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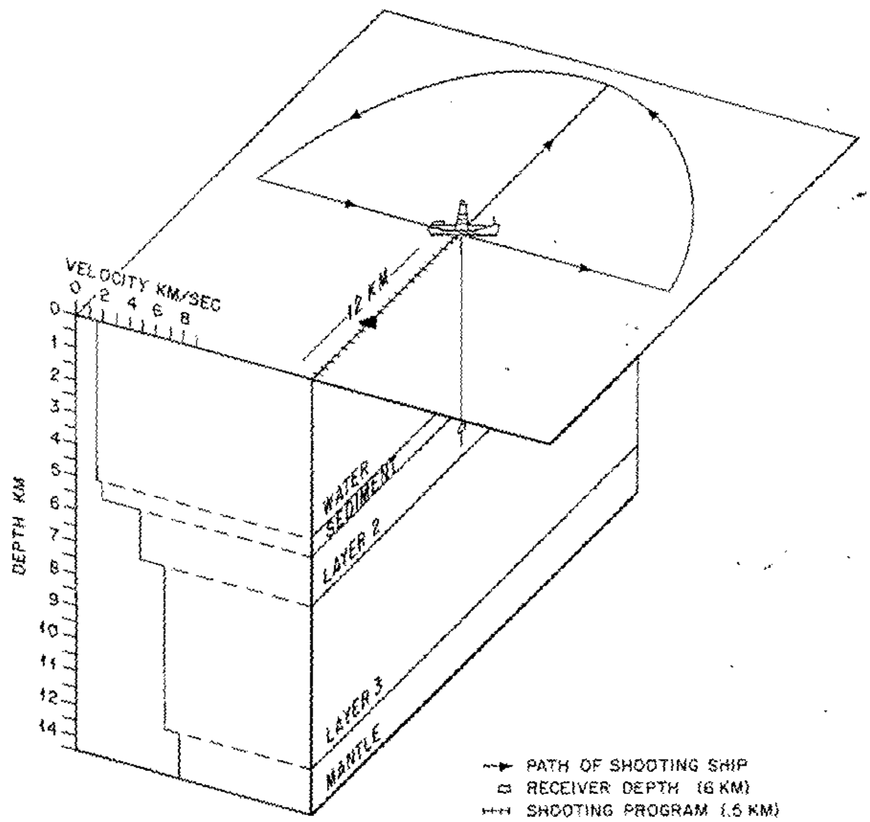

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LEGS 63-69--*GLOMAR CHALLENGER* SCHEDULE *(re-entry scheduled)

Leg	Port	Arrival Date	Departure Date	Days at Sea	Purposes
63	San Pedro	19 Sep	7-11 Oct	37-41	N.E. Pacific Paleo-environment
64	Mazatlan	16 Nov	21 Nov	46	Gulf of California (Ocean Crust)
65	Mazatlan	6 Jan 79	11 Jan 79	53	Gulf of California (P. Margin)*
66	Manzanillo	5 Mar	10 Mar	48	Mid-American Trench (Mexico)*
67	Manzanillo	27 Apr	2 May	50	Mid-American Trench (Guatemala)
68	San Jose	21 June	26 June	48	Galapagos (Costa Rica Ridge)*
69	Guayaquil	13 Aug	18 Aug	50	Galapagos (Geothermal Mounds Area)*

LEGS 70-81--TENTATIVE EXTENSION SCHEDULE

Leg	Port	Time of Departure	Purpose
	Balboa	Early Nov., 1979	Drydock
	Balboa	Early Dec., 1979	21-day transit
70	Recife	Late Dec., 1979	Paleoenvironment (SA-4)
71	Capetown	Mid-Feb., 1980	Paleoenvironment (SA-3, SA-3A, Agulhas Plat.)
72	Capetown	Early Apr., 1980	Paleoenvironment (SA-1, 2)
	Monrovia	Mid-May, 1980	15-day transit
73	Brest	Early June, 1980	Passive Margin (Biscay)
74	Plymouth	Late July, 1980	Passive Margin (Rockall Bank and Biscay)
75	Vigo	Mid-Sep., 1980	Passive Margin (N.W. Africa)
76	Monrovia	Mid-Nov., 1980	Paleoenvironment (SA-6, 7)
77	Montevido	Early Jan., 1981	Paleoenvironment (SA-5)
78	Rio de Janeiro Port of Spain	Early Mar., 1981 Mid-Mar., 1981	10-day transit Passive and Active Margin (Venezuelan Basin)
79	Miami	Early May, 1981	Passive Margin (Blake Plateau)
80	Miami	Late June, 1981	Passive Margin (Blake-Bahama Basin)
81	Norfolk	Early Aug., 1981	Passive Margin (slope and rise)

SUMMARY OF DEEP SEA DRILLING PROJECT: Leg 59

Shipboard Conclusions on Regional Tectonism

Regional conclusions based upon Leg 59 and previous drilling in the area are reasonably uncomplicated for the Palau-Kyushu Ridge, the Parece Vela Basin, and the West Mariana Ridge, but the West Philippine Basin continues to be enigmatic with abundant incompatible and inconclusive evidence.

Both remnant arcs have similar records of short, intense periods of explosive volcanism. Although accumulation rates of the Palau-Kyushu arc were so rapid in the middle Oligocene that no paleontological boundaries were crossed, minimum rates can be postulated. The following sequence of events can be postulated: Palau-Kyushu volcanism began no earlier and perhaps significantly later than about 40 m.y. and built about 2 km of intercalated flows, dikes, sills, and breccias, with average velocities of 3.5 km/sec., to the level reached by Site 448 penetration. Another 0.6 km accumulated in less than a few million years, making the local volcanic activity in the arc less than 9 m.y., ending at 32 or 31 m.y. Above the last lava flow, another 166 m of volcanic ash and tuff from unspecified sources accumulated for an unspecified time but, by 26 m.y., deposition of nannofossil chalk and ooze began, and dominated through late Oligocene/middle Miocene time. During latest Oligocene, at about +25 m.y., arc subsidence began and thereafter the depth of sedimentation was close to the CCD.

Over 600 m of volcaniclastic water-laid tuffs and breccias accumulated on the West Mariana Ridge in 1.5 m.y. or less, volcanism terminating in late Miocene, about 10 m.y. Site survey seismic data suggests that in excess of 2 km of this volcaniclastic material covers the arc; with a 400 m/m.y. accumulation rate, the period of volcanic activity on the arc probably is greater than 5 m.y.

A classic case for symmetrical spreading in the Parece Vela Basin can be built from Sites 449 and 450 data. If the deep central rift of the IPOD Trough that bisects the basin is the fossil center for back-arc spreading, then the age of the last volcanism on the Palau-Kyushu arc and the basement ages at Site 449, 450, 53, and 54 should fall along a straight line on a time-distance plot and the time of extinction of spreading will be indicated by the IPOD Trough time coordinate. This simple test is complicated by the fact that, at Sites 53 and 450, basement was not reached. Rather, shallow intrusions within a wedge of rapidly accumulated tuffs from the West Philippine Ridge were encountered. The position of both intrusions fall off the line, giving younger dates. Sites 448, 449, and 54 fall roughly on a 2 cm/yr slope and the IPOD time coordinate is about 10 m.y. Although these are tentative shipboard estimates and must be checked by magnetic reversal patterns and absolute dating, they confirm that a simple symmetrical spreading from a central rift fits available data for the Parece Vela Basin.

The origin of the West Philippine Basin is a dilemma. Patterns of magnetic anomalies, structural trends, heat flow patterns and bathymetric trends all fit a model of northeast-southwest-oriented spreading from the Philippine Ridge toward the Oki Daito Ridge on the north side. It is difficult, however, to visualize a spreading center that would have been active at this orientation while subduction was occurring along the eastern boundary of the Palau-Kyushu arc. Certainly the basin is deeper than implied by the comparison of their ages with mid-ocean ridge time-elevation curves. Absolute dating of samples collected from the West Philippine Basin hopefully will help solve these problems.

Chemical studies of basalts from the West Philippine and Parece Vela Basins should be valuable to determine whether special melting mechanisms or crystal fractionation trends within the basalts, or even different mantle chemistries, can be recognized for these basins. The 600 m of flows and breccias on the Palau-Kyushu Ridge, and the tuffs and breccias on the West Philippine Ridge provide opportunity to study temporal change in chemistry and petrology within an arc, to investigate diagenetic and hydrothermal alterations within basaltic glass-rich breccias and tuffs, and to identify metallogenic processes that operate within arc systems. Perhaps chemical knowledge of the lavas on the Palau-Kyushu arc can be used to predict the depth to the fossil Benioff zone and the relative position of the site within the original arc and thus suggest where arcs may sunder during initiation of a new back-arc spreading center.

The thick sequences of coarse volcaniclastic sediments provide good opportunity to investigate tectonic, volcanic, and sedimentological interrelationships; the repetitious sequences of coarse angular debris grading upward into fi--

bated layers probably represents spasmodic deposition controlled by tectonic events. Fragments of corals, gastropods, and larger foraminifers suggest original shallow water deposition. Lenses of lignite in the tuffs show that some land surface was vegetated within the West Philippine arc complex. Scattered pumiceous layers may record andesitic volcanic events. The sharp contrast between coarse angular basaltic sedimentary breccias on the distal end of the sediment wedge at Site 447 in the West Philippine Basin, and the monotonous fine tuffs of the equivalent sediment wedge on the eastern side of the Parece Vela Basin, also presents a challenging sedimentological problem.

For every solution to original problems that is found during intensive exploratory programs such as the Leg 59 part of the Mariana Transect, a myriad of newly recognized problems arise. Deep Sea Drilling will continue to be the most effective investigative tool available for these problems.

SUMMARY OF DEEP SEA DRILLING PROJECT: Leg 60

Introduction

The *Glomar Challenger* left Guam on March 21, 1978 to drill the second part of a series of holes along a transect at about 18°N latitude in the South Philippine Sea. These holes were designed to provide data concerning formerly and currently active inter-arc basins and island arc ridges in the South Philippine Sea. The western half of the transect was completed on Leg 59 with holes in the Philippine Sea, on the Palau-Kyushu Ridge, in the Parece-Vela Basin and on the West Mariana Ridge. The major objectives of Leg 60 were threefold:

1.) to study the effects of the subduction process on the fore-arc region of the Mariana island arc;

2.) to trace the structural evolution of the presently active island arc and its relationship to the remnant arcs; and

3.) to investigate the mode of spreading and petrologic character of the crust in the actively spreading inter-arc basin, the Mariana Trough.

The ship returned to Guam on May 15, 1978, after having drilled ten sites (17 holes) along the transect.

The Great Western Pacific Unconformity.

Two holes were attempted at Site 452. This site was intended to provide a reference for comparison of oceanic sediments and crust with material to be recovered in subsequent drilling on the inner wall of the trench. At both holes the drill string penetrated less than 30 m of Quaternary pelagic clay before hitting impenetrable Upper Cretaceous cherts. Leg 60 was not the first DSDP cruise to run afoul of chert under shallow burial in the western Pacific. No fewer than 16 sites between the Caroline Ridge near the southern Mariana Trench and the region north of the Shatsky Rise off Japan have been drilled through an unconformity between Miocene to Quaternary sediments, and underlying Jurassic or Cretaceous cherts. Apparently, the combined effects of low surface-water productivity, distance from terrestrial sources, and subsidence of the western Pacific below the calcite compensation depth produced a long interval during which virtually no sediment was deposited over much of the western Pacific. As a result of drilling at Site 452, no Tertiary sediments from the Pacific Plate were expected at sites on the inner trench wall.

THE MARIANA TROUGH

Sedimentation Patterns

Sediments in the Mariana Trough sites are a composite of biogenic, hemipelagic, and volcaniclastic components, in which the latter two predominate. In all sites, Pleistocene oozes are distinctly siliceous (radiolarians, diatoms, sponge spicules). Prior to about midway in the Pleistocene, however, no siliceous microfossils are preserved. This transition occurs at about the same time at other Leg 60 sites and has been reported by previous DSDP legs (31, 58, 59). It thus appears to be of some regional significance. Nannofossils occur in most sediments, but foraminifers are rare to absent, and total calcium carbonate is usually less than 1%, indicating sedimentation very close to the carbonate compensation depth.

The major source of volcaniclastic material to all the sites in the Mariana Trough was the Mariana Arc. Little contribution came from the West Mariana Ridge, since volcanism there effectively ceased in early late Miocene time (see Leg 59 Cruise Summary), about 10 m.y. ago (ash layers do exist in earliest Pliocene strata at Site 451, however). Some of the arc-derived sediment reaching Sites 455 and 456 probably was detritus produced by erosion from the Mariana islands, but most of the volcanic material at Sites 453 and 454 must have originated as pyroclastic debris. At Site 453, the abundance of glass and the frequency of vitric tuffs diminishes up-section, whereas the thickness of individual mudstone and ooze layers increases. This suggests either that volcanism has diminished on the Mariana Arc since the Miocene, or that spreading in the Mariana Trough has moved the sites away from its principal volcaniclastic source, the Mariana Arc. At Site 458, east of the active Mariana Arc, volcanic ash is abundant in post-Miocene (especially post-late Pliocene) sediments. This implies that volcanic activity on the arc has not diminished since the Miocene, and therefore that spreading in the Mariana Trough is responsible for the upward reduction in volcaniclastic components at Site 453.

The increase in age of the oldest cored sediments away from a large graben in the center of the Mariana Trough (the suspended axis of spreading) suggests that the trough is being extended by a process similar to typical sea-floor spreading. Also, the temporal change in the abundance of volcanic ash content at the Leg 60 sites suggests that the distance between the western sites (453 and 455), but not the eastern sites (456 and 455), and the present Mariana arc has increased during the Pleistocene.

Basalts in the Mariana Trough

Several different basalt types were recovered in the short basement sections at each of Sites 454 and 456. These were typically pillow basalts with some thicker flows. At Site 454 the basalts are interbedded with sediments. In general, the basalts are sparsely phyric with minor plagioclase, or plagioclase and olivine microphenocrysts. They are considerably more vesicular than typical ocean ridge basalts, and the average thickness of petrographically identified pillow or flow units (about 10 m) is considerably less than found by drilling on the Mid-Atlantic Ridge (i.e., an average of about 65 m at Site 395A, drilled on Leg 45, with the thickest unit 209 m thick).

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Metagabbro-Metabasalt Breccias at Site 453

At site 453 igneous and metamorphic polymict breccias were recovered that are so unusual that their place in the evolution of crust within the Mariana Trough is uncertain. Three breccia types were encountered. The uppermost of these (86 m thick) is predominantly composed of coarse gabbro clasts (up to 45 cm drilled length) with lesser metabasalts, cemented in carbonate, clay, and/or iron oxide matrixes. Some of the gabbros are pegmatitic, and others contain bent and dislocated minerals, evidence for penetrative deformation. Most are amphibole gabbros, but olivine, clinopyroxene, and orthopyroxene occur in many. Many have cumulus textures. The second breccia consists almost entirely of metavolcanic fragments, and the third is a continuously cored 1.5 m long serpentinized noritic-gabbro cataclastite, cored just prior to bit failure.

Most of the gabbros, and all of the basalts, were distinctively metamorphosed to greenschist facies mineral assemblages prior to incorporation into the breccia. Chlorite, prehnite, pumpellyite, epidote and stilpnomelane are the typical metamorphic minerals. A portion of the upper breccia, and both of the lower breccias, experienced hydrothermal alteration. This resulted in retrograde metamorphism to lower greenschist facies mineral assemblages and pyrite mineralization. It may have been responsible for a sharp increase in Mg^{++} in sediment pore waters just above the breccias.

Because of the pervasive metamorphism of the basalts and the gabbros in the upper breccias, and the lack of fresh (or even altered) basalt pillow fragments, it is not possible to envision this rock assemblage coming from exposures of inter-arc basin crust. Instead it is suggested that these rocks represent deep-seated portions of crust originally beneath the West Mariana Ridge, exposed and uplifted during the early rifting of the Mariana Trough. They may have been deposited in the pond as landslide debris. The metamorphism appears to be of higher grade than typical ocean-ridge greenschist facies rocks, and probably occurred at greater depths.

Recent (perhaps active) Hydrothermal Activity at Site 456

Basaltic rocks at Site 456 show the effect of hydrothermal activity that may still be going on. As at Site 453, there is an increase in Mg^{++} in sediment [illegible] waters just [illegible] is smaller at Site 456. In both Holes 456 and 456A, alteration is most intense at the top of the basement rocks. Pyrite mineralization is abundant. Interbedded and incorporated limestones have been recrystallized and pyritized. Other basalts and associated mudstones have been silicified with quartz and opalline silica abundant in the groundmass and filling vesicles.

The zone of pyrite mineralization is 19 m thick in Hole 456, and 10 m thick in Hole 456A. Below this, in both holes, alteration is to clays, Fe-oxides, and palagonite, with minor FeMn oxides encrusting fracture surfaces. Toward the base of both holes, rocks are considerably fresher and even include fresh glass. Hydrogeneous Fe-Mn deposits similar to those drilled on Leg 54 at the Galapagos Mounds Geothermal Area (Geotimes, 1977) occur near the top of this zone in Hole 456. The lowermost sediments above basement are distinctly reddish in color, suggesting that they contain a component of basal red clays, similar to hydrothermally-derived sediments cored from the flanks of the East Pacific Rise.

A heat flow value of 2.7 HFU was obtained in Hole 456, and a value of 1.1 HFU in Hole 456A. Such extreme local variability is almost certainly a consequence of present-day hydrothermal flux. The occurrence of hydrothermally altered basalt at the top of both holes (200 m apart) suggests that upward migration of fluids may have been stopped by the less permeable sediments.

Tectonic relationships

As previously mentioned, the ages of the oldest cored sediments suggest that the Mariana Trough is spreading symmetrically from an axial graben in a manner similar to typical sea floor spreading. This observation is supported by reflection seismic profiles across the center of the trough which show block fault dominated bathymetry, with slopes facing the central graben having dips near 25°, whereas slopes facing the edges of the trough have dips of less than 10°. The magnetic profiles across the drill sites are low amplitude and are heavily influenced by topography, so they could not be confidently correlated. However, some preliminary anomaly identification was attempted on the ship which, when considered along the oldest sediment dates, give spreading rates for the Mariana Trough of around 2 cm/yr (half-rate).

Magnetic polarities in the basalts at both Sites 454 and 456 match the signs of the magnetic anomalies of the areas drilled; the inclination ranges suggest extrusion at about the present latitude.

THE MARIANA ARC AND ARC-TRENCH GAP

Five sites (nine holes) were drilled in the portion of the Mariana Transect between the trench axis and the presently active volcanic arc. The sites were chosen with the following objectives:

1.) To determine the nature and origin of the underlying arc material;

2.) To assess what contributions to the structure of the arc-trench region are made during the various stages of volcanism, vertical tectonic movement, accretion and/or erosion at the subduction contact;

3.) To evaluate the composition and timing of the various volcanic events in relation to the history of subduction and island arc and back-arc basin development; and

4.) To obtain information on the present physical geology at the drill sites, including degree of deformation, fracturing, physical properties of the cores, paleomagnetics, metamorphic (and hydrothermal) effects, etc., that can be compared with regional geophysical and tectonic models of the arc-trench gap.

See Site Reports 457-461A for a description of the results.

History of Sedimentation

In the Mariana arc-trench gap, the Cenozoic sedimentary history begins in the Eocene with a general unconformity between Cenozoic sediments and basement. At Site 459 the sediments cored immediately above island-arc type basement are middle Eocene claystone with cherts, whereas at Site 458 they are early Oligocene and at Site 460 they are late Eocene coarse sandstones. These variations in the age and facies of the deepest sediments, at sites spaced fairly close together, underscore the general unconformity between the sediments and their volcanic-arc type substratum. The sediments are coarse, poorly sorted detrital sandstones (Site 458) or sands, gravels, and conglomerates (Site 460). The basal volcaniclastic debris is strongly or completely altered with unusual (reddish

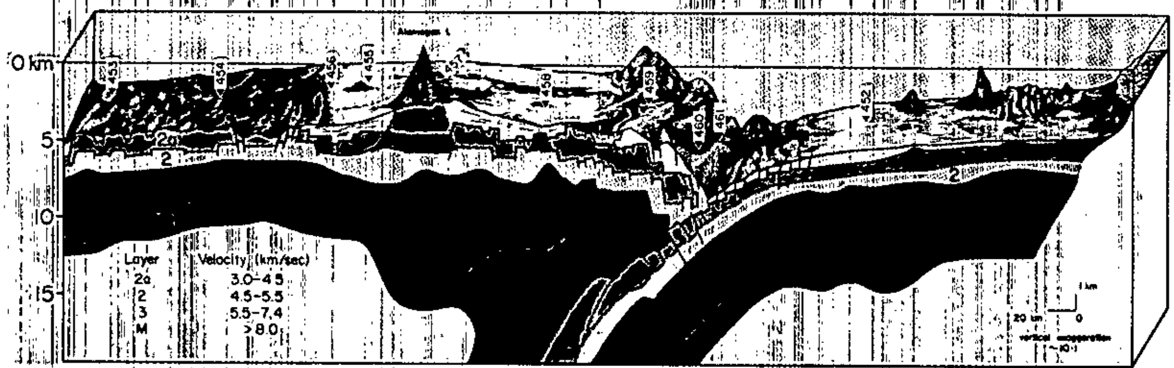

Figure 1: Physiographic diagram of the eastern half of the South Philippine Sea Transect investigated by drilling on Leg 60. Site locations are shown by arrows. Crustal structure, as inferred from seismic refraction stations, is also shown. With depth, successive layers are: (1) sediments; (2) Layer 2a; (3) Layer 2B; (4) Layer 3; (5) mantle.

pink, red purple, brown) colors (Sites 458, 459, and 460). Eocene clays and claystones at Site 459 may have resulted from reworking of altered (submarine or subaerial?) volcanic materials.

Cenozoic sedimentation is controlled by several major factors: biogenic accumulation, redistribution of volcanic products, depth of deposition versus the CCD, and tectonics. Biogenic sediments are mainly calcareous (nannofossils) through the Eocene to the Pliocene and are particularly well-developed in Oligocene-Miocene chalk at Site 458, suggesting deposition not far from the equatorial zone of high productivity. In the late Pliocene and Pleistocene, siliceous biogenic components increase significantly at all sites. Volcaniclastic materials are present throughout, but they decrease at the end of the early Oligocene (Sites 458 and 459), and are particularly abundant in Pleistocene sediments.

The Mariana arc-trench Cenozoic history is a good example of tectonically controlled sedimentation, with the record of tectonic events preserved in the stratigraphic column. Reworking and redeposition are a constant feature of all the sequences, including the carbonate-rich (mid- to early late Miocene) sequence of Site 458. Cenozoic sediments, Mesozoic sedimentary rocks (cherts) and igneous rocks (basalts, basaltic andesites, mafic rocks, metadiabases and metabasalts) occur throughout younger Cenozoic sediments in the two trench sites (460 and 461). This indicates that at the time of deposition, outcrops of rocks of these types were present nearby. The presence of redeposited Cretaceous material in Quaternary sediments implies tectonic disturbance.

At Site 459, thick turbidites were deposited during Oligocene and early Miocene time, indicating active vertical tectonics resulting in subsidence of that site relative to the surrounding trench slope break region. In contrast, the time-correlative sediments at Site 458, which is about 40 km west of 459, contain no turbidites, suggesting that this site is an uplifted portion of the fore-arc.

Frequent hiatuses occur throughout the Cenozoic sequences, especially in the Neogene. These non-depositional and/or erosional periods may be tied to active tectonic events which modified topographically controlled bottom current regimes, and the relative composition of sedimentary materials (detrital versus biogenic).

The nature of small-scale sediment deformation in the region between the present Mariana Trench and the active arc suggests that this region has been under tensional stress during the major part of the Cenozoic.

Petrologic Summary, Arc-Trench Sites

The clinopyroxene-bearing, glassy, plagioclase-free lavas (tentatively for this report called "boninites") recovered in the upper portions of Hole 458 are of particular importance with regard to inferences about the tectonic association of the fore-arc region. Lavas of this type have not been reported from intra-oceanic localities (i.e., seafloor or oceanic islands), nor from inter-arc basin localities. But they have been reported from other frontal-arc sequences (e.g., Bonin Islands) from the inner trench wall (e.g., southeast of Guam), and from zones of compressional tectonics (e.g., Cape Vogel, New Guinea). This suggests that they are either a product of arc volcanism, or are at least closely associated with such volcanism.

Interbedded with the "boninites" of Site 458 are more typical clinopyroxene-plagioclase basalts, some of which contain minor orthopyroxene and quartz. The presence of orthopyroxene and groundmass quartz distinguishes these rocks from most seafloor basalts and interarc basin basalts and suggests that they were produced by arc-related volcanism. The fact that these lavas are intercalated with the "boninites" is perhaps the strongest evidence for attributing the origin of the boninites as well to arc volcanism.

The igneous and metamorphic fragments recovered at Sites 460 through 461A are altered and metamorphosed basalts, gabbros, and polymict breccias of the type commonly found in ophiolites. Without stratigraphic relationships, it is difficult to deduce much about the origin of these fragments. However, it is worth noting that they lack high-pressure/low temperature metamorphic mineral assemblages (i.e., glaucophane-jadite etc.) and, instead, have high temperature assemblages (i.e., amphibolite facies). In addition, the polymict breccias bear a close resemblance to the breccias cored at Site 453 in the Mariana Trough, except that they contain abundant amphibole in place of the stilpnomelane evident in the Site 453 samples. Tectonic fabrics are evident in the 460-461A, as well as the 453, samples.

Tectonics

Preliminary interpretation of the samples and data acquired during Leg 60 support several major aspects of a crustal model, including: 1.) the eastern limit of Mariana Trough back-arc basin crust (and thus the point of initial opening) is beneath the arc-derived sediments at least as far east as the presently active volcanic islands; 2.) volcanics (perhaps of anomalous compositions exist at shallow depths in the fore-arc region (Site 458) and are probably related to the observed large gravity and magnetic anomalies there; 3.) probable arc-related volcanic basement underlies the fore-arc region at least as far east as Site 459 near the trench-slope break; and 4.) the entire subduction region, including the oceanic plate, inner trench wall, and fore-arc region is dominated by normal faulting and tensional strain.

The fourth feature is perhaps the most striking aspect of this converging active margin. The predominance of slumping and normal faulting extends from the regional scale of the geophysical surveys to the minute scale of the deformation of lithified sediments in Hole 459B. The level of tensional deformation increases from the relatively undisturbed crust at Site 458 to the increasingly deformed crust at Site 459, to the rubble at Sites 460 and 461. Extensive vertical motion (mainly down-faulting toward the trench) as evidenced by displacement of sediments relative to the CCD, turbidites, and reworking of previously deposited material, also exists with increasing intensity toward the trench. No evidence is present for a massive accretionary wedge, although this lack of evidence is made less compelling by the sparse drilling results on the inner wall of the trench. Certainly whatever accretion has occurred has not uplifted the outer trench slope. There are no sediments ponded in the trench axis and there are almost no sediments anywhere below the trench slope break derived either from the oceanic plate or from the island arc. Based on drilling at Site 452, few or no post-Cretaceous sediments were expected to be derived from the Pacific Plate. However, the presence of redeposited Cretaceous radiolarians and some of the metabasalts and gabbros at Sites 460 and 461 probably came from accreted fragments of the Pacific Plate in the inner trench wall. Nevertheless, at this early stage of consideration of the Leg 60 results, the character and age trends of the fore-arc and trench wall sediments suggest that the overriding plate (the arc) is being tectonically eroded and itself subducted, rather than accreted, along its contact with the subducting slab.

LEG 61 SUMMARY

Introduction

The plan for Leg 61 was that it should be entirely devoted to drilling a single, multiple re-entry hole. This hole was to penetrate the Cretaceous and Late Jurassic rocks overlying the true oceanic basement and penetrate 200 m into the top of the Pacific Plate. During the leg a pilot hole, 462, was drilled to a total depth of 617 m. The multiple re-entry hole, 462A, was drilled to a total depth of 1068.5 m. A total of 1245.5 m of sediment and basalt was cored and 725.5 m recovered. Hole 462A was terminated in a thick sill complex. At a depth of 995 m, a thin bed of sediment contained a fauna of Hauterivian age. No datable sediments were found below this depth.

Scientific Objectives

The precise location of Site 462 was chosen to penetrate the basement at anomaly M-26, approximately 155 m.y. old, into the Nauru Basin west of the Ralik Chain of the Marshall Islands. This area formed at a fast-spreading, Pacific plate boundary, 145-155 m.y. ago in the Late Jurassic (See Figure 2). Cores from this locale should allow us to better understand biostratigraphic evolution and sedimentary processes in an open-ocean, Mesozoic environment, the petrologic nature of fast-spreading oceanic crust, the tectonic history of the Late Jurassic Pacific plate, and the nature of the Jurassic magnetic quiet zone.

Sedimentation and Stratigraphy

Sedimentation in the Nauru Basin has since at least Cenomanian time been dominated by turbidite deposition from surrounding highs. Three major sedimentary units were delineated at Site 462 and 462A:

1.) 0-297 m: Calcareous and radiolarian oozes and chalks, mainly of turbidite origin and of Oligocene or younger age.

2.) 297-447 m: Cherts, chalks and limestones of Eocene to Maestrichtian age.

3.) 447-599 m: Volcanogenic and zeolitic sandstones, mudstones and limestones, extending downward into the sill complex.

Sediments found deep within the sill complex (Unit 4) are discussed in the section on Igneous Petrology. The depth of the site is 5180 m and well below the CCD. The "background" sediments are brown-red clays.

Unit 1 is made up of turbidite units 0.1 to 8 m thick. A typical unit is made up of a basal layer of white foram-nanno ooze that grades up into light brown radiolarian age which in turn is capped by brown pelagic clay. The ooze-chalk transition lies between 230 and 250 m. Much of the fine fraction $CaCO_3$, in the form of small planktonic and benthic forams and nannofossils, probably have their origin in the highly eroded northeast face of the Ontong-Java Plateau. The bathymetry of Site 462 shows turbidite and levee features showing flow into the area from the southwest.

Against this general background of turbidite oozes and chalks two less common but significant lithologic contributions are found in Unit 1, ash and shallow water sand.

The ashy component is brown within radiolarian ooze and greenish-gray within carbonate ooze. Yellow-brown glass, glass partly altered and crowded with opaque dust, feldspar, pyroxene, and some amphibole are the components from volcanic activity nearby. Perhaps they record the early Quaternary growth of Kusaie Island, the easternmost and apparently youngest of the Caroline Islands chain, lying about 260 km to the southwest.

Sands of shallow-water origin are thickest at about 210 m depth and have a carbonate and volcanic component. The carbonate assemblage is Eocene in age but also contains Paleocene and Cretaceous redeposited elements. The assemblage indicates an origin in a reef to shallow-bank environment. In thin section, intensely recrystallized and strongly calcite-cemented rock fragments of Eocene age were transported into the deeper water Oligocene facies. A similar event took place during Oligocene time in the Line Islands (See Table 1, Site 165 of DSDP Leg 17).

Volcanic grains are mainly lithic grains, commonly vesicular as well as opaque to transmitted light at their thickness, but vitric and crystal (pyroxene) grains are also present. Like the limesand, they are detrital in origin. Probably they represent times in the Oligocene when parts of the Marshall Islands were elevated above sea level, eroding foraminifers of probable Eocene age and volcanic rock from the tops and submarine slopes of the islands.

Unit 2 is essentially a diagenetically advanced and older version of Unit 1. Turbidites dominate this lim- unit.

encountered at many DSDP sites. At 447 m sub-bottom there is a fairly sharp break in the type of sedimentation from the dominantly calcareous Unit 2 to a volcaniclastic-rich Unit 3.

Unit 3 embraces the time interval between late Campanian/early Maestrichtian and Cenomanian. The top of the unit comprises light olive-gray to pale yellow nannofossil chalks and limestones. These sediments, which contain considerable percentages of unspecified carbonate, traces of volcanogenic grains, very sparse Radiolaria and sponge spicules, are interpreted as a pelagic product in which the amount of redeposition has been modest.

Interbedded and intermixed with these "host" lithologies are a series of greenish gray to greenish-black volcaniclastic sediments. These deposits display a range of sedimentary structures: tabular and trough cross-lamination, horizontal and parallel lamination, angular and scoop-shaped scours, pebbly mudstone conglomerates whose clasts range up to 2 cm, slump structures, grading. The basal part of the volcaniclastic section comprises a matrix-rich volcanic breccia ("wackestone"), where sparse altered mafic clasts are enveloped in bluish-gray clay. Volcanic glass, heavy minerals, Radiolaria, sponge spicules, fish remains, and clay constitute the fine fraction.

Associated with these volcaniclastic sediments are a variety of shallow-water skeletal grains. These shallow-water fossils of Maestrichtian to late Campanian age indicate that shallow banks within the photic zone existed. The presence of calcite-cemented material mixed with the free individual foraminifer tests suggests that these banks may have emerged and that, subsequently, fragments of these emergent limestone mixed with co-existing reef and fore-reef material in the turbidites.

The coincidence of redeposited fossils of Campanian-Maestrichtian age in deep water facies of the same age at Site 462 and at Sites 165 (Leg 17), 315, and 316 (Leg 33) in the Line Islands indicates that during Campanian-Maestrichtian time limestone islands, indicative of a relative sea level regression, existed over a wide area of the central Pacific Basin.

The volcaniclastic sediments, with their associated fauna, are clearly redeposited and, since many of them display features typical of Bouma sequences, they may be readily interpreted as turbidites. The matrix-rich volcanic breccias were probably formed by deposition from a plastic mobile mass, possibly some kind of debris flow. It is possible that the original texture was more granular initially, and considerable in situ devitrification of glass to clay minerals has taken place. All these volcaniclastic sediments presumably reflect synchronous volcanism nearby—a phenomenon that must have had regional significance.

Below the volcaniclastic sediments are light olive-gray claystones to limestones that typically occur in sequences that are calcareous and laminated at the base and pass upwards into more clay-rich burrowed tops. Above this burrowed level, zeolitic claystones, usually consisting of pale bluish-green and pale brown layers (2 to 3 cm thick) are typically developed. The olive-gray limestones to claystones are here interpreted as redeposited material, and the zeolitic claystones as the product of background pelagic sedimentation. Further down the section the thickness of the zeolitic claystones gradually increases and colors of grayish-red and reddish-brown zeolitic claystones to siltstones, with local faint horizontal lamination, become the dominant lithology. Traces of radiolarians, sponge spicules, fish teeth and nannofossils constitute the fauna and flora. Occasionally, beds of greenish-gray horizontally laminated volcaniclastics are interbedded. Near the base of the section, green mottles and calcite veins occur, horizontal lamination is common; a nannofossil marlstone is recorded, and zeolitic mudstone (with nannofossils in Section 1) is dominantly reddish to light brown but contain horizontal mm-scale laminae colored dark yellowish-orange, moderate brown, and grayish-green. Most significant perhaps are interbedded reddish-brown and greenish-brown horizontal laminae and a distinct black thin layer. Zeolitic mudstone, containing a piece of moderate brown porcellanite is in contact with basalt.

The zeolitic mudstones presumably represent the alteration products of fine-grained volcanic material which has undergone modest redeposition; the former presence of siliceous organisms, tentatively identified in smear slides is supported by the presence of chert.

The grayish-brown to black sediments, dated at about the Cenomanian-Turonian boundary, are intriguing in that similarly colored coeval organic-rich sediments are recorded from a variety of locations within the major ocean basins and in pelagic sections on land. In the Pacific, for example, Cenomanian organic-rich layers are present on Hess and Shatsky Rises, where their origin is interpreted as a function of the intersection of an expanded oxygen-minimum layer with the shallow surface. The presence of similar organic-rich levels in sediments laid down in water depths several kilometers greater than this would require modification of this simple model.

The discovery at Site 462 of redeposition bank and reef skeletal debris of Campanian-Maestrichtian age is of considerable interest. It shows that the Marshall Islands, the logical source of this material, have a Cretaceous shallow-water reefal history comparable to the Line Islands. Prior to Leg 61 our knowledge of the age of the Marshall Islands was entirely confined to the results of the Eniwetok drilling. There basalt was reached below middle Eocene reefs. We must now assume that perhaps drilling at Eniwetok stopped in a post-Cretaceous reef flow and that the Cretaceous reef was not reached.

Igneous Petrology

The mid-Cretaceous volcanic section represents a voluminous outpouring of tholeiitic basalt magma. The volcanic complex is a hugh, non-edifice building, off-ridge outpouring, chemically similar to mid-ocean ridge tholeiite (MORB). MORB is made up of single sills, multiple sills, extrusive or semi-extrusive flows, and hyaloclastic sediments.

The upper 170 m of the complex from 560 to 730 m is made up of interbedded sills, and hyaloclastic sediments. The single sills are characterized by:

1.) glassy margins or fine-grained marginal zones with sub-horizontal attitude, and
2.) orderly coarsening-inward grain size variations, coarse-grained interiors and diabasic textures.

Thicknesses range from a few tens of cm to over 50 m. Multiple sills are more difficult to distinguish, but where fine-grained to glassy apophyses are present, multiple intrusion can be demonstrated on a small scale. On larger scales, it has been inferred by the presence of alternating fine-grained and coarser-grained units which lack glassy margins.

The upper part of the sill complex in Hole 462 consists of intercalated igneous and sedimentary units, the latter largely hyaloclastic. Four of these were found between 580 and 606 m sub-bottom. The stratigraphically highest of these layers is a grayish-black to black waxy claystone with relict hyaloclastite texture containing abundant zeolites and fragments of dark material which may be either organic or Fe rich. Chemical analysis of the material (XRF) reveals a composition very similar to that of the enclosing sill, except for an elevated Mg content. The second and thickest of these sedimentary intervals comprises greenish-black siltstones to claystones, horizontally and cross-laminated. The component particles are chiefly altered volcanic glass, set in a matrix of clay that probably resulted from terminal devitrification of an igneous precursor.

The sediments described above are presumably rafts or relic layers of considerable lateral extent enveloped during emplacement of the basic sill; they are likely, therefore, to have undergone considerable thermal metamorphism. The stratigraphically highest intercalation, with its black waxy character, is similar to dark Cenomanian sediments that lie directly above the sill; these are inferred to have been deposited under reducing conditions. The grayish-red and grayish blue-green volcaniclastic claystones, perhaps the product of an oxidizing environment may be pre-Cenomanian. The above remarks are, however, entirely unsubstantiated--much would depend on whether the intrusion had merely prized apart the sediments or whether any material had been assimilated. Redeposition processes have clearly operated during formation of the cross- and horizontally-laminated greenish-black siltstones that constitute the two central intercalations. For example, in Hole 462A at a depth roughly equivalent to Hole 462 volcaniclastic sandstones and siltstones show abundant grading, cross and parallel laminations, and soft sediment deformation.

The middle 200 m of the volcanic complex from 730 m to 930 m consist of sills similar to those described above interbedded with extrusive or semi-extrusive flows. No sediments were recovered in this interval. The flows have the following characteristics:

1.) variable, but small thickness (0.3-2.0 m) of units;
2.) thick (up to 4 cm) glassy margins on upper and lower contacts;
3.) fine grain size throughout, but patchy appearance which results from mixed textures;
4.) variable attitude of glassy margins (dips range from horizontal to vertical) and contorted shapes, often with re-entrant surfaces;
5.) cooling cracks normal to glassy surfaces are ubiquitous. Numerous cracks are present in the interior crystalline portions of units and do not display preferred orientation; and
6.) inclusions and thin apophyses of fine-grained material in more coarse-grained basalt suggest turbulent flow and mixing within cooling units.

The above characteristics and the total lack of sediment inclusions leave little doubt that these units were extruded directly onto the seafloor. They have none of the characteristics of pillow lava. The mode of extrusion of these flows could either be:

1.) slabby pahoehoe type, or
2.) a series of shingled, lobate and narrow advancing flow fronts similar to pillow lava, but extruded more rapidly.

From 930 m to 1068 m, generally sill-type basalts were recovered except for about 3 m of volcaniclastic sediments between 994 m to 998 m. The sills in this interval are generally thicker than those above and consist of fine to medium-grained diabase. Below 1000 m the basalts are finer grained, having textures ranging from variolitic to subophitic to intergranular or intersertal. They may represent an intercalation of sills and flows, although no contacts were recovered.

At 994 m, and underlying 428 m of almost continuous diabase, 239 cm of volcaniclastic sediment was recovered. The uppermost portion of this unit is grayish-red and the lower portions are various shades of dark gray and brownish-black. Sandy, and rarely pebbly, siltstone occurs. This unit exhibits evidence of scour, parallel and cross laminations, and three obvious instances of graded bedding becoming finer upwards from fairly sharp contacts. A 20 cm conglomerate layer with a matrix similar to the sandy siltstone described above is present. The clasts are angular "intraformational" material, average 5 to 8 mm in size, and are oriented parallel to bedding. The largest clast measures about 20 x 5 cm. Rarely basalt pebbles occur as clasts, but no carbonate material was observed. The coarsest material in this layer occurs near the middle, with grain size grading in both vertical directions to coarse sand size. Underlying the conglomerate is 117 cm of generally homogeneous sandy siltstone containing rare coarser and fine laminae.

A second lower conglomerate also containing angular clasts occurs. The clasts are "interformational" material, average about 5 mm in size, and range up to 15 mm. Boundaries of this unit are rather abrupt. The lowest unit in this sequence is 46 cm of sandy siltstone containing faint parallel layering at 1 to 2 cm intervals. At the base of this unit occurs a 1 to 2 cm interval of gray material, and on one corner of the lowest piece is a small amount of black vitreous material.

Several smear slides taken along the unit reveal the sediment composition. The assembly indicates bathyal depths of deposition. Thus, these oldest fossils, of Hauterivian age, show that the Nauru Basin was perhaps 5 km deep at that time, approximately 30 m.y. after the formation of the underlying basement at the site. Such a paleodepth is not inconsistent with a depth predicted by an exponential cooling curve.

Petrographically, the basalts are aphyric to sparsely phyric and have a few phenocrysts of clear to light brown augite, zoned by bytownite to labradorite, and occasionally olivine pseudomorphs usually altered to green smectite. Sideromelane and augite are also often replaced by smectite. Opaque minerals are generally represented by titanomagnetite. Textures range from glassy to variolitic to diabasic with all intermediate textures represented. In the thicker sills patches of distinctive granophyre-facies mineralogy appear. These patches usually consist of intergrown quartz and potassium feldspar micro-pegmatite with many patches also including a colorless acicular prismatic phase which could be apatite.

Fracturing is common in the basalts. Most of these fractures are filled with veins containing one or more of the minerals pyrite (and marcasite), zeolite, calcite, magnetite, chlorite, various smectite, and a green clay-like mineral.

At least two major types of post-solidification alteration have probably affected the rocks:

1.) seawater alteration which results in the precipitation of smectites, calcite, zeolite, sulfides, SiO_2, Mn/Fe hydroxides, and
2.) late magmatic or deuteric processes which have resulted in the production of micropegmatite, amphibole, and possibly chlorite, quartz, and Fe-oxide mineralization.

About 150 samples from Hole 462 and 462A down to 953 m were analyzed for Si, Al, Ti, Mg, Fe, Ca and K and about 15 for Mn and P using onboard XRF techniques. All the analyzed samples have chemical compositions which are very similar to those of altered MORB. The rocks display a narrow range of TiO_2, K_2O, MgO, CaO, and SiO_2, but unusually large variation in the abundance of Al_2O_3, and FeO in the light of the narrow variation of the other major oxides. Few inter-element correlations, such as K-Ti, Mg-Fe, Mg-Ca, K-Ca, etc., are observed. Those which are observed, such as TiO_2 vs. FeO/MgO display greater scatter

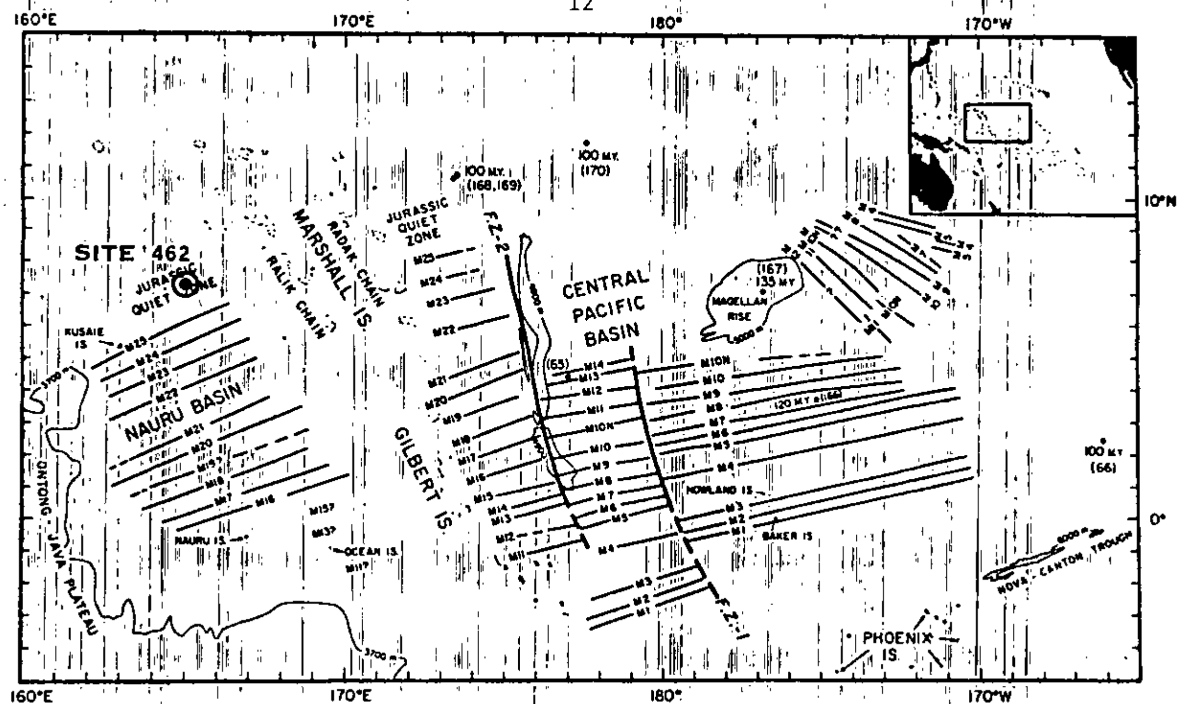

Figure 2: Mesozoic magnetic lineation patterns of the Nauru and Central Pacific Basins showing the location of Site 462 in the Jurassic Quiet Zone (from Larson, 1976).

abundances of TiO_2 for a given Fe/Mg are different. Another significant difference between these rocks and MORB is their extremely low K_2O abundance. Many of the analyzed samples have K_2O abundances which are comparable to those found in dunite.

Hole 462 and 462A are separated by about 500 m. Some igneous correlations can be made between them. The thick sill at the bottom of Hole 462 is the same sill at 462A between 605 and 656 m. Some of the sediment horizons encountered at similar sub-bottom depths in both holes may be continuous between the holes. Most of the thin sills of Hole 462 do not extend laterally to Hole 462A. Many of the thinner sediment horizons also appear to "lens out."

This pattern suggests significant three-dimensional lithologic heterogeneity on the scale of less than 500 m. However, since the chemical compositions of the uppermost basalts in each hole are very similar, it is probable that they are closely related temporally. They may even have been fed by the same major conduit.

Paleomagnetism

Late Cretaceous-aged sediments were measured on the shipboard Digico spinner magnetometer and demagnetized with the Schonstedt alternating field (AF) demagnetizer in an attempt to isolate the top of the Cretaceous normal magnetic interval in Nauru Basin sediments.

Sampling of time equivalent sections of early Campanian through Cenomanian age in Holes 462 and 462A shows the presence of the reversed interval corresponding to anomalies 33-34, the edge of the Cretaceous long normal polarity interval. In addition to the reversal, there is a peculiar deviation of inclinations just preceding the termination of this reversed period. Its occurrence in both cores in precisely the same stratigraphic position suggests that it may be a real feature of the magnetic field. Paleolatitude derived from the scattered inclinations from Site 462 cores suggests a paleolatitude of 7°S in early Campanian-Santonian time. Sparse sampling through Cenomanian time suggests a steepening to 10° or more. The sediments have stable inclinations well within the range of the igneous rocks. They are also characterized by relatively strong NRM intensities and mean demagnetizing fields considerably larger than the basalts.

The mid-Cretaceous volcanic complex was sampled continuously to determine its magnetic properties. The magnetic properties of the volcanic complex suggest that it was emplaced in a relatively short amount of time on the Pacific plate at about 25°, South latitude sometime during the mid-Cretaceous normal magnetic interval.

Regional Geology and Geophysics

Within the Nauru Basin, correlation of the presence of the volcanic complex with seismic profiler records show that many flat-lying, hard layers beneath the middle Eocene chert horizon exist. These flat-lying reflectors obscure the original basement surface that presumably has the appearance of smoothed, buried, abyssal hills typical of other areas of seafloor generated at fast-spreading rates. The Nauru Basin is also characterized by a lack of refracted arrivals observed on sonobuoys, and a thick unit of 3.5-4.5 km/sec material measured with wide-angle reflections. Both of these characteristics are probably due to propagation of acoustic energy through the upper portion of the volcanic complex that consists of intercalated sills and volcaniclastic sediments at Site 462.

Late Jurassic magnetic anomalies M29 to M20 are well-lineated, high-amplitude anomalies that exhibit the fine-scale features and characteristic amplitude envelope that make them recognizable lineations on a world-wide scale. Although the seafloor trends uphill across these lineations, both the seafloor and the middle Eocene chert horizon remain as relatively smooth surfaces. South of M20 are anomalies M19 to M16 that are lineated, but anomalously low-amplitude features that also lack their characteristic small-scale features and uniform cross-sectional shapes. The seafloor and middle Eocene chert surface in this region are rough, apparently representing faulting during the culmination of the mid-Cretaceous volcanic event that appears somewhat smoothed in the overlying sediments. This faulting and thickening of the sill complex has presumably disrupted the underlying oceanic crust enough to deform the late Jurrassic magnetic signature.

Besides the Nauru Basin, the mid-Cretaceous volcanic event is likely to be present in other areas. The Ontong-Java Plateau to the west has Aptian-aged basalts sampled at Site 289 that are similar in chemistry to the Site 462 igneous units. To the east across the Marshall Islands, Site 169, bottomed in a mid-Cretaceous sill that is likely to be related to the same event. The island chains themselves, such as the Marshalls, Gilberts, Carolines, and Line Islands, may represent slightly later culminations of the mid-Cretaceous outpouring, although no certain dates exist on the volcanic foundations of these islands so their histories are presently a matter of pure speculation.

Returning to the mid-Cretaceous volcanic complex at Site 462 and the well-defined Jurassic magnetic anomaly pattern of that region, it may well be asked how these two features can co-exist in the same area. Although the volcanic complex is strongly magnetized with mid-Cretaceous remanent magnetization, we do not believe this is difficult to explain if viewed simply as a geometric problem. Since the volcanic complex was emplaced during the mid-Cretaceous, it is uniformly and normally magnetized. It presumably extends over a broad area, and thus can be approximated as a uniformly magnetized slab that is infinite in both horizontal directions. Such a body will produce no magnetic anomaly, regardless of its remanent magnetic intensity because no magnetization variation exists in any horizontal direction.

The crucial, unanswered question raised by Site 462 is the manner in which this large volume of volcanic material was subsequently injected into this area without disturbing the existing well-defined magnetic anomaly pattern. The igneous units at Site 462 are generally thin and fine grained, indicating emplacement at shallow depths in close proximity to source conduits. Thus, the volcanic complex could not have its sources tens or hundreds of kilometers away and be explained as having flowed in from a large horizontal distance to simply cover the underlying oceanic crust with its magnetic anomaly signal. It must have source conduits confined within the site survey area (100x100 km) that is the location of magnetic anomalies M26, M27 and M28. These anomalies are well lineated with no fracture zones, offsets or seamounts disturbing the anomaly pattern. The amplitudes are low and constant at about 80 gammas, and the cross-sectional shapes are uniform. This characterizes a very high signal to noise level magnetic anomaly environment that implies very precise initial conditions of formation and no subsequent deformation. How a subsequent volcanic complex, at least 500 m thick can be emplaced through this Jurassic oceanic crust without disturbing its magnetic anomaly signal is not obvious. The feeder dikes must have been restricted and localized so that magma could pass through them without reheating a significant percentage of the existent oceanic crust. This seems implausible considering the size of the volcanic complex, but the facts remain. Until Site 462 is deepened by future drilling, or other sites are located in this area to investigate the relationship of the mid-Cretaceous volcanic complex to the underlying Jurassic oceanic crust, the origins of this complex will remain an enigma.

SITE REPORTS

Leg 59

Co-Chief Scientists L. Kroenke and R. Scott report:

Site: 450 (SP-6A) Lat.: 18°00.02'N
Long.: 140°47.34'E
Water Depth: 4720 m

Hole 450 was located on the eastern side of the Parece-Vela Basin. Penetration was successful to a depth of 340 m. Within this sequence the following units were differentiated: Unit 1A, Lower Pleistocene to Upper Miocene(?), dark brown pelagic clay (26.5 m). Unit 1B, Upper Miocene (?) to Middle Miocene, dark brown to gray brown pelagic clay with ash (61.5 m). Unit 2A, monotonous Middle Miocene dark gray vitric tuffs, with little pelagic clay (236.5 m). Unite 2B, pale reddish-brown hydrothermally altered tuffs containing abundant zeolites (8.5 m). Unit 2C, pale yellowish-white baked and leached contact (1 cm). Unit 3, plagioclase-olivine phyric intrusive pillow basalt (7.0 m). Within the intrusive pillowed complex are fragments of green, contact metamorphosed tuff.

Based upon refraction profiles, the intrusive body is small and contact relations suggest that this body intruded unconsolidated ashes close to the surface forming pillow-like shapes. The basin basement was not reached and its age remains undetermined.

Site: 451 (SP-5) Lat.: 18°00.88'N
Long.: 143°16.57'E
Water Depth: 2086 m

Site 451 was located on the eastern edge of the West Mariana Ridge. Penetration was successful to a depth of 930.5 m. Within this sequence, the following units were differentiated: Unit 1, Quaternary to Pliocene, pale yellowish-brown foram-nanno chalk with minor ash and pumice (0 to 36.0 m). Unit 2, Pliocene to Upper Miocene, pale yellowish-brown foram-nanno chalk intercalated with dark gray and greenish-gray basaltic ash and tuff (36.0 to 147.5 m). Unit 3, Upper Miocene to uppermost middle Miocene(?), varicolored green, black and gray intercalated ashes, tuff, volcaniclastic sedimentary breccias and nannofossil bearing tuffs (147.5 to 930.5 m).

Basaltic clasts in the breccias are highly vesicular and, along with the pyroclastic debris in the sediment, require explosive volcanism of the type associated with island arcs. Volcanic boulders that contain two pyroxenes and opaque mineral phenocrysts are probably of calc-alkalic affinities. Accumulation rate of these volcaniclastic sediments was about 400 m per million years. Two hiatuses were recognized, one at the Quaternary-Pliocene boundary, and the other at or close to the Pliocene-Late Miocene boundary.

Leg 60

Co-Chief Scientists D. Hussong and S. Uyeda report:

Site: 452 (SP-1B) Lat.: 17°40.19'N
Long.: 148°37.73'E
Water Depth: 5858 m

Site 452 is located in the northern Mariana Basin on old Pacific plate crust. Twenty-seven meters of brown zeolitic pelagic clay were recovered before repeated difficulty recovering the core inner barrel culminated in the third core becoming jammed in the bottom of the pipe. This necessitated abandoning the hole, and it was subsequently discovered that the drill bit, bit release sub and both drill collars had been lost. The ship was shifted 200 feet south of 452 to attempt Hole 452A.

Site: 452 (SP-1B) Lat.: 17°40.17'N
Hole: 452A Long.: 148°37.75'E
Water Depth: 5862 m

Hole 452A was the second attempt to drill on Pacific plate crust in the northern Mariana Basin. It is located 200 feet south of Hole 452. The hole penetrated 25 m of Quaternary pelagic clay before reaching radiolarian mudstone and chert of Cretaceous age. The Cretaceous-Quaternary hiatus at SP-1 has extended southwards, into the northern Mariana Basin, the unconformity found in the northern Pacific Basin located between the mid-Pacific mountains and the Shatsky Rise. The duration of the regional hiatus varies, indicating a progressive extension of the area of deposition following the post-Late Cretaceous non-depositional or erosional event.

At a total depth of 46.5 m, drilling had to be stopped after heavy torquing and apparent collapse of chert into the hole endangered the bottomhole assembly, which was still mostly above the sediment. The shallow chert layer seems persistent in the SP-1 area, so rather than risk loss of our only bit release sub-assembly (this component of the bottomhole assembly is necessary for downhole logging, a primary objective of Leg 60), we have left the SP-1 area and will begin drilling the SP-4 series of holes in the Mariana Trough.

Site: 453 (SP-4F)	Lat.:	17°54.42'N
	Long.:	143°40.95'E
	Water Depth:	4693 m

Site 453 is located in the westernmost of three drilling targets in the Mariana Trough (SP-4F) and is in a sediment pond about 20 km long and three to four km wide striking approximately 030°. The site is about 10 km east of the eastern edge of West Mariana Ridge. We penetrated 605 m below sea floor; recovery was 39%. A downhole heat flow of 2.4 HFU was obtained on the first use of the Uyeda/Kinoshita heat probe. The hole was not logged because the pipe was bent after taking the final core.

The sediment section consists of 455.5 m of muds, silts, and sands composed mainly of volcanic debris. Oldest fossils are Early Pliocene or Latest Miocene from the *T. rugosus* nannofossil subzone. This provides a "basement" age of slightly over 5 m.y. and is substantiated by paleomagnetic evidence in the sediments. This yields an average half-spreading rate of 1.6 cm per year in the Mariana Trough, although other evidence suggests that spreading may have been episodic. Sediment accumulation rates are very high, averaging 90 m/m.y. Below the sediments, 85.5 m of coarse poorly sorted igneous polymict breccia containing minor basalts but mainly large angular gabbro and metagabbro clasts up to half meter in size overlie 28.5 m of metamorphosed (lower greenschist facies) polymict breccia containing mainly metavolcanic clasts with no large cobbles and rare gabbros. Beneath these are 35.5 m of sheared metaigneous rocks including a continuously recovered 1.5 m interval of highly sheared gabbroic cataclastite rich in serpentine and norite. Metamorphism appears hydrothermal in origin in the lower parts of breccias. Seismic evidence suggests that the top of the cored igneous rock, which may be a slump or landslide sequence over a possible fault zone, is flat-lying and on the order of 500 m above acoustic basement.

Site: 454 (SP-4E)	Lat.:	18°00.78'N
	Long.:	144°31.92'E
	Water Depth:	3818.5 m

Site 454 (SP-4E) is in a small sediment pond in the shallow central portion of the Mariana Trough. It is the apparent youngest crust west of the back arc basin [illegible] of spreading where it was possible to -trating 38.5m of hemi-pelagic, biogenic, mainly siliceous sediments, the hole had to be abandoned when adverse weather conditions caused rolls occasionally reaching 13 degrees.

Site:	454	Lat.:	18°00.78'N
Hole:	454A--SP-4E)	Long.:	144°31.92'E
		Water Depth:	3819 m

Hole 454A (SP-4E) was begun without repositioning the ship after being forced to abandon Hole 454 and wait 20 hours for adverse weather to clear. Total penetration was 171.5 m with a 41% recovery rate. The upper 67 meters were vitric mud and ash with abundant radiolarians and nannoplankton, underlain by an approximately 10 meter thick sequence of massive pillow basalts composed of at least two cooling units with distinct mineralogies. From 77 to 117 m vitric mudstones and tuffs interbedded with apparently thin (less than 50 cm each), pillow basalt flows were encountered. Two massive, generally aphyric, fine grained basalt flows about 12 and 8 m thick, separated by 2 m of sediment, overlie the deepest sediment that was recovered from about 139-149 m beneath the sea floor. These sediments contained nannoplankton indicating an age range of 0.9 to 1.6 m.y. These determinations partially overlap an age range of 1.4 to 1.9 m.y. derived from paleomagnetic analysis. The sediments contain several sedimentary cycles of graded bedding over laminated bedding which overlie bioturbated layers. Below these deepest cored sediments, interbedded spherulitic pillow fragments and microlitic basalts were encountered to the bottom of the hole. The deeper basalts were very fractured and repeatedly caved in, eventually causing termination of the hole. The hole was fully logged from the bottom of the partially lifted drill string (82 m) to the bottom of the partially collapsed hole (about 150 m below the sea floor). The logging was very successful, permitting reasonable reconstruction of the interbedded sequences. The large scale downhole resistivity experiment was also successfully completed. Downhole heat-flow measurements gave a value of 0.06 HFU, which may represent the cooling effect of sea water circulating into the basement from the drill hole.

Site: 455 (SP-4D)	Lat.:	17°51.26'N
	Long.:	145°2.48'E
	Water Depth:	3468 m

Site 455 (SP-4D) is 54 km east of the suspected Mariana Trough spreading axis, near a bathymetric high rising above the volcanogenic sediment apron

from the active Mariana volcanic arc. The sediments at the site pinch out from over 1 km to about 300 m thick. The crust at Site 455 should be of intermediate age between Site 453 (SP-4F) and Site 454 (SP-4E) to the west if spreading is fairly symmetric. Total penetration was 104 m with a 30% recovery rate. The upper 22 m were vitric mud with sandy ash layers. Vitric nannofossil oozes are also present in some bands. From 22 to 96 m were volcanic sand and gravel with minor nannofossil mud and silty tuff. Volcaniclastics are angular basalt grains, bits of basalt glass and pumice fragments, probably from nearby Pagan and Alamagan Islands. Below 96 m recovery was only two pieces of pale olive green sediment. The upper piece is a burrowed vitric mudstone and the lower piece is a graded tuff bed overlain by laminated and cross-laminated vitric mudstone. These lithologies resemble the graded bed sequences from the Early Pliocene at Site 453 and the Early Pleistocene at Site 454. The oldest sediment at Site 455 can be referred to the *Gephyrocapsa caribbeanica* subzone (0.9 to 1.6 m.y.). The hole was abandoned with no downhole logging because of massive caving of the sand into the hole. The ship subsequently moved to Site 456, about 17 km west of Site 455, in a second attempt to meet the SP-4D objectives.

Site: 456 (SP-4D) Lat.: 17°54.68'N
Long.: 145°10.78'E
Water Depth: 3586 m

Site 456, the second drilling target of the SP-4D objectives, is located in a small sediment pond on a local bathymetric high that was chosen because it is inaccessible to the bottom transported volcanic sand which forced early abandonment of the first SP-4D site (Site 455, located 17 km east of 456). At Hole 456, 169 m were drilled with 19% recovery. The upper 56 m are Late Pleistocene *(E. ovata)* vitric mud and nannofossil ooze with ash layers (Unit 1). Below this, the *G. caribbeanica* subzone (0.9-1.6 m.y.) is completely missing, suggesting a possible local hiatus. Unit 2 (56-134 m) is Early Pleistocene *(E. annulata* zone) semilithified vitric mudstone and nannofossil chalk, showing cycles with bioturbated and non-bioturbated beds. Unit 3 (134-169 m) is almost entirely aphyric pillow basalts with minor interbedded limestones and mudstones in the top few meters; these are recrystallized near the contact with basalts. The basalts are intensely altered with the upper part under reducing and the lower part under oxidizing conditions. The occurrence of pyrite, minor Fe-Mn hydrogenous sediments and pore water chemistry suggest that the alteration may be hydrothermal. The altered basalts fractured easily, leading to drilling instability and early abandonment of the hole. To determine the lateral extent of alteration, an offset of 200 m was made and Hole 456A (17°54.70'N; 145°10.88'E) was drilled, which penetrated 159 m. The sediment section of Hole 456A correlates closely with Hole 456 except that Unit 2 is thinner at Hole 456A; igneous basement in Hole 456A was reached at 114 m subbottom. In spite of the proximity of the holes, the igneous lithologies differ (456A has a unit of plagioclase-phyric basalt and the basalt alteration is less pronounced). Greatly differing heat flow values in the holes (about 3.2 HFU in 456 and about 1.3 HFU in 456A) may relate to the variability in the extent of alteration. The basement is reversely magnetized, matching the negative anomaly of the site which was tentatively identified as 2 and 2' (2.3 m.y.). Logging was not conducted at 456 or 456A because both holes caved in completely, to the extent that the bottomhole assembly had to be blown off to retrieve the drill string at 456A.

Site: 457 (SP-3B) Lat.: 17°49.99'N
Long.: 145°49.02'E
Water Depth: 2637 m

Site 457 is located on the axis of the Mariana Island arc, near the north eastern base of Alamagan Island, where very thick apparently volcaniclastic sediments pinch. The objective of Site 457 was to determine the structure and nature of the arc upon which present volcanoes are built. This would permit a direct comparison with the Kyushu-Palau and West Marian Ridges drilled on the previous leg. Unfortunately, only 51.5 m was recovered with 37.5% recovery. The cores were coarse sand and drilling breccia, derived from volcanic rock, pumice and ash. They are all late Pleistocene in age (nannoplankton in oldest sediment: *Emiliania ovata* subzone).

Site: 458 (SP-3B & 3D) Lat.: 17°51.85'N
Long.: 146°56.06'E
Water Depth: 3449 m

Site 458, the first drill site of the Mariana fore-arc series, is located on the southeast periphery of a 40 mgal gravity anomaly between the trench axis and active volcanic arc. The site objectives included the sedimentary history and the nature and origin of the basement of the Mariana fore-arc region. Of the total penetration of 465.5 m (core recovery rate 21%), the upper 256.5 m are sedimmainly of siliceous nannofossil-foraminifer vitric mud and ooze (0-95 m), nannofossil chalk (95-247 m) and laminated graded vitric siltstone and sandstone (247-256.5 m). A hiatus of at least 6 m.y. is recognized in middle Miocene (8-16 m.y) above the chalk layer. The oldest sediment age is early Oligocene.

Basement rocks recovered are pillows and massive volcanic flows. The upper portion (256-379 m) is mainly aphyric, two-pyroxene basaltic rocks. The section includes peculiar glassy rocks most closely resembling boninites in that they have magnesium orthopyroxene micro-phenocrysts, abundant acicular clinopyroxene and no plagioclase. The lower portion (379-465.5 m) is highly altered and fractured augite-plagioclase basalts. The upper and lower portions are normally and reversely magnetized, respectively. Heat flow is estimated at 0.7 HFU. Downhole logging was not possible because of the lack of a bit release sub-assembly.

Site:	459 (SP-3C)	Lat.:	17°51.75'N
Holes:	459, 459A, 459B	Long.:	147°18.09'E
		Water Depth:	4121 m

Site 459 is located on the eastern edge of the deep sediment pond immediately above the Mariana Trench slope break. Hole 459 was abandoned when the lower half of the core barrel containing the mudline core dropped down the drill string and fishing attempts were unsuccessful. Hole 459A, a pilot hole for potential re-entry, was washed down to 78 m. Hole 459B cored a total of 691.5 m with a recovery rate of 26%. The upper 559 m are sediments consisting mainly of late to early Pleistocene vitric mud and ooze with ash layers over a thick pile of turbidites of middle Miocene through late Oligocene age, underlain by early Oligocene to middle Eocene clays. Hiatuses are recognized for 0.9-1.6, 1.8-3.0, 5.0-11.0, and 45-47 m.y. The sedimentary sequence shows that the Site 459 area was subjected to active vertical displacement and tensional stress in the late Oligocene to middle Miocene period. Igneous basement rocks are fine to medium-grained vesicular clinopyroxene-plagioclase basalts. Alternation of pillows and thick flows or sills is inferred from variation in vesicularity. Notable features are the absence of orthopyroxene and presence of micrographic intergrowths of quartz and feldspar in coarser grained rocks. Gearhart-Owen logging and large-scale electrical conductivity experiments were successfully conducted in Hole 459B. Heat flow measured is 0.7 HFU.

Site:	460 (SP-2B)	Lat.:	17°40.14'N
Hole:	460	Long.:	147°35.92'E
		Water Depth:	6451.5 m
Hole:	460A	Lat.:	17°40.02'N
		Long.:	147°35.16'E
		Water Depth:	6443.5 m

Site 460 is located in a small sediment pond deep on the inner (arc-side) wall of the Mariana Trench. Penetration was 85.0 m with a 32% core recovery at Hole 460 and 99.5 m with a recovery of 37% at Hole 460A. The 76 m of sediment cored at Hole 460 consisted of Pleistocene diatomaceous ooze and siliceous mud, underlain by calcareous mud of Eocene to Oligocene age. At Hole 460A, similar Pleistocene sediments are underlain by reworked sediments with a mixture of ages including all the Cenozoic and Cretaceous. The deepest sediments are early Miocene or late Oligocene conglomerates. In both holes, there are cobbles of basalts, altered basalts and metabasalts in the sediments and possibly occurring as talus below them. The metabasalts contain amphibolite facies ocean floor metabasalts.

Site:	461 (SP-2B)	Lat.:	17°46.05'N
Hole:	461	Long.:	147°41.18'E
		Water Depth:	7029 m
Hole:	461A	Lat.:	17°46.02'N
		Long.:	147°41.26'E
		Water Depth:	7034 m

At Site 461, two holes were drilled with the objective of probing into the deep inner wall of the Mariana Trench. The site was located on a very small patch of sediment on a local high, which we hoped would be isolated from the coarse gravels that caused drilling difficulty at Site 460. Penetrations were, unfortunately, limited to 20.5 m (core recovery 42%) at Hole 461 and 15.5 m (core recovery 47%) at Hole 461A, because of drilling difficulties due to an inadequate sediment cover over igneous and metamorphic cobbles. Sediments recovered show an upper one to three meters of siliceous mud of latest Quaternary age. Core 1 of 461A contains mixed assemblages of late Oligocene and early Oligocene-late Eocene calcareous nannoplankton. The lower approximately 10 m are subangular to subrounded granules and pebbly conglomerates with igneous, metamorphic and sedimentary fragments, having no diagnostic assemblages. Cobbles of metabasalts, metadiabases and metagabbros of up to amphibolite facies were recovered. True <u>in situ</u> basement was not attained.

Leg 61

Co-Chief Scientists R. Larson and S. Schlanger report:

Site: 462 (CP-1) Lat.: 7°14.92'N
462A Long.: 165°01.89'E
Water Depth: 5186 m

Site 462A was spudded in calcareous and radiolarian ooze of Pleistocene age. Spot cored through 297 m of Pliocene through early Oligocene oozes and nannofossil chalks; 153m of chalks, cherts, and limestones of early Oligocene to Maestrichtian age; 111 m of volcaniclastic sandstones, siltstones, and zeolitic claystones of middle Maestrichtian to Cenomanian age. At 563 m, directly underlying Cenomanian deep water sediments, entered a sill-pillow basalt lava complex containing intercalated volcaniclastic sediments that are generally unfossiliferous but locally contain radiolarians. Parts of this complex intrudes sediments deposited in bathyal depths as evidenced by agglutinate foraminifera faunas. Faunas within the sediment intercalations show following ages: Aptian at 700 m sub-bottom, Barremian at 740 m sub-bottom and possible Hauterivian at 750 m sub-bottom and may be all post Aptian in age as it is all normally magnetized.

Only basalts were recovered from 953 to 993 m, although the drill penetrated several soft layers from 980 to 990 m. Basalts from 953 to 993 m consist entirely of fine to medium grained diabase that appears increasingly fractured with depth. Occasional zones of finer grained basalt occur but no indications of pillow structures have been observed and glass has only occurred at one sediment-igneous rock contact. The fractures are generally lined with a greenish-black coating often as slickensides and may contain calcite and pyrite. Thin sections show a subophitic texture with roughly equal amounts of plagioclase and clinopyroxene and lesser amounts of opaque minerals and brown clay. No olivine was noted although some of the brown clay occupies areas with euhedral boundaries. 2.4 m of mainly volcaniclastic sediment was recovered from 993 to 998 m. The upper portion of this unit is grayish-red and finer-grained than the gray to black underlying material. This latter material is a sandy siltstone with pebbles, scour, parallel and cross lamination and graded bedding. A pelagic layer is included in the siltstone that contains Hauterivian radiolaria, deep benthic forams, and fish debris. The assemblage is assigned definitely to *Eucyrtis tenuis* Zone based on common occurrence of *Lithocampe elegantissima*, *Dictyomitra lacrimula*, *Eucyrtis micropora*, *Crucella* sp. and *Sethocapsa* sp. This assemblage is slightly older than those of Cores 43 and 46. The fine grained grayish-red sediments are the only reversed magnetized material in the entire volcanic complex. All the basalts below 953 meters have large normally magnetized NRM values, large susceptibilities, and very low stability on demagnetization. There is probably a strong drilling remanence and very little correlation between petrology and magnetic properties. The drill penetrated several soft layers from 998 to 1015 m and again from 1059 to 1068 m but only basalts were recovered from 998 to 1063 m. These basalts have textures ranging from variolitic to subophitic to intergranular or intersertal and probably represent an intercalation of sills and flows although no contacts have been recovered. Fractures are most abundant in the vicinity of the sediments at 993 to 998 m with fine-grained basalts tending to be more fractured. Plagioclase and clinopyroxene are essential minerals accompanied by opaque and clay minerals. Olivine is occasionally present although olivine and glass are usually altered to clay. Fracture surfaces are coated with a greenish-black mineral and some calcite, pyrite and zeolites. Logging of the hole was completed on 27 July.

Leg 62

Co-Chief Scientists J. Theide and T. Vallier report:

Site: 463 (MM-1) Lat.: 21°21.04'N
Long.: 174°40.07'E
Water Depth: 2519 m

Site 463, located in the northwestern mid-Pacific mountains, was continuously cored to a depth of 822.5 m, but did not reach igneous basement. The sediment section records an Early Cretaceous through Pleistocene history of carbonate deposition and can be subdivided into five lithologic units. The oldest unit, 190 m thick, Barremian in age, consists of interbedded pelagic and clastic limestone beds. The clastic limestone contains shallow water carbonate debris and some volcanic components. Lithologic Unit 4, 45 m thick, of Aptian age, is an ashy and carbonaceous limestone recording a history of volcanic and anoxic events. The overlying third unit, 136 m thick, is an Aptian to late Albian sequence of multicolored pelagic limestone with rare chert. Unit 2 consists of 405 m of calcareous ooze and chalk with common chert that ranges from late Albian to early Maestrichtian in age. The youngest unit, 47 m thick, is nannofossil ooze of early Eocene to Pleistocene age. Major hiatuses separate lower Eocene from lower Maestrichtian beds and upper Oligocene from upper Miocene strata. The upper Miocene and Pliocene nannofossil floras are composed almost entirely of discoasters.

Site: 464 (HR-2) Lat.: 39°51.64'N
Long.: 173°53.33'E
Water Depth: 4637 m

The large aseismic Hess Rise in the central North Pacific was sampled at Site 464. A few pieces of basalt were recovered in the lowermost of 34 continuously taken cores which penetrated discontinuous sedimentary sequence of Pliocene to Albian age. The basalt is overlain by a chert, chalk and marlstone sequence (Unit 3), which is 218.5 m thick. We succeeded to sample the soft sediments which are intercalated between the chert layers only occasionally, but they appear to consist mostly of dark brown to dark red chalk, marlstone and claystone.

The poorly sampled chert sequence underlies 53 m of homogeneous brown pelagic clay (Unit 2) and 15 m of clayey siliceous ooze to siliceous clay (Unit 1) with radiolarians, diatoms, silicoflagellates, sponge spicules, and calcareous nannofossils. Manganese nodules were encountered at the surface and within the youngest part of the sedimentary column. Because the thick brown clay sequence is essentially barren of fossils and because the recovery of datable sediments was very poor in the chert, the sedimentary sequence is poorly dated.

A major hiatus at 89 meters subdivides the section into two biostratigraphic units: Cores 1 to 10 of late Miocene to late Pliocene age and Cores 11 to 32 of late Aptian (?) and Albian age. The hiatus between these stratigraphic intervals spans more than 90 m.y. In Cores 1 to 5, moderately to strongly etched nannofossil assemblages and rare plankton forams indicate that the site was very close to the CCD during the late Cenozoic. The Pliocene radiolarian and diatom assemblages show a diverse, mixed association of equatorial and high latitude species. The brown clays of Cores 5 to 10 are essentially barren, but have been dated to be late Miocene to early Pliocene by radiolarians and late Miocene by nannofossils in Cores 7 to 10. In Cores 11 to 32, small scrapings of sediments between the chert pieces contain fairly well-preserved nannofossils, which show dissolution features with depth. Occasionally Albian planktonic forams and poorly preserved, but non-diagnostic radiolarians, were recovered.

Site: 465 (HR-1) Lat: 33 49.23'N
465A Long: 178 55.14'E
Width: 2161 m

The sediment and uppermost 64 m of volcanic basement were continuously cored to a sub-bottom depth of 476 m on southern Hess Rise. The Albian to Pleistocene sediments reflect the transition of the s... ern Hess Rise depositional paleoenviro... from the tropical to temperate latitude due to horizontal movement of the Pacific plate, and from shallow to intermediate water depth caused by subsidence of the aseismic rise.

Unit 3 consists of highly altered, un-vesicular (~5mm diam.) hyalopilitic basa... Many samples show flow orientation of fdspar. laths and microlites. Oldest sediments (Unit 2, 136 m. thick) are olive-gray laminated upper Albianto Cenomanian limestone, showing many indications of current activity and redeposition along the former sea floor. Pyrite, dolomite, and barite in veins throughout the lowermost meter of limestone suggest post-depositional hydrothermal activity. Overlying sediment (Unit 1, 276 m) consists of Coniacian to Pleistocene nannofossil ooze and foram nannofossil ooze with intercalated chert. This reflects a slowly deepening, relatively quiet depositional environment within an intermediate depth water mass.

Significant hiatuses occur from early Cenomanian to late Coniacian, Santonian to late Campanian, and late Paleocene to Pliocene. Calcareous oozes of Unit 1 show signs of intense dissolution despite their shallow deposition. A highlight of this site is the recovery of an apparently complete sedimentary sequence across the Cretaceous-Tertiary boundary with well-preserved sediment of the <u>G. eugubina Zone</u> present in Core 3, Hole 465A. Preliminary paleomagnetic studies of the upper Albian sediments suggest that the site was never south of the Equator. A heat flow value of 1.36 HFU is similar to that of averaged N. Pac. h.f. data for crust of this age.

Site: 466 Lat.: 34°11.46'N
Long.: 179°15.34'E
Water Depth: 2665 m

On the Southern Hess Rise, 28 Nautical miles N.E. of Site 465, 312 m of Albian to Pleistocene sediment was continuously cored. Two major lithologic units, at least three hiatuses, and no igneous basement were cored. Oldest sediment (Unit 2) are 66 m of upper Albian and lower Cenomanian olive-gray nannofossil chalk and limestone. It is correlative with the upper Albian limestone cored at 465, but is not as laminated and has a higher carbonate content. Overlying sediment (Unit 1) contains: 158 m Turonian to early Maestrichtian age cherty nannofossil ooze; and 88 m Eocene to Pleistocene nannofossil ooze. Pliocene-Pleistocene sediment contain 65 m of diverse siliceous and calcareous microfossils. Two mixed zones exist--an Eocene -- late Cretaceo...

SHIPBOARD SCIENTIFIC STAFFING

Leg 61

R. Larson	Co-Chief Scientists	USA	Lamont-Doherty Geo. Obs.
S. Schlanger		USA	Hawaii Institute of Geo.
R. Boyce	Staff Representative/ Physical Prop. Spec.	USA	Deep Sea Drilling Project
S. Snchera	Igneous Petrologist	USSR	Academy of Sciences
H. Tokuyama	Igneous Petrologist	Japan	Ocean Research Institute
H. Jenkyns	Sedimentologist	UK	Oxford University
R. Moberly	Sedimentologist	USA	Hawaii Institute of Geo.
V. Riech	Sedimentologist	FDR	Bundesanstalt fur Geo- wissenschaften und Rohstoffe
I. Premoli-Silva	Paleontologist (foraminifera)	Italy	Universita Degli Studi di Milano
W. Sliter	Paleontologist (foraminifera)	USA	United States Geological Survey
H. Thierstein	Paleontologist (nannofossil)	USA	Scripps Inst. Oceanography
P. deWever	Paleontologist (radiolaria)	France	Universite des Sciences et Techniques
M. Steiner	Paleomagnetist	USA	California Institute of Technology

Leg 62

J. Thiede	Co-Chief Scientists	Norway	Universitetet Oslo
T. Vallier		USA	United States Geological Survey
C. Adelseck	Staff Representative/ Sedimentologist	USA	Deep Sea Drilling Project
W. Dean	Sedimentologist	USA	U.S. Geological Survey
V. Koporulin	Sedimentologist	USSR	Academy of Sciences
D. Rea	Sedimentologist/ Geophysicist	USA	University of Michigan
K. Windom	Igneous Petrologist	USA	Iowa State University of Science and Technology
K. Seifert	Igneous Petrologist	USA	Iowa State University of Science and Technology
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P. Cepek	Paleontologist (nannofossil)	FDR	Bundesanstalt fur Geo- wissenschaften und Rohstoffe
R. Schmidt	Paleontologist (nannofossil)	Netherlands	Geological Institute of Utrecht
C. Sancetta	Paleontologist (diatom)	USA	Stanford University
A. Schaaf	Paleontologist (radiolaria)	France	Institute of Geology
W. Sayre	Paleomagnetist	UK	University of Southampton
N. Fujii	Physical Properties Specialist	Japan	Kobe University

Leg 63

B. Haq	Co-Chief Scientists	USA	Woods Hole Oceanographic Institution
R. Yeats		USA	Oregon State University
K. Pisciotto	Staff Scientist/ Sedimentologist	USA	Scripps Institution of Oceanography
V. Grechin	Sedimentologist	USSR	Academy of Sciences
A. Niem	Sedimentologist	USA	Oregon State University
J. Crouch	Sedimentologist/ Geophysicist	USA	Scripps Institution of Oceanography
M. Leinen	Sedimentologist/ Geochemist	USA	University of Rhode Island
J. Barron	Paleontologist (diatom)	USA	U.S. Geological Survey
D. Bukry	Paleontologist (nannofossil)	USA	Scripps Institution of Oceanography
R. Poore	Paleontologist (foraminifera)	USA	U.S. Geological Survey
R. Wolfart	Paleontologist (radiolaria)	FRG	Bundesanstalt fur Bodenforschung
C. Denham	Paleomagnetist	USA	Woods Hole Oceanographic Institution
T. Shibata	Igneous Petrologist	Japan	Okayama University
A. Douglas	Geochemist (organic)	UK	The University
S. Pal	Geochemist (inorganic)	Mexico	Universidad Nacional Autonoma de Mexico

Leg 64

J. Curray	Co-Chief Scientists	USA	Scripps Inst. of Ocean.
D. Moore			Scripps Inst. of Ocean.

Leg 65

B. Lewis	Co-Chief Scientists	USA	University of Washington
P. Robinson		USA	University of California

Leg 66

C. Moore	Co-Chief Scientists	USA	University of Rhode Island
J. Watkins		USA	Gulf Research & Development Company

Leg 67

J. Aubouin	Co-Chief Scientists	France	Universite Pierre et Marie Curie
R. von Huene		USA	U.S. Geological Survey

Leg 68

J. Cann	Co-Chief Scientists	UK	The University
M. Langseth		USA	Lamont-Doherty Geological Observatory

Leg 69

D. Cronan	Co-Chief Scientists	UK	Royal School of Mines
R. von Herzen		USA	Woods Hole Ocean. Inst.

REPORT FROM SITE SURVEY MANAGEMENT

Data Bank

The following data have been received:

- Final report of South Philippine Sea Survey DB 758.
- "German cruises to Continental Margin of N.W. Africa, 1975, general report and preliminary results from Valdevia 10 and Meteor 39"--DB759.
- "Bericht BGR Antarktis Expedition 1978 mit S.S. Explora"--DB 760.
- Mid-America Trench and Atlantic Site 1, magnetic tape data.
- *Glomar Challenger*, Leg 37, airgun profiler records and PDR profiler records.
- Final Guaymas Expedition Cruise Report for Feb. 9-Mar. 18-- *R/V Thomas Washington*.
- Map showing all tracks in SA-1, SA-2, SA-3, SA-4.
- MCS reflection data across Shikoku Basin and Daito Ridges: 1976, Part I, IPOD-Japan Basic Data Series.
- WHOI-L-DGO 1978 Survey of AT 2.3-- Computer tape of *Atlantis II* 97 Leg 2 magnetics, navigation and bathymetry; charts of bathymetry and magnetics.
- Mid-America Trench--mcs profiles and navigation, contoured bathymetry and magnetics and coring logs.
- PAC 14--Magnetics, bathymetry, gravity and station locations.
- JOIDES Safety and Pollution Prevention Check Sheets for Leg 62 Pacific sites (EP 1, 3, 5, 6, & 8; HR 1 & 2; MM1; GA 1, 2, & 3).
- Original IPOD line monitor records.
- Microfilm, sepia and microfiche, from U.S. Department of Commerce, Environment Data Service.
- Sudatlantikfahrt 78 mit MS EXPLORA, from Dr. Karl Hinz, BGR, Germany.
- Computer tape of AT 1 Data.
- Computer tape of AT 2 97, Leg 2 bathymetry and magnetics.
- Computer tape of DEEPSONDE Leg 2 (PAC 4).
- Safety Package, Leg 63, from JOIDES Safety and Pollution Prevention Committee.
- Open File Report #78-706 with photographs of seismic profiles.

Data Encoding

Igneous Rocks--Document

Earlier this year, the text of the document "Coding Instructions for Gross Lithology--Igneous Rocks" was prepared. The text was entered into the computer and is now available as a hard copy document and as a computer file which can be revised easily. It is intended for DSDP igneous rocks data encoders, and eventually for users of the file.

Leg 45 Geochemical Data

Encoding of Leg 45 geochemical data for basalts is completed. Data were encoded from the shipboard reports and from manuscripts submitted for Volume 45 of the Initial Reports. There were over 470 analyses. Because major and minor elements are stored in separate files, nearly 600 records were encoded.

Paleontological/Lithological

Coding continues for the paleontological and lithological data bases.

INITIAL REPORTS SCHEDULE

Concern is frequently expressed about the publication status of Initial Reports. Below is a table, prepared from the NSF files, listing the time elapsed for:

A. Time in months from end of leg to submission of camera copy to NSF.

B. Time between receipt of camera copy and publication.

C. Total elapsed time in months from end of leg to publication of Initial Report volume.

Leg No.	A	B	C	Leg No.	A	B	C
1	11	?	?	23	20	3	23
2	12	4	16	24	26	3	29
3	13	3	16	25	18	3	21
4	17	2	19	26	23	4	27
5	13	3	16	27	19	2	21
6	15	3	18	28	26	3	29
7	20	2	22	29	19	3	22
8	21	3	24	30	27	3	30
9	22	2	24	31	18	3	21
10	33	2	35	32	20	2	22
11	21	3	24	33	25	2	27
12	20	4	24	34	24	2	26
13	24	3	27	35	26	3	29
14	18	3	21	36	29	3	32
15	27	7	34	37	29	5	34
16	21	3	24	38	24	3	27
17	25	2	27	39	26	6	32
18	20	3	23	40	37		
19	17	4	21	41	27	7	34
20	21	3	24	42A	31		
21	17	4	21	42B	32		
22	18	5	23				

REPORT FROM THE EXECUTIVE COMMITTEE
(9 May, 1978)

Site Survey Panel Reorganization

The Executive Committee approved the Planning Committee's recommendations concerning the reorganization of the Site Survey Panel to consist of one voting member from each IPOD member nation, the Subject Panel Chairmen (AMP, PMP, OPP, and OCP: non-voting), a Planning Committee representative (non-voting), a DSDP representative (non-voting), and a representative from the IPOD-JOIDES geophysical data repository (non-voting).

Paleontologic Reference Centers

The Executive Committee concurred with the Planning Committee's action approving the starting of a second paleontologic reference center at the Scripps Institution of Oceanography.

Plans for Drilling in 1979-1981

The Executive Committee endorsed the Planning Committee's actions directing the PMP and OPP to develop scientific objectives and plans for sites in the 1979-1981 period, subject to refinement in detail, and noting that six legs of drilling should be in the North Atlantic and one in the Caribbean, and that there is some urgency in developing detailed plans.

Plans for Drilling 1981 and Beyond

Three options are possible:

1.) Further *Challenger* drilling without any *Explorer* drilling.
2.) Begin using the *Explorer* as soon as possible.
3.) *Challenger* drilling through FY '81, and begin *Explorer* drilling in FY '82, with details provided as to what should be done with the *Explorer*.

The Executive Committee asked the Planning Committee to proceed expeditiously in preparing a proposal for drilling in the period 1981 and beyond, using the *Challenger* until 1981, and the *Explorer* starting in FY '82, but with the flexibility of +2 years in the scheduling of the transition from *Challenger* to *Explorer*.

Program Review

Peer review has been completed, and the technical and engineering reviews are proceeding. The engineering report will take until October to finish, and if a large drill ship is required for the program, the report will examine the *Explorer*. The costs of the riser will also be investigated.

NSF has requested from the non-U.S. members of JOIDES a statement of support, including the strongest possible statement of concurrence in the proposal for the 1979-81 drilling, and a commitment to the program.

DRAFT REPORT: EXCOM MEETING
15-16 August, 1978--Woods Hole, MA

Report From DSDP

1.) Engineering Studies--Development of certain tools such as the pressure core barrel is being carried out, but funding is not currently available to actively pursue major engineering studies. Discussion followed concerning directions for future engineering advances, including drilling techniques, lift capability, BOP, and cost vs. length of drill string.

2.) *Challenger*--Water has been detected in one of the bow thruster gearboxes. Partial repairs were carried out in Majuro. Both the seals and the studs will be replaced during drydocking.

The *Challenger* will undergo its mandatory biannual overhaul during drydocking in September and obtain renewal of regulatory certificates. This would remove the requirement for a mandatory drydocking during FY '79.

3.) Budget--DSDP is operating under a phase-down budget for FY '79. If the program is extended, start-up funds may become available during FY '79.

4.) Initial Reports--The contractor has defaulted on the Initial Report printing contract. Remaining work will be picked up by Rand McNally. A total of eight IR volumes are expected for FY '78.

The multi-facetted reasons for IR delays were discussed. Although the length of time to produce an IR has increased in recent years, the quality of the science, particularly the paleontology, has significantly improved. It is desirable to decrease the time now required to produce IR's; however, quality should not be compromised.

Report From NSF

1.) FUSOD Progress--Review of the FUSOD document is going well. The Giletti report was filed in May. The engineering review by Donhausier Marine, Inc. will be completed in October. They are reviewing possible technical problems, such as the need to develop remote sensing for a bottom blow-out device.

A third engineering study by the NRC/NAE started 1 June to run for two years. They first met on 1 July and plan a first workshop in September, 1978 with an interim report.

A Blue Ribbon Committee will consider the reports of the three above committees. Meetings are scheduled for September through December of this year. It is hoped that they will have a report by November.

2.) Foreign Support--The U.K. has agreed to participate in the 80-81 extension of IPOD, subject to the absolute requirement of logging. CNEXO is also expected to give a positive response. The other non-U.S. members were not able to comment.

Report From The Planning Committee

1.) Logging--Concern was expressed that the quality of the science be maintained. Logging is an integral part of scientific program. It will cost .6 million dollars to log the remaining legs. These funds are not currently available.

The day rate for the *Glomar Challenger* during FY '79 is expected to be 26-27 thousand dollars a day. The inactive rate is approximately half this, plus the additional savings on fuel and maintenance.

The motion was made & seconded that the Executive Committee feels so strongly about the requirement for logging of all holes that, if funds are not otherwise available, the DSDP drilling operation should be curtailed to the extent necessary to make funds available for this purpose. Passed unaminously.

The logging motion should be implemented at the earliest possible time, which will be at the beginning of Leg 63.

If funds have not become available by the next PCOM meeting, the *Glomar Challenger* schedule should be adjusted accordingly. Efforts to approach other funding sources should be coordinated through Peterson. A letter will be written from the EXCOM to NSF explaining this action.

2.) Legs 64-65--Curray and Moore met with the Mexicans on 11 August to explain *Challenger* operations. The Mexicans have not yet given permission to work in their waters.

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The Safety Panel has not met to approve all of the sites on Legs 64 an 65. These will be considered at the of Safety Panel meeting on 2 and 3 Octobe A special meeting of Leg 65 co-chiefs, principal investigators of experiments, p and DSDP personnel was held on 30-31 Au 1978.

3.) Equipment--The availability of water sampling equipment and geothermal hardware was discussed. Money for geothermal hardware is available in start-up funding, but it is not clear that it or the equipment will be available in time for the geothermal legs. Some equipment is commercially available from Custer.

Below 200°C it is possible to work reasonably well with water and mud. Above 200°C water sampling is not reliable using Custer equipment. The Japanese developed some sampling equipment for high temperature sediments in trenches which may be adaptable.

1979-81 Plans

The possibility of tying into continental drilling transects and COCORP lines was discussed. The U.S. continental drilling group is primarily interested in resources and problems of continental tectonics. COCORP is a project using seismic reflection techniques on land. Some of its lines near the Gulf of Mexico or off Eastern North America may tie in with IPOD work.

An effort should be made, possibly through *Geotimes*, to solicit non-JOIDES scientists' input into the 1979-81 program.

Post-1981 Drilling

The PCOM was asked to develop two programs for the 81+ period:

1.) A program which is a further revision of the Seattle document utilizing *Explorer* with riser capability, and *Explorer*, no riser, or super-*Challenger*.

2.) The second program would be for three additional years of continued *Challenger* drilling beyond October, 1981, conforming to FUSOD recommendations.

The programs should include geographic areas, time requirements, number of holes, and transit times. A tentative program will be submitted to NSF in mid-November, and both will be reviewed at the PCOM meeting in November, and the EXCOM meeting in December. In addition to drilling, the program should consider geophysics, site surveys, logging, [illegible]

Expanded Memberships in JOIDES

The non-U.S. IPOD members were asked to comment on expanded membership. Some saw nothing wrong with adding new member institutions at not less than the standard fee, but had reservations about consortia joining as a single member. Others voiced similar feelings, but felt that the question of consortia should be explored in spite of problems. Annex A of the Memoranda of Understanding, which concerns shipboard staffing, may have to be modified if new members are added. It was felt that any potential new member should have a strong deep water oceanographic program. EXCOM members were requested to bring a considered opinion on the question of expanded membership to the next meeting.

REPORT FROM THE PLANNING COMMITTEE
(1-4 May, 1978)

Status of Volumes--Initial Reports

To ensure that the time lag be reduced to the two years, the PCOM recommends the following actions be taken:

1.) Hold post-cruise meetings as soon as feasible (6-9 months) following completion of the leg;
2.) Enforce strictly the 14-month deadline for receipt of initial report manuscripts, and accept late manuscripts only if they do not result in any delay in publication;
3.) Proceed with production and publication in the order in which final volume manuscripts are completed;
4.) Hire an adequate number of science representatives to provide the necessary liaison to implement the above;
5.) Reiterate clearly to the chief scientist/scientist designates their responsibilities and commitment in accepting a position aboard the drilling ship; and
6.) Consider the past performance of leg scientists and refuse to re-assign delinquent scientists to subsequent drilling legs.

Report from the Geothermal Working Group

Drilling plans--Leg 68.

Priority 1: Galapagos Mounds Transect. Sites (not in order of priority):

GSC-1: 0°33.2'N, 86°06'W; 2750 m water depth; area of low heat flow, no mounds.

GSC-2: 0°34.2'N, 86°06'W; 2710 m water depth; mounds in area of low heat flow.

GSC-3: 0°34.4'N, 86°06'W; 2730 m water depth, mounds in area of low heat flow.

GSC-4: 0°35.2'N, 86°06'W; 2730 m water depth, area of high heat flow, no mounds.

GSC-5: 0°36.4'N, 86°05.55'W; 2710 m water depth; mounds in area of high heat flow.

GSC-6: 0°36.4'N, 86°04.65'W; 2740 m water depth; area of high heat flow, no mounds.

Priority 2: Alternate multiple re-entry site in thicker sediments on older crust to north or south of mounds area.

Priority 3: Single bit basement traverse (2 or 3 holes) north of mounds area to test for tectonic rotation.

Back-up: 1.) Drill more single bit holes in mounds area to fill in details of hydrothermal system.
2.) Move to Costa Rica Rift to drill pilot holes for Leg 69 multiple re-entry attempt.

Hydraulically Operated Core Barrel--The barrel, designed to recover approximately 10 m cores, is under development at DSDP and should be available by November.

Pressure Core Barrel--The barrel will be deployed on Leg 62. It is now under construction and will go to sea following land tests.

Caribbean Drilling--The PMP recommends that drilling during the Caribbean leg should be given priority as follows: the prime site should be the Venezuelan Basin. As second priorities, the Barbados Outer Ridge or CAR-3 should be drilled, depending on time available.

A site has been identified where "basement" lies beneath the dipping reflectors found under layer "B", and where it is reachable by multiple re-entry. The site on the Barbados rise is to penetrate an imbricate zone to underlying sediments. Sites on the Grenada and Sierra Rises are intended to be for biostratigraphic purposes.

Report from the Gulf of California Working Group

The group selected and agreed upon a list of 22 possible drilling sites in the mouth of the Gulf of California and in the Guaymas Basin. Final selection of the precise sites and alternate locations cannot be made until completion of the processing, analysis and plotting of all data. General locations and objectives for the sites are given in the minutes of the Working Group.

The OCP requests that:

1.) Casing be put in basement at the sites;
2.) Drilling proceed to 300° C.

Site Survey Panel Reorganization

The existing JOIDES Site Survey Panel has been modified. The panel will consist of one member from each member nation, the subject panel chairmen (non-voting), and a Planning Committee representative (non-voting). A representative from the IPOD-JOIDES geophysical data repository will attend in an advisory and non-voting capacity together with a non-voting DSDP representative. The duties of the group will be the following:

1.) Insure international cooperation and coordination in site surveying;
2.) Recommend working groups as required;
3.) Review adequacy of the surveys as presented by the working groups;
4.) Identify data gaps and recommend appropriate action;
5.) Recommend and review other plans for the international coordination of long-term regional studies and the use of new techniques and technology.

The sense of the motion includes that under normal circumstances one meeting per year would be required. Working group representatives and other experts would be asked to attend as needed on the invitation of a committee member.

The chairman of each working group will be a member of either the Site Survey Panel or the relevant subject panel.

Paleo Reference Centers

The plan is to have five reference centers in various locations in the world. The first center at Basel has been operational for two years. The suggestion is to have Scripps do the preparation work for the second center, with the material to be stored with the DSDP cores. The Planning Committee approved of the starting of a second reference center at the Scripps Institution of Oceanography.

Planning for 1979-81 Drilling

The Planning Committee considered a number of options for drilling in the proposed IPOD extension.

After considerable discussion concerning adequate planning for the 1979-81 period and provision for consideration of input from all interested parties, the PCOM recommends the following:

1.) The Passive Margin and Ocean Paleoenvironment Panels should be the primary bodies for summarizing and presenting the primary objectives and suitable sites for drilling to meet these objectives. Specifically, all other Panels and any other interested parties are asked to provide their input on objectives and site selection to either the PMP or the OPP with copies to the Chairman of the PCOM or directly to the PCOM for distribution. The OCP has requested that one of its members be invited to participate in all appropriate PMP discussions.

2.) Planning is to be directed to the broad objectives as outlined in the 79-81 proposal with site specific or transect specific selection to be based on all information acquired since the proposal was written and not overly biased by the suggestions presented in the proposal.

3.) It is important for purposes of free and easy communication that as soon as a panel identifies an objective or site that the DSDP/IPOD Site Proposal form be completed and forwarded to the JOIDES Office for distribution. The form is found in *Joides Journal* Vol. III, No. 3, October, 1977. Standard site designators should be used to avoid confusion.

4.) Any panel or individual may submit a site for consideration.

5.) Although the PMP and OPP will certainly be cognizant of the final site composition of each leg, the PCOM will formulate the final recommendations on timing and site composition for the legs. The PMP and OPP are requested to recommend their sites and objectives with stated priority for each.

The PMP and OPP were requested to develop in consultation with other interested panels specific objectives and plans for sites for seven legs of drilling in the North Atlantic and Caribbean and five legs in the South Atlantic to be drilled during 1979-81.

Difficulties with leg staffing are again becoming extremely acute. The PCOM requests that all recommendatshipboard staffing forwarded to DSDP by non-U.S. IPOD national committees must include nominations of scientists that can fill a variety of positions. It is exceedingly difficult to select a shipboard staff that will carry out the best scientific program if, in addition to the other constraints, the DSDP Chief Scientist must work with only single nominees from a national committee. The national committees may certainly order their nominations.

Additionally, the PCOM requests that every nomination include a complete vitae. Nominations made by JOIDES Panels should include at least the full name and address. If such nominees are citizens of a non-U.S. IPOD country, the names will be appropriately forwarded to respective PCOM members for consideration.

DRAFT REPORT: PCOM MEETING
18-20 July, 1978--Woods Hole, MA

Report from DSDP

1.) *Challenger* Progress--Site 462A in the Nauru Basin was discussed in detail. It was hoped that Jurassic sediment would be recovered so an extension to Leg 61 was requested and granted. In the final drilling, a bit dropped a cone. Fishing attempts failed so the site was returned to with a fishing specialist. After the hole was cleaned, the PCOM instructed the *Challenger* to finish one additional bit, log the hole and arrive in Majuro on 29 (30) July.

The remaining IPOD legs were shortened to accommodate the additional time given to Site 462A. The operational plans for the remainder of Leg 62 were: Majuro--MM-1--HR Sites-Honolulu-San Francisco. This option adds 2-1/2 days to total transit time and cuts 11 days off the following legs.

2.) 1979 Budget--DSDP is now operating under a phase-down budget. While a continuing budget is possible in November, the numbers represent essentially level funding.

	FY '78 (M $)	FY '79 (M $)
From NSF	16.511	15.500
Carry over	.987	.035
Total	17.489	15.535
Site Surveys	.800	0
JOIDES	.285	0
Totals (Site Surveys and JOIDES subtracted for comparative purposes)	16.413	15.535
Drilling Contract	10.200	10.700 ($500,000 increase)
Minimum net loss	1.4	
Probable net loss	1.7	

Moore noted that with these budgets, no logging was programmed beyond Leg 63.

3.) Downhole Instrumentation--Stan White has agreed to coordinate plans for downhole instrumentation and similar programs at DSDP. Anyone considering such experiments should keep Stan informed of their plans.

Report from NSF

1.) There has been $1 million set aside for post-1979 drilling, but there is nothing for site surveys. The language in the appropriation legislation was restrictive. The final budget will not be available until after the Senate meets on the subject.

2.) The post-81 program review is proceeding (See Planning for Post-81, page 50).

Panel Reports and Requests

These are abbreviated from even the PCOM minutes. For full details, please see the separate panel report which follows.

Report from the Inorganic Geochemistry Panel

The Planning Committee endorses the request of the Inorganic Geochemistry Panel and the Geothermal Working Group that water sampling and temperature measuring devices capable of sampling and measuring water of 200-300°C be available on legs where these devices are appropriate to the scientific objectives of drilling.

The problem of sampling for organic geochemistry work in which the samples are not available for either lithology or paleo work was discussed. In at least one instance, it was clear that a critical stage boundary was present in the sample set aside for organic geochemistry, but the sample could not be worked on. It was agreed to look into ways of giving the geochemists a sufficient volume of sample while still allowing the paleontologists and sedimentologists to examine the cores.

Future Leg Planning

Legs 64 and 65

1.) Guaymas will not be used as the port of call. Mazatlan will be used instead.

2.) A fallback position in case of a possible disruption in plans for the Gulf of California was discussed. Possibilities include a fallback to the Caribbean holes, and the Guatemala transect. The JOIDES Office will check into the status of Guatemala Site Survey plans.

3.) The subject panels supply the Planning Committee with recommendations as to the priority of objectives for drilling in the Caribbean.

4.) Three downhole experiments are planned for Leg 65: a.) A hydrofracture experiment; b.) an oblique seismic experiment (see cover); and c.) an experiment to leave a geophone in a DSDP hole.

Leg 68 and 69

1.) The Galapagos Spreading Center was chosen because of the combination of good weather, the required sediment cover was present, and the area was well known from previous surveys. Problems encountered on Leg 54 were noted, but the Geothermal Working Group had agreed that single entry holes with good logging and temperature measurements would be quite valuable. The suggested program is to drill one leg in an open geothermal system, the Mounds Area in the Galapagos Spreading Center, and a second leg in a closed system on the Costa Rica Rift.

The proposed areas are outside any National jurisdiction. The sites in the Mounds area have 25-35 m of sediment cover, and heat flow ranges from 12 heat flow units to 4 heat flow units. The suggested program would require 15 to 20 days to drill five holes in the Mounds area.

2.) The original plans for drilling Legs 68 and 69 will be reversed. This would maximize the chances of achieving a deep hole early in Leg 68, and returning on Leg 69 to log the holes, thus giving the best possible in situ measurements.

3.) It is possible that penetration may be increased if casing can be reamed into the rubble zone. Such a system is currently being developed.

1979-81 Drilling Plans

A drilling program, identified as "Alternative Model Drilling" in the preliminary proposal USCD-0862, pages 6-37 and 6-40, was presented and modified. The proposed schedule is listed under Figure 3.

Proposal for Drilling in the Period 1981 and Beyond

The document resulting from the meeting of an ad hoc group held at the University of Washington, 20-21 June, 1978, entitled, "The Relation of Scientific Ocean Drilling Objectives to Drilling Platform Capabilities: A Preliminary Planning Document," was distributed during the meeting.

The subject panels will be asked to:

1.) Determine what is meant by "Regional" surveys and whether land/sea transects are feasible in some areas.

2.) To define problem areas, regional surveys that are necessary, and the time required for a program.

Continental Margins: Geological and Geophysical Research Needs and Problems

The Planning Committee expressed concern for the future of Deep Sea Drilling in the context of the report on "Continental Margins: Geological and Geophysical Research Needs and Problems." Part IV Conclusions and Recommendations of this report were distributed.

The following statement was adopted:

The Planning Committee agrees with the "Continental Margins" and "FUSOD" reports that appropriate geophysical surveys should precede drilling any specific site. It disagrees with the statements of the "Continental Margins" report, which suggests that geophysical surveys of the entire continental margin need to be completed before any drilling can begin. The Planning Committee feels that this procedure would create such a great hiatus in drilling that a program like IPOD could not reasonably be reinitiated. The Planning Committee feels that drilling is a vital part of the study of the continental margins, rather than a "second priority" undertaking, and should proceed apace with the completion of geophysical surveys appropriate to the area.

Seaprobe Status

Seaprobe data has been sent to NSF and to JOIDES. The *Seaprobe* has been converted to rotary drilling capability and is being chartered for drilling off the East Coast of the U.S. and in the Gulf of Mexico. The vessel has a 6-8,000 ft. (1.7-2.4 km) depth capability. If there is a regeneration of interest in the vessel, there is a possibility that WHOI could reactivate the *Seaprobe* and use it for certain targets. The *Seaprobe* will be reexamined after the technical review, especially in light of the new rotary drilling capability.

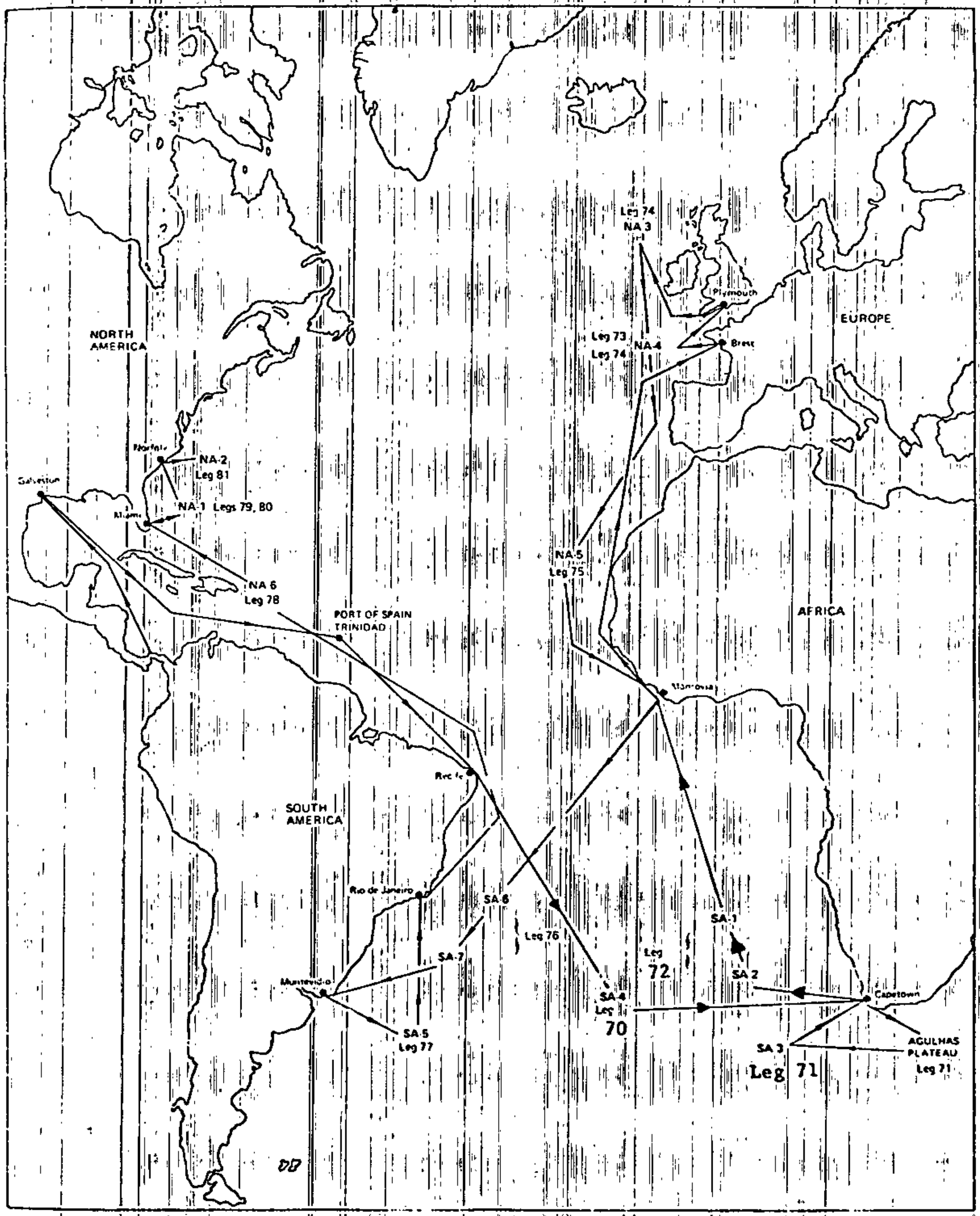

Figure 3: Preliminary and Tentative Schedule for 1979-1981--*Challenger* Program (modified from UCSD 0862).

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REPORT FROM THE DOWNHOLE MEASUREMENTS PANEL (24 February, 1978)

Recent Logging and Analysis of Previous Logging

Leg 46--Mid-Atlantic Ridge, Hole 396B, was logged to 200 m into basement. All of the main tools were run successfully, but the excentralizer and calipers failed so the porosity and density logs are unreliable. The logs are now available on request.

Leg 48--Bay of Biscay and Rockall Bank Holes 401, 402A, 403, 405, and 406; all of the main tools were run plus a sonic amplitude log. The logs are now available.

Leg 50--Moroccan continental margin sediment, holes 415 and 416. All of the main logs were run except high resolution temperature and caliper. The excentralizer was not working so the porosity and density logs are unreliable. A detailed Initial Reports article on the logging and physical properties has been prepared.

Leg 51--Bermuda Rise hole 417D. All of the main logs were run but the caliper failed. The logs are now available.

Leg 57--Japan trench holes 438A, 439, 440B, and 441A. All of the main tools were run including the high resolution thermometer, but not the caliper. There was no excentralizer so the density and porosity logs are unreliable. The logs will be available on request after October, 1978.

General Comments on Logging Results

Most of the important logs have been run into holes on five legs, although there have been considerable difficulties. The one consistent and serious failure was the excentralizer which holds the tools against the side of the hole. A caliper also was generally not run successfully. These failures make the density and porosity logs of doubtful value and reduce the reliability of the other logs.

The results of logging show that there is extensive large-scale crack and fracture porosity in young oceanic crust so that core samples do not give physical properties that are representative of the bulk physical properties of the drilled crustal sections. The seismic velocities, densities and electrical resistivities from logging are all much lower than those obtained on core samples. In contrast, the large-scale porosity of the old upper crust is small, the voids and fractures largely being filled, so that the physical properties from core samples approach those from the logging. These new results are an important complement to the surface geophysical data on the aging of the upper oceanic crust.

Deep holes into sediments were logre with excellent data on Leg 48 in the Nos eastern Atlantic margin and on Leg 57 i the Japan trench. The logs were particularly valuable on Leg 48 in stratigraphi corellation between sites and with seism reflectors. On Leg 57, tectonic fractur development in the hemipelagic sediments landward of the trench axis was well outlined by the logs, as were the main lithologic changes.

Oblique Seismic Experiment

The oblique seismic experiment was successfully carried out on Leg 52 in the western Atlantic. For this experiment a three-component geophone was clamped successively at several different depths in the hole while 10 kg explosive shots were fired by an independent shooting ship at various directions and distances up to 10 km from *Glomar Challenger*. The experiment results in a high-accuracy velocity-depth profile of the upper oceanic crust over a 20 km diameter area. The data complement core sample measurements, downhole logging and seismic refraction for the determination of the velocity structure of the upper oceanic crust.

Pore Water Sampler

An in situ sediment pore water sampler has been constructed and used very successfully on Legs 56 and 57. The data generally shows high alkalinities throughout the drilled sections. The results confirm that the water squeezed from core samples is generally representative of in situ pore water with only slight dilution by seawater.

Downhole Magnetometer

A downhole magnetometer logging tool has been proposed. Tests done in land boreholes into basalt lava flows suggest that such an instrument would detect magnetic field reversals as well as variations in the magnetic properties of crustal rocks. The results of such a tool should be scientifically important and the Panel has recommended that the Project purchase or rent a downhole tool if a supplier can be found. It would be used primarily in deep crustal holes.

Large-Scale Resistivity Experiment

A large-scale resistivity experiment has been proposed that will give the bulk electrical resistivity of a large volume of the upper oceanic crust. It employs widely spaced electrodes suspended in the hole on a special this experiment combined with logging and sample electrical measurements will give estimates of the large-scale porosity. There is no other large-scale resistivity measurement technique (for example comparable to seismic refraction for sonic velocity) that can give large-scale crack and fissue porosity and its variation with depth and crustal age. Such porosity is important to our understanding of hydrothermal circulation in the crust and of the availability of water for alteration and metamorphism. The data should complement large-scale porosity estimates based on seismic studies.

Permeability and Hydrofracturing Experiment

It has been proposed that:

1.) In situ permeability be determined by isolating sections of a hole with inflatable packers and measuring flow rates with increasing and decreasing pressure; and

2.) The direction and magnitudes of the principle horizontal stresses in the upper oceanic crust be determined by increasing the pressure in a sealed portion of the hole until the rock fractures. A borehole sonic televiewer is required to determine the orientation of the fracture.

This experiment would be extremely valuable scientifically if reliable data could be obtained. Permeability is a critical and virtually unknown parameter for our understanding of hydrothermal circulation in the oceanic crust. Hydrofracturing could give the in situ stress and thus information on the driving forces operating on the lithosphere and on the sources of intraplate earthquakes. However, both of the experiments have been difficult to carry out even in land boreholes where conditions are much easier than at sea. The technical difficulties are very serious.

As a first test it is planned to pump against the one Lynes packer (MINI-BOP) at present owned by DSDP to see if the packer will provide an adequate seal in the hole and to see if the *Challenger* pumps can provide adequate pressure to the sealed portion of the hole.

Long-Term Instrumentation of Holes

Downhole instrument packages have been proposed to be left behind in completed holes. Data would be telemetered to the surface. The initial packages planned are:

1.) A dilatometer for use as a strainmeter and seismometer along with downhole temperature sensors; and

2.) A short-period, three-componen geophone. Later development will include broad-band seismometers.

The proposed instrumentation obviously would be scientifically very valuable, particularly for global seismic studies. The technical difficulties are very great, but appear to be manageable. It is hoped that the first hole can be instrumented on Leg 64.

Logging and Experiments in Old Holes

A *Glomar Challenger* leg in the Atlantic devoted to logging and inhole experiments in existing re-entry holes into the oceanic crust has been proposed. Four re-entry holes are available in the mid- and western Atlantic: 395A (Leg 45), 396B (Leg 46), 417D (Legs 51 and 52), and 418A (Legs 52 and 53). Previous experience suggests that these holes could be re-entered. The suggested program includes: standard logging, an oblique seismic experiment, a large-scale resistivity experiment, permeability and in situ stress measurements using packers, and long-period instrumentation.

PROPOSAL FOR SPECIAL DOWNHOLE MEASUREMENTS
USSR Academy of Sciences

Seismic Downhole Studies in the Frequency Range 5-10 hz

1.) Indirect Seismic Logging--Seismic waves will be generated in the hole in succession at various depths while receiving will be performed near the ocean surface or on the sea floor; instruments will be situated according to the profile network in the vicinity of the hole.

Instruments: Source-hole perforator. Sensors are single hydrophones, multi-channel arrays, autonomous bottom seismometers.

Time: Work in the holes drilled by *Glomar Challenger* can be started in the second half of 1979.

2.) Vertical Seismic Profiling and Azimuth Observations--Seismic wave generation is performed near the ocean surface of the profile network in the hole area; receiving is performed in the hole at various depths.

Instruments: Source--airguns or explosions. Sensors--multi-channel tool AVSP-7 for registration of the vertical field component azimuth multichannel tool ASU-4.

Time: Work in the holes drilled by *Glomar Challenger* can start in the second half of 1979.

Note: Approximately six months prior to the beginning of the work described above, it will be necessary for Soviet specialists to acquaint themselves with the equipment of *D/V Glomar Challenger* during its stay in port between legs to determine the adjustment of cables to the instruments, the choice of regime of descent and lifting operations, the electric feeding of receivers, placement of recording instruments, etc.

3.) Sounding Between the Holes--Seismic waves will be radiated in one hole in succession at various depths, receiving will be performed in another hole at various depths, while recording will be on the sea floor or in a surface buoy.

Instruments: Source--hole perforator. Sensors are the same as in #2, as well as instruments designed in the USA.

Receivers: Autonomous bottom seismometer and surface buoy connected with the receivers by cable.

Time: Precise time of this work is not clear yet. It depends on the time of construction of instruments for long-term measurements and on the possibility of organizing work simultaneously in two holes. Approximately 1980 can be suggested, but the first experiments are desired in 1979 together with long-term hole measurements planned by U.S. institutions in the Eastern Pacific.

Downhole Magnetometer Measurements

Measurements will be carried out directly after the drilling and will be continued permanently in the process of instrument motion in the hole.

Instruments: Downhole complex magnetometer KSM-65 SG. The main technical characteristics are:

* Range of measured values of the magnetic field: ±60,000 gm with a magnetic sensitivity of up to 0.15 standard units.
* Systemic error component: for vertical field component up to ±30 gm, for horizontal component up to ±100 gm.
* Random error component: for magnetic field up to 2.5%, for magnetic sensitivity up to 5.0%.
* Temperature range: -10 to +180°C.
* Allowable pressure: 1200 km/cm^2.
* Outer diameter of tool: 65 mm.
* Weight of tool: 30 kg.
* Cable used: 3-cored cable of type KTBF-6.

Time: Work in the holes drilled by *Glomar Challenger* can begin in 1979.

Preparation: To solve the problems of instrument usage, Soviet specialists should visit *D/V Glomar Challenger* in 1978 during its stay in the port between legs.

REPORT FROM THE OCEAN CRUST PANEL (13-15 April, 1978)

Planning For Drilling in 1979-81

The OCP requests that, as its highest priority, time should be given for one leg to complete the trans-Atlantic traverse, with single bit holes at sites AT3, AT4 and AT7. All of these sites have been surveyed already.

This transect was an important part of the original ocean crust proposal, and its importance is emphasized by the great contrast between the holes drilled at AT2.3 (417 and 418), and those at AT5 (395) and AT6 (396). In order to understand the way in which the crust at AT2.3 has evolved into its present state, intermediate samples are needed urgently. A paper in support of this proposal was previously circulated with OCP minutes, July 1977. Although it would be desirable scientifically for all of these sites to be drilled on the same leg, they might be picked up, if necessary, individually as ship time became available.

As its second priority, OCP requests that one further leg should be devoted to drilling at one of the sites drilled in above-mentioned section, a multiple re-entry site to give 1 km penetration into the oceanic crust. Seismic measurements suggest that the crustal conditions (low degree of open cracks, softening of the crust by weathering) that led to the excellent drilling at sites 417 and 418 should have developed in crust as young as 50 to 75 m.y. At 417 and 418 the final restriction on penetration seemed to be drill-string length, with the string failing twice at lengths of about 6.4 km. In younger, shallower crust, such a string length would allow penetration to about 1 km, substantially deeper than has been achieved so far. In the lower part of sites 417 and 418, and at the bottom of 395, intrusives began to appear, and it seems likely that all three holes stopped just short of a transition from a section predominantly of lavas to one predominantly of intrusives. Such a transition is seen in ophiolites at a depth of about 800 m, where it coincides with important changes in the mode of hydrothermal alteration. OCP believes that such a site would have very high scientific value. A paper supporting this proposal was previously circulated with OCP minutes, July 1977.

Single Bit Sites at the Mouth of the Gulf

The panel considered a number of candidates for sites for single bit drilling at the mouth of the Gulf. They are set out, in order of priority, in the following list. Not included in the list, but assumed to have high PMP/OPP priority, was the stratigraphic reference site near the tip of Baja California, but to the west of the other sites.

1.) A pilot hole at GCA-1 for the subsequent multiple re-entry.

2.) A pair of sites straddling the continent-ocean boundary as closely as possible, one on continental crust, the other on oceanic crust. The boundary can be identified topographically and magnetically with some precision in this area, and the holes could be sited within a few km of it.

At the Ewing Symposium several speakers gave accounts of geochemical work that suggested major geochemical divisions within the oceanic crust, based on major element analyses of glasses, trace element analyses of rocks, and isotopic analysis of rocks. One such transition occurs at between 30° and 36°N, and another at between 22° and 28°S (at the ridge crest). Exactly how such transitions occur is open to argument. At present, the majority view favours the idea that they reflect large-scale geochemical transitions in the mantle, perhaps generated very early in the Earth's history. This is a very new set of ideas, and owes a lot to the results of hard-rock drilling in the Atlantic, which has been the source of most samples used in the compilation so far. The OCP attaches great importance to following up these initial results, to attempt to understand how such features arise and how they might be important in understanding global geology. The best strategy for reaching this objective would seem to be to concentrate on a transition between two such geochemically distinct areas, and try to answer such questions as: Is the transition sharp or gradational? In what direction does the transition run away from the ridge crest? Along a crustal flow line? Along a mesospheric flow line?

The transition at 30°-36°N will not be very accessible during the 1979-81 phase of drilling, but that 22-28°S lies in the area where many of the OPP/South Atlantic Working Group sites are proposed to look at palaeo-oceanography. This area has the advantage that here mantle and crustal flow lines diverge quite widely, so that a distinction between the different cases should be apparent.

OCP proposes that consideration be given during planning and drilling of the South Atlantic OPP programme to sampling this crustal geochemical transition where possible. It might be possible, for example, to place some of the sites to sample it without detriment to OPP objectives, or to ensure good basement penetration at a particularly critical site where this might not otherwise have been achieved.

Planning For Legs 64 and 65

Scheduling--The panel agreed with the recommendation of the Gulf of California Working Group that the activities should be divided to have one leg (64) of single bit sites both at the mouth of the Gulf and in the Guaymas Basin area, followed by one leg (65) devoted to multiple re-entry. The consequences of working in this way would be that the best sites could be chosen for re-entry, and the relative likelihood of successful re-entry could be assessed, after the first leg's drilling.

Survey Results--The multi-channel transect was not available, but in the mouth of the Gulf, single-channel airgun and 3.5 kH_z pinger records defined the sediments very clearly. Sediment thicknesses reach a maximum of 500 m just adjacent to the continental margin off Cabo S. Lucas. Dredging gave granodorite on Cabrillo Seamount and on outcrops on the continental margin. Pillow basalts were dredged from the axial valley near GCA-1. The survey in the Guaymas Basin was still in a fragmentary state, and had not been compiled relative to topography. However, there seemed to be 100-200 m of sediment at the spreading axis there. Further definition will have to await working up of the results.

The following holes are proposed:

1.) A pair of holes approximately equally spaced between the previous sites and the ridge crest, to study the progressive evolution of continental margin sediments and oceanic crust with distance from the margin. These will be placed after Lewis has inverted the magnetic anomalies for the transect, and he and Harrison have checked the inversion against the polarity time scale, so as to intercept crust of clearly-defined magnetic polarity.

2.) A hole in one of the serpentinite diapir structures associated with the Tamayo Fracture Zone.

3.) A hole in the median ridge of the Tamayo Fracture Zone (discussed in a paper circulated with OCP minutes for November, 1977).

4.) A hole in unequivocally continental basement and Cabo S. Lucas.

Single Bit Sites in Guaymas Basin--The principal objectives for drilling in this area are to drill a zero-age hole, to look at oceanic crust formed in regions of high sedimentation rate, to examine sedimentation in a young ocean, to study restricted basin settings, to study diagenesis of siliceous sediments, to drill in an area of high heat flow, to examine hydrothermal circulation and hydrothermal deposits, and to examine oceanic crust giving rise to no magnetic anomalies, and probably metamorphosed.

Site A: A site on the spreading axis in the region of highest heat flow.

Site D: A site half-way to the edge of the basin on the west.

Site B: Another site on the spreading axis in an area of lower heat flow.

Site E: A site at the margin of the basin on the west.

Site C: A symmetrical site, halfway to the edge of the basin on the east.

Multiple Re-entry in Guaymas Basin--The panel agreed that a multiple re-entry site in the Guaymas Basin, if possible on the spreading axis where heat flow is highest, should be a very high priority, as suggested by the Gulf of California Working Group. If drilling conditions are notably better at one re-entry site or the other, then drilling effort should be concentrated on the site drilling best. If both sites are drilling equally well, then marginal priority should be given to penetration at GCA-1.

Technical Requirements--The OCP recommends that the facility for drilling casing into basement should be available for Leg 65, and that the cementing capability on the ship should be operative.

The OCP recommends that on Legs 64 and 65 the capability should be available of continuing drilling and coring, and of measuring temperature and taking water samples, up to 300°C. The experience of geothermal drilling on land suggests that this is the maximum temperature normally encountered. This might require metal core-liner, a different bit (the diamond bit now on board might be adequate), and special temperature-measuring and water-sampling apparatus. Present temperature limits are: Plastic core liner, 87°C; Gerhardt-Owen logs, 150°C (except for comp. density tool, then 105°C); and drill bit, 200°C.

Planning for Legs 66 and 67

The panel expressed interest in the suggestion of the Middle America Trench Working Group that reference sites should be drilled on oceanic crust outside the trench axis on both Middle American transects. These sites are on fast-spread Pacific crust several tens of millions of years old, and should give good crustal recovery. The OCP feels that these sites are of clear scientific importance from a crustal point of view, and would like to be involved in the analysis of the crustal material drilled. The material should be particularly important for understanding the processes of aging in fast-spread crust.

Planning for Legs 68 and 69

A letter was discussed, which argued for a concentration of effort on drilling in the first leg (in both Galapagos and Costa Rica Rift areas), and on experiments, logging, etc. in the second leg. The panel feels, on the whole, that it was preferable to spread the experiments over both legs, especially since many experiments might have to be done in single bit holes, since difficult drilling conditions might not allow multiple re-entry holes to be drilled readily. These could not be re-occupied on a subsequent leg. OCP therefore recommends that the plan be as originally suggested, with one leg of drilling in the Galapagos mounds area, and one in the Costa Rica Rift area.

Drilling in the Galapagos Area--The Geothermal Working Group suggested a single transect of six single bit holes, spaced 1 km apart, at right angles to the spreading axis, running from an area of high heat flow to one of low heat flow about 20 km from the ridge axis. This was to be followed by a multiple re-entry at one of the sites.

The OCP recommends that the Working Group consider:

1.) Further single bit sites in the hot part of the system to give a two-dimensional pattern. (These might be part of a back-up array if the multiple re-entry site was not feasible.)
2.) Sites at another area to the south, where the sediment is thicker and the rocks older, say 2 m.y., in case drilling is particularly bad in the mounds area.
3.) Two sites to the north of the spreading axis, to give information on tectonic rotation of oceanic crust.

Gas-Chromatographic Analysis on Ship of Dissolved Gases in Water Samples--Water samples will be recovered on Legs 64, 65, 68, and 69 from sediment overlying basement and, hopefully, from within the basement itself. Some of this water is likely to be hydrothermal in origin, consisting of sea water that has circulated through the ocean crust, has become chemically modified while doing so, and is moving towards the surface to discharge at the ocean floor. Similar water, though modified by dilution by sea water, was collected in the Galapagos Rift by *Alvin*.

Many of the components of this water can be analysed on shore. With proper storage, they remain unmodified for several months, and shore-based analysis is usually more reliable than that performed at sea. However, some components are labile, that is, they cannot be stabilized, and must be measured soon after collection if the measurements are to be meaningful. Such components are pH, alkalinity, total dissolved CO_2, H_2S, O_2 (and N_2 and Ar). These components exert a powerful influence on the behavior of the solution, and are important indicators of the origin of solutions. Many can be analyzed already on board, but total dissolved CO_2 and other dissolved gases cannot.

Total dissolved CO_2 is a major labile component in such fluids, and its content will exert an important control on calculation of in situ pH. CO_2 contents are likely to be higher than in normal sea water, since CO_2 will be leached from the rocks. Its measurement on board immediately after sampling is imperative, and requires either a CO_2 analyzer or a gas chromatograph equipped with a stripper device.

Though in some waters, CO_2 contents can be calculated from an alkalinity titration, this is not the case for geothermal fluids, which are expected to have pH less than 5, past the end-point pH of the titration. However, a modified gas chromatograph can be used to replace the present alkalinity titration which is both time-consuming and requires relatively large sample volumes.

The modification to the chromatograph would take the form of an apparatus for stripping gases from solution and injecting them into the present chromatographic instrument.

REPORT FROM THE OCEAN PALEOENVIRONMENT PANEL (22-23 June, 1978)

The 1979-1981 Program

The Seattle document was reviewed. It was decided to list OPP objectives requiring improved drilling capabilities compared to that of the *Glomar Challenger*. Every effort will be made to improve core recovery and core quality, the ultimate goal being 100% undisturbed sediment core recovery.

Future drilling plans utilizing the *Glomar Challenger* will be examined during the next meeting. In particular, all panel members should be prepared to work on plans for:

1.) Drilling south of 50°S (see also proposal by SW Atlantic-Southern Ocean Working Group).
2.) Mesozoic sites in all major oceans.
3.) High latitude North Atlantic sites.
4.) Mid- to low-latitude transects on rises and margins.
5.) Southern Ocean Rises.

Caribbean--It appears that a leg could be devoted to the Caribbean during the 1979-1981 period. OPP representatives (Hsü, Kennett, Lancelot) will keep in contact with the PMP Caribbean Working Group. Hsü and Curray will also propose site in the Venezuela and Colombia Basins in order to obtain good Tertiary sections near site 151 and near the isthmus of Panama.

OPP feels that in view of weather constrains any drilling in the Caribbean should be carefully planned to avoid a delay in drilling in the Southeast Atlantic.

Review of Leg 63 Program

Crouch presented the results of the recent surveys of the California borderland sites. He recommended, and the panel concurred, that EP-4A (Patton Basin) be dropped from the program and be replaced by EP-4C (San Miguel Gap).

All EP sites were reviewed and assigned priorities in the following manner:

	Site		Priority	Est. No. of Days
(Leg 67)	EP1	To be drilled on Leg 67; needs to be moved outside 200-mile limit from shore	1	6
(Leg 63)	EP2	Tip of Baja California, now labelled GCA-8	2	8
	EP3	Old Mohole test site. Presently approved by Safety Panel to basalt. Winterer will request that this restriction be reconsidered. Lancelot will search files for additional seismic profiles in area.	1	5
	EP4B	Patton Escarpment	1	6
	EP4C	San Miguel Gap	1	10
	EP5A	Base of Patton escarpment South	1	6
	EP5B	Base of Patton escarpment North	2	5
	EP6	Distal Delgada fan	1	5
	EP6A	"Delgada Ridge" (Alternate site documented by Eli Silver)	2	10
	EP7	Rejected		
	EP8	Off Magdalena Bay, Baja California	1	5
	EP9	(Has been transformed into EP2 = GCA-8)		

Review of Shipboard Staffing--Legs 64-69

Leg 64 is nearly completed. OPP recommends that a diatom expert be added (e.g. Mikkelsen, Baumgartner).

OPP concurs with views from SCP regarding the nanno-specialist and recommends that Mannivit be replaced by a Tertiary specialist. (Lancelot will arrange replacement with French authorities.)

Leg 65 is in progress. OPP recommends close cooperation between Leg 64 and Leg 65 stratigraphers. Senor and Senora Longoria could be invited to cooperate on Leg 65 Foram studies.

Legs 66-67 are in progress. No particular comments from OPP at this time.

Legs 68-69 are in progress. OPP strongly recommends that at least two highly qualified stratigraphers be included in the shipboard party for these legs. Their participation will be essential for study of the sediment column, especially if alternate sites are considered, in view of the high technological risk that characterizes the main objectives of these legs.

Review of Shipboard Staffing--Legs 70-72

The panel recommends the following names for consideration as possible co-chief scientists for the South East Atlantic legs:

Hsü	Sclater
Shackleton	Berger
Van Andel	Thiede
Lancelot	Rabinovitz
Shouten	Needham

The panel also recommends that special attention be given to nominate an expert in magnetic anomalies for the M.A.R. sites (SA-4) and further recommends that organic geochemists participate on board for the Angola and Cape Basin sites.

REPORT FROM THE ORGANIC GEOCHEMISTRY PANEL
(19-20 June, 1978)

Reports from Shipboard Organic Geochemists

Leg 56 (Whelan)--Drilling in the west wall of the Japan Trench encountered gas early. Gas was dominantly methane, sometimes accompanied by H_2S, and was considered to be biogenic. There was poor core recovery, and cores were usually shattered. Essentially no gas was found in drilling in the east wall. Some samples contained fish teeth and manganese nodules. In future work, it is recommended that an electronic integrator be available and used with the geochemical instruments.

Leg 57 (Bell)--Higher organic carbon values found in samples from Leg 57 than from Leg 56. Bell iterated Sato's recommendations: (1) legs need two organic geochemists supported by two technicians; (2) integrators required for all instruments; (3) there are numerous sources of contamination and the sources must be avoided as much as possible; (4) more samples are necessary for organic geochemistry; (5) the economic importance to be derived from deep sea drilling must be emphasized; and, (6) organic geochemistry can aid sedimentology.

Leg 58 (Waples)--Samples from Leg 58 were uniformly lean in organic carbon. Only small shows of gas were observed. The holes drilled provided good samples for studies of diagenesis. Samples showed decrease of organic carbon and of nitrogen with depth. Loss of carbon appears to be first order. Arrhenius plots were used to interpret possible losses of carbon and nitrogen.

Leg 59 (Brassell)--Holes on this leg showed a mixture of sediment types with depth. No significant concentrations of hydrocarbon gases were observed. Organic carbon was determined by CHN analyzer for frozen samples (100-150 cm intervals).

Legs 56-57, Samples

Distribution--Sampling of frozen samples was carried out on 4 April, 1978 by the DSDP/IPOD curatorial staff at Scripps. Five teams of investigators received samples and six samples from Leg 56 were sent to Eglinton after 4 April.

Several items are noted relative to these samples:

1.) The time between shipboard sampling and receipt of samples by the investigators was inordinately long. Much of this delay was caused by the wait for LECO organic carbon determinations. It was decided that in the future, samples could be selected and sent without this organic carbon information.

2.) Samples taken for organic geochemistry should be noted in shipboard description. Some samples are presently indicated as missing in the shipboard description, and this oversight should be corrected at least by the end of the cruise.

3.) A closer relationship must be established between sedimentological information and organic geochemical samples and data.

4.) Shipboard information must be obtained as early as possible. Shipboard organic geochemist should prepare a summary report concerned with samples collected for OGP. This report should be available at the end of the cruise.

5.) The OGP encourages the project to reduce the time between sample collection and sample storage at Scripps, if at all possible.

6.) The OGP recommends that metal encased, maximum-minimum thermometers be included with every frozen sample shipment from the ship to Scripps.

Preliminary Statements--The generally high concentrations of organic carbon and the systematic sample collection makes these samples of great interest for organic geochemistry.

1.) Erdman (Phillips)--About 400 samples from several legs have been looked at systematically for organic carbon, lipid extract, distribution of heavy alkanes, 13C of lipids and kerogen and a comparison of these parameters with the physical environment, depth and age. Future work will move into studies of the fate of organic nitrogen with depth and age. Emphasis will be placed on young samples and the following will be measured in sediments (excluding shells): N/C, amino acids, nucleic acids, sugars, and polymers of natural products. Some precedent for this kind of work comes from Leg 50 where the release of N as NH_3 was observed.

2.) Whelan (WHOI)--One of the most interesting low molecular weight hydrocarbons observed during Leg 56 shipboard gas analyses was neopentane. This compound may be caused by microbial processes with perpanes as the possible precursor structures.

3.) Lauda (Florida-Atlantic)--Chlorins have been extracted from samples from Leg 56, and samples from Leg 57 are undergoing extraction. Chlorins were identified by uv-visible spectroscopy. The direction of this work is to determine the chemical changes that take place with depth. Preliminary work shows that the total pigment decreases with depth. A "pigment yield index" has been defined and is the amount of pigment relative to organic carbon. This index also decreases with depth. A carotenoid (tetraterpene, C_{40}) was isolated from a shallow Pleistocene core sample. Leg 57 provides a set of samples with consistent sediment type and thermal stress. It is expected that the chemical results show the chlorin to porphyrin transition.

4.) Johnson (Exxon)--Preliminary results for canned samples from Legs 56 and 57 show that the bulk of the organic matter is from terrestrial sources being woody or coaly with some herbaceous and a little algal material. All samples show some reworking. Organic carbon ranges from 0.32 to 1.14 and averages 0.7%. The thermal alteration index is between 1 and 2+ and all organic matter is immature. The pollen in the samples indicates a fresh water environment. Headspace analyses for C_1-C_4 hydrocarbons show 47 to 23,000 ppm with 99-100% methane. Total gas (C_1-C_4) content in four samples ranged from 5,000 to 10,000 ppm.

Recommendations by Organic Geochemistry Panel for Future Legs

Sampling--(1) Reaffirms that frozen samples should be taken on all legs as prescribed by the shipboard operations manual; (2) Recommends that OGP frozen samples be entered in shipboard log and summary reports for the legs. (3) Recognizes the need for greater sedimentological control and recommends that (a) on shipboard the organic geochemist work carefully with sedimentologists, and (b) samples be taken from every important lithotype to reduce sampling bias; and, (4) Recognizes that the shipboard organic geochemist needs more explicit instructions, including wherever possible an orientation program concerning his/her responsibilities. The Panel recommends that the shipboard organic geochemist be required to communicate (a) all relevant information at the end of his leg to all investigators who intend to work on frozen samples, and (b) all relevant information gathered at post-cruise meeting to investigators who are analyzing frozen samples. For legs where no organic geochemist was onboard and where significant organic geochemical studies are being carried out in shore-based laboratories, the OG Panel recommends that one involved investigator be permitted and supported to go to the post-cruise meeting. This investigator would be responsible to communicate his observations to all other organic geochemists studying samples from the same leg. (5) Urges each shore-based investigator to prepare a single page description of his general interest in organic geochemistry of DSDP/IPOD by 15 July, 1978. These descriptions will be included in a booklet to be given to shipboard organic geochemists to help them make decisions with regard to sampling for the OG Panel.

Galimov suggested that the organic geochemistry program should be better organized with various teams directed to make certain analyses. Although this approach could result in a wide range of different kinds of analyses, the OG Panel felt that such a directed program would not work well at this time.

Analysis

Organic carbon determinations using the CHN analyzer should be made by all shipboard organic geochemists on the OGP samples. The CHN analyzer data can be improved by:

1.) providing integrator for calculations.
2.) supplying better standards. The present standard is acetamide on quartz sand. The project needs a full range of natural standards from 0.1 to 5% organic carbon.
3.) supplying new source of HCl and water. Shipboard HCl and water may contain organic carbon.

The Rock Eval provided information on type and maturity of organic matter in these samples. One sample of pelagic clay showed significant peaks at S_1, S_2, and S_3; the S_2 may be drilling contaminant. Nannofossil oozes showed significant S_1 and S_2, while vitric tuffs showed only small S_1 and S_2. The Columbia Scientific Supergrator, used with Rock Eval, functioned poorly as an integrator, with the H-P gas chromatograph working well. It was suggested that the integrating parameters be changed to accommodate varying peak sizes. The single 2.48% immature organic carbon standard for Rock Eval is considered to be inadequate. Erdman agreed to prepare a series of natural standards for use with Rock Eval and CHN. For Rock Eval analyses, it was suggested that:

1.) The shipboard organic geochemist should gain experience with the instrument before his cruise.
2.) A shipboard technician from DSDP be fully acquainted with the instrument.
3.) Shipboard organic geochemists should arrange to overlap schedules when they are on sequential cruises so that the succeeding geochemist can communicate directly with the preceding geochemist.
4.) Shipboard organic geochemists should prepare a written report for succeeding geochemists describing any problems, breakdowns, interesting results, etc.

To provide for greater information in the booklet for shipboard organic geochemists, the following agreed to provide one page summary on instrumentation by 15 July, 1978:

1.) Waples--CHN analyzer

2.) Whelan--H-P gas chromatograph and gas sampling

3.) Brassell--Rock Eval

Interests by Geographic Areas

Gulf of California

Simoneit--There is much interest in the Gulf of California legs (64 and 65) by the PMP, OCP, OPP, IGP, and OGP. During recent site-survey cruises in the area of the Guayamas Basin by Scripps, the piston core failed and only 2 m cores were recovered. The sediments are mostly hemipelagic and the area is characterized by high heat flow. Organic carbon ranges from 1 to 2.4% in the surface sediments. In earlier studies some sediments had a petroliferous odor; triterpenoid stereochemistry can be used as an indicator of pollution on thermogenic components (example given of work off coast of Southern California). Carbon isotopic composition of methane in one sample was -69%, in the biogenic range with possible thermogenic input. Eight replies of specific interest have been received, and any others should be directed to Simoneit.

Welte--Studies of the Gulf of California may help to solve the black shale problems of the Atlantic Ocean. Two aspects of the area are important:

1.) Model of depositional environments of organic matter, basin bottom, basin margin, and turbidite deposits of transported organic matter.
2.) High heat flow in young sediments. Path of diagenesis may differ where there is rapid heating compared with areas like on Leg 47 where heating was slow.

South Atlantic

Hsu--The Ocean Paleoenvironment Panel was told to plan five legs in the South Atlantic. Four areas of interest are:

1.) Angola Basin
2.) Cape Basin
3.) Walvis Ridge
4.) East flank of Atlantic Ridge

Major topics are:

1.) Mid-Cretaceous Event symbolized by the black shales.
2.) Cretaceous-Tertiary Boundary Problem which needs adequate samples to determine the physical-Chemical conditions during this period of geologic time.
3.) Neogene History and possible stress in oceanic environment due to salinity differences.
4.) Mid-Miocene Crises caused by possible change in oceanic circulation patterns.

To study these topics requires both siliceous and calcareous fossils. Thus, samples must be obtained above the paleo-CCD. There are a number of areas of mutual interest between the OG and OP Panels, and cooperation between these Panels should lead to enhanced understanding of paleoenvironments as well as organic geochemistry.

Tissot--The objective of an organic geochemical study in the South Atlantic is to develop a detailed stratigraphic and sedimentological analysis of the occurrences of anaerobic conditions (reflected by presence of laminated black shale) in the Angola Basin. The composition and origin of organic matter in the anaerobic sediments will be determined. In addition, the depth zonation of lithofacies across the north flank of the Walvis Ridge into the Angola Basin should be examined. Of lower priority is a deep hole in the Cape Basin.

Welte--More emphasis should be placed on effects of maturation in individual laminae. Study of laminae may lead to information on possible alternations of environmental conditions.

Leg 50--Summary of Papers

Winterer summarized the general setting. The area represents a "not so passive margin." The section penetrated contains a major unconformity with the Upper Cretaceous missing. The section present is composed mainly of clastic turbidities containing mostly terrestrial organic material, some of which was oxidized on land and carried into the depositional basin. The turbidities may record early uplift of the Atlas Mountains.

Kvenvolden presented a summary on the organic geochemistry completed on samples from Leg 50. This summary is to be included in the Initial Reports and was prepared at Winterer's request. The report describes the results from both shipboard and shore-based studies. The major conclusions reached are that much of the organic matter is terrestrial in origin and is immature. However, the organic matter shows an increase of maturity with depth. Near the bottom of the section sampled, the organic matter is on the threshold of being mature, about to enter the phase of oil generation.

Galimov detailed the comprehensive organic geochemical observations made in his shore-based laboratory. These observations (changes in percent gas, heavy hydrocarbons, ^{13}C, humic acids, tetrapyrrols, n-alkanes, pristane/phytane ratios) point to maturation with organic matter at 1600 m depth entering the initial, main phase of oil generation. Galimov felt that Kvenvolden's summary should include less information on shipboard studies. Kvenvolden pointed out that the shipboard studies were particularly valuable because, on the basis of this preliminary work, major conclusions regarding source and maturity of organic matter were reached. These conclusions were amplified but not changed by later shore-based investigations. The OG Panel agreed that Kvenvolden's summary should cover shipboard as well as shore-based results from all participating laboratories. Galimov emphasized that in future drilling, deeper holes are needed to learn more about the diagenesis of organic matter.

Welte pointed out that samples from Leg 50 showed that amorphous marine organic material was deposited on the shelf and was later transported to the foot of the slope.

Erdman discussed terms "maturation" and "source rocks." He emphasized the importance of organic richness and indicated that samples from Leg 50 were not rich enough in organic carbon to be considered good source rocks. He noted the differences in concentrations of alkanes and aromatics in two samples and reported that most of the nitrogen has disappeared. Erdman discussed relationship between OEP and depth and age; he concluded that age is most important in terms of changes in OEP.

Whelan briefly mentioned that the analyses of hydrocarbon gases indicates that these gases likely migrated.

REPORT FROM THE POLLUTION, PREVENTION, AND SAFETY PANEL

The PPSP met on 16 March and 13-14 July to review sites for Legs 62 and 63. After the 14 July meeting, the SIO Panel met separately to formulate its decisions. A meeting to review sites for Legs 64 and 65 was held on 2-3 October. The results of that meeting are not reported here.

At the July meeting, Dr. P. Dickey discussed the geology of abnormal pressure. This discussion outlined some of the problems of drilling with a riser when such pressure is encountered. T. McCullough next reviewed petroleum occurrences in California, followed by an evaluation of possible petroleum areas in the California Borderland area. This provides a partial analogy of what may be expected in the offshore.

The analogy showed that high-pressure sediments would not be expected at the depths to be penetrated on Leg 63. J. Crouch reviewed the geology of the California Borderland and surrounding areas as a prelude to his discussion of proposed drill sites there.

Leg 62

Sites HR-1, HR-2, MM-2, JDF-1 were approved without qualification. The Gulf of Alaska sites (GA-1, GA-2, GA-2B, and GA-3) and limited adjustments along the Conrad line were approved. Site JDF-2 was approved by the JOIDES panel but given a more restricted location by the SIO Panel. Site MM-1 was approved with the qualification that cores be carefully monitored geochemically when significant organic matter is present.

Leg 63

Sites EP-1 = GCA-8A = EP-2; EP-3B, 3C, 4B, 5A, 5B, 5C, 6; 6CA-9, 6CA-9, 6CA-8B, where approved without qualification. Permission was given to leave Sites 4C, 4D, 4E, and 4F open for re-entry. Site SP-3C-1 may be left open if no hydrocarbons are encountered. Site EP-4C was approved with limited drilling depth and real time gas chromotography monitoring; EP-6A needs more documentation if serious consideration is given to drilling it; and EP-8 was approved with limited penetration.

REPORT FROM THE SITE SURVEY PANEL
(13-14 April, 1978)

Passive Margin Objectives

In the Caribbean the objectives are the Barbados outer ridge (only velocity data needed) and the Colombian basin where multi-channel reflection data are required.

In the N. W. Atlantic the prime sites are:

1.) North of the New England seamounts on the Scotia continental rise. Gridded high resolution single channel, mcs and velocity depth data are needed.

2.) On the New Jersey slope, along USGS Line 2. This site needs a grid of high resolution single channel, mcs and velocity depth data.

3.) Blake outer ridge and slope. This site also needs gridded mcs high resolution single channel and velocity depth data.

4.) Blake Bahama Basin. This site has gridded mcs single channel and sonobuoy data. It may only need better velocity depth data.

5.) A lower priority site is in the Grand Banks area. This site needs more data but it is expected that the Canadians will be doing the work.

In the N. E. Atlantic the prime sites are:

1.) Bay of Biscay. The French have a considerable amount of high-quality reflection data in the area. They plan to do site specific studies near DSDP Sites 400 and 401. The English have GLORIA data in the area that has proved to be very useful in evaluating structural trends.

2.) Rockall Bank. The English have a large quantity of data. They apparently intend to further refine their resolution using maxipulse sources and GLORIA side-scan sonar methods.

3.) N.W. Africa-Morocco. This site is lower priority but has a wealth of German mcs and GLORIA side scan data. Sites with potential safety problems exist and any further site specific surveys will require very accurate navigation to avoid diapiric structures.

It was noted that innovative techniques to determine velocities were needed for two reasons. First, it is important to determine the depth of drilling objectives, especially where they are near the limit of the drill string. Second, in cases where one might have gas filled zones beneath clathrates, they could be detected by their low velocities.

The French are using reflection amplitude information to determine acoustic impedances and hence velocity contrasts. This technique should be further investigated and could be applied to old data.

In deep water mcs data do not have sufficient movement to accurately determine velocities. It was suggested that refraction methods using OBS's and high-frequency sources might be used at potential drill sites to better define the velocities.

Paleoenvironment Sites in the South Atlantic--The OPP has proposed four months of drilling in the S. W. Atlantic and six months of drilling in the South East Atlantic. In the S.W. Atlantic a series of holes in the areas of the Vema Channel, Brazil Basin and northern Argentine basin are proposed. Widely spaced lines exist in these areas and site specific surveys are required. In the S.E. Atlantic a transect of holes from the mid-Atlantic ridge to the East is requested. In addition, areas to the north of the Walvis ridge (Angola Basin), on the Walvis ridge and to the south of the Walvis Ridge (Cape Basin) have been specified. Little data exists in these areas, with the exception of the Walvis ridge where considerable German and French data exists.

Structure and Membership of the JOIDES Site Survey Panel

The SSP agreed to submit to the PCOM a recommendation to change the JOIDES SSP structure as follows.

It is recommended that the existing JOIDES Site Survey Panel be modified. The proposal panel would consist of one member from each member nation, the subject panel chairmen, and a PCOM representative. A representative from the IPOD-JOIDES geophysical data repository would attend in an advisory and ex-officio capacity together with an ex-officio DSDP representative. The duties of this group would be the following:

1.) Insure international cooperation and coordination in site surveying.
2.) Recommend working groups as required.
3.) Review adequacy of the surveys as presented by the working groups.
4.) Identify data gaps and recommend appropriate action.
5.) Recommend and review other plans for the international coordination of long-term regional studies and the use of new techniques and technology.
6.) Under normal circumstances, one meeting per year would be required. Working group representatives and other experts would be asked to attend as needed on the invitation of a committee member.

REPORT FROM THE STRATIGRAPHIC CORRELATIONS PANEL
(22-24 May, 1978)

Recommendations

1.) The SCP suggests that a statement of actual dates of publication be included in the index volume in order to comply with the rules of priority of the International Commission on Zoological Nomenclature.

2.) Range charts for each site should be included in all Paleontological contributions of Initial Reports.

3.) Each paleontology report submitted to the IR's include a description of the methods used in analysis, such as that of estimating relative species abundance. Each paleontologist should be notified of this requirement in advance of his participation, along with the other instructions for preparation of reports.

4.) For the Mesozoic, a data file has been compiled that can be consulted for information from the increasingly large base in the IR's. The SCP recommends that a hard copy of the data of this file be placed in the lab on board the *Glomar Challenger*, along with instructions on how the data can be used. The SCP agrees that as the data file grows, so will demand for it on board ship. It is inevitable that a point will be reached when data retrieval on ship will be needed. The SCP suggests that expanded computer facilities be considered in future planning, especially for *Glomar Explorer*.

5.) Priority levels of need for cored section recommended to PCOM for the upcoming legs:

- Paleocene-Middle Eocene Interval
- Upper Eocene-Lower Oligocene Interval
- Upper Miocene (old Site 155, especially the area of the Gulf of Panama)
- Mesozoic-Cenozoic Boundary

Future Drilling

CAR 1: The depth (4950 m) is too great for good faunal control except Rads for select intervals. It should be moved to 3500-4000 m.

CAR 2: There is an important level at Miocene-Pliocene Boundary. Attention should be given to continuous drilling, especially in calcareous sediments.

CAR 3: Strong support is present for this site. The possibility of penetration of Mesozoic Section is of great interest to SCP.

CAR 5 & 6: These are of highest priority to the SCP. These sites are needed for linkage between Atlantic and Pacific in the Cretaceous; Site 154A had poor recovery.

Site SA4 is considered redundant. Leg 3 cut the same sections. This site is not a priority for SCP.

SCP wants to point out the lack of Neogene in core sections to date in past drilling in the North West Atlantic Basins.

The highest SCP priority is one Georges Banks Area, Cretaceous and Upper Jurassic sections.

The second SCP priority is the Blake Plateau, Paleogene.

REPORT FROM THE GULF OF CALIFORNIA WORKING GROUP OF THE PASSIVE MARGIN PANEL
(24 April, 1978)

Site Selection

Only tentative drilling sites can be proposed at the present time. All data from the most recent site survey cruise has not yet been processed and analyzed. Nevertheless, the assembled group selected and agreed upon a list of 22 possible drilling sites in the two areas; the mouth of the Gulf and the central part of the Gulf centered around the Guaymas Basin. Final selection of the precise sites and alternate locations cannot be made until completion of the processing, analysis and plotting of all data. Responsibility for these decisions on final site selection was assigned during discussions, the deadline being the July Safety Review. General agreement was reached, however, on general locations and objectives for these 22 sites listed below with approximate locations, water depth, approximate anticipated sediment thicknesses, scientific objectives, and assignment of responsibility for final site selection. All locations, water depths and sediment thicknesses are approximate. Most or all single bit sites will be drilled to basement and to bit destruction. The group recommends that Leg 64 do all top priority single bit sites, and that Leg 65 attempt two re-entry sites, one each in the Guaymas Basin and the mouth of the Gulf. Should the re-entry sites fail, a large number of alternate single bit sites are proposed.

GCA-1: 22°47'N, 107°59'W;
Water approximately 3000 m, sed. approximately 150 m;
Single bit Leg 64;
Re-entry Leg 65, hopefully to 500 m into basement.
Objective--Sample near-zero age ocean crust at fast-spreading center.

GCA-2: 22°52'N, 103°43'W;
Water < 3000 m, sed. 0.05-0.06 sec;
Single bit Leg 64.
Objective--Intermediate age ocean crust.

GCA-3: 22°56'N, 108°56'W;
Water > 3000 m, sed. 0.25 sec.;
Single bit Leg 64.
Objective--Slightly older crust than GCA-2.

GCA-4: 22°57'N, 108°58'W;
Water 3100 m, sed. 0.3 sec.;
Single bit Leg 64.
Objective--Outboard alternate site off tip of Baja California. Area has anomalously high velocity (7.3-7.5) "near" surface.

GCA-5: 22°58'N, 109°02'W;
Water 3100 m, sed. 600 m;
Single bit, Leg 64, to be drilled before GCA-4.
Objective--Inboard site for oldest ocean crust off tip of Baja California. Site GCA-4 to be drilled only if this site bottoms in continental crust.

GCA-6: 23°02'N, 109°03'W;
Water 2700 m, sed. 0.2 sec;
Single bit, Leg 64.
Objective--Lowest continental crust with small pond of sediment. To confirm continental crust and hope to obtain information on subsidence rates.

GCA-7: Precise site to be selected in a sediment pond higher on continental margin.
Single bit, Leg 64.
Objective--Higher on continental crust, with same objectives.

GCA-8: 22°30'N, 109°50'W;
Water 2800 m, sed. 900 m;
Single bit, Leg 64 or 65.
Objective--Thick late Tertiary record in San Lucas Fan for California Current history for OPP.

GCA-9: Approximately 20°50'N, 107°W;
Water 3100 m, sed. 300-400 m;
Single bit, Leg 64 or 65.
Objective--Proto-Gulf pelagic section from an earlier episode of spreading.

GCA-10: 23°07'N, 108°29'W;
Water 2800 m, sed. 0.7 sec. max.;
Single bit, Leg 65 alternate.
Objective--Median Ridge of Tamayo F.Z.; Select site in south trough off ridge flank; could be turbidites, serpentinite, basalt, etc. Magnetic anomaly associated with F.Z.

GCA-11: 23°11'N, 108°23'W;
Water 2900 m, sed. 0.1 sec.;
Single bit, Leg 65 alternate.
Objective: Diapir north of Tamayo F.Z. This is one of series of diapirs being studied by RISE. Magnetic anomaly 3000 gamma. Probably propose site in sediment pond on top. May be dived by *Alvin* in 1979.

GCA-12: 27°02'N, 111°25'W;
Water 2040 m, sed. (pending processing of multi-channel lines);
Single bit, Leg 64, Re-entry Leg 65.
Objective--Located in southern rift valley in Guaymas Basin. To sample zero-age crust or magma chamber. Heat flow approximately 30 HFU in several lowerings.

GCA-13: 27°27'N, 111°23'W;
Water 2030 m, sed. unknown;
Single bit, Leg 64.
Objective--Zero-age crust or magma chamber in northern rift of Guaymas Basin. Heat flow not as high, but some hydrothermal deposits found in dive by Lonsdale near here.

GCA-14: 27°23'N, 111°17'W;
Water 1830 m, sed. probably < 300 m;
Single bit, Leg 64.
Objective--Near rift, slightly older (approximately 350,000 yrs.) ocean crust drowned under sediment. If GCA-12 fails as re-entry, this is an alternate for re-entry.

GCA-15: 27°19'N, 111°10'W;
Water 1820 m, sed. < 500 m;
Single bit, Leg 64.
Objective--Older (approximately 900,000 yrs.) ocean crust than GCA-14, farther out on transect.

GCA-16: 27°52'N, 111°40'W;
Water 900 m, sed. unknown;
Single bit, Leg 64.
Objective--Proto-Gulf of California on mainland flank of Guaymas Basin, for determination of age, water depth, and if possible nature of crust underlying the structural depression which preceded rifting the present Gulf. Also, lies in oxygen minimum for penetration of laminated sediments.

GCA-17: 26°14'N, 110°13'W;
Water 1500 m, sed. unknown;
Single bit, Leg 64.
Objective--Same as GCA-16, in mainland flank of Carmen Basin.

GCA-18: Location of site to be selected later. This target was requested to evaluate nature of and seaward extent of Santa Rosalia mineralized zone. If survey control can be located or run, and if drilling is recommended, this would probably be a single bit site for either Leg 64 or 65.

GCA-19: 22°31'N, 111°29'W;
Water 1870 m, sed. < 300 m;
Single bit, Leg 65.
Objective--Symmetrical site to GCA-14, near rift Guaymas Basin.

GCA-20: Site to be selected;
Single bit, Leg 64 alternate.
Objective--Older, about 2 m.y. crust in Guaymas Basin.

GCA-21: Site to be selected;
Single bit, Leg 65 alternate.
Objective--Older, about 3 m.y. crust in the Guaymas Basin.

GCA-22: Site to be selected;
Single bit, Leg 65 alternate.
Objective--Discontinuity in basement due to jumping of spreading axis.

REPORT FROM SOUTHEASTERN ATLANTIC AND SOUTHERN OCEANS WORKING GROUPS

Preliminary Site Proposals for Southeastern Atlantic Angola Basin--Cape Basin--Walvis Ridge--Mid-Atlantic Ridge

The scientific objectives of South Atlantic drilling were defined and a summary of the proposal was published in the *JOIDES Journal* (Vol. III, No. 1, pp. 27-29, 35). Since then input has been received from several other panels. Three southeastern Atlantic cruises are planned during the two-year IPOD extension and preliminary sites are suggested.

There are two major site catagories:

1.) Relatively deep single-bit (and possibly one re-entry) in the basins, and cluster of shallow holes on the ridges. The deep holes are necessary to reach the older sediments and to provide long, continued vertical sections. The clusters are designed to obtain spatial control on paleo-oceanographic gradients and temporal controls on paleo-oceanographic events. The time needed to drill a cluster of shallow holes is about the same order of magnitude as that required to drill one deeper hole.

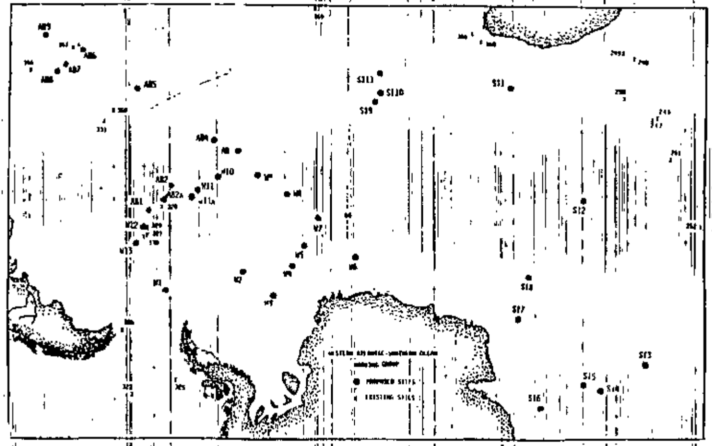

Figure 4: Map of Western Atlantic and Southern Oceans--Existing and Proposed Sites.

2.) A total of two deep holes (~ 1000 meters), two intermediate holes (~ 500 m), and three clusters of 13 intermediate and shallow holes are planned. The minimum total on site time should range between 90-110 days. Considering the cruising time and other time-consuming factors, (breakdown, weather delays), the program should be arranged for at least three cruises.

The site proposals are preliminary and serve mainly to: (1) focus attention on the scientific objectives; (2) to demonstrate feasibility, and (3) to provide information for logistical planning. The final positioning of the sites will depend upon more thorough studies of the available profiles (particularly the multiple channel surveys by the French and German during 1977-1978 to the Angola Basin and Walvis Ridge, the results of which are still being processed), and after the IPOD site-surveys (mainly to the Mid-Atlantic Ridge and Cape Basin) next spring. The Southeastern Atlantic Working Group intends to hold meetings before and after the proposed site surveys.

Preliminary Proposals for South Atlantic Drillings

Southeast Atlantic Transect (SA-1, SA-2, S-3)

Very little drilling has been carried out in the southeast Atlantic, particularly in the Cape and Angola Basins. The following objectives can be achieved by a transect from the Angola Basin, across the Walvis Ridge, into the Cape Basin:

1.) To obtain a record of paleo-oceanographic history of the Southeast Atlantic, which is an indispensable element for a synthesis of the paleoenvironmental evolution of a spreading ocean. This would lend deeper insight into the cause and development of: (a) the Mid-Cretaceous events when black shales were forming in this part of the Atlantic; (b) the Cretaceous-Tertiary boundary and the accompanying crisis; (c) the Paleo-climatic changes during the Cenozoic, leading to Antarctic glaciation and the genesis of Antarctic bottom current, and (d) other paleoenvironmental changes related to oceanic circulations as recorded by the fossils and the sediments of the Southeast Atlantic.

2.) To understand the role of an aseismic ridge (namely Walvis Ridge) in affecting the paleo-oceanographic circulations and the paleoenvironments of adjacent basins.

3.) To utilize the sedimentary record from an aseismic ridge, which at one time might have sloped from a depth near sea-level at the top to thousands of meters toward the basins, to obtain quantitative paleobathymetric data. This data would be used for unravelling the subsidence history of aseismic ridges, and for determining the depth-variations of CCD.

4.) To utilize the sedimentary record from an aseismic ridge, which underlies a watermass at varying depth, to obtain quantitative paleotemperature data; such data are particularly useful for reconstructing the temperature-structures of ancient water masses.

5.) To provide additional record, to be combined with the available record from the African margin DSDP sites, for investigating the gradients of the Benguela current.

6.) Other important objectives are of particular interest to the OCP and to the PMP. For example, the origin of aseismic ridges and the cause and history of their subsidence.

The Angola Basin-Walvis Ridge-Cape Basin transect is considered as the main target of the South Atlantic Drilling. The program includes the following site-proposals:

Angola Basin — Holes SA I-1 (deep)
SA I-2 (intermediate)

Cape Basin — Holes SA III-1 (deep)
SA III-2 (intermediate)

Walvis Ridge — Cluster of holes SA-II, 1-6 (shallow or intermediate)

All, except perhaps SA I-1 and III-1 are single bit holes. Two holes are proposed in both the Angola and Cape Basins. This is necessary to obtain critical information on the mid-Cretaceous event and the Cretaceous-Tertiary boundary.

Therefore, we propose SA I-1 and SA III-1 over 90 m.y. and 110 m.y. isochrones respectively, and SA I-2 and III-2 over 68 m.y. isochrone. The Walvis Ridge cluster of holes is chosen as originally planned in 1976.

Mid-Atlantic Ridge Traverse (SA-4)

The previous South Atlantic drillings have failed to obtain adequate record on the paleoenvironments of the Mid-Tertiary because of extensive dissolution of its fossil records. The dissolution has been related to a halt in sea-floor spreading by the Leg 3 scientists, but is now interpreted as a manifestation of the Mid-Miocene CCD crisis which raised the CCD some 1000 to 2000 meters. There has been speculations that the CCD crisis was related to the role of the Mediterranean, which changed from an open ocean, to an "estuary" to a "lagoon" in its relation to the Atlantic. However, a test of this and other models depends on the knowledge of the periodicity and amplitude of the CCD changes.

The Mid-Atlantic record is not only important for the problem of CCD changes, but also provides keys to our understanding of the latest Eocene, Oligocene, and Miocene climatic and environmental changes, related to ever-changing oceanic circulations. In order to obtain Mid-Tertiary fossil records, sites should be located where the earliest sediments were deposited on M.A.R., at depths above the CCD at that time.

Aside from the preliminary paleo-environmental objectives, a DSDP drilling in Target Area SA IV could: (1) sample the crust; (2) clarify the Mid-Tertiary sea-floor spreading history (linear or non-linear rate); and (3) ascertain the relation of high Fe-Mn sediments at the ridge-crest to spreading rate or to other factors.

Two clusters of seven shallow holes are planned for this traverse of the east flank of the Mid-Atlantic Ridge slightly north of 30°S. Clusters SA IV, 1-3 could be drilled in several days, and are mainly designed to obtain information of Middle Miocene spreading history, and on Middle Miocene CCD crisis. Cluster IV, 4-7 could be drilled in less than 10 on-site days. It is designed to obtain information on the Oligocene paleo-oceanographical revolution as a response to the start of Antarctic glaciation.

It is suggested that the 1979 site surveys be carried out in the region 1° or 2° north (of 26°S) and away from the transform, or in a region farther south (along 30°-31°S traverse between anomalies 5 and 21), where we have adequate sedimentary cover to yield useful information.

There have been a number of ship-tracks crossing the region; the available magnetic data suggest the presence of one or more transform faults at about 30°S (DSDP ICR, V. 3, Ladd, et al., 1973). Our preliminary proposals chosen on the basis of available information place the SA IV clusters between Anomalies 5 and 21 along a traverse at about 26°-27°S in a zone just north of a transform fault. The sedimentary cover is very thin at proposed sites SA IV, 4-7, as shown by the CFP of V-2011. However, the C-801 profile at about 30°S indicates the presence of some 100 or 150 m of sediments at equivalent isochrone positions (SA IV, 4-7).

Recommendations of the OGP and OPP

This report was presented to the OGP on 20 June. They recommended that:

1.) Site I-1 be shifted eastward to the 110 m.y. isochrone to core Lower Cretaceous as well as Upper Cretaceous black shales. It was pointed out during the discussions of OPP that a hole (DSDP 364) had been drilled on 110 m.y. isochrone landward of marginal escarpment, during the Leg 40. There seems insufficient justification to repeat the drilling <u>unless</u> an 110 m.y. isochrone site could be positioned in a more basinal setting seaward of the marginal escarpment, and 200 miles beyond the coast. Therefore, the OPP suggests that the Site I-1 be tentatively located as recommed, but French CNEXO profiles should be consulted to see if a site on 110 m.y. isochrone could be found in the settings specified above.

2.) At least our site at intermediate paleodepth in the Angola Basin should be drilled into the Cretaceous black shales to provide information on paleoenvironments for such intermediate depths during the time of black shales formation. The OPP recommended that all Walvis Ridge holes on the Angola Basin side be drilled into the basement, which may penetrate the Upper Cretaceous black-shale section. Meanwhile, the working group should study available profiles about the possibility of shifting the Walvis Ridge traverse to a more easterly location to reach older Mesozoic sediments.

The SCP had questioned the redundance of SA-IV (east flank of MAR). The present program has been designed to complement, or fill, important gaps left by the first South Atlantic drilling (Leg 3). The cruise only obtained Middle Miocene materials from a very incomplete section (with the faunas largely dissolved) at one hole (Site 17); Sites IV 1-3 are specially desired to obtain the missing sections. Critical data are needed on the Paleogene crisis (late Eocene-Oligocene) on the east flank of the Ridge to determine the lateral and vertical paleoceanographic gradient. These sites are also expected to solve the very puzzling and probably very important question on the wide-spread occurrence of the monospecific Braarudosphaera sediments.

In conjunction with the tentative 1979-81 schedule proposed by DSDP, the following suggestions are made:

Leg 70--Recife-Capetown, October-December, 1979. Mid-Atlantic Ridge holes are logically to be drilled during the crossing of *Glomar Challenger* from west to east, because the program involves least risk of weather or mechanical difficulties. It could be best combined with the long cruising time of the Atlantic crossing. After the Ridge holes are drilled, the remaining time should be devoted to initiate the drilling of the Walvis Ridge profile, or SA III-2, if time considerations and weather conditions are particularly favorable.

Leg 71--Capetown-Capetown (if no Angola port is available), December, 1979-February, 1980. Cape Basin holes should be drilled during the southern summers. The cruise should complete the drilling of the Walvis Ridge traverse and the Cape Basin holes.

Leg 72--Capetown-Monrovia, February-April, 1980. Angola Basin holes, and the completion of the Walvis Ridge traverse if it has not been done before.

REPORT FROM THE SOUTHWEST ATLANTIC WORKING GROUP

The Southwest Atlantic region has undergone pronounced geographic alterations through the Mesozoic and Cenozoic which have apparently led to a metamorphosis from a temperate marine climate to the frigid ocean of ice it is today. During the Cenozoic this region represented an important conduit for northward bottom-water from sources to the South in the Weddell Sea and other Antarctic regions. The Vema and Hunter Channels presently dissect the east-west trending Rio Grande Rise in the southwest Atlantic and thus allow the movement of bottom waters northwards and southwards in abyssal basins of the central and North Atlantic. The Vema Channel represents the only area of potential northward flow because the Walvis Ridge, in similar position in the southeast Atlantic, lacks deep dissections. An understanding of bottom water flow throughout the oceans represents an important element of global paleoceanography. Sites drilled in the Southwest Atlantic fulfill several purposes:

1. To examine the history of bottom water flow through the region during the Cenozoic based on its erosional, transportational and depositional consequences; on calcium carbonate dissolution and on the oxygen isotopic record.

2. To provide sequences older than the Cenozoic to assist in the definition of the paleoceanographic conditions related to the early opening and development phases of the Atlantic of the same ages in the southeastern sector.

3. To provide required Cenozoic biostratigraphic sequences in southern Atlantic temperate and warm subtropical areas.

4. To provide sites on the northern part of the Falkland Plateau for examination of the biostratigraphic, biogeographic, and sedimentological history related to major changes in circulation patterns through the Mesozoic and Cenozoic. The paleoceanographic alteratons occurred in response to initial opening and enlargement of the South Atlantic, the development of bottom water passageways through ridges and fracture zones in the vicinity of the Falkland Plateau, the opening of the Drake Passage and climatic evolution of Antarctica and the Southern Ocean.

Northern Falkland Plateau

In order to understand bottom water history in a region it is necessary that a group of complimentary sites be obtained with the same and different structural units. Interpretations based on the drilling of single sequences are often equivocal because the effects of local erosion cannot be clearly differentiated from broader-scale regional effects. We thus propose a group of sequences be obtained from the southwest Atlantic region to supplement the single useful site already available (Site 358) from the northeastern Argentine Basin. The proposed sections start with the sites AB1, AB2, and AB2A which bracket the northward flow of deep water around the eastern end of the Falkland Plateau. These sites can be compared with those to the north, around the Rio Grande Rise, and with proposed sites in the Weddell Sea to give a detailed history of climatic change and associated erosional and depositional episodes.

East Flank of Vema Channel

The extensive seismic profiles of LDGO, illustrated by Le Pichon et al., (1971, Phys. + Chem of Earth, vol. 8, chap. 2), reveal that the broad plateau on the east flank of the channel at a depth of 4200m is underlain by 1.0 - 1.5 seconds of sediment which is relatively transparent. Because of the irregular basement relief it's difficult to extrapolate other DSDP results to this region. However, the bulk of the material underlying the plateau is probably Mesozoic pelagic carbonates, perhaps similar to the sequence which was partially drilled at Site 357 to the east. The major objectives of drilling a suite of sites on the flanks of the Vema Channel would be:

1. to recover this thick sequence of presumably Mesozoic material for interpretation of depositional environments and deep circulation conditions in the SW Atlantic during the early stages of its opening;

2. to evaluate possible effects of bottom water at shallower depths through the channel and recent changes in carbonate dissolution and the position of the CCD. These sites are well suited for these purposes, inasmuch as they are sufficiently deep to clearly represent ocean basin depositional processes versus those of the continental margin. Terrigenous dilution should be minimal.

Southwest Brazil Basin

A site in the southwest part of the Brazil Basin would be located so as to obtain the erosional products of the AABW through the Vema Channel. Such a site would allow the history of AABW through the Vema Channel to be established and compared with the Hunter Channel as the principal conduits for AABW flow (McCoy and Zimmerman, in press). A lobe of sediments exists north of the Vema Channel which McCoy and Zimmerman suggest represent northerly dispersal of sediments through this Channel during the late Pliocene and Quaternary. The dating of these sediments should provide information on the inception and variations in intensity of northward bottom water flow during the Cenozoic.

South of Hunter Channel

A site located to the south of this channel will allow similar studies of the history of North Atlantic Bottom Water (NABW) flowing southwards through the region.

Meridional Transect

Proposed sites AB3 and AB4 span the Polar Front in its most northern position and are located on a meridional section of the Mid-Atlantic Ridge. Thus, they are well situated to record the development of this front and its variation in location through time. Although the reasons for drilling these two sites stand on their own, they also form the northern end of a longer meridional transect of sites which are proposed for future high-latitude drilling. This total transect will allow a more detailed reconstruction of changes in the oceanographic gradients in high southern latitudes.

NEWS ITEMS AND ERRATUM

Planning for Post-1981

Plans for post-1981 are proceeding well. The January PCOM report, listed in the June, 1978 *JOIDES Journal*, shows a diagram of the NSF review process. The response of the Science Review Committee was positive. A preliminary Technology Review (Engineering Study) has been submitted to NSF. The final report is due in October. The National Science Board, which oversees NSF, is expected to review these and other reports and submit its formal statement by December.

Two ad hoc meetings have taken place within the JOIDES organization to initiate plans for *Explorer* drilling. Attendees of these meetings included representatives from the four problem panels, DSDP, NSF, and the chairman of the Planning Committee. At the first meeting, held at the University of Washington in June, 1978, a working paper was prepared detailing and examining the scientific objectives of an *Explorer* program, and a further *Challenger* program. This paper drew heavily from both the FUSOD report and the panel white papers.

In September, a similar group met to discuss and plan a preliminary *Explorer* schedule and a post-1981 three-year *Challenger* schedule. The *Explorer* program consists of eight years of drilling (two years without riser, and six years with riser). These schedules were based upon the scientific objectives discussed in the Seattle and FUSOD reports and panel white papers. Both schedules (*Explorer* and *Challenger*) and the Seattle paper will be submitted to the four problem panels for review at their fall meetings. They will then be reviewed again by the PCOM and EXCOM at their November and December meetings.

Table 9 from FFAS Preliminary Report

Three researchers* at the Social Science Data Center at the University of Connecticut are carrying out a study of "Federal Funding of Academic Marine Science." Table 9 from a preliminary report compiling but not analyzing nearly 800 responses (54 percent), from marine faculty, professional research personnel, and administrators is given below. In reading the Table, it should be noted that the number of "NSF-DSDP" responses is low, indicating a lack of familiarity with the program among many of the respondents.

*E.C. Ladd, Jr., D.D. Palmer, and W.W. Shannon

U.S. Academic Marine Scientists' Assessment of the Quality of Academic Marine Scientific Work Funded by the Federal Funding Agencies† (percent by row)

	Percent Excellent or Generally High Quality	Percent Mediocre Quality	Percent Substandard or not Science At All	Rank	Number of Respondents
NSF-DSDP	95.5	3.7	0.8	1	243
NSF-Oceanography Section	94.5	4.8	0.8	2	564
HEW-NIH	89.9	6.9	3.2	3	188
NSF-Environmental Biology	87.9	9.3	2.7	4	182
ONR	86.3	12.3	1.5	5	562
NSF-IDOE	79.6	17.3	3.1	6	515
NSF-Polar Programs	76.1	17.2	6.7	7	267
USGS	70.4	24.9	4.6	8	281
ERDA	57.2	33.6	9.2	9	339
NOAA-NMFS	42.1	42.9	15.0	10	273
NOAA-Sea Grant	34.4	40.6	24.9	11	566
EPA	32.1	42.7	25.2	12	396
Corps of Army Engineers	24.0	42.7	33.3	13	342
U.S. Coast Guard	23.0	43.6	33.3	14	204
BLM	13.1	33.4	53.4	15	419

†Based on the following question: "How would you characterize the overall quality of academic marine scientific work funded by the following agencies?"

1978-1979 JOIDES MEETINGS

Approved and Tentative

Panel	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
EXCOM	15-16 WHOI				11-13 Hawaii				4-6 Houston				14-16 Reykjavik			26-30 USSR	
PCOM				6-9 Hawaii				5-9 SIO									
DMP			27 WHOI														
ILP																	
IHP																	
IGP																	
OCP			2-4 Newcas.														
AMP			26-28 Toronto														
PMP		22-25 Bermuda															
OPP			28-30 Toronto														
OGP																	
PPSP			2-3 SIO														
SPPP	23-24 SIO																
SSP				2-3 LDGO													
SCP																	
LEGS	62	Drydock	63		64		65		66		67	68		69		Drydock	70

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