68 in the Caribbean and eastern Pacific demonstrated that complete and undisturbed sequences of unconsolidated sediments could be recovered with the HPC. The OPP has adopted use of the HPC as a major element in the South Atlantic drilling program.

B. South Atlantic Program

The plans for the South Atlantic program were reviewed, and recommendations were made regarding Legs 73-75.

1. Leg 73 will be a transect of shallow holes across the South Atlantic Ridge. The HPC will be used to recover the upper sections or for total recovery (i.e., no rotary drilling). The OPP requested that logging be cancelled on Leg 73 because:

   a. Operation time on this leg is short, and because at least the upper sections at each site will be completely recovered, (HPC'd).

   b. Sediments are so thin that only a small percentage of each hole would be logged.

   c. Leg 73 occurs at the time of contract renewal with Gerhardt-Owen and therefore money could be saved.

The PCOM recommended that an exception be made to the rule of logging every hole so that Leg 73 holes did not have to be logged.

2. Leg 74 will be a transect across the Walvis Ridge. In view of the time constraints, if necessary, every other hole will only be hydraulically piston cored, i.e., holes 1, 3, 5 will be HPC'd and rotary drilled and holes 2 and 4 will be HPC'd and not rotary drilled. Two recommendations were made by the OPP for changes in this leg:

   a. 5 operational days be taken from Leg 75 and added to Leg 74 for a total of 45 operational days.The additional 5 days of Leg 74 would be used to either:

.. ... to completion SAII-2 or SAII-4, or

ii. HPC one site twice

The PCOM agreed to this recommendation.

b. Logging be done at Sites SA II-1, 3, and 5 and be omitted at 2, 4, and 7 because of the close spacing of the sites and the reduced number of operational days available. Should either 2 or 4 be drilled to completion, then the site would be logged.

The PCOM recommended that on Leg 74 only rotary drilled holes should be logged.

3. Leg 75. An additional request was made for time changes in Leg 75. When Leg 73 was being planned, it was hoped that modifications in the HPC would reduce the time required for its use. In addition, Leg 73 transit time was initially calculated as 14 days, but will more likely be 18 days. Leg 73 now has 30 operational days and it needs 34 to meet its first priority objectives. It might be possible to pick up 2 days by using Ascension instead of Recife as a port.

The OPP asked that 3 days be taken from Leg 75 and added to Leg 73. This would leave 29 operational days in Leg 75. There are 2 high priority sites on Leg 75, SA I-IC and SA I-SA, with estimated drilling times of 25 and 7 days. Using these estimates, if 3 days were removed, there would only be time to drill one hole.

The PCOM recommended that no further time adjustments be made in Legs 75 and 73.

VII. IGP

A. Information Items

1. T. Donnelly's geochemical data, on inorganic solids will be published in I.R. Vol 54, and should be out shortly. The information will be presented in a specific format, and in the future everyone will be asked to submit their data in that format.

2. Y. Tardy has recommended that bulk chemistry is done in the future, that specific attention paid to the mineralogy, especi from Legs 76 onward, wh diagenesis will play an import role. The IGP expects to ma specific recommendations at next meeting.

B. Equipment Recommendations.

1. A better top loading balance is necessary to get better porosity data. Such a balance will probably cost around $2,000.

2. A centrifuge.

C. Future Work.

The IGP is very interested in special physical properties studies, particularly those relating to permeability. In the North Atlantic program, the inorganic and organic geochemistry interests will walk hand in hand, and both geochemists should be on board the Challenger.

The PCB has a narrow bit and isn't compatible with many downhole instruments. The in situ water sampler can't be used with the HPC. This instrument hangs about .5m from the bit and decends into the soft sediments. This is an important instrument to test in situ gas compositions. The IGP is on record as requesting a compatible bit system so that all of these instruments may be used with a standard bit system. DSDP engineers are working on this.

VIII. OGP

A. Equipment

Three equipment recommendations were made:

1. Stiffer temperature probes to obtain more and better temperature data for interpretation of maturity of organic matter,

2. Modified pressure core barrel capable of closing on frozen cores (hydrates) and

3. Rock-Eval should be used on shipboard only when the staff includes someone trained to operate it.

B. Shipboard Staffing and Operations

Many organic geochemists have not had much experience with gas problems. An important reason for having an organic geochemist on board is to help monitor and assess potential hydrocarbon problems. The OGP recommended that the candidate organic geochemist be present at the Leg Safety Review so that he or she will be more aware of potential problems. The PCOM endorsed this recommendation.

The OGP would like to have a DSDP technician trained to operate the Rock-Eval. The training however, is non-trivial, involving understanding and interpreting the data. Using an inexperienced person has not been satisfactory in the past. It was recommended that DSDP obtain a list of experienced Rock-Eval users, and when Rock-Eval-type information is important, include an experienced person on board.

C. Frozen Samples

The DSDP curatorial staff, was commended for their efforts in getting samples catalogued and distributed. 623 frozen samples from Legs 63 through 67 were distributed. The OGP feels the curatorial services are understaffed and that every effort should be made to reduce the time between sample acquisition and distribution.

Several changes have been made in the organic geochemistry. sample distribution procedures:

a. Correspondence with investigators studying frozen samples now provides names of staff representatives.

b. Staff representatives are present during sample distribution and make sample descriptions.

c. Investigators, upon receipt of frozen samples, are expected to return a form to the appropriate staff representative acknowledging sample receipt, purpose of studies, tentative title for the Initial Report Paper and estimated number of pages required in the Initial Report.

d. Ice cubes sealed in the plastic sack are used to monitor temperature history during transit from DSDP to investigators. This is done in place of maximum-minimum thermometers.

D. Gas Hydrate Experiment.

A letter from Hunt to the Planning Committee describing a gas hydrate experiment for Leg 76 was distributed.

This experiment, subject to safety approval, would take several pressure core barrel samples to a maximum depth of about 400 m in the Blake Outer Ridge. The reliability of the PCB is critical to this experiment. The PCB is being tested on Leg 72. There has been a major change in the design, with soft seals, capable of being run to 5000 psi being used. One of the service companies was thought to have a working PCB. Although it would probably be expensive, Salisbury was asked to investigate the possibility of using such an instrument if DSDP's, PCB is not reliably operating.

X. SSP

The SSP recommended that index maps be prepared showing the locations of the site survey track information. They further recommended that no site should be drilled unless all of the relevant data, necessary to making a final site selection decision, be available to the IPOD Data Bank. This recommendation was particularly aimed at having sufficient regional data.

Lengthy discussion developed. On the one hand it could be a powerful tool to use in getting agencies and governments to submit their data relevant to drilling into the IPOD Data Bank. The PCOM agreed with the philosophy of the SSP recommendation, but it was not clear how "relevant data" would be determined. The PCOM therefore requested that the SSP make recommendations to the PCOM about which data should be submitted to the Data Bank for each site. The PCOM will then use various persuasive mechanisms to encourage submittal of the appropriate data.

XI. SCP

A. Paleo Data Base

The SCP has been discussing ways of improving the paleo data base and emphasized its importance. The Cretaceous data base for example is usable, but doesn't include everything. A Jurassic data base is being prepared. Sites designated for sampling for the micropaleo reference collections will be encoded in the Data Base.

B. Working Groups and Panel Liaisons.

A North Atlantic Stratigraphic gaps working group was established. This working group is attempting to interface with panels and working groups that are proposing drill sites to eliminate biostratigraphic deficiencies.

Informal liaisons have been established with several of the panels. The liaison is helpful in highlighting biostratigraphic needs and problems to site planners, for example, in the Mid-America Trench drilling, pointing out the importance of recovering the Eocene-Oligiocene horizon.

NSF REPORT

I. 81-83 CHALLENGER PROPOSAL

The preliminary Challenger proposal as arrived at NSF, and has been internally circulated to program directors and other officials. The final proposal is expected at NSF in mid March. No clear review procedures have been established yet.

Funding plans have also not been established. NSF funds will be severely reduced, however, the possibility of additional funding from other members and/or government agencies is being pursued.

II. OCEAN MARGIN DRILLING (OMD)

Recent developments in the Explorer program were presented. Eight oil companies have entered into a preliminary agreement with the National Science Foundation to examine the possibility of funding an Ocean Margin Drilling program. Accompanying the new funds will be a revision in the NSF structure. The Ocean Sediment Coring program will be replaced by the Ocean Drilling Program and be elevated to the division level.

The program is considered to be on the level of a National effort. A twofold proposal for this program was sent to Congress in January:

1. A request for continuation of IPOD funds in 1981, with phase-out funds in 1982.

2. A request for a ten year Ocean Margin Drilling program to consist of investigating the four Ocean environments as currently discussed in JOIDES; active margins, ocean crust, ocean paleoenvironment, and passive margins. A continuation of Challenger level funding and an addition 10 M$ are requested for this program. A 3 phase program is being proposed:

Phase 1 - 1 year (FY '81)

The first year will consist of the initial planning effort, including problem definition, choosing the platform, and determinination of site survey needs. At the end of FY '81 a go/no go decision will be made based on:

a. the viability of the program

b. its potential as a joint industry/academic venture

c. the pace and direction that is thought necessary for the program to proceed

Phase 2 - 2 years (FY '82-84)

In this phase the program planning and preparation will be intensified (e.g., site surveys), the ship will be converted, and the riser developed and built.

Phase 3 - 6 years (FY '84-90)

Scientific and Drilling Operations.

A final agreement with the petroleum industry still has to be negotiated. At the present time, there is an agreement in principal to enter into negotiations, with industry and government each contributing 10 M$ next year. Some of the areas of the program have been defined and these include:

a. it will be a basic research program

b. publication of scientific results

c. liability

d. management, with JOI, Inc. as the science manager

Congressional hearings will review the proposed program. A house authorization committee has reviewed the program. Several congressmen have visited the EXPLORER and one has written a letter to the President stating that this step was a bold approach to funding basic science.

Congress is also aware of the proposal to continue Challenger drilling. Another argument against continuing the Challenger is that too many major projects, especially long term projects, will decrease the flexibility of NSF to respond to individual research projects. In most cases, when funding for a particular project stops, those funds are lost to the sponsoring group. In the case with the Challenger, this money won't be "lost" to the scientific ocean drilling community, it will be used in the Ocean Margin Drilling Program.

81-83 CHALLENGER PROPOSAL

I. INTRODUCTION

The 81-83 Challenger proposal addresses a wide variety of important basic scientific problems. In light of the emphasis on the societal as well as scientific importance of the Explorer, it was pointed out that there are two major, geologic type problems facing society, energy and climate. The use of the HPC for high resolution, Neogene stratigraphy will contribute significantly to our understanding of climatic fluctuations. The increased understanding of physical properties will also help to assess waste disposal problems.

II. REVISIONS

The 81-83 Challenger proposal has gone through several iterations. A new revision was distributed at the beginning of the meeting. PCOM members and Panel chairmen, took sections in their field of expertise and further revised them. These were assembled by the PCOM chairman and given to Salisbury to be printed in a final version that will be submitted to NSF.

DSDP REPORT

I. DEVELOPMENTAL ENGINEERING

A. HPC Modifications

1. A system that will go from HPC'ing to rotary drilling without tripping the bit will be tested on Leg 72.

2. A mechanism to obtain oriented cores was attempted on an earlier Leg. This has been modified and the new system will be tested on Leg 72. This is a relative orientation that is obtained by using a swivel above the core barrel to take the torque out of the wire line.

3. Improved flapper core catchers and stronger polycarbonate core liners will also be evaluated on Leg 72.

4. Design efforts are continuing to determine the optimum core length. New 20 to 30 foot core barrel lengths will be tested on Leg 75.

B. Pressure Core Barrel (PCB)

The PCB will be tested on Leg 72. One reason for past failure was the hard seal, now a soft teflon seal, capable of withstanding 5000 psi in the laboratory, will be employed.

Two complete PCB assemblies and two additional pressure ball valves will be on board.

C. Extended Core Barrel (XCB)

The XCB will have a spring loaded cutting tool extending 6-8" beyond the bit and will be used in material that is too hard to HPC but soft enough to be disturbed by rotary drilling. The intention is to eventually build a compatible system of drill bits so that drilling can proceed - HPC - XCB - rotary without tripping the bit. The XCB will be tested on shore after Leg 71.

D. Drill Bit Motion Sensor

The drill bit motion sensors have been tested on land. This instrument is designed to assess what happens to the drill bit, and monitor ship motion. The information will be used in future designs to try to optimize bit life and improve core recovery. The DSDP engineers wanted PCOM support for ship time to do these tests.

The Challenger has been funded in 2 year increments and this has often been used as an excuse not to do engineering studies. If more time had been allocated in the early stages of the program, engineering developments would probably be further along. By consensus the PCOM encourages co-chief scientists to allow time for engineering tests during their Legs.

II. STATUS OF CHALLENGER.

A report about CHALLENGER down time was distributed in the pre-meeting mailing. The most persistent problem has been the thrusters, accounting for almost 50% of the ships down time. This is especially true of the sterm thrusters since they require drydocking for repair. In the 3 months since the report was written, there was a computer breakdown and the ships electrical system closed down. Seven days were lost.

Starting in 1976, port call time was increased from 3 to 5 days so that more routine maintenance could be done. The South Atlantic Legs are only about 40 days each. This adds a significantly higher percentage of port time to these Legs. DSDP was asked to try to make port call length proportional to the length of the Leg. This should be possible in U.S. ports, although it will be more difficult in non-U.S. ports.

III. BUDGETS

Increased fuel costs have made serious inroads on the Challenger budget. U. S. ports, where fuel is cheaper, will be used as much as possible. NSF has been asked for an additional .5 M$. Unfortunately, the NSF has been flooded with such requests and doesn't have the funds to meet them.

This again points to the problem of funds for logging. ONR has expressed interest in logging some of the '81 holes, but there aren't any serious commitments yet. One of ONR's concerns was with the quality of the logs. DSDP holes do not have the uniform conditions that are present in industry holes. Even though DSDP logs are not up to industry standards they are still very useful, and the PCOM feels they are important. A lot has already been learned from logs, particularly about seismic reflectors. On Leg 50 some of the main results were through logs. It was asked if the logging contract could stipulate that payment would be dependent upon log quality. At this time the logging business is very good and such a contract would not be likely. Designing tools to work with our hole conditions would be useful though.

IV. INITIAL REPORTS

A. Microfiching

Producing IR microfiche masters for Volumes 1-44 will cost approximately $2000. The copies will cost $160 a set. They will be particularly valuable since many of the earlier volumes are out of print.

B. Color Reproductions

Firms in L.A. and San Diego have been contacted about the price of color reproductions in the IR's, but nothing firm has been established.

V. INITIAL CORE DESCRIPTIONS

ICD's are becoming mini-IR's thick, costly, and typeset. DSDP is considering printing about 100 for shipboard and core repository people and microfiching the other copies. The initial response from people that DSDP has contacted has been both positive and negative. In view of its limited access, and short life, and mailing costs, the PCOM by consensus unanimously endorsed printing 100 ICD's and microfiching the rest.

VI. STRIP COLOR PHOTOGRAPHS

Tom Chase of the USGS made continuous strip color photographs of the Leg 64 hydraulic piston cores. These were very successful. However, the quality of the core color deteriorates rapidly in the first two months. DSDP would like to transfer the process to the ship.

The PCOM endorsed shipboard continuous strip photography, provided that its operation and funding does not disturb coring and logging operations.

VII. DEEP SEA SEDIMENT HANDBOOK

A request was received to use the high quality color photographs of DSDP cores in a publication about deep sea sediments. The publication would consist of about 200 plates and have 3 parts:

1. Classification and composition of deep sea sediments and colors.

2. Description of lithofacies and environments.

3. Sediment diagenesis and burial compaction.

AAPG has agreed to finance the publication. It could be a companion volume to the AAPG "Decade of Ocean Drilling" volume. The proposing group requested about $1000 support from DSDP for some of the preparation costs. DSDP saw this volume as helping them in two ways:

1. The master plates could be used by DSDP for the SP4 request to make a new set of instructional posters and charts for the Challenger.

2. It would reach a wide community and be good publicity for the DSDP information.

DSDP was asking PCOM's advice because of the precedent of using DSDP money. PCOM also wanted to be

... that an AAPG copyright wouldn't intere with DSDP use of the photographs. The PCOM heartily endorsed the publication, but could not give any financial support. If DSDP needed the work done to meet an SP4 request, they could make a financial arrangement for that.

HPC PLANNING COMMITTEE

The need for a group to be a forum to advocate for and promote use of the HPC was recognized. Discussion developed concerning the parent organization, composition, and mandate for this group. The JOIDES PCOM decided to establish an HPC Working Group. This would provide the opportunity for an international forum as well as the possibility of using JOIDES funds to hold a meeting.

DRAFT REPORT
INFORMATION HANDLING PANEL
10-11 January, 1980-La Jolla

Overriding interests of IHP - as they have always been - are the present state of data base development and the future (after IPOD) maintenance and operation of these data bases. In light of the possible changes in the drilling program and in the management of that program which are likely to occur in the next few years, the panel is concerned that the data management function of the IHG continue to completion for all CHALLENGER data.

1. The IHP strongly recommends that the Planning Committee, Executive Committee, and NSF assure continued funding, at least at the present level, of the IHG for at least three years past the termination of drilling. This is absolutely necessary for the completion of the mandated data management function of the program. The people of the IHG are an extremely valuable resource to the scientific community; therefore plans to insure the continued functioning of the group must be made now, so that these people are assured of some reasonable continuity of their positions. Meanwhile, the members of the group should be incorporated in plans for future drilling programs because of their unequaled experience and record of excellent performance.

2) It is also recommended that either (1) the present IHP continue its function of overseeing this work until its completion; or (2) under <u>any</u> reorganization of the panels which might occur, some member(s) of the present IHP who are familiar with the goals and problems of managing the CHALLENGER data be assigned to any newly constituted panel whose responsibility it is to oversee the management of the EXPLORER sample data. This recommendation is made to ensure continuity in the transition from the CHALLENGER to the EXPLORER programs and to maintain maximum availability of all deep-sea drilling data to the scientific ommunity.

Further, the present DSDP experience has provided many lessons in data management. The IHP recommends that these lessons should be incorporated in a formal data management plan to be prepared for any project to follow the present project. This plan should be a part of any proposals put forth and not added as an afterthought.

Other recommendations

3) <u>Errata</u>. The errata for volumes 1-34 are now completed and await final typesetting. These corrections are designed to be divided into individual sections, which will be cut out and placed in the volumes to which they relate. Therefore, there appears to be no logical reason to wait for errata for volumes 35-44 to be compiled before publishing that part which is already completed. The publication of the errata is extremely important to the integrity of the volumes and should be available for distribution as soon as possible. We recommend, therefore, that errata for volumes 1-34 be published immediately and the errata for volumes 35-44 be published as soon as the data are available. It is especially crucial that the errata be included in the microform version of each volume, which is imminent.

4) <u>Fossil abundance data</u>. The quality and future usefulness of paleontologic data depends not only on the reliability and uniformity of identifications of fossils, but also on associated records of numerical or relative abundance. The Panel on Paleontology and Stratigraphy had earlier made a strong recommendation that information on abundance accompany every record of a

microfossil species, and the IHP now emphatically repeats this recommendation. DSDP should find effective means to bring this requirement to the attention of every biostratigrapher at the beginning of each cruise leg.

5) Tech manual. The IHP is concerned that the analytical methodology and data collection procedures associated with the analyses and information published in the Initial Reports do not appear to have been documented thoroughly and properly. As a result the panel feels that the value of the data base as a whole is considerably diminished and urges that compilation of the Sed Pet Tech Manual proceed on an urgent basis.

6) Chemistry data. We recommend that DSDP shipboard chemists should be assigned, during their shore stay, to the job of digitizing the backlog of pore water chemistry data from the shipboard lab. If this is done immediately, the job should take only 2 to 3 months. The shore lab data should then be incorporated, and subsequent data entered as assigned. For solids, data on chemistry is already digital and in similar format to the igneous rock data.

7) Data base transfer. Recognizing that use of DSDP data system by U. S. scientists during past years was much more active than by scientists from IPOD countries, IHP encourages IPOD countries to consider establishing their own DSDP data systems with help from DSDP or consider other means to stimulate the use of DSDP data by their scientific communities.

The panel recommends and IHG is agreeable to the principal of transferring parts of the data base to foreign IPOD institutions: however, our limited resources will require that responsibility for the maintenance and updating of such files rest with the recipient. DSDP will provide all reasonable cooperation in this regard.

DRAFT MINUTES
OCEAN PALEOENVIRONMENT PANEL
18, 19 February 1980 - SIO

South Atlantic Program

I. Legs 71 and 72.

Drilling results from Leg 71 were were reviewed. Staffing changes on Leg 72 were discussed.

II. Legs 73-75

The report of the Safety review was given. Sites were prioritized. (For a list of proposed sites see JOIDES Journal Vol. VI, No. 1, p. 55-57). Recommendations regarding the drilling program were made and are included in the PCOM report.

Future Drilling Plans

The status of site selection for Legs 76-77 and 79 to 82 in the North Atlantic was reviewed.

The status of the OMD and the 1981-83 proposal for DSDP-IPOD was reviewed. Members of the panel expressed concern about the impact of the OMD Program. They re-iterated their support of the 1981-83 proposal.

To prepare for the possibility of an 1981-83 continuation of the DSDP-IPOD program, a working group was designated to plan sites for the North Atlantic transect. The group was asked to identify sites that fall along the track line of the Glomar Challenger or in the proximity of N. Atlantic PMP sites that might be drilled or HPC'ed as contingency sites.

HPC System

Mike Storms presented an update of the HPC system and developments in progress to improve the corer:

1. Orientation - The installation of drag blocks to reduce rotation of the barrel and a camera system to photograph the azimuth of orientation are planned.

2. Non-trip System - Development of a system in which the corebit can be jettisoned to save on trip time.

3. Longer core barrel - A computer program is being developed to evaluate the optimum core barrel length.

4. Extended core barrel - through-the-bit system for HPC is being built and will be tested on Leg 74.

Sampling HPC Cores

Because of the great demand anticipated for HPC cores, a committee was appointed to review existing DSDP core sampling procedures and policies and suggest changes or modification that may be needed at the next panel meeting.

DRAFT REPORT
PASSIVE MARGIN PANEL
7-9 January 1980-Woods Hole, MA.

The meeting was primarily concerned with discussing and finalizing plans for the North Atlantic Program. This information, as well as the 81-83 CHALLENGER extension proposal and Ocean Margin Drilling information, is given in the Planning Committee Report.

NORTH ATLANTIC PROGRAM INFORMATION (not covered under the PCOM Report)

There are approximately 120m of turbidites at the re-entry site proposed for Leg 82. It is not clear yet if DSDP can case this far. An analysis of uncored stratagraphic sequences and boundaries in the North Atlantic prepared by members of the SCP was presented. The important stratagraphic gaps were highlighted. The SCP urged that every effort be made to select sites where complete sequences could be obtained across these intervals.

DRAFT REPORT
POLLUTION PREVENTION
AND SAFETY PANEL
13 February, 1980 - S.I.O.

The meeting opened with a short discussion of some possible improvements in the review process.

1. It was remarked that the information packages assembled for Safety Review are frequently inadequate in many respects, and that the Check Sheets do not always convey the information they are supposed to provide. It is difficult to compare the drilling results at many sites to the original proposals we reviewed due to the changes in the numbering system. This complaint has been made before, and it is noted that the Site Summaries issued by the DSDP and Site Reports in the JOIDES Journal sometimes, but not always, bear the dual designators.

   It was recommended that a standard practice be made of using dual designations both in the Site Summaries and the JOIDES Journal (i.e., Site 512 (AB-1C'b)).

   It was also recommended that the Safety Review Check Sheets be revised and be made to indicate more clearly the information required by the Safety Panel. Blank copies of the present sheets are being sent to each Safety Panel member (JOIDES and SIO) for suggested changes, and they are asked to return them to the Chairman (JOIDES S.P.) by April 1 in order that they can be included in the "Guidelines for Co-Chiefs" now being drafted by the DSDP.

2. The value of a concise retrospective view at the end of each Cruise Leg of the elements considered important at the Safety Review for that Leg was brought up for discussion. It was decided that an information sheet to be completed by the Co-Chiefs after each hole would provide the Safety Panel with an early comparison of what had been proposed or predicted with what had been accomplished or found. Such categories as hole location, depth of penetration, stratigraphic units, seismic markers, hydrocarbons encountered,. and hole abandonment were suggested. The Panel felt that the availability of this information would greatly improve the overall safety review process.

It was recommended that the Chairman draft such a form and circulate it for comment, and that, if possible, it be put into final form for use on Leg 72. The assistance of the SIO Safety Panel was particularly solicited.

SAFETY REVIEW

The recommendations of the JOIDES Safety Panel on sites proposed for Legs 73, 74, and 75 are as follows:

LEG 73

SA IV-1
Approved as proposed.

SA IV-1B
Approved as proposed.

SA IV-2A
Approved as proposed.

SA IV-2B
Approved as proposed.

SA IV-3A
Approved as proposed.

SA IV-3B
Approved as proposed.

SA IV-4A
Approved as proposed.

SA IV-5
Approved as proposed.

SA IV-6
Approved as proposed.

SA IV-7
Approved as proposed.

SA III-2
Approved as proposed.

SA III-2A
Approved as proposed.

LEG 74

The poor quality of the seismic records shown offered no reliable evidence of the nature of the basement which Sites SA2-1 through 5 are proposed to penetrate. However, based on the reported recovery of altered basalts and volcanics from CHARCOT dredge hauls near the traverse, the Panel approved a basement test to be drilled first at SA2-1. If basement at that site proves to be other than igneous, no further basement penetrations are approved for this leg: if the basement is igneous, the standard 100 m penetration is approved at all the sites proposed. Subject to this qualification, the Panel recommends as follows:

SAII-1
Approved as proposed.

SAII-2
Approved as proposed.

SAII-3
Approved as proposed.

SAII-4
Approved as proposed.

SAII-5
Approved as proposed.

SAII-6
Approved for penetration only 100 m below the prominent reflector at about 6.7 sec. at location proposed on Line FG 7906.

LEG 75

Due to the anomalous character of the "basement" reflector in this region (e.g., at 2030 hrs, UTMSI 36) and the apparent sub-basement reflectors at Site SAI-1c (BGR 78-41), the possibility exists that the "basement" rocks could be other than igneous. If the first basement penetration shows this to be the case, the Safety Panel recommends that no further attempts be made to drill into it. If the basement is igneous, the standard 100 m penetration into it is approved.

SAI-1A
Move basinward to new location at 2000 hrs on UTMSI 36 in order to avoid the drape of lower beds over small basement high at originally proposed site. Otherwise approved as proposed for penetration to the basement reflector at about 7.5 sec.

SAI-1B
Approved as proposed for penetration to basement reflector at about 7.5 sec on UTMSI 31.

SAI-1C
Approved as proposed for penetration to basement reflector at about 7.44 sec on BGR 78-41.

SAI-2A
Approved as proposed.

SAI-2B
Approved as proposed.

SAI-4A
Disapproved, see remarks for 4C.

SAI-4b
Disapproved, see remarks for 4C.

SAI-4C
Penetration into the angular unconformity at the upper surface of the buried, rotated blocks as proposed at 4A and 4B is an unacceptable risk. However, if the scientific objective can be attained by drilling into the same truncated beds at a location where they are only thinly capped by younger sediments, and where they outcrop a short distance from the site, then the possibility of encountering a trapping situation is minimal.

Suggested Site 4C, located at SP 1280 on BGR 78-36 appears to be such a location. Drilling into the topographic shoulder there to a depth of no more than 100 m below the angular unconformity should encounter only beds that crop out down dip on the scarp face to the west. Such a limited penetration at this site is approved.

SAI-5A
Approved as proposed.

SAI-5B
Approved as proposed.

SAI-5C
Approved as proposed.

SAI-5D
Approved as proposed.

SITE SURVEY PANEL
29-30 November, 1980 - La Jolla

Reports from Site Survey Working Groups*

I. N.W. Atlantic R. Sheridan presented a report on the status of thirteen site surveys in this region. Surveys completed by November 1979 are shown in Table 2.

II. NE Atlantic Working Group E. J. W. Jones reported the outcome of discussions with D. Roberts and L. Montadert. Four regions have been surveyed in some detail.

(1) Rockall Multichannel seismic lines spaced 10-20 km apart, have been recorded in the vicinity of potential drill sites on the southwestern part of the plateau, near 56°N, 24°W. Four multichannel lines have also been shot near sites in the southeastern portion of the area, near 55°N, 20.5°W.

(2) Goban Spur A considerable amount of multichannel data exists in this region.

(3) Armoricain Margin There is dense multichannel seismic coverage in this portion of the Bay of Biscay. Approximately 2000 km of additional multichannel seismic data were obtained by France during the summer of 1979.

(4) Galicia Bank Seismic reflection lines have been shot in this area.

Jones emphasized that the availability of much of the multichannel data for open publication still has to be determined.

III. SW Atlantic Working Group

Sites AB-1 through AB-10 (Falkland Plateau and Rio Grande Rise) were surveyed by the University of Texas Marine Science Institute during 1979. Copies of the data, which include multichannel seismic, have recently been deposited in the IPOD Data Bank. P. Rabinowitz provided the safety package reports for individual sites.

IV. SE Atlantic Working Group

Sites SAI - 1, 2 and 5 and SA IV 1 through 7 were surveyed by the UTMSI in 1979, using multichannel seismic. SA II 1 through 6 were surveyed in 1979 by the JEAN CHARCOT (using GLORIA and SEABEAM) and by the University of Capetown.

V. Caribbean Working Group

The status of site surveys in this area was reviewed at the May 1979 meeting of this working group. At that time the CAR 1 (Barbados Ridge) and CAR 2 (Granada Trough) survey data had been prepared for the safety panel review. The working group recommended that CAR 3 and CAR 7 should receive high priority for future site surveys as the present data coverage is insufficient for a final decision on the exact position of the holes. Data are available for CAR 4, 5, 6 and 8 and are to be compiled by LDGO, UTMSI, and IFP.

VI. Galapagos Working Group

No report available.

IPOD Data Bank

At the last meeting of the Panel it was recommended that index maps be prepared showing the locations of the site survey information which has been submitted to the Data Bank. P. Rabinowitz presented maps of the North Atlantic and Pacific showing the location of data presently held on file. The South Atlantic map, incorporating the surveys carried out during the summer of 1979, still has to be compiled. All of the US institutional data is in digital form: non-US data has not yet been digitized. Rabinowitz noted that some non-US data in the Data Bank is only in the form of ships' tracks, without the accompanying geophysical information.

Rabinowitz also reported that preparations are well underway for the publication of site survey data in a volume similar to those in the Initial Report series. All US institute data is in camera-ready form. Rabinowitz regretted that a substantial amount of data which has been used for locating sites has not been made available for publication in the compilation volume. This point was discussed at some length by the panel, which recognized that data transfers to the IPOD Data Bank had not always been made. The Site Survey Panel then made the following recommendation to the Planning Committee: That all data relevant to making a final decision on the location of a drilling site be made available to the IPOD Data Bank and that no drilling should be conducted until this has been done.

Site Surveying Activity: 1980/81

I. France V. Renard reported that, although no specific IPOD site surveys are to be undertaken during the 1980/81 period, data relevant

Site	Type of Survey	Time of Completion	Institution
ENA - 1	24-fold: Multichannel seismic grid	Fall 1977	L-DGO
	24-fold: Multichannel seismic tie-line	Fall 1977	USGS
ENA-2	48-fold: Multichannel seismic cross lines	1977	USGS
	48-fold: Multichannel seismic grid	1979	BGR
ENA-3	Single channel line	1979	USGS
ENA-4	Single channel line	1977	USGS
ENA-5	24-fold multichannel seismic line	1975	USGS
	12-fold multichannel seismic grid	1979	USGA
ENA-6	24-fold multichannel seismic cross lines	Fall 1977	L-DGO
	Single channel grid	1976	L-DGO
ENA-7	24-fold multichannel seismic cross lines	1977	L-DGO
	Single channel grid	1976	L-DGO
ENA-8	24-fold multichannel seismic line	Fall 1977	GSC
ENA-9	24-fold multichannel seismic line	1977	GSC
ENA-10	24-fold multichannel seismic line	1977	GSC
ENA-11	24-fold multichannel seismic line	1978	L-DGO
ENA-12	24-fold multichannel seismic line	1976	UTMSI
ENA-13	24-fold multichannel seismic line	1976	UTMSI

COMPLETED NORTH ATLANTIC SITE SURVEYS

TABLE 2

*Ships tracks for the site surveys were included as appendices in the minutes and may be obtained from the SSP chairman, the JOIDES Office, or the IPOD Data Bank.

to future site selection will be obtained from the Bay of Biscay and Galicia Bank. It is planned to acquire approximately 2000 km of additional multichannel seismic data in this region. Single channel seismic, magnetic, gravity and SEABEAM data are to be recorded in the Barbados region.

II. Japan S. Nagumo presented a map showing the locations proposed for drilling during 1981 and beyond. Three holes are proposed on the inner slope of the Japan Trench, two on the outer slope, two in the Sea of Japan and three in the Nanki Trough. The site survey activity that is planned is shown in Table 3.

III. U.K. E. J. W. Jones indicated that plans for specific site surveys in the Rockall and Goban Spur area are still undergoing consideration for the 1980/81 period. Data pertinent to drilling locations already proposed will be collected on the continental margin to the southwest of Britain (1980) and in the Barbados region (1980).

IV. U.S. B. T. R. Lewis reported that the 1980 site survey plans are now firm. These are as follows:

ENA-1: 24-fold mc seismic tie-line (UTMSI)

ENA-3: 24-fold mc seismic grid (WHOI)

ENA-4: 24-fold mc seismic grid (WHOI)

ENA-8: 24-fold mc seismic grid (L-DGO)

ENA-11: 24-fold mc seismic grid (L-DGO)

ENA-12: 24-fold mc seismic grid (UTMSI)

ENA-13: 24-fold mc seismic grid (UTMSI)

A meeting to discuss 1981 site surveys has been arranged for early in 1980.

V. West Germany W. Weigel indicated that data relevant to future site selection, including some multichannel seismic, would be collected from the following regions during the 1980/81 period:

(1) NW Africa, in the region southof the MOR sites. Magnetics,gravity, reflection andrefraction seismics (1980/81)

(2) E. Mediterranean, in the vicinity of the AnatolianFracture Zone (1980)

(3) Porcupine Bank and PorcupineTrough (1981)

(4) East Greenland margin (1980/81)

Site Surveying for drilling after 1981

The present stage of negotiations concerning drilling after 1981 were outlined. A PCOM proposal for drilling during the 1981/83 period was reviewed. It was argued strongly that the SSP should produce a parallel document on site surveying. The Panel endorsed his view and recommended that a review be made of existing data in the vicinity of the 81/83 sites and that a proposal for future surveys be drafted on the basis of these reports as soon as possible. The Panel felt that the data reviews could best be made by the existing working parties on site surveys, set up in November, 1978, the members of which are drawn from the regional working groups. The SSP therefore recommends to each working group that site surveys receive high priority for discussion at their next meeting. It is essential that each working group produces a report on site surveying requirements for the proposed 81/83 drilling period (the report to be sent initially to the chairman of the SSP for wider circulation). The reports will be the basis of a site survey proposal which will be drawn up by the SSP.

Site Surveys Using High-Resolution Seismic Techniques

The Panel recognizes that for some investigations at drill-sites the seismic data collected during site surveys has insufficient resolution. Three fields are identified:

1) The detection of shallow gas pockets. G. Claypool emphasized that these are of particular concern to the safety panel. Although the possibility of shallow gas pockets is almost routinelyinvestigated before commercial drilling there has been little systematic work carried out near IPOD drill sites.

(2) The success of the hydraulic piston corer has opened up many fruitful avenues of research. Except for the top 100 m of the sediment column, which can often be resolved using a 3.5 KHz transducer, the resolution of seismic surveys over future drill-sites is insufficient to make full use of the HPC. Y. Lancelot reviewed the use of high resolution seismic data in the mapping of shallow regional unconformities.

(3) R. von Huene pointed out that in areas of complex topography and geology, such as the lower parts of trench slopes, the present resolution of the seismic data does not permit anything other than a tentative correlation of seismic reflectors with the lithostratigraphic units encountered in drilling. He argued that much more high resolution seismic work is needed in those regions.

The SSP therefore recommends that in future site surveying far more attention should be paid to the collection of high resolution shallow seismic data. The use of SEABEAM should be seriously considered for surveys in areas of complex topography and geology.

YEAR	VESSEL	AREA	TYPE OF SURVEY
1980 (Feb-March)	HAKUHO-MARU	Japan Trench	Single channel seismic, magnetics, gravity
1980 (Jul.-Sept.)	HAKUHO-MARU	NW and Central Pacific	Single Channel seismic, magnetics, gravity
1980	KAIYO-MARU	Decision not made	300 km multichannel seismic
1980	Charter Ship	Decision not made	Single channel seismic
1981 (May-June)	HAKUHO-MARU	Japan Trench	Single channel seismic, magnetics, gravity
1981	KAIYO-MARU	Decision not made	300 km multichannel seismic
1981	Charter Ship	Decision not made	Single channel seismic

Site Surveys Planned by Japan

Table 3

1980 APPROVED JOIDES MEETINGS

PANEL	JAN	FEB	MARCH	APRIL	MAY	JUNE	JULY	AUG	SEP	OCT	NOV	DEC	JAN
EXCOM			25-26 N Orleans				17-19 Paris				17-19 URI		
PCOM		25-29 Wash, DC					2-4 Paris			15-17 URI			
DMP					20-21 LDGO								
IHP	9-11 SIO												
IGP													
OCP		20-22 Djibouti											
AMP							4-5 France						
PMP	7-9 PMP								9-11 Barbados				
OPP		18-19 SIO					7-8 France						
OGP								23-25 N.H.					
PPSP		13 SIO				19 SIO							
SP4													
SSP					14-15 Hamburg								
SCP					7-9 SIO								
Ad hoc/ W.G.					HPC 8-9 Wash.D.C.								

...ST OF JOIDES COMMITTEES, PANELS AND WORKING GROUPS

Executive Committee (EXCOM)

Dr. John Steele, Chairman
(Alternate: Dr. Arthur Maxwell)
Woods Hole Oceanographic Institution
Woods Hole, MA 02543
Tel: (617) 548-1400, Ext. 2500

Dr. D. James Baker, Jr.
(Alternate: Dr. Joe S. Creager)
Department of Oceanography, WB-10
University of Washington
Seattle, WA 98195
Tel: (206) 543-7160
(543-5060)

Professor Dr. F. Bender
(Alternate: Prof. Dr. H. J. Durbaum)
Bundesanstalt fur Geowissenschaften
und Rohstoffe
3 Hannover 51, Postfach 510153
FEDERAL REPUBLIC OF GERMANY
Tel: 0511, 06481

Dr. William W. Hay
(Alternate: Dr. C. G. A. Harrison)
Rosenstiel School of Marine and
Atmospheric Science
4600 Rickenbacker Causeway
Miami, Florida 33149
Tel: (305) 350-7519
(350-7000)

Dr. G. Ross Heath
(Alternate: Dr. George Keller)
Oregon State University
School of Oceanography
Corvallis, OR 97331
Tel: (503) 754-3504
(754-4763)

Dr. Charles E. Helsley
(Alternate: Dr. Ralph Moberly)
Hawaii Institute of Geophysics
University of Hawaii
2525 Correa Road
Honolulu, HI 96822
Tel: (808) 948-8760
(948-8765)

Sir Peter Kent, F.R.S.
(Alternate: Dr. P. F. G. Twinn)
Natural Environment Research Council
Polaris House
North Star Avenue
Wilts SN2 1EU
Swindon
ENGLAND
Tel: (0793) 40101, Ext. 314

Dr. John A. Knauss
(Alternate: Dr. Jean-Guy Schilling)
University of Rhode Island
Kingston, R.I. 02881
Tel: (401) 792-6222
(792-6102)

Monsieur Gerard Piketty
(Alternate: Monsieur Jacques Debyser)
C.N.E.X.O.
B.P. 107, Paris 16
FRANCE
Tel: 723 5528, Ext. 420

Dr. Noriyuki Nasu
Ocean Research Institute
University of Tokyo
Nakano, Tokyo 164
JAPAN

Dr. William A. Nierenberg
Scripps Institution of Oceanography
University of California, San Diego
La Jolla, CA 92093
Tel: (714) 452-2826

Prof. T. K. Treadwell, Jr.
(Alternate: Dr. Worth D. Nowlin, Jr.)
Department of Oceanography
Texas A&M University
College Station, TX 77843
Tel: (713) 845-7211
(714)(845-2153)

Dr. M. N. A. Peterson (DSDP Rep.)
(Alternate: Dr. Y. Lancelot)
Deep Sea Drilling Project, A-031
Scripps Institution of Oceanography
La Jolla, CA 92093
Tel: (714) 452-3500
(452-3521)

Dr. A. V. Sidorenko
(Alternate: Dr. N. A. Bogdanov, or
Dr. P. P. Timofeev)
22, Staro Monetny Pereylok
Institute of the Lithosphere
USSR Academy of Sciences
Moscow,
U.S.S.R.
Tel: 233-06-20

Dr. Manik Talwani
(Alternate: Dr. Dennis E. Hayes)
Lamont-Doherty Geological Observatory
Palisades, N.Y. 10964
Tel: (914) 359-2900

Planning Committee (PCOM)

Mr. John Ewing, Chairman
Woods Hole Oceanographic Institution
Woods Hole, MA 02543
Tel: (617) 548-1400, Ext. 2828

Dr. Helmut Beiersdorf
(Alternate: Dr. U. von Rad)
Bundesanstalt fur Geowissenschaften
und Rohstoffe
3 Hannover 51, Postfach 510153
FEDERAL REPUBLIC OF GERMANY
Tel: 0-511-6468-788

Dr. William R. Bryant
(Alternate: Dr. Stefan Gartner)
Texas A&M University
Department of Oceanography
College Station, TX 77843
Tel: (713) 845-2153
845-2154

Dr. J. R. Cann
(Alternate: Mr. D. G. Roberts)
Department of Geology
The Univesity
Newcastle-upon-Tyne
NEL 7RU
ENGLAND
Tel: 0632-28511, Ext. 3090/3098
(Inst. Oceanographic Sciences
Brook Road, Wormley, Godalming
Surrey GU8 5UB
ENGLAND)

Dr. Joe S. Creager
(Alternate: Dr. Dean A. McManus)
Department of Oceanography, WB-10
University of Washington
Seattle, WA 98195
Tel: (206) 543-5099 a.m.
543-9944 p.m.

Dr. J. Dymond
Oregon State University
School of Oceanography
Corvallis, OR 97331
Tel (503) 754-2296

Dr. Dennis E. Hayes
(Alternate: Dr. Marc Langseth)
Lamont-Doherty Geological Observatory
Palisades, N.Y. 10964
Tel: (914) 359-2900

Dr. Kazua Kobayshi
Ocean Research Institute
University of Tokyo
1-15-1 Minamidai
Nakano, Tokyo 164
JAPAN

Dr. Yves Lancelot
(Alternate: Dr. Matt Salisbury)
Deep Sea Drilling Project
Scripps Institution of Oceanography
La Jolla, Ca 92093
Tel: (714) 452-3521
(452-3503)

Dr. Xavier LePichon
C.N.E.X.O.
B.P. 107, Paris 16
FRANCE
Tel: 723-5528

Dr. Ralph Moberly
(Alternate: Dr. Charles E. Helsley)
Hawaii Institute of Geophysics
University of Hawaii
2525 Correa Road
Honolulu, HI 96822
Tel: (808)948-8765
(948-8760)

Dr. Ted Moore
Graduate School of Oceanography
University of Rhode Island
Kingston, R.I. 02881
Tel: (401) 792-6178

Dr. L. Nikitin
Institute of Earth's Physics
of USSR Academy of Sciences
10 B. Gruzinskaya
Moscow
U.S.S.R.

Dr. Wolfgang Schlager
(Alternate: Dr. Wayne D. Bock)
Fisher Island Station
Miami Beach, FL 33139
Tel: (305) 672-1840
(R.S.M.A.S., University of Miami
4600 Rickenbacker Causeway
Miami, FL 33149)

Dr. E. L. Winterer
(Alternate: Dr. William Riedel)
Scripps Institution of Oceanography
La Jolla, CA 92093
Tel: (714) 452-2083
(452-4386)

JOIDES ADVISORY PANELS

Downhole Measurements (DMP)

Dr. R. Hyndman, Chairman
Pacific Geoscience Centre
Dept. Energy, Mines and Resources
9860 West Saanich Road
P.O. Box 6000
Sidney, B.C. V8L 4B2
CANADA
Tel: (604) 656-8269

Dr. Heinz Beckmann
Geologisches Institut
Technische Universitat Claustahl
3392 Clausthal-Zellerfeld 1
Leibnizstrasse 10
FEDERAL REPUBLIC OF GERMANY
Tel: 052323/722-2235

Dr. Eugene Boyce (DSDP Rep.)
(Alternate: Dr. Matt Salisbury)
Deep Sea Drilling Project
Scripps Institution of Oceanography
La Jolla, CA 92093
Tel: (714) 452-2779
(452-3503)

Dr. William Bryant (Ex-officio)
Texas A&M University
Department of Oceanography
College Station, TX 77843
Tel: (713) 845-2153
845-2154

Dr. N. Christensen
Dept. Geological Sciences, AK-20
University of Washington
Seattle, WA 98195
Tel: (206) 543-7143

Mr. A. H. Jageler
Amoco Production Research Company
P.O. Box 591
Tulsa, OK 74102

Dr. Hajimu Kinoshita
Dept. Earth Science
Chiba University
Chiba, JAPAN

Dr. D. H. Matthews
Dept. of Geology and Geophysics
Cambridge University
Madingley Rise, Madingley Road
Cambridge CB3 OEZ
ENGLAND

Dr. Y. Neprochnov
(Alternate: Dr. A. Pokryshkin)
P.P. Shirshov Institute of Oceanology
USSR Academy of Sciences
22 Krasikova Street
Moscow, 109387
U.S.S.R.

Dr. Vincent Renard
Centre Oceanologique de Bretagne
B.P. 337
29273 Brest Cedex
FRANCE
Tel: 80-46-50

Dr. A. F. Richards (Ex-officio)
Marine Geotechnical Laboratory
Lehigh University, Building 17
Bethlehem, PA 10815
Tel: (215) 861-3649

Mr. J. R. Severns
McCulloh Oil Corporation
10880 Wilshire Blvd.
Los Angeles, CA 90024

Industrial Liaison (ILP)

Mr. W. A. Roberts, Chairman
Executive Vice President
Phillips Petroleum Company
Bartlesville, OK 74004
Tel: (918) 661-3833

Mr. R. L. Adams
Executive Vice President
Conoco Inc.
P.O. Box 2197
Houston, TX 77001
Tel: (203) 359-3500

Prof. N. P. Budnikov
Ministry of Geology of USSR
4/6 Bolshava, Gruzinskaya
Moscow 123812
U.S.S.R.

Mr. Melvin J. Hill
Vice President and Coordinator
Gulf Oil Corporation
P.O. Box 1166
Pittsburgh, PA 12530
Tel: (412) 391-2400

Dr. Ing. Guenter Peterson
Deutzche Schachtbau-und
Tiefborhrgesellschaft mbH
Postfach 1360
D-4450 Lingen (Ems)
FEDERAL REPUBLIC OF GERMANY

Monsieur Gilbert Rutman
Societe Nationale des Petroles
D'Aquitaine
Tour D'Aquitaine—Cedex No. 4
92080 Paris La Defense
FRANCE

Mr. G. Williams
UK Offshore Operations Association, Ltd.
192 Sloane Street
London SW1 90X
ENGLAND
Tel: 01-235-0762

Information Handling (IHP)

Dr. D. W. Appleman
Department of Mineral Sciences
Natural History Building
Smithsonian Institution
Washington, D.C. 20560
Tel: (202) 381-6331

Dr. Thomas Davies
Department of Geology
Middlebury College
Middlebury, VT 05753
Tel: (802) 388-7957

Dr. H. Glashoff
Documentation Service
Bundesanstalt fur Geowissenschaften
und Rohstoffe
3 Hannover 51, Postfach 51053
FEDERAL REPUBLIC OF GERMANY

Mr. John C. Hathaway
U.S. Geological Survey
Bldg. B. Quissett Campus
Woods Hole, MA 02543
Tel: (617) 548-8700
FTS: 837-4155, or 4134

Dr. A. Loeblich, Jr.
Department of Geology
University of California
Los Angeles, CA 90024
Tel: (213) 825-1475

Dr. M. S. Loughridge
Marine Geology and Geophysics Branch
National Geophysical and Solar
Terrestrial Data Center
Code D621, NOAA
Environmental Data Center
Boulder, CO 80302
Tel: (303) 499-1000, Ext. 6487

Dr. Ted Moore (Ex-officio)
Graduate School of Oceanography
University of Rhode Island
Kingston, R. I. 02881
Tel: (401) 792-6178

Dr. P. Woodbury (DSDP Rep.)
Deep Sea Drilling Project, A-031
Scripps Institution of Oceanography
La Jolla, CA 92093
Tel: (714) 452-3526

Dr. V. V. Zdorovenin
(Alternate: Dr. V. S. Scherbakov)
Institute of Physics of the Earth
USSR Academy of Sciences
10, B. Gruzinskaya
Moscow, 123810
U.S.S.R.
(Ministry of Geology of USSR
4/6 B. Gruzinskaya
Moscow, U.S.S.R.)

Inorganic Geochemistry (IGP)

Dr. Joris M. Gieskes, Chairman
Scripps Institution of Oceanography
University of California, San Diego
La Jolla, CA 92093
Tel: (714) 452-4257

Dr. J. Dymond (Ex-officio)
School of Oceanography
Oregon State University
Corvallis, OR 97331
Tel: (503) 754-2296

Dr. H. Elderfield
Dept. of Earth Sciences
The University
Leeds LS2 9JT
ENGLAND

Dr. Margaret Leinen
University of Rhode Island
Graduate School of Oceanography
Kingston, R. I. 02881
Tel: (401) 792-6268

Dr. Frank Manheim
U.S. Geological Survey
Woods Hole, MA 02543
Tel: (617) 548-8700

Dr. Ken Pisciotto (DSDP Rep.)
Deep Sea Drilling Project, A-031
Scripps Institution of Oceanography
La Jolla, CA 92093
Tel: (714) 452-3521

Dr. I. D. Ryabchikou
(Alternate: Dr. A. Sharaskin)
Institute of Geology of Ore
Deposits, Petrology, Mineralogy,
& Geochemistry of the USSR
Academy of Sciences
Staromonetny 33
Moscow, 109017
U.S.S.R.
(Institute of Geochemistry
USSR Academy of Sciences
47, a, Vorobiovskoe Shosse
Moscow, U.S.S.R.)

Dr. S. Savin
Case Western Reserve University
Cleveland, OH 44106
Tel: (216) 368-3690

Dr. Y. Tardy
Laboratoire de Pedologie et Geochemie
38, rue des Trente-six Ponts
31078 Toulouse
FRANCE

Dr. K. H. Wedepohl
34 Gottingen
Geochemisches Institut der Universitat
Goldschmidstrasse 1
FEDERAL REPUBLIC OF GERMANY

Ocean Crust (OCP)

Dr. Paul J. Fox, Chairman
Centre Oceanologique de Bretagne
B.P. 337, 29.273
Brest, Cedex
FRANCE
Tel: 98 458 055

Dr. N. A. Bogdanov
(Alternate: Dr. A. A. Tsvetkov)
22, Staromonetny Pereylok
Institute of the Lithosphere
USSR Academy of Sciences
Moscow
U.S.S.R.
Tel: 233-06-20
(Institute of Geology of Ore
Deposits, Petrology, Mineralogy
& Geochemistry of the USSR
Academy of Sciences
Staromonetny 33
Moscow, 109017, U.S.S.R.)

Dr. R. G. Coleman
U.S. Geological Survey
345 Middlefield Road
Menlo Park, CA 94025
Tel: (415) 323-8111, Ext. 2334

Dr. J. Dymond (Ex-officio)
School of Oceanography
Oregon State University
Corvallis, OR 97331
Tel: (503) 754-2296

Prof. Dr. Rolf Emmermann
Institut fur Petrographie und Geochemie
der Universitat Karlsruhe
Kaiserstrasse 12
D-7500 Karlsruhe
FEDERAL REPUBLIC OF GERMANY

Dr. Jean Francheteau
Centre Oceanologique de Bretagne
B.P. 337
29273 Brest Cedex
FRANCE
Tel: 98 458 055

Dr. J. Honnorez
School of Marine & Atmospheric Sciences
University of Miami
4600 Rickenbacker Causeway
Miami, FL 33149
Tel: (305) 350-7508

Dr. Paul Johnson
Department of Oceanography
University of Washington
Seattle, WA 98195
Tel: (206) 543-5060

Dr. Roger Larson
Lamont-Doherty Geological Observatory
Palisades, N.Y. 10964
Tel: (914) 359-2900, Ext. 346

Dr. Ralph Moberly (Ex-officio)
Hawaii Institute of Geophysics
University of Hawaii
2525 Correa Road
Honolulu, HI 96822
Tel: (808) 948-8765

Dr. Jim Natland (DSDP Rep.)
(Alternate: Matt Salisbury)
Deep Sea Drilling Project, A-031
Scripps Institution of Oceanography
La Jolla, CA 92093
Tel: (714) 452-3538
(4522-3503)

Dr. M. Ozima
(Alternate: Dr. Ikuo Kushiro)
Geophysical Institute
Faculty of Science
University of Tokyo
Bunko-ku Tokyo 113
JAPAN

Dr. Ralph Stephen
Woods Hole Oceanographic Institution
Department of Geology and Geophysics
Woods Hole, MA 02543
Tel: (617) 548-1400, Ext. 2583

Dr. John Tarney
Department of Geological Sciences
The University
P.O. Box 363
Birmingham, B15 2TT
ENGLAND
Tel: 021-472-1301

Dr. M. Treuil
(Alternate: Dr. Henri Bougault)
Institute Physique du Globe
Universite Paris 6
4, Place Jussieu
Paris Cedex 05
FRANCE
Tel: 336-2525
(Centre Oceanologique de Bretagne
B.P. 337
29273 Brest Cedex
FRANCE)

Ocean Margin Active (AMP)

Dr. Roland von Huene, Chairman
U. S. Geological Survey
345 Middlefield Road
Menlo Park, CA 94025
Tel: (415) 856-7105

Mr. P. F. Barker
Department of Geological Sciences
The University
P.O. Box 363
Birmingham B15 2TS
ENGLAND
Tel: 021 472 1301, Ext. 2081

Dr. Rene Blanchet
(Alternate: Dr. Jean-Paul Cadet)
Lab. Oceanologie et Geodynamique
Universite de Bretagne Occidentale
29279 Brest Cedex
FRANCE
Tel: (98) 03-16-94, Ext. 330
(Universite d'Orleans)

Dr. William Coulbourn (DSDP Rep.)
(Alternate: Dr. Jim Natland)
Deep Sea Drilling Project, A-031
Scripps Institution of Oceanography
La Jolla, CA 92093
Tel: (714) 452-4844

Dr. Joe S. Creager (Ex-officio)
Department of Oceanography, WB-10
University of Washington
Seattle, WA 98195
Tel: (206) 543-5099 a.m.
(206) 543-9944 p.m.

Dr. W. R. Dickinson
Department of Geosciences
University of Arizona
Tuscon, AZ 85721
Tel: (602) 626-2178

Dr. Y. I. Dmitriev
Institute of Geology of Ore Deposits,
Petrology, Mineralogy, and Geochemistry
of the USSR Academy of Sciences
Staromonetny 35
Moscow, 109017
U.S.S.R.

Dr. D. M. Hussong
Hawaii Institute of Geophysics
University of Hawaii
2525 Correa Road
Honolulu, HI 96822
Tel: (808) 948-8711

Dr. Daniel Karig
Department of Geological Sciences
Cornell University
Ithaca, N. Y. 14853
Tel: (607) 256-3679

Dr. Keith Kvenvolden (OGP Rep.)
U. S. Geological Survey
345 Middlefield Road
Menlo Park, CA 94025
Tel: (415) 323-8111, Ext. 2513

Dr. Xavier LePichon (Ex-officio)
C.N.E.X.O.
B.P. 107, Paris 16
FRANCE
Tel: 723-5528

Dr. Kazuaki Nakamura
Earthquake Research
University Institute of Tokyo
Bunkyo, Tokyo 113
JAPAN

Dr. T. Shipley (DSDP Rep.)
Deep Sea Drilling Project
Scripps Institution of Oceanography
La Jolla, CA 92093
Tel: (714) 452-4193

Dr. Hansjust Walter
Bundesanstalt fur Geowissenschaften
und Rohstoffe
Stillewag 2, D-3000 Hannover
FEDERAL REPUBLIC OF GERMANY
Tel: 0511-64681

Dr. Joel Watkins
Exploration & Production Division
Gulf Science & Technology Company
P.O. Box 2038
Pittsburgh, PA 15230

Ocean Margin Passive (PMP)

Dr. Robert Sheridan, Chairman
University of Delaware
Department of Geology
Newark, DE 19711
Tel: (302) 738-1272

Dr. Helmut Beiersdorf (Ex-officio)
Bundesanstalt fur Geowissenschaften
und Rohstoffe
3 Hannover 51, Postfach 510153
FEDERAL REPUBLIC OF GERMANY
Tel: 0511-6468-788

Dr. Arnold H. Bouma
Office of Marine Geology
U. S. Geological Survey
P.O. Box 6732
Corpus Christi, TX 78411

Dr. William Bryant (Ex-officio)
Texas A&M University
Department of Oceanography
College Station, TX 77843
Tel: (713) 845-2153

Dr. J. R. Curray
Scripps Institution of Oceanography,
A-015
La Jolla, CA 92093
Tel: (714) 452-3299

Dr. John Grow
U.S. Geological Survey
Woods Hole, MA 02543 02543
Tel: (617) 548-8700

Dr. K. Hinz
Bundesanstalt fur Geowissenschaften
und Rohstoffe, Abt. Geophysik
3 Hannover 51, Postfach 510153
FEDERAL REPUBLIC OF GERMANY
Tel: 0511-6468330

Dr. John M. Hunt (OGP Rep.)
Woods Hole Oceanographic Institution
Department of Chemistry
Woods Hole, MA 02543
Tel: (617) 548-1400, Ext. 2562

Dr. H. Kagami
Ocean Research Institute
University of Tokyo
Nakano, Tokyo 164
JAPAN
Tel: 03-376-1251

Dr. Yves Lancelot (DSDP Rep.)
(Alternate: Dr. Ken Pisciotto)
Deep Sea Drilling Project
Scripps Institution of Oceanography
La Jolla, CA 92093
Tel: (714) 452-3521
(452-3521)

Dr. L. Montadert
(Alternate: Dr. Bernard Biju-Duval)
Institute Francais du Petrole
Division Geologie
1 et 4, Avenue de Bois-Preau
B.P. 18, 92 Rueil-Malmaison
FRANCE
Tel: 749-02-14

Prof. V. Nalivkin
(Alternate: Dr. M. E. Artemiev)
Liteynyi Prospect
Leningrad
U.S.S.R.
(Institute of Earth's Physics
USSR Academy of Sciences
10 B., Gruzinskaya
Moscow, U.S.S.R.)

Mr. D. G. Roberts
Institute of Oceanographic Sciences
Brook Road, Wormley, Godalming
Surrey GU8 5UB
ENGLAND
Tel: 042-879-4141

Prof. Dr. E. Seibold
(Alternate: Dr. von Stackleberg)
Geologisch-Palaontologisches Institut
Universitat Kiel
Olshausenstrasse 40/60
D-23, Kiel
FEDERAL REPUBLIC OF GERMANY
(Bundesanstalt fur Geowissenschaften
und Rohstoffe
3 Hannover 51, Postfach 510153
FEDERAL REPUBLIC OF GERMANY)

Dr. S. Snelson
Shell Oil Company
P.O. Box 481
Houston, TX 77001

Dr. J. Thiede
Institute for Geologi
Universitetet I Oslo
Postboks 1047
Blindern, Oslo 3
NORWAY
Tel: 46-6800, Ext. 9692

Dr. P. R. Vail
EXXON Production Company
P.O. Box 2189
Houston, TX 77001

Dr. Jan E. Van Hinte
Vrije Universiteit
Aardwetenschappen
P.O. Box 7161
Amsterdam 1011
THE NETHERLANDS

... (OPP)

Dr. Robert G. Douglas, Chairman
Dept. of Geological Sciences
University of Southern California
University Park
Los Angeles, CA 90007
Tel: (213) 741-7676

Dr. Charles Adelseck (DSDP Rep.)
(Alternate: Dr. William Coulbourn)
Deep Sea Drilling Project
Scripps Institution of Oceanography
La Jolla, CA 92093
Tel: (714) 452-4172
(452-4884)

Dr. W. H. Berger
Scripps Institution of Oceanography
La Jolla, CA 92093
Tel: (714) 452-2750

Dr. Herve Chamley
Sedimentologie et Geochimie
Universite des Sciences et
Techniques de Lille
U.E.R. des Sciences de la Terre
B.P. 36
59650 Villeneuve D'Ascq
FRANCE

Dr. Geoffrey Eglinton (OGP Rep.)
University of Bristol
School of Chemistry
Bristol B58 ITS
ENGLAND

Dr. Dieter Futterer
Geol.-Paleontol. Inst. der Univ. Kiel
23 Kiel, Olshausenstrasse 40/60
FEDERAL REPUBLIC OF GERMANY

Dr. J. Hays
Lamont-Doherty Geological Observatory
Palisades, NY 10964
Tel: (914) 359-2900, Ext. 403, 404

Dr. H. C. Jenkyns
Department of Geology and Mineralogy
University of Oxford
Parks Road
Oxford OX 1 3PR
ENGLAND
Tel: (0865) 54511

Dr. James P. Kennett
University of Rhode Island
Graduate School of Oceanography
Narragansett Bay Campus
Kingston, R. I. 02881
Tel: (401) 792-6216

Dr. Ted C. Moore (Ex-officio)
Graduate School of Oceanography
University of Rhode Island
Kingston, R. I. 02881
Tel: (401) 792-6178

Dr. William Ruddiman
Lamont-Doherty Geological Observatory
Palisades, NY 10964
Tel: (914) 359-2900, Ext. 528, 529

Dr. S. O. Schlanger
Hawaii Institute of Geophysics
University of Hawaii
2525 Correa Road
Honolulu, HI 96822

Dr. W. V. Sliter
U. S. Geological Survey
Branch of Paleontology and
Stratigraphy, MS 970
12201 Sunrise Valley Drive
Reston, VA 22092

Dr. Y. Takayanagi
(Alternate: Dr. Hakuyu Okada)
Geol. and Paleont. Inst.
Tokohu University
Sendai
JAPAN
Tel: 0542-37-1111
(Geoscience Inst., Shizuoka Univ.
Shizuoka 422
JAPAN)

Dr. P. P. Timofeev
(Alternate: Dr. I. Murdmaa)
Institute of Geology
USSR Academy of Sciences
7 Pyzhevsky per
Moscow ZH-17
U.S.S.R.
(Institute of Oceanology
USSR Academy of Sciences
22 Krasikoua Street
Moscow, 109387
U.S.S.R.)

Dr. E. L. Winterer (Ex-officio)
Scripps Institution of Oceanography
La Jolla, CA 92093
Tel: (714) 452-2083

Organic Geochemistry (OGP)

Dr. Keith Kvenvolden, Chairman
U.S. Geological Survey
345 Middlefield Road
Menlo Park, CA 94025
Tel: (415) 856-7150

Dr. Earl W. Baker
Dean of Science
Florida Atlantic University
Boca Raton, FL 33431
Tel: (305) 395-5100, Ext. 2701

Mr. Geoffrey Eglinton (OPP Liaison)
University of Bristol
School of Chemistry
Briston BS8 ITS
ENGLAND

Dr. J. Gordon Erdman
Phillips Petroleum Complany
Bartlesville, OK
Tel: (918) 336-6600

Dr. E. Galimov
(Alternate: Dr. E. Romankevich)
Institute of Geochemistry
USSR Academy of Sciences
47 a, Vorobiovskoe shosse
Moscow
U.S.S.R.
(USSR Academy of Sciences
Inst. of Oceanology
22 Krasikoua Street
Moscow, 109387, U.S.S.R.)

Dr. John M. Hunt
Woods Hole Oceanographic Institution
Department of Chemistry
Woods Hole, MA 02543
Tel: (617) 548-1400, Ext. 2562

Dr. Philip A. Meyers
Department of Atmospheric & Oceanic Science
University of Michigan
Ann Arbor, MI 48109
Tel: (313) 764-0597

Dr. Ken Pisciotto (DSDP Rep.)
(Alternate: Dr. Jim Natland)
Deep Sea Drilling Project
Scripps Institution of Oceanography
La Jolla, CA 92093
Tel: (714) 452-3521
(452-3538)

Dr. Bernd R. Simoneit
Institute of Geophysics and Planetary Physics
University of California
Los Angeles, CA 90024
Tel: (213) 825-3331

Dr. B. Tissot
Institut Francais du Petrole
1 et 4, Avenue de Bois-Preau
B.P. 18
92502 Rueil Malmaison
FRANCE

Dr. Dietrich Welte
(Alternate: Dr. E. Degens)
Lehrstuhl fur Geologie, Geochemie, und Lagerstatten des Erdolsun derKohle
Rhein-West. Techn. Hochschule
51 Aachen
FEDERAL REPUBLIC OF GERMANY
(Dept. Geologie, Univ. of Hamburg
Hamburg, GERMANY)

Dr. E. L. Winterer (Ex-officio)
Scripps Institution of Oceanography
La Jolla, CA 92093
Tel: (714) 452-2083

... Prevention and Safety Panel (PPSP)

Dr. Louis E. Garrison, Chairman
U.S. Geological Survey
P.O. Box 6732
Corpus Christi, TX 78411
Tel: (512) 888-3295
(512) 888-3294

Dr. N. I. Beliy
(Alternate: Dr. O. O. Scheremet)
Ministry of Gas Industry
8UL Stroitelei
117939 Moscow
U.S.S.R.
Tel: 1330130

Dr. George Claypool
(Alternate: Dr. Keith Kvenvolden)
U.S. Geological Survey
Branche of Oil and Gas Resources
Denver Federal Center
Denver, CO 80225
Tel: (303) 234-3561
(U.S. Geological Survey
Menlo Park, CA 94025
Tel: (415) 323-8111, Ext. 2817)

Mr. Brian E. Davies
Sohio Petroleum Company
100 Pine Street
San Francisco, CA 94111
Tel: (415) 445-9400

Dr. Robert Douglas (Ex-officio, OPP sites only)
Dept. of Geological Sciences
University of Southern California
University Park
Los Angeles, CA 90007
Tel: (213) 741-7676

Mr. John Ewing (Ex-officio)
Department of Geology and Geophysics
Woods Hole Oceanographic Institution
Woods Hole, MA 02543
Tel: (617) 548-1400, Ext. 2828

Dr. P. J. Fox (Ex-officio, OCP sites only)
Centre Oceanologique de Bretagne
B.P. 337, 29.273
Brest, Cedex
FRANCE
Tel: 98 458 055

Dr. H. Grant Goodell
Department of Environmental Sciences
University of Virginia
Charlottesville, VA 22901
Tel: (804) 924-7761, Ext. 219

Dr. Arthur E. Green
EXXON Production Research Laboratory
P.O. Box 2189
Houston, TX 77001
Tel: (713) 965-4172

Prof. A. J. Horn
34 Lloyden Drive
Atherton, CA 94025
Tel: (415) 323-7126

Dr. Ernst Hotz
c/o Deminex
Dorotheenstrasse 1
4300 Essen
FEDERAL REPUBLIC OF GERMANY
Tel: 0201-726350

Mr. J. Laherrere
(Alternate: Mr. Christian Bois)
Director, Dept. of Assistance Research
Total CFP—39 Quai A. Citroen
75739 Paris Cedex 15
FRANCE

Dr. Yves Lancelot (DSDP Rep.)
(Alternate: Dr. Matt Salisbury)
Deep Sea Drilling Project
Scripps Institution of Oceanography
La Jolla, CA 92093
Tel: (714) 452-3521
(452-3503)

Dr. David B. MacKenzie
Marathon Oil Company
P.O. Box 269
Littleton, CO 80160

Dr. Arthur E. Maxwell (Ex-officio)
Woods Hole Oceanographic Institution
Woods Hole, MA 02543
Tel: (617) 548-1400, Ext. 2250

Dr. R. Sheridan (Ex-officio, PMP sites only)
University of Delaware
Department of Geology
Newark, DE 19711
Tel: (302) 738-2569

Mr. G. D. Taylor
British Petroleum Company Ltd.
Britannic House/Moore Lane
London, EC2Y 9BU
ENGLAND

Dr. R. von Huene (Ex-officio, AMP sites only)
U.S. Geological Survey
345 Middlefield Road
Menlo Park, CA 94025
Tel: (415) 323-8111

Sedimentary Petrology and Physical Properties (SP4)

Dr. A. Richards, Chairman
Marine Geotechnical Laboratory
Lehigh University, Building 17
Bethlehem, PA 18015
Tel: (215) 861-3649

Dr. Michael Arthur
Oil and Gas Division
U. S. Geological Survey
Denver Federal Center
Denver, CO 80225

Dr. Richard Bennett
NOAA/AOML
15 Rickenbacker Causeway
Miami, FL 33149
Tel: (305) 361-3361, Ext. 318/319/320

Dr. John Conolly
Era North America Inc.
200 Railroad Avenue
Greenwich, CT 06830
Tel: (203) 622-9130

Dr. John W. Handin
Center for Tectonophysics
Texas A&M University
College Station, TX 77843
Tel: (713) 845-3251

Dr. George deVries Klein
Department of Geology
University of Illinois
Urbana, IL 61801
Tel: (217) 333-3540 (message)
(217) 333-2076 (office)

Dr. I. N. McCave
School of Environmental Sciences
Univ. of East Anglia
Norwich NR4 7TJ
ENGLAND
Tel: (0603) 56161

Dr. F. Melieres
Laboratoire de Geologie Dynamique
Universite Pierre et Marie Curie
75230 Paris Cedex 05
FRANCE
Tel: 336-2525, Ext. 5157

Dr. Ralph Moberly (Ex-officio)
Hawaii Institute of Geophysics
Univesity of Hawaii
2525 Correa Road
Honolulu, HI 96822
Tel: (808) 948-8765

Dr. O. H. Pilkey
Department of Geology
Duke University
Durham, N.C. 27708
Tel: (919) 684-2206

Dr. Peter Rothe
Geographisches Institut der Universitat
Mannheim
Abteilung fur Geologie
6800 Mannheim 1
Schloss, Postfach 2428
FEDERAL REPUBLIC OF GERMANY
Tel: 0621-292-5458

Dr. Matt Salisbury (DSDP Rep.)
(Alternate: Dr. E. Boyce)
Deep Sea Drilling Project, A-031
Scripps Institution of Oceanography
La Jolla, CA 92093
Tel: (714) 452-3503

Prof. Peter P. Timofeev
Geological Inst. Acad. of Sc. of USSR
Deputy Director
7, Pyshevsky per,
Moscow ZH-17 109017
U.S.S.R.
Tel: 231-9418

Site Surveying (SSP)

Dr. E. J. W. Jones, Chairman
Department of Geology
University College London
Gower Street
London WCIE 6BT
ENGLAND
Tel: 01-387-7050

Dr. Robert G. Douglas (Ex-officio, OPP)
Dept. of Geological Sciences
University of Southern California
University Park
Los Angeles, CA 90007
Tel: (213) 741-7676

Dr. P. J. Fox (Ex-officio, OCP)
Centre Oceanologique de Bretagne
B.P. 337, 29.273
Brest, Cedes
FRANCE
Tel: 98 458 055

Dr. Dennis Hayes (Ex-officio, PCOM)
Lamont-Doherty Geological Observatory
Columbia University
Palisades, N.Y. 10964
Tel: (914) 359-2900

Dr. Brian Lewis
Department of Oceanography, WB-10
University of Washington
Seattle, WA 98195
Tel: (206) 543-6043

Dr. Shozaburo Nagumo
(Alternate: Dr. Nadamori Murauchi)
Earthquake Research Institute
University of Tokyo
Bunkyo-ki, Tokyo 113
JAPAN
(Department of Earth Sciences
Chiba University
Yayoi-cho, Chiba
JAPAN 280)

Dr. Philip Rabinowitz (Ex-officio, Data Bank)
Lamont-Doherty Geological Observatory
Columbia University
Palisades, N.Y. 10964
Tel: (914) 359-2900, Ext. 501

Dr. Roland Schlich
Institute de Physique du Globe
Observatoire Geophysique du Park
St.-Maur, 4 Avenue de Neptune
94 St.-Maur-Des-Fosses
FRANCE

Dr. Wolfgang Schlager (Ex-officio, PCOM)
Fisher Island Station
Miami Beach, FL 33149
Tel: (307) 672-1840

Dr. A. A. Schreider
(Alternate: Dr. I. Kosminskaya)
Shirshov Institute of Oceanology
22, Krasikova Street
Moscow, 109387
U.S.S.R.
(Institute of Earth's Physics
USSR Academy of Sciences
10, B. Gruzinskaya
Moscow
U.S.S.R.)

Dr. Robert Sheridan (Ex-officio, PMP)
University of Delaware
Department of Geology
Newark, DE 19711
Tel: (302) 738-2569

Dr. Tom Shipley (DSDP Rep.)
(Alternate: Dr. Matt Salisbury)
Deep Sea Drilling Project
Scripps Institution of Oceanography
La Jolla, CA 92093
Tel: (714) 452-4193
(452-3503)

Dr. Roland von Huene (Ex-officio, AMP)
U.S. Geological Survey
345 Middlefield Road
Menlo Park, CA 94025

Dr. Wilfried Weigel
Institute fur Geophysik der
Universitat Hamburg
Bundeskasse 55
D-2000 Hamburg 13
FEDERAL REPUBLIC OF GERMANY

Stratigraphic Correlations (SCP)

Dr. Richard Poore, Chairman
U. S. Geological Survey
345 Middlefield Road
Menlo Park, CA 94025
Tel: (415) 323-8111, Ext. 2768

Dr. V. Basov
22, Staromonetny Pereylok
Institute of the Lithosphere
USSR Academy of Sciences
Moscow
U.S.S.R.
Tel: 233-0620

Dr. R. H. Benson
E-206, NHB
Smithsonian Institution
Washington, D.C. 20560
Tel: (202) 381-6400

Dr. P. Cepek
Bundesanstalt fur Geowissenschaften
und Rohstoffe
3 Hannover 51, Postfach 510153
FEDERAL REPUBLIC OF GERMANY
Tel: 0511-6468783

Dr. Joe S. Creager (Ex-officio)
Department of Oceanography, WB-10
University of Washington 98195
Seattle, WA 98195
Tel: (206) 543-5099 a.m.
(206) 543-9944 p.m.

Dr. D. Graham Jenkins
Department of Earth Science
The Open University
Milton Keynes, MK76AA
ENGLAND
Tel: (0908) 63116

Dr. Catherine Nigrini
510 Papyrus Drive
La Habra Heights, CA 90631
Tel: (213) 697-8842

Dr. J. B. Saunders
Naturhistorisches Museum Basel
CH-4051, Basel, Augustinergasse 2
SWITZERLAND
Tel: 061-258282

Dr. John Usher (Ex-officio)
Deep Sea Drilling Project, A-031
Scripps Institution of Oceanography
La Jolla, CA 92093
Tel: (714) 452-3529

JOIDES WORKING GROUPS

Gulf of California

Dr. J. R. Curray, Chairman
Scripps Institution of Oceanography
La Jolla, CA 92093
Tel: (714) 452-3299

Dr. Augustin Avala-Castanares
Coordinacion de la Investigacion
Cientifica
Universidad Nacional Autonoma
de Mexico
Mexico 20, D.F.
MEXICO

Dr. Jim Ingle
Department of Geology
Stanford University
Stanford, CA 94305
Tel: (415) 497-2531

Dr. Roger Larson
Lamont-Doherty Geological Observatory
Palisades, N.Y. 10964
Tel: (914) 359-2900, Ext. 346

Dr. Brian T. R. Lewis
Department of Oceanography
University of Washington
Seattle, WA 98195
Tel: (206) 543-6043

Dr. David G. Moore
Deep Sea Drilling Project, A-031
Scripps Institution of Oceanography
La Jolla, CA 92093
Tel: (714) 452-3521

Mediterranean/Caribbean Sea

Dr. L. Montadert, Chairman
Institut Francais du Petrole
Division Geologie
1 et 4, Avenue de Bois-Preau
B.P. 18
92 Rueil-Malmaison
FRANCE
Tel: 967-11-10
976-17-66

Dr. Mahlon M. Ball
U.S. Geological Survey
Woods Hole, MA 02543
Tel: (617) 548-8700

Dr. A. W. Bally
Shell Oil Company
P.O. Box 2099
Houston, TX 77001

Dr. V. Chehovich
Inst. of Geology
USSR Academy of Sciences
7, Pyzhevsky per ZH-17
Moscow
U.S.S.R.

Dr. Kenneth Hsu
Geologisches Institut der E.T.H.
Sonneggstrasse 5
Zurich 6
SWITZERLAND
Tel: (01) 32-62-11, Ext. 3669

Dr. William Ludwig
Lamont-Doherty Geological Observatory
Palisades, N.Y. 10964
Tel: (914) 359-2900

Dr. I. Premoli-Silva
Instituto di Paleontologie
Paizzale Gorini 15
20133 Milano
Tel: (02) 29 28 13
ITALY

Dr. W. Schreyer
Institut fur Mineralogie
Rugh-Universitat Bochum
D 463, Bochum-Querenburg
Universitatstrasse 150
Postfach 2148
FEDERAL REPUBLIC OF GERMANY

Dr. Joel Watkins
Exploration & Production Division
Gulf Science & Technology Company
P.O. Box 2038
Pittsburgh, PA 15230

Mesozoic

Dr. James Ingle, Chairman
Department of Geology
Stanford University
Stanford, CA 94305
Tel: (415) 497-2531

Dr. W. H. Berger
Geological Research Division
Scripps Institution of Oceanography
La Jolla, CA 92093

Dr. Jere H. Lipps
296 Geology-Physics Building
University of California
Davis, CA 95616

Dr. H. Schrader
School of Oceanography
Oregon State University
Corvallis, OR 97331

Dr. Hans Thierstein, Chairman
Scripps Institution of Oceanography
University of California
La Jolla, CA 92093
Tel: (714) 452-4646

Dr. Robert G. Douglas
Dept. of Geological Sciences
University of Southern California
University Park
Los Angeles, CA 90007
Tel: (213) 741-7676

Dr. Hugh Jenkyns
Dept. Geology and Mineralogy
University of Oxford
Parks Road
Oxford, OX1 3PR
ENGLAND
Tel: (0685) 54511

Dr. Yves Lancelot
Deep Sea Drilling Project
Scripps Institution of Oceanography
La Jolla, CA 92093
Tel: (714) 452-3521

Dr. Roger Larson
Lamont-Doherty Geological Observatory
Columbia University
Palisades, N.Y. 10964
Tel: (914) 359-2900, Ext. 346

Dr. W. Sliter
Branch of Paleontology and
Stratigraphy, MS 970
12201 Sunrise Valley Drive
Reston, VA 22092

Middle America

Dr. J. Watkins, Chairman
Exploration & Production Division
Gulf Science & Technology Company
P.O. Box 2038
Pittsburgh, PA 15230

Dr. R. Couch
School of Oceanography
Oregon State University
Corvallis, OR 97331

Dr. J. C. Moore
Department of Earth Sciences
University of California, Santa Cruz
Santa Cruz, CA 95060
Tel: (408) 429-2504

Dr. D. Sealy
EXXON Production Research Company
P.O. Box 2189
Houston, TX 77001
Tel: (713) 965-4222

Dr. L. Sykes
Lamont-Doherty Geological Observatory
Palisades, N.Y. 10964
Tel: (914) 359-2900

Dr. R. von Huene
U.S. Geological Survey
345 Middlefield Road
Menlo Park, CA 94025
Tel: (415) 323-8111

North Atlantic (Eastern)

Dr. L. Montadert, Co-Chairman
Inst. Francais du Petrole, Div. Geol.
1 et 4, Ave. de Bois-Preau
B.P. 18
92-Rueil-Malmaison
FRANCE
Tel: 967-11-10
976-17-66

Dr. David G. Roberts, Co-Chairman
Inst. Oceanographic Sciences
Brook Road, Wormley, Godalming
Surrey GU8 5UB
ENGLAND
Tel: 042-879-4141

Dr. Karl Hinz
Bundesanstalt fur Geowissenschaften
und Rohstoffe
Abt. Geophysik, 3 Hannover 51
Postfach 510153
FEDERAL REPUBLIC OF GERMANY
Tel: 0511-6468330

Dr. E. Seibold
Geol.-Paleon. Inst., Univ. Kiel
Olshausenstrasse 40/60, D-23 Kiel
FEDERAL REPUBLIC OF GERMANY

Dr. Jorn Thiede
Institut for Geologi
Universit et I Oslo
Postboks 1047
Blindern, Oslo 3
NORWAY
Tel: 46-6800, Ext. 9692

North Atlantic (Western)

Dr. R. Sheridan, Chairman
Department of Geology
University of Delaware
Newark, DE 19711
Tel: (302) 738-2569

Mr. John Ewing
Department of Geology and Geophysics
Woods Hole Oceanographic Institution
Woods Hole, MA 02543
Tel: (617) 548-1400, Ext. 2265

Dr. John A. Grow
U.S. Geological Survey
Woods Hole, MA 02543
Tel: (617) 548-8700

Dr. James P. Kennett
Graduate School of Oceanography
Narragansett Bay Campus
University of Rhode Island
Kingston, R.I. 02881
Tel: (401) 792-6216

Southeast Atlantic

Dr. Kenneth J. Hsu, Chairman
Eidg. Technische Hochschule Zurich
CH-8006 Zurich
Sonnegstrasse 5
SWITZERLAND
Tel: (01) 32-62-11, Ext. 3669

Dr. Karl Hinz
Bundesanstalt fur Geowissenschaften
und Rohstoffe
Abt. Geophysik, 3 Hannover 51
Postfach 510153
FEDERAL REPUBLIC OF GERMANY
Tel: 0511-6468330

Dr. Hugh Jenkyns
Dept. Geology & Mineralogy
University of Oxford
Parks Road
Oxford, OX1 3PR
ENGLAND
Tel: (0685) 54511

Dr. Yves Lancelot
Deep Sea Drilling Project
Scripps Institution of Oceanography
La Jolla, CA 92093
Tel: (714) 452-3521

Dr. David Needham
Centre Oceanologique de Bretagne
29273 Brest, CEDEX
FRANCE

Dr. K. Perch-Nielson
Technische Hochschule E.T.H.
Sonneggstrasse 5
Zurich 6
SWITZERLAND

Dr. Phil Rabinowitz
Lamont-Doherty Geological Observatory
Palisades, N.Y. 10964
Tel: (914) 359-2900, Ext. 501

Dr. N. J. Shackleton
University of Cambridge
Sub-Dept. of Quaternary Research
The Godwin Laboratory
Free School Lane
Cambridge
ENGLAND
Tel: 0223-58381

Dr. B. Tissot
Institute Francais du Petrole
Division Geologie
1 et 4 ave de Bois-Preau
B.P. 18
92502 Rueil Malmaison
FRANCE

Southwest Atlantic and Southern Ocean

Dr. James P. Kennett, Chairman
Graduate School of Oceanography
Narragansett Bay Campus
University of Rhode Island
Kingston, R.I. 02881
Tel: (401) 792-6216

Dr. P. F. Barker
Department of Geology
University of Birmingham
P.O. Box 363
Birmingham B15 2TT
ENGLAND
Tel: 021 472 1301, Ext. 2081

Dr. R. Dingle
Geology Department
Cape Town University
Rondebosch, Cape Town
SOUTH AFRICA

Dr. Dennis Hayes
Lamont-Doherty Geological Observatory
Palisades, N.Y. 10964
Tel: (914) 359-2900

Dr. David A. Johnson
Submarine Geology and Geophysics
National Science Foundation
1800 G Street, N.W.
Washington, D.C. 20550
Tel: (202) 632-4215

Dr. J. LaBrecque
Lamont-Doherty Geological Observatory
Palisades, N.Y. 10964
Tel: (914) 359-2900

Dr. R. Schlich
Institute de Physique du Globe
Observatoire Geophysique du Parc
St.-Maur, 4 Avenue de Neptune
94 St.-Maur-Des-Fosses
FRANCE

Dr. John Sclater
Department of Earth and
Planetary Sciences
Massachusetts Institute of Technology
Cambridge, MA 02139
Tel: (617)253-1980

Dr. Tj. J. Van Andel
Department of Geology
Stanford University
Stanford, CA 94305
Tel: (415) 497-0765

Dr. S. Wise
Department of Oceanography
Florida State University
Tallahassee, FL 32306

ALPHABETIC/TELEPHONE DIRECTORY

NAME	PANEL AFFILIATION	TELEPHONE	NON-U.S. COUNTRY*
ADAMS, R. L.	ILP	(203) 359-3500	
ADELSECK, C.	OPP	(714) 452-4172	
APPLEMAN, D.	IHP	(202) 381-6331	
ARTEMIEV, M.	PMP		USSR
ARTHUR, M.	SP4	(714) 452-3500	
AYALA-CASTANARES	Gulf of CA W.G.		Mexico
BAKER, D. J.	EXCOM	(206) 543-7160	
BAKER, E.	OGP	(305) 395-5100 Ext. 2701	
BALL, M.	Med Carib W.G.	(617) 548-8700, Ext. 141	
BALLY, A.	Med/Carib W.G.	(713) 220-5975	
BARKER, P.	SW Atl/S. Ocn W.G.	021 472 1301 Ext. 2081	U.K.
BASOV, V.	SCP	233-0620	USSR
BECKMANN, H.	DMP	05323/722-2235	FRG
BEIERSDORF, H.	PCOM, PMP	0511-6468-788	FRG
BELIY, N.J.	PPSP	1330130	USSR
BENDER, F.	EXCOM	0511, 64681	FRG
BENNETT, R.	SP4	(305) 361-3361, Ext. 381, 319	
BENSON, R.	SCP	(202) 381-6400	
BERGER, W.	OPP	(714) 452-2750	
BIJU-DUVAL, B.	PMP	749-02-14	France
BLANCHET, R.	AMP	(98) 03-16-94, Ext. 330	France
BOCK, W.	PCOM	(305)	
BOGDANOV, N.	EXCOM, OCP		USSR
BOIS, C.	PPSP		France
BOUGAULT, H.	OCP		France
BOUMA, A.	PMP		
BOYCE, E.	DMP, SP4	(714) 452-2779	
BRETT, R.	NSF	(202) 632-4274	
BRYANT, W.	PCOM, PMP, DMP	(713) 845-2153	
BUDNIKOV	ILP		USSR
CADET, J-P	AMP		France
CANN, J.	PCOM	0632-28511, Ext. 3090	U.K.
CEPEK, P.	SCP		FRG
CHAMLEY, H.	OPP		France
CHEHOVICH, V.	Med/Carib W.G.		FRG
CHRISTENSEN, N.	DMP	(206) 543-7143	
CLAYPOOL, G.	PPSP	(303) 234-3561	
CLOTWORTHY, J.	JOI Inc.	(202) 333-8276	
COLEMAN, R.	OCP	(415) 323-8111, Ext. 2334	
COULBOURN, W.	AMP, OPP	(714) 452-4884	

*Due to the abundance of U.S. participants, if no country is listed assume USA.

NAME	PANEL AFFILIATION	TELEPHONE	NON-U.S. COUNTRY
CONOLLY, J.	SP4	(203) 622-9130	
COUCH, R.	Mid An W.G.		
CREAGER, J.	PCOM, AMP, SCP	(206) 543-5099, (206) 543-4130	
CURRAY, J.	PMP, Gulf of CA W.G.	(714) 452-3299	
DATA HANDLING GROUP	DSDP	(714) 452-3530	
DAVIES, B.	PPSP	(415) 445-9400	
DAVIES, T.	IHP	(802) 388-7957	
DEBYSER, J.	EXCOM	723-5528, Ext. 420	France
DEGENS, E.	OGP		FRG
DICKINSON, W.	AMP	(415) 497-3226	
DINGLE, R.	SW Atl/So Ocn W.G.		South Africa
DMITRIEV, Y.	AMP		USSR
DOUGLAS, R.	Meso W.G.	(213) 741-7676	
DURBAUM, H.	EXCOM	0511, 64681	FRG
DYMOND, J.	PCOM, IGP, OCP	(503) 754-2296	
EGLINTON, G.	OGP, OPP	(918) 336-6600	U.K.
EINSELE, G.	OPP		FRG
ELDERFIELD, H.	IGP		U.K.
EMMERMAN, R.	OCP	(0721) 6083323	FRG
ERDMAN, G.	OGP	(918) 336-6600	
EWING, J.	PCOM, PSPSP, W No Atl. W. G.	(617) 548-1400, Ext. 2828	
FOX, P.	OCP, SSP, PPSP	(518) 457-3974	
FRANCHETEAU, J.	OCP	98 80-46-50	France
FUTTERER, D.	OPP		FRG
GALIMOV, E.	OGP		USSR
GARRISON, L.	PPSP	(512) 888-3295	
GARTNER, S.	PCOM	(713) 845-2154	
GIESKES, J.	IGP	(714) 452-4257	
GLASHOFF, H.	IHP		FRG
GOODELL, H. G.	PPSP	(804) 924-7761, Ext. 219	
GREEN, A.	PPSP	(713) 965-4172	
GROW, J.	PMP, W No Atl W.G.	(617) 548-8700	
HANDIN, J.	SP4	(713) 845-3251	
HARRISON, C.	EXCOM	(305) 350-7400	
HATHAWAY, J.	IHP	(617) 548-8700	
HAY, W.	EXCOM	(305) 350-7519	
HAYES, D.	PCOM, SSP, So Atl/So Ocn W.G.	(914) 359-2900	
HAYS, J.	OPP	(914) 359-2900 Ext. 403, 404	
HEATH, R.	EXCOM	(503) 754-3437	
HELSLEY, C.	EXCOM	(808) 948-8760	
HILL, M.	ILP	(412) 391-2400	
HINZ, K.	PMP, SE Atl & E No Atl W.G.	0511-6468330	FRG
HONNOREZ, J.	OCP	(305) 350-7508	
HORN, A.	PPSP	(415) 323-7126	
HOTZ, E.	PPSP	0201-726350	FRG
HSU, K.	OPP, SE Atl & Med Carib W.G.	(01) 32-62-11, Ext. 3669	Switz

	AFFILIATION	TELEPHONE	NON-U.S. COUNTRY
HUNT, J.	PMP, OGP	(617) 548-1400, Ext. 2562	
HUSSONG, D.	AMP	(808) 948-8711	
HYNDMAN, R.	DMP	(604) 656-8269	Canada
INGLE, J.	Cenozoic & Gulf of CA W.G.	(415) 497-2531	
IPOD DATA BANK		(914) 359-2900 Ext. 502	
JAGELER, A.	DMP		
JENKINS, G.	SCP	(0908) 63116	U.K.
JENKYNS, H.	OPP, Mesozoic & SE Atl W.G.	(0685) 54511	U.K.
JOHNSON, D.	SW Atl/So Ocn W.G.	(202) 632-4215	
JOHNSON, P.	OCP	(206) 543-5060	
JOI INC.		(202) 333-8276	
JOIDES Office		(617) 548-1400, Ext. 2828	
JONES, E.	SSP	01-387-7050	U.K.
KAGAMI, H.	PMP	03-376-1251	Japan
KARIG, D.	AMP	(607) 256-3679	
KELLER, G.	EXCOM	(503) 754-4763	
KENNETT, J.	OPP, SW Atl/So Ocn & W No Atl W.G.	(401) 792-6216	
KENT, P.	EXCOM	01-930-9232	
KINOSHITA, H.	DMP		Japan
KLEIN, G.	SP4	(217) 333-2076	
KNAUSS, J.	EXCOM	(401) 792-6222	
KOBAYASHI, K.	PCOM	03-396-1251	Japan
KOSMINSKAYA, I.	SSP		USSR
KUSHIRO, I.	OCP		Japan
KVENVOLDEN, K.	OGP, AMP	(415) 323-8111, Ext. 2817	
LABRECQUE, J.	SW Atl/So Ocn W.G.	(914) 359-2900	
LAHERRERE, J.	PPSP		France
LANCELOT, Y.	PCOM, EXCOM, PMP, PPSP, SE Atl & Meso W.G.	(714) 452-3521	
LANGSETH, M.	PCOM	(914) 359-2900	
LARSON, R.	OCP, Gulf of CA & Meso W.G.	(914) 359-2900 Ext. 346	
LEINEN, M.	IGP	(401) 792-6268	
LEPICHON, X.	PCOM, AMP	723-5528	
LEWIS, B.	SSP, Gulf of CA W.G.	(206) 543-6043	
LIPPS, J.	Cenozoic W.G.		
LOEBLICH, A., Jr.	IHP	(213) 825-1475	
LOUGHRIDGE, M.	IHP	(303) 499-1000, Ext. 6487	
LUDWIG, W.	Med Carib W.G.	(914) 359-2900	

NAME	PANEL AFFILIATION	TELEPHONE	NON-U.S. COUNTRY
MACKENZIE, D.	PPSP	(303) 794-2601 Ext. 410	
MANHEIM, F.	IGP	(617) 548-8700	
MATTHEWS, D.	DMP		U.K.
MAXWELL, A.	EXCOM, PPSP	(617) 548-1400, Ext. 2250	
McCAVE, I.	SP4	(0603) 56161	U.K.
McMANUS, D.	PCOM	(206) 543-5099	
MELIERES, F.	SP4	336-2525, Ext. 5157	
MERDINGER, C.	EXCOM	(714) 452-2836	
MEYERS, P.	OGP	(313) 764-0597	
MOBERLY, R.	PCOM, OCP, SP4	(808) 948-8765	
MONTADERT, L.	PMP, E No Atl & Med Carib W.G.	749-02-14	France
MOORE, J.	Mid Am W.G.		
MOORE, T.	PCOM, OPP, IHP	(401) 792-6178	
MURAUCHI, N.	SSP		Japan
MURDMAA, I.	OPP		USSR
NAGUMO, S.	SSP		Japan
NAKAMURA, K.	AMP		Japan
NALIVKIN, V.	PMP		USSR
NASU, N.	EXCOM		Japan
NATLAND, J.	OCP, AMP, OGP	(714) 452-3538	
NEEDHAM, D.	SE Atl W.G.		France
NEPROCHNOV	DMP		USSR
NIERENBERG, W.	EXCOM	(714) 452-2826	
NIGRINI, C.	SCP		
NIKITIN, L.	PCOM		USSR
NOWLIN, W.	EXCOM	(713) 845-7211	
OKADA, H.	OPP		Japan
ORCUTT, J.	OCP	(714) 452-3499	
ORR, W.	NSF	(202) 632-5849	
OZIMA, M.	OCP		Japan
PERCH-NIELSON, K.	SE Atl W.G.		Switz
PETERSON, I.	ILP		FRG
PETERSON, M.	EXCOM	(714) 452-3500	
PIKETTY, G.	EXCOM	723-5528, Ext. 420	France
PILKEY, O.	SP4	(919) 684-2206	
PISCIOTTO, K.	IGP, OGP, PMP	(714) 452-3521	
POKRYSHKIN, A.	DMP		USSR
POORE, R.	SCP		
PREMOLI-SILVA, I.	Med/Carib W.G.		Italy
RABINOWITZ, P.	SSP, SE Atl W.G.	(914) 359-2900, Ext. 501	
RENARD, V.	SSP	80-46-50	France

NAME	PANEL AFFILIATION	TELEPHONE	COUNTRY
RICHARDS, A.	SP4, DMP	(215) 861-3649,	
RIEDEL, W.	PCOM	(714) 452-4386	
ROBERTS, D.	PMP, E No Atl W.G., PCOM	042-879-4141	U.K.
ROBERTS, W.	ILP	(918) 661-3833	
ROMANKEVICH, E.	OGP		USSR
ROTHE, P.	SP4	0621-292-5458	FRG
RUDDIMAN, W.	OPP	(914) 359-2900 Ext. 528, 529	
RUTMAN, G.	ILP		France
RYABCHIKOV, I.	IGP		USSR
SALISBURY, M.	SP4, PCOM, DMP,OCP, PPSP	(714) 452-3503	
SARNTHEIN, M.	OPP		FRG
SAUNDERS, J.	SCP		Switz
SAVIN, S.	IGP	(216) 368-3690	
SCHERBAKOV,O. O.	IHP		USSR
SCHERMET, V. S.	PPSP	133-01-30	USSR
SCHILLING, J-G	EXCOM	(401) 792-6102	
SCHLAGER, W.	PCOM, SSP	(305) 672-1840	
SCHLANGER, S. O.	OPP		
SCHLICH, R.	SW Atl/So Ocn W.G.		France
SCHRADER, H.	Cenozoic W.G.		
SCHREIDER, A.	SSP		USSR
SCHREYER, W.	Med/Carib W.G.		FRG
SCLATER, J.	SW Atl/So Ocn W.G.	(617) 253-1980	
SEALY, D.	Mid Amer W.G.	(713) 965-4222	
SEIBOLD, E.	PMP		FRG
SEVERNS, J.	DMP		
SHACKLETON, N.	OPP, SE Atl W.G.	0223-58381	U.K.
SHARASKIN, A.	IGP		USSR
SHERIDAN, R.	PMP, SSP, PPSP W No Atl W.G.	(302) 738-1272	
SHIPLEY, T.	AMP, SSP	(714) 452-4193	
SIDORENKO, A.	EXCOM		USSR
SIMONEIT, B.	OGP	(213) 825-3331	
SLITER, W.	OPP, Mesozoic W.G.		
SNELSON, S.	PMP		
STEELE, J.	EXCOM	(617) 548-1400, Ext. 2500	
STEPHEN, R.	OCP	(617) 548-1400, Ext. 2583	
SYKES, L.	Mid Amer W.G.	(914) 359-2900	
TAKAYANAGI, Y.	OPP	0542-37-1111	Japan
TALWANI, M.	EXCOM	(914) 359-2900	
TARDY, Y.	IGP		France
TARNEY, J.	OCP	021-472-1301	U.K.
TAYLOR, G.	PPSP		U.K.
THEYER, F.	NSF	(202) 632-5849	
THIEDE, J.	PMP, E No Atl W.G.	46-6800, Ext. 969	Norway
THIERSTEIN, H.	OPP, Mesozoic W.G.	(714) 452-4646	
TIMOFEEV, P.	OPP, EXCOM, SP4	231-9418	USSR
TISSOT, B.	OGP		France
TREADWELL, T.	EXCOM	(713) 845-7211	
TREUIL, M.	OCP	336-2525	France
TSVETKOV, A.	OCP		USSR
TWINN, P.	EXCOM	01-930-9232	U.K.

	AFFILIATION	TELEPHONE	NON-U.S. COUNTRY
USHER, J.	IHP, SCP	(714) 452-3529	
VAIL, P.	PMP		
VAN ANDEL, T.	SW Atl/So Ocn W.G.	(415) 497-0765	
VAN HINTE, J. E.	PMP		Nether-lands
VON HUENE, R.	AMP, SSP, PPSP Mid Amer W.G.	(415) 856-7105	
VON RAD, U.	PCOM	0-511-6468-788	FRG
VON STACKLEBERG	PMP		FRG
WALTER, H.	AMP	0511-64681	FRG
WATKINS, J.	AMP, Mid Amer & Med Carib W.G.		
WEDEPOHL, K.	IGP		FRG
WEIGEL, W.	SSP		FRG
WELTE, D.	OGP		FRG
WHITE, S.	PPSP, SSP	(714) 452-3503	
WILKNISS, P.	NSF	* (202) 632-4134	
WILLIAMS, G.	ILP	01-235-0762	U.K.
WINTERER, E.	PCOM, OPP, OGP	(714) 452-2083	
WISE, S.	SW Atl/So Ocn W.G.		
WOODBURY, P.	IHP	(714) 452-3526	
ZDOROVENIN, V.	IHP		USSR

PUBLICATION HISTORY

Volume I of the JOIDES Journal was composed of the following issues:

May, 1975	Edition 1975/1
August, 1975	Edition 1975/2
November, 1975	Edition 1975/3

Volume II of the JOIDES Journal was composed of the following issues:

March, 1976	No. 4	1976/1	Special Issue: Manual on Pollution Prevention & Safety
April, 1976	No. 5	1976/2	
September, 1976	No. 6		

Volume III of the JOIDES Journal was composed of the following issues:

January, 1977	No. 1		
September, 1977	No. 2		
October, 1977	No. 3	Special Issue:	Initial Site Prospectus: Supplement Number One, Distributed in April, 1978.

Volume IV of the JOIDES Journal was composed of the following issues:

February, 1978	No. 1
June, 1978	No. 2
October, 1978	No. 3

To date, Volume V of the JOIDES Journal is composed of the following:

February, 1979	No. 1
June, 1979	No. 2
October, 1979	No. 3

To date, Volume VI of the JOIDES Journals is composed of the following:

February, 1980	No. 1		
June, 1980	No. 2	Special Issue:	Initial Site Prospectus: Supplement Number Two

PUBLICATION STATEMENT

JOIDES Journal is printed and distributed by the JOIDES Office at the Woods Hole Oceanographic Institution for the International Phase of Ocean Drilling (IPOD) under a contract provided by the National Science Foundation and administered through the Joint Oceanographic Institutions Inc., 2600 Virginia Avenue, N.W., Washington, D.C. 20037. The material is based upon research supported by the National Science Foundation under Contract No. NSF EAR 78-08082.

The purpose of the JOIDES Journal is to serve as a means of communication among the JOIDES Committees and Advisory Panels, the National Science Foundation, the Deep Sea Drilling Project, and interested earth scientists. Any opinions, findings, and conclusions or recommendations expressed in this publication are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.

Comments and suggestions concerning the content of this issue of JOIDES Journal should be directed to: Suzanne O'Connell, Woods Hole Oceanographic Institution, Department of Geology and Geophysics, Woods Hole, MA 02543. Comments and suggestions concerning future issues should be directed to: Paula Worstell, JOIDES Office, Scripps Institution of Oceanography, La Jolla, CA 92093.

Additional copies of this issue and available back issues should be requested from: Joint Oceanographic Institutions Inc., 2600 Virginia Avenue, N.W., Suite 512, Washington, D.C. 20037; telephone number: (202) 333-8276; cable address: JOIINC.

BACK ISSUES

Copies of the following back issues of JOIDES Journal are available from the JOI Inc. Office:

September, 1976	No. 6
January, 1977	VOL. III, No. 1
September, 1977	VOL. III, No. 2
October, 1977	VOL. III, No. 3 Special Issue: Initial Site Prospectus
February, 1978	VOL. IV, No. 1
April, 1978	Supplement Number One (For Special Issue published October, 1977; Volume III, No. 3)
June, 1978	Vol. IV, No. 2
October, 1978	Vol. IV, No. 3
February, 1979	Vol. V, No. 1
June, 1979	Vol. V, No. 2
October, 1979	Vol. V, No. 3
February, 1980	Vol. VI, No. 1
June, 1980	Vol. VI, No. 2
June, 1980	Supplement Number Two (For Special Issue published October, 1977: Volume III, No. 3)