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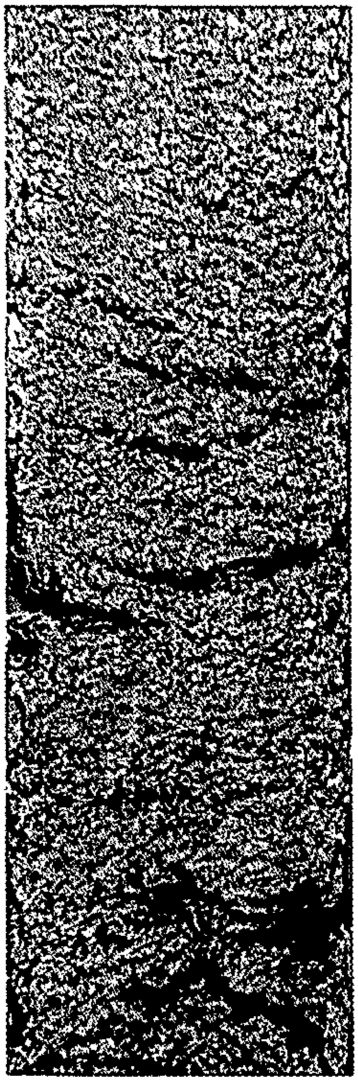
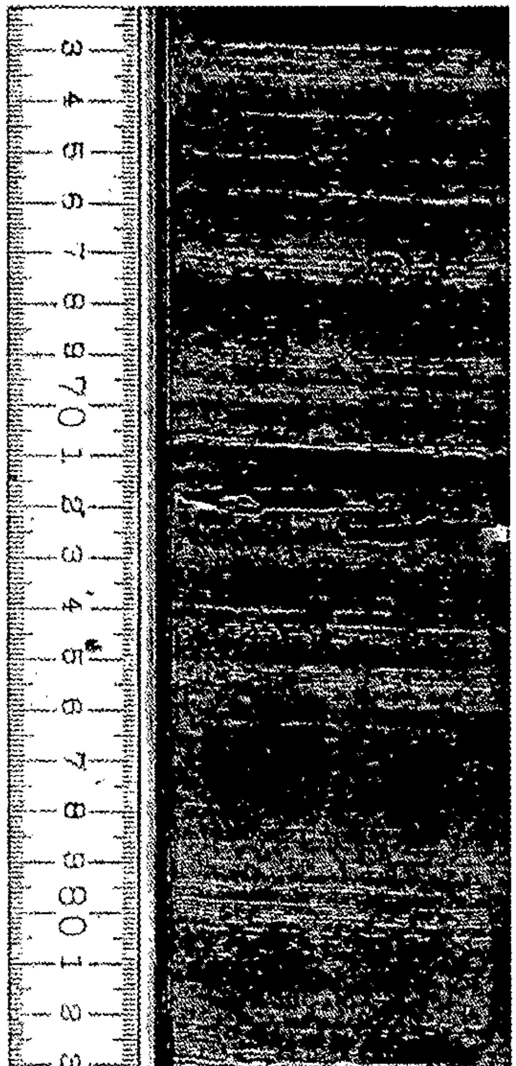
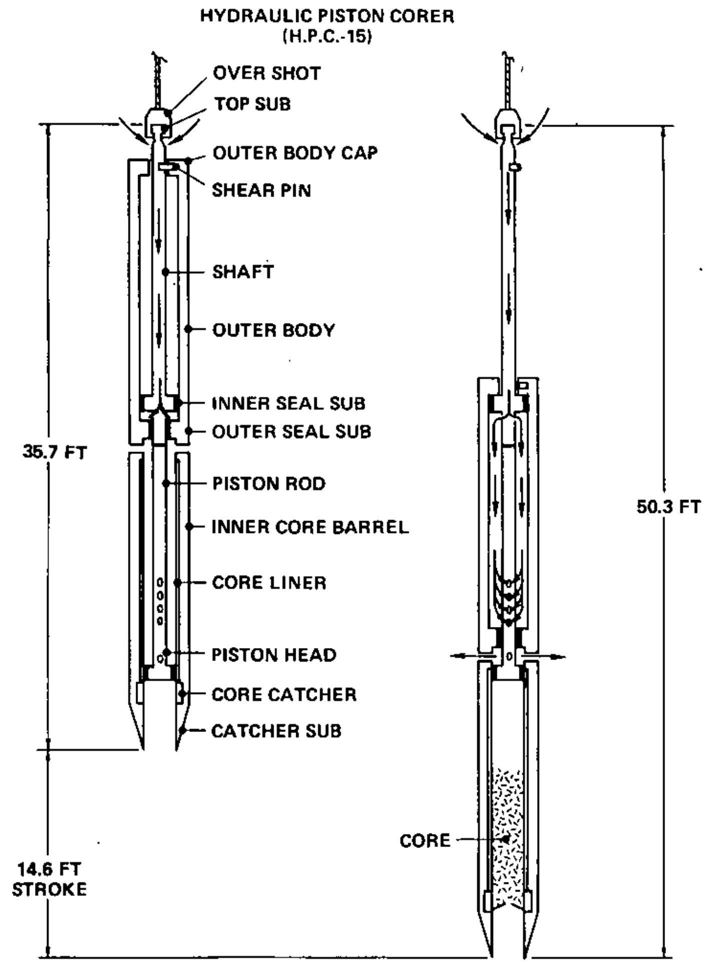


Hole 479



Hole 480

LEG 64



Cover:

The two cores shown on the cover are from Leg 64, The Guymas Basin (see Figure 3, p. 11) for location. Both cores recovered Quaternary sediments, and despite the great difference in degree of disturbance, the shipboard party concluded that the upper 152 m is duplicated in the two holes. The following is an excerpt from the shipboard core descriptions:

Site 479, Core 12 — Cored Interval: 98 to 107.5 m sub-bottom, 100% recovery

"Uniform, moderate olive brown (5Y 4/4) muddy diatomaceous ooze, and rare streaks of lighter pale olive (10 Y 6/2). Any bedding has been totally disturbed. No evidence of varves, sand or H_2S gas."

Site 480, Core 20 — Cored Interval: 95 to 99.5 m sub-bottom, 99% recovery

"Moderate olive brown (5Y 4/4) muddy diatomaceous ooze and pale olive (10Y 6/2) diatomaceous ooze laminae occur together as varve-like couplets on a mm-scale. A gray sand layer occurs with a discordant, sharp contact against the varves, but shows no grading. Unconformities and some cross-bedding observed in the varved section."

Core 12, Site 479 was taken using conventional rotary drilling technique. Core 20, Site 480 was taken using the Hydraulic Piston Corer (HPC-15) recently developed by M. Storms and S. Serocki at DSDP, and operated by D. Cammeron on Leg 64. Information about the capabilities and operational schematics for the hydraulic piston corer are given under News Items and Errata, page 54.

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LEGS 67-69—GLOMAR CHALLENGER*

Leg	Port	Arrival Date	Departure Date	Days at Sea	Purpose
67	Manzanillo	08 May 79	27 June 79	50	Mid-America Trench (Guatemala)
68	Puntarenas, C.R.	02 July	22 Aug	51	Galapagos (Costa Rica Ridge)
69	Balboa	27 Aug	17 Oct	51	Galapagos Mounds
	Balboa	19 Oct	23 Oct	4	In Transit
	Curacao	01 Nov	15 Nov	14	In Transit

*Approximate dates

LEGS 70-81—TENTATIVE EXTENSION SCHEDULE

Leg	Port	Time of Departure	Purpose
70	Recife	19 Nov., 1979	Paleoenvironment (Mid-Atlantic, SA-4)
71	Cape Town	14 Jan., 1980	Paleoenvironment (Walvis Ridge, SA-II; Cape Basin, SA-III-2)
72	Cape Town	08 Mar., 1980	Paleoenvironment (Angola Basin)
	Monrovia	26 Apr., 1980	15-day transit
Mini-leg—Engineering Studies			
73	Brest	Late May, 1980	Passive Margin (Biscay)
74	Plymouth	Late July, 1980	Passive Margin (Rockall Bank and Biscay)
75	Vigo	Late Oct., 1980	Passive Margin (N.W. Africa)
76	Monrovia	Late Oct., 1980	Paleoenvironment (SA-6, 7)
77	Montevideo	Mid-Nov., 1981	Paleoenvironment (SA-5)
78	Rio de Janeiro	Mid-Mar., 1981	12-day transit
	Port-of-Spain	Early Apr., 1981	Passive and Active Margin (Venezuelan Basin)
		Early May, 1981	
79	Miami	Mid-May, 1981	Passive Margin (Blake Plateau)
80	Miami	Late June, 1981	Passive Margin (Blake-Bahama Basin)
81	Norfolk	Late Sept., 1981	Passive Margin (slope and rise)

SUMMARY OF DEEP SEA DRILLING PROJECT

LEG 63
(Co-Chiefs: B. Haq and R. Yeats)

Seven sites were occupied, three off southern California and four off the west coast of Mexico. The California sites (467-469) comprised an investigation of the outer California Continental Borderland. Sites 469-472 were located on the Pacific plate west of the continental slope, and Site 473 was on the Rivera plate at the mouth of the Gulf of California (Figure 1).

The Pacific Ocean provides a natural laboratory in which the dynamic interrelation between paleoceanography and paleoclimatology and the associated changes in the biotic communities can be studied. It has retained a relatively stable configuration during most of the Neogene, and its earlier paleogeographic history is fairly well understood. In the eastern Pacific, the southward flowing California Current is a major eastern boundary current that has dominated the hydrography of this area since the Cretaceous (Sliter, 1972). During the Neogene, the intensity of this current has oscillated considerably in response to major climatic changes, and these oscillations are reflected by changes in the marine biota in the marginal eastern Pacific (Ingle, 1973).

Several major objectives of Leg 63 were to study:

1. Neogene paleoceanography of major northeastern Pacific boundary currents.
2. Neogene evolution of planktonic communities associated with these major currents.
3. Correlation of open-ocean plankton biostratigraphy with local California biostratigraphy.
4. The change of the continental margin off California and Baja California from a subduction zone to a transform boundary, and finally to an inactive margin.

Downhole geophysical logs were obtained at Sites 467, 471, and 473.

Site 467—33°50.97'N, 120°45.47'W

Site 467 at San Miguel Gap in the outer California Continental Borderland was proposed to provide an expanded reference section of Miocene to Quaternary age, which would provide clues to Neogene paleoceanographic history and permit correlation between local California biostratigraphic sections and open-ocean tropical and mid-latitude Pacific sequences dated by planktonic microfossils. Four lithologic units were distinguished.

Unit 1 consists of Pliocene and Quaternary silty clay and diatomaceous nannofossil clay with local concretions or thin beds of argillaceous limestone (Figure 2). Sonic log velocity increases linearly from 1.6 to 1.9 km/s in these sediments with velocity highs of 3.5 to 5.0 km/s corresponding to limestone interbeds. Sedimentation rates increase from 75 m/m.y. for Quaternary sediments to 150 m/m.y. for lower Pliocene sediments. Two hiatuses were cored, one from about 0.9 to 1.5 m.y. at 70 m depth, and another from about 3.3 to 3.6 m.y. at 245 m depth. The base of lithologic Unit 1, at 367 m within the early Pliocene, is a diagenetic (lithification) break from clay to claystone, that corresponds to a change from weak, discontinuous low-frequency seismic reflections in Unit 1 to strong, fairly continuous reflections in Unit 2.

The Unit 1/Unit 2 boundary at 367 m appears to be a slight angular unconformity based upon single-channel seismic profiles, but there is insufficient paleontological control to determine whether there is also a hiatus in sedimentation. The interval from 388 to 484 m is characterized by a slight increase in velocity on the sonic log from 1.5 to 1.6 km/s in spite of increased consolidation of sediments. Slower velocity may be related to high gas content in Unit 2; methane percentage was highest in this interval. Unit 2 from 367 to 700 m consists of calcareous claystone with minor siliceous claystone which becomes more lithified with depth. The sedimentation rate decreases from about 150 m/m.y. for Pliocene sediments to 50 m/m.y. for upper Miocene sediments. In the interval between 400 and 500 m, siliceous microfossils and planktonic foraminifers disappear; only coccoliths persist below this depth. A major seismic reflector occurs within Unit 2 at 528 m. Corresponding to an increase in laboratory-measured velocity with depth from 1.61 km/s in relatively gassy sediments to 3.38 km/s in better cemented strata. On the sonic log, velocity increases linearly from 1.6 to 1.9 km/s in the interval 484 to 514 m, then varies from 2.0 to 3.2 km/s in the interval 514 to 749 m.

Unit 3 is early late to late middle Miocene interbedded pumiceous lapilli tuff and nannofossil-clayey chalk, limestone, and claystone. The late Miocene age of the volcaniclastic rocks is in contrast to the middle and early Miocene age of most volcanic rocks elsewhere in the Borderland, although the lithology is similar to that of the middle member of the Blanca Formation of Santa Cruz Island. The top of Unit 3 is

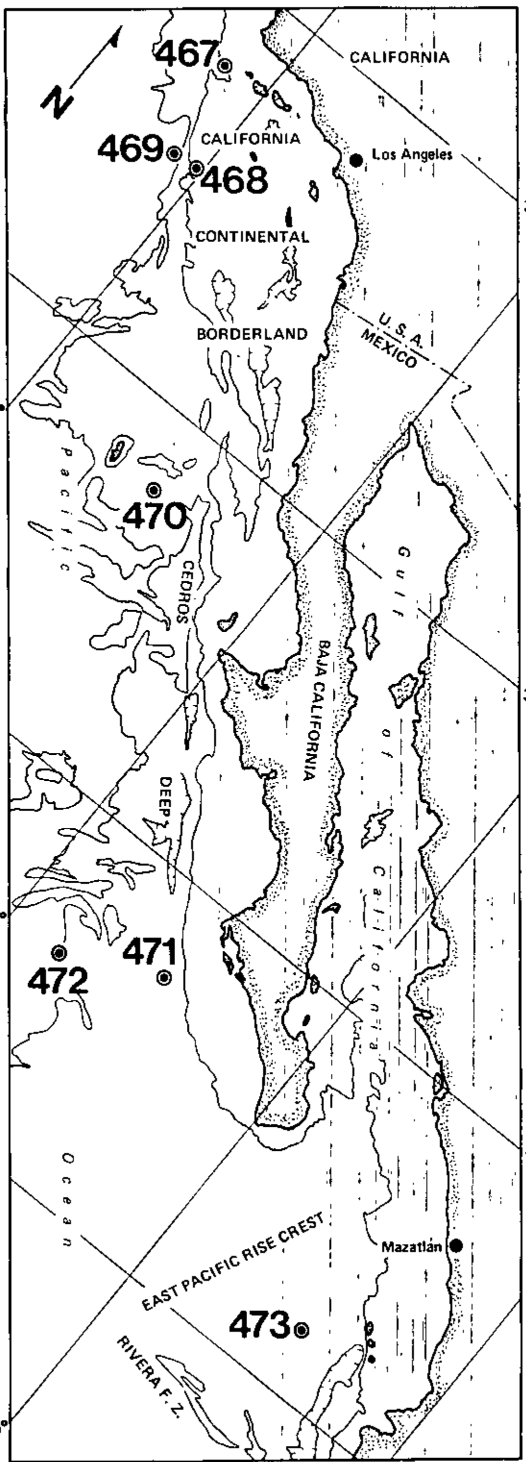


FIGURE 1
LEG 63 OPERATING AREA

picked at the first lapilli tuff bed (700 m), but a prominent seismic boundary separating a unit with strong, continuous low-frequency reflectors from an underlying unit with weak reflectors occurs at 747 m, where pumiceous lapilli tuff becomes the dominant lithology. Sonic log velocity of the lapilli tuff unit is 2.2 km/s.

Unit 4 is similar to Unit 2, consisting of interbedded clayey chalk and calcareous claystone with minor thin beds of fine-grained quartzo-feldspathic sandstone. It is of middle Miocene age with the oldest nannofossil assemblages slightly younger than 16.5 m.y. Sonic log velocity increases linearly from 2.2 to 2.9 km/s in Unit 4. There are several layers of velocity near 3.5 km/s.

Site 468—32°37.03'N, 120°07.07'W

Three holes were cored at Site 468 on the Patton Escarpment. Hole 468 was cored continuously to 241 m and abandoned due to sloughing of middle Miocene volcaniclastic sand and breccia into the hole. Hole 468A was spudded 1.2 km upslope where the post-Miocene section is thicker, and the volcanic sand was expected to be thin or absent. It was continuously cored to 35.5 m. The sand line parted at this hole. The hole was re-spudded as Hole 468B and cored to 415.5 m.

Lithologic Unit 1 is Quaternary and consists of olive-gray nannofossil foraminifer ooze interbedded with glauconitic foraminifer sand. Unit 1 is 19 cm thick in Hole 468 and about 7 m thick in Hole 468A. Unit 2 is upper Miocene to upper Pliocene nannofossil foraminifer ooze, foraminifer nannofossil ooze, and glauconitic silty sand; it extends from 19 cm to 4.1 m in Hole 468 and 7 to 35.5 m in Hole 468A and 468B. Sedimentation rates for both units are 6.5 m/m.y. A hiatus of up to 4 m.y., between 6 and 10 m.y., separates Units 2 and 3. Unit 3 extends from 4.1 to 108 m in Hole 358 and 35.5 to 149.5 m in Hole 468B. It consists of interbedded nannofossil and diatomaceous nannofossil ooze with terrigenous components (sand, silt, and clay) increasing downsection. The top of Unit 3 is marked by a sharp drop in abundance of foraminifers and glauconite. Vitric ash layers occur near the base of the unit. The unit extends from 10 to 14.5 m.y. with a sharp increase in sedimentation rate at 45 m (13 m.y.) from 4 to 5 m/m.y. to 60 m/m.y. Unit 4 is divided into Subunit 4A (108-184 m in Hole 468; 159-235 m in Hole 468B) which contains middle Miocene fossils as old as 16.5 m.y., with sedimentation rate 60 m/m.y., and Subunit 4B which is unfossiliferous except near the top, where it contains microfossils similar to overlying strata. Subunit 4A consists of diatomaceous, calcareous sandy claystone with less common silty claystone, sandstone, ash, and pumiceous lapilli tuff. The boundary with Subunit 4B is marked by a sharp change in velocity from 1.6 to 2.0 km/s and in density from 1.6 to 1.8 g/cc to 1.7 to 2.4 g/cc. Subunit 4B is well-indurated dolomitic silty claystone alternating with andesite and dacite breccia, pumiceous lapilli tuff, and volcaniclastic sandstone. Although unfossiliferous, the basal part of Subunit 4B is gradational into middle Miocene strata. The inferred underlying subduction complex was not reached. The presence of relatively well-preserved siliceous microfossils in the middle Miocene at Site 468 argues in favor of diagenesis as the reason for their absence in the middle and upper Miocene at Site 467.

Site 469—32°37.00'N, 120°32.90'W

At the foot of Patton Escarpment west of Site 468, a single hole was continuously cored to 453.5 m subbottom depth, the lower 59.5 m in basement rocks. The hole could not be logged because the hydraulic bit release became stuck. Four lithologic units were recognized. Unit 1 is 42 m of Quaternary clay with minor foraminifer and nannofossil ooze. Unit 2 is upper Pliocene foraminifer nannofossil ooze with local silty clay layers in the upper part and a lower subunit of foraminifer ooze grading into glauconitic sand, siliceous nannofossil ooze, and nannofossil ooze of late middle to middle Miocene age. The two subunits are separated by a hiatus from about 3.3 to 4.2 m.y. and together span the interval from 42 to 228 m depth. Two more hiatuses (between 5.7 and 10 m.y. and between 10.8 and 13 m.y., respectively) occur within the lower subunit of Unit 2. Unit 3 is silty claystone and tuff in the upper part (228 to 368.5 m depth), an altered diabase sill (368.5 to 387 m depth) in the middle, and a nannofossil chalk with metalliferous sediment (dolomitic iron-rich clay) in the lower part (387 to 396 m). The sill is post-early Miocene in age and consists of fine- to medium-grained altered diabase with a chilled margin of aphyric, microcrystalline basalt at the base and probably at the top. Interstitial quartz in the upper part of the sill suggests some differentiation. The remanent magnetization is moderately stable with a nearly horizontal vector inclined at -4° average. The median destructive field (MDF) is about 100 oe. The ages of the sediments above and below the sill are middle Miocene and late early Miocene, respectively. The basement (Unit 4) is microcrystalline pillow basalt, basalt breccia, green serpentinized hyaloclastite, and rare thin pods of indurated metalliferous sedimentary rock between pillows, together with veins of jasper in basalt fractures. The basalt pillows are altered, largely aphyric with glassy margins and pseudomorphs after olivine microphenocrysts. Their magnetic polarity is mixed, with inclinations ranging from -27° to +58°; MDF is 140-160 oe throughout.

Sedimentation rates are 27 m/m.y. in the upper 90 m and average about 60 m/m.y. below this level. In the early middle Miocene, the rate increased to about 100 m/m.y. with the Sphenolithus heteromorphus nannofossil zone. These high sedimentation rates are similar to those encountered at the earlier borderland sites, 467 and 468, and to those in the Monterey Shale in some onshore basins. They are related to an influx of terrigenous material at that time. The change from high to low sedimentation rates in the late middle Miocene coincides with a major unconformity in the borderland area. The terrigenous component of Site 469 is lower above the top of Unit 3, probably the result of isolation of the continental source of sediments by the formation of intervening borderland basins and ridges during late middle Miocene. This isolation would also explain the almost non-terrigenous nature of Unit 2 at this site. The middle Miocene tuffaceous sediments in Unit 3 may have been derived from sources such as the nearby Patton Ridge. The presence of andesite and dacite at the edge of the continental shelf suggests that the volcanics may be related to the intersection of the East Pacific Rise with the continental margin rather than to island arc activity. The metalliferous sediments overlying ocean-floor pillow basalt with quench texture characterize the site as an oceanic crust site typical of the flank of the East Pacific Rise. The nannofossil age of the sediment immediately overlying the basement is estimated to be 17 +/- 0.5 m.y.

Site 470—28°54.46'N, 117°31.11'W

Site 470, east of Guadalupe Island, was proposed to continuously core the sediment section only partially recovered in 1961 at the Experimental Mohole site and was located 8 km SSW of the Experimental Mohole. Hole 470 was continuously cored to basalt at 163 m. Hole 470A resampled critical sediment intervals from 47.5 to 95 m and 161.6 to the top of the basalt, which had poor recovery in Hole 470, and then continuously cored in basalt to 215.5 m. Sediments recovered were Quaternary silty clay from 0 to 32 m, upper Miocene to upper Pliocene nannofossil clay and nannofossil ooze from 32 to 68 m, middle and upper Miocene diatomaceous silty clay, diatomaceous nannofossil clay, and minor ooze from 68 to 126 m, middle Miocene nannofossil ooze and diatomaceous nannofossil ooze from 126 to 162 m, and more compact middle Miocene nannofossil ooze and clayey nannofossil ooze with dolomite and pyrite increasing downsection to the top of basalt at 167 m. Thin interbeds of limestone with middle Miocene coccoliths similar to these basal sediments occur in interstices between basalt pillows in the basement. Sediment velocity is a consistent 1.5 km/s, and sediment density is 1.5 g/cc, increasing to 1.75 g/cc in basalt sediments. Sedimentation rate is 14 to 16 m/m.y. with hiatuses at 3 to 4.4 m.y., 5.8 to 7.4 m.y., and 8.4 to 10 m.y. The youngest hiatus is more speculative. The top of the basalt is four meters deeper in Hole 470A than in Hole 470. Basalt density is 2.6 to 3.9 g/cc, and velocity is 4.9 to 6 km/s. Three basalt units are present; pillow basalt with glassy margins and coarse-grained centers, 167 to 183 m; a diabase sill or massive flow sequence, 183 to 189 m; and pillow basalt, similar to the upper unit, to the bottom of the hole. All of the units are very stably magnetized, with normal polarity in the upper two units and reversed in the lower one. The MDF generally exceeds 350 oe; occasionally it is as high as 800 oe. The age of the crust at the site based on magnetic anomalies is in agreement with the age of basal sediments overlying the basalt (14.5 +/- 0.5 m.y.) and with the age based on the cooling/time subsidence curve. The high amount of terrigenous material in the late Miocene and younger section may be due to increased tectonism and volcanism in adjacent Baja California.

Site 471—23°28.93'N, 112°29.78'W

Hole 471 was drilled in a sedimentary wedge west of the foot of the continental slope off Baja California. Five sedimentary units were delineated as follows:

Unit 1, from mudline to 63.5 m, is Quaternary and Pliocene nannofossil silty clay with minor ash, deposited at 15 m/m.y.

Unit 2, 63.5 to 155.2 m, is diatomaceous clay and silty clay and clayey diatomaceous ooze. The sediments are principally late Miocene in age and were deposited at 35.5 m/m.y.; the Miocene-Pliocene boundary is in the uppermost part of the unit. Unit 1 and 2 sediments have densities of 1.5 g/cc and velocities of 1.55 km/s.

Unit 3 extends to 304 m and consists of porcellanite and porcelaneous silty claystone with some opal-CT chert and thin beds of clayey limestone. Analysis of downhole logs suggests that Unit 3 may extend to 317 m. Core recovery averages 5% in this unit, and the density and neutron logs suggest the presence of softer sediment interbeds in the unit which were not recovered. The top of Unit 3 is a diagenetic break marked by a sharp increase in density to 1.6 to 2 g/cc for porcellanite and up to 2.8 g/cc for limestone; velocity increases sharply to 1.8 to 3.8 km/s (porcellanite) and 4-6 km/s (limestone). Sparse microfossils are of late Miocene age, but most samples are barren.

Unit 4 comprises the main part of what was probably a part of a deep-sea fan and extends from 304 (or 317) to 735.7 m. It consists of bioturbated silty claystone with thin interbeds of calcite-cemented turbidite sandstone with Bouma DE and CDE sequences. Minor clayey limestone and rare vitric tuff also occur. Biostratigraphic control is limited to nannofossils that indicate a middle Miocene age with a sharp increase in sedimentation rate at about 360 m depth to at least 380 m/m.y. The seismic record shows an angular unconformity at this boundary, and the biostratigraphic record is consistent with a hiatus at the Unit 3/Unit 4 boundary. This would make the sedimentation rate in Unit 3 somewhat lower than 35 m/m.y. Sediment densities are generally about 2 g/cc in Unit 4 with carbonate and calcareous sandstone spikes of 2.4 to 3 g/cc. Sediment velocities are 2 km/s, increasing downsection to 2.3 km/s; carbonate and sandstone spikes are as high as 4.9 km/s. Gas chromatography indicated the presence of hydrocarbons of C_5 and higher molecular weight associated with some sandstone layers; associated claystone is non-petroliferous. Slight gas entry in two thin zones was suggested by downhole temperature logs.

Unit 5, 735.7 to 741.5 m, consists of hemipelagic claystone and 20 cm of altered sediment at the top of a diabase unit. The sediments of this unit are intensely burrowed and contain microfaults, and calcite veins. The altered sediment includes pyrite- or chalcopyrite (?)- bearing claystone (possible vein mineralization) black chert, and red-brown metalliferous sediment. Sediment velocity and density are the same as Unit 4, but there are no carbonate or sandstone peaks. Intercalations of metalliferous sediment also occur within the diabase unit. The diabase unit is highly altered and consists of a least 2 or 3 sills. The magnetic polarity of the sills is normal, with generally low stabiity (MDF = 18-145 oe); the remanence is probably not primary. Local fragmental texture may be due to emplacement

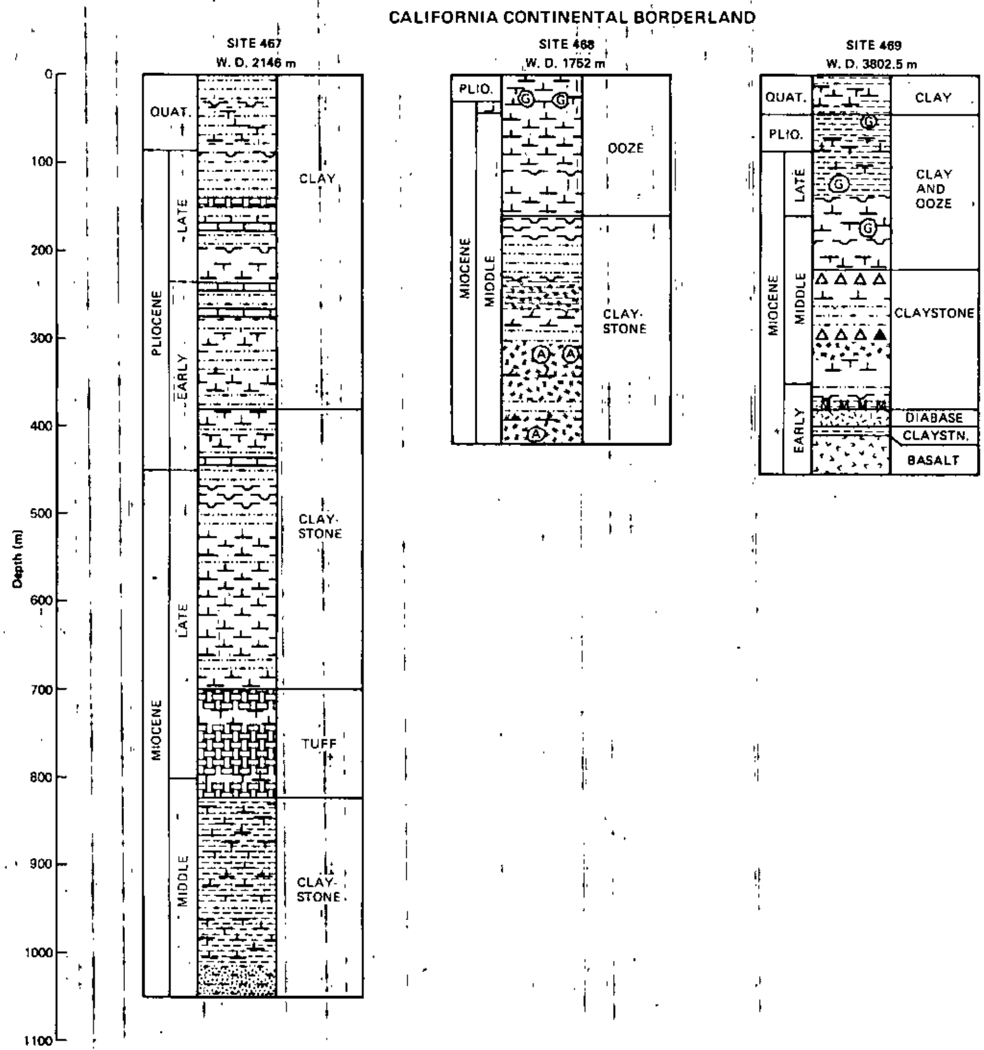
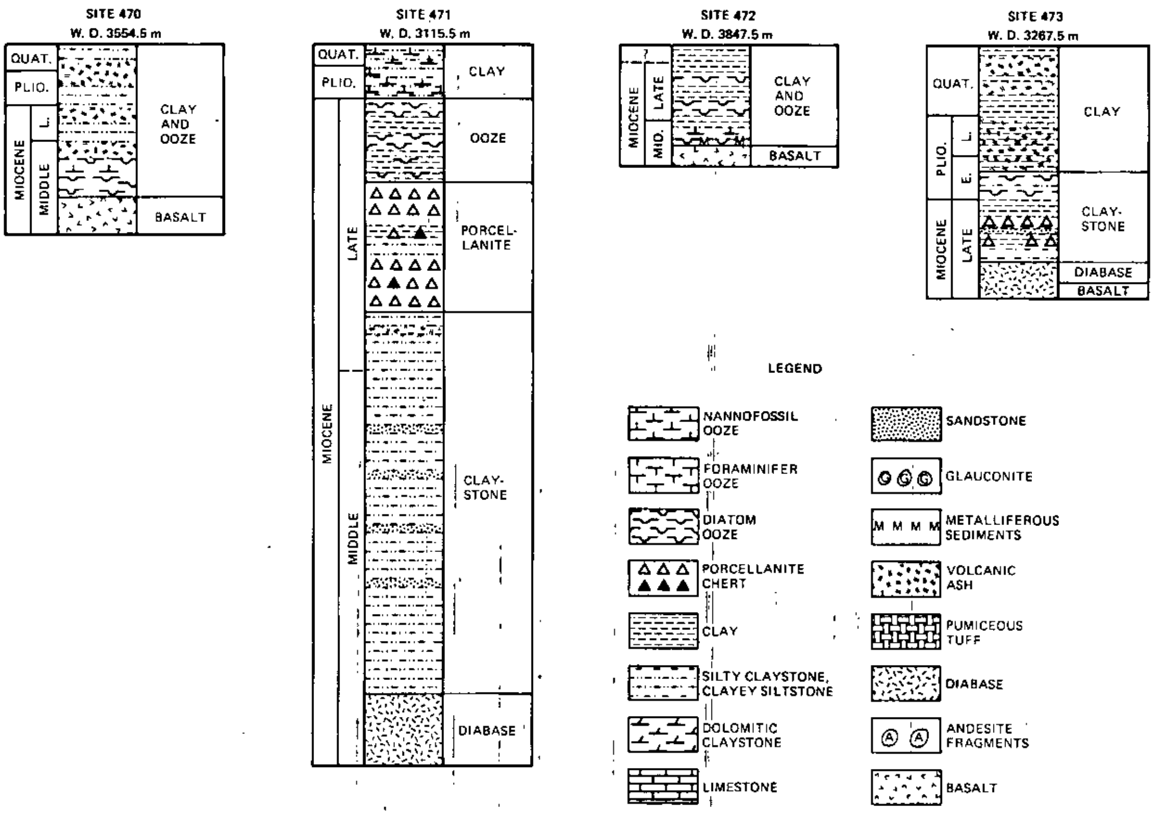


FIGURE 2
Core Lithologies for Leg 63

WESTERN CONTINENTAL MARGIN OF MEXICO



autobrecciation during intrusion into soft, water-saturated sediment, although slickensides indicate some shearing after consolidation. The diabase density is 2.3 to 2.8 g/cc, and its velocity is 3.1 to 5.4 km/s. The variability is, in part, caused by different degrees of alteration. The age of oldest sediment cored above basement is 14.5-15.0 m.y., 3-4 m.y. older than the 11 m.y. age extrapolated from the nearest linear magnetic anomalies.

A full suite of downhole logs was run from about the top of Unit 3 (top porcellanite) to total depth. The density, sonic, and neutron logs clearly show the presence of soft sediment interbeds in Unit 3 not recovered by coring. The porcellanite and limestone beds show as spikes on the logs. Metalliferous sediment interbeds up to 1 m thick in the diabase show quite clearly in density and sonic logs. The conductivity curve on the neutron logs shows good resolution of thin interbeds of sandstone in Unit 3. The neutron log, density log, and wave-train sonic log indicate considerable variation in the character in the diabase sills which may indicate fracture porosity or changes in the degree of alteration. Two temperature logs and two heat-probe measurements indicate a high geothermal gradient and high heat flow. Temperature is 12.8°C at 95 m and 22.8°C at 155 m. Assuming a conductivity of 2.3 mcal/cm-sec-°C for the sediments, heat flow at the site is 75.37 mW/m^2 (1.8 HFU) based on downhole logs and 138.17 mW/m^2 (3.3 HFU) based on heat-probe data.

Site 472—23°00.35'N, 113°59.71'W

This site was proposed to obtain a late Neogene record of pelagic sedimentation unaffected by terrigenous sediment sources such as those affecting Site 471. Oceanic crust is dated independently at this site by linear magnetic anomalies. Unit 1 consists of yellowish brown pelagic clay of early Quaternary to late Miocene age and was recovered from mudline to 24.5 m. Unit 1 is almost barren of microfossils. Its gradational contact with Unit 2 is marked by an increase in siliceous microfossils and by a color change suggesting a change from oxidizing to reducing conditions with depth. Unit 2 consists of greenish gray clayey diatomaceous oooze and clay of late and middle Miocene age (24.5 to 91 m). Unit 3 consists of diatomaceous nannofossil ooze with minor vitric ash and with metalliferous dolomitic nannofossil ooze at the base (112 m). A well-preserved silicoflagellate record was recovered in Units 2 and 3. Unlike Units 1 and 2, sediments of Unit 3 contain abundant calcareous nannofossils and some planktonic foraminifera deposited above the CCD. Oldest sediment above basalt contains nannofossils from the <u>Sphenolithus heteromorphus</u> Zone of middle Miocene age, 15 +/- 0.5 m.y. This age is in agreement with magnetic anomalies but is younger than the age predicted from the Sclater curve based on basement depth.

Sedimentation rates are about 5 m/m.y. in sediment younger than about 8 m.y., and 11 m/m.y. in older sediment. One heat probe measurement taken at 88 m recorded a temperature of 14.3°C. The sediment density is 1.5 g/cc, and the sediment velocity 1.5 km/s. Basement recovered at this site is olivine plagioclase pillow basalt with well-developed quench textures. Eleven different cooling units (pillows) were recognized. The basalt contains two layers of middle Miocene limestone in Core 15.

The drill pipe was raised above the mudline, and Hole 472A was washed down to obtain a second temperature measurement in sediment below 100 m. Basalt was encountered at 94.5 m, 17.5 m shallower than in the original hole, and the second temperature measurement couldnot be made. A 20 m basalt core was recovered with the drill pipe in Hole 472A.

Site 473—20°57.92'N, 107°03.81'W

Site 473 on the Rivera plate south of Tres Marias Islands was cored continuously to obtain a late Neogene reference section at the mouth of the Gulf of California and to investigate the possibility of oceanic crust at the mouth of the Gulf formed prior to 4 m.y. Terrigenous clay of Quaternary to early Pliocene age, locally, with silt or ash, was cored to 143 m, and moderately indurated diatomaceous and calcareous claystone of early Pliocene age was cored from 143 to 181 m. The boundary between these units, based mainly on difference in consolidation, is a seismic reflector. From 181 m to the base of the section at 248.1 m, silty claystone and local silty quartzose sand of early Pliocene and late Miocene age include turbidites with common Bouma C-D-E and D-E sequences. The paleontological age of the basal sediment is estimated to be 6 to 7 m.y. This age could prove to be slightly younger, as it is based on the presence of nannofossil species that may be reworked into younger sediments. Sediment velocities are 1.5 to 1.6 km/s to 181 m, increasing to 1.98 at the sediments. Densities are 1.5 g/cc, increasing downward to 1.7 g/cc. Heat probe measurements at 67, 143, and 182 m suggest a geothermal gradient of 63°C/km (heat flow, 58.22 mW/m^2 or 1.4 HFU), but measurements at 105 and 219 m suggust a gradient of 173°C/km (163.29 mW/m^2 or 3.9 HFU). A gradient of 100°C/km (120.42 MW/m^2 or 2.9 HFU) is suggested by a downhole temperature log from 133 to 185 m, consistent with the temperature controlled first appearance of opal-CT and the disappearance of siliceous microfossils at 181 m. The reason for the discrepancies among gradients is unclear. Igneous rocks below the sediments are mainly massive altered diabase with density 2.7 g/cc and velocity 5.2 to 5.3 km/s, but pillow basalt was found at the bottom of the last core.

Sedimentation rates are 60 m/m.y. for the last million years (0-50 m depth) and 33 m/m.y. for the rest of the section. The high percentage of terrigenous material, including turbidites, at the site was surprising in view of the pelagic appearance of the sediments on the seismic record.

Discussion

The quality of the calcareous nannofossil and foraminifer record from Leg 63 sites is below our expectations. This is partly due to diagenetic dissolution and recrystallization of the deeper buried sediments, and partly due to dilution by terrigenous detritus and/or deposition below the CCD. Shipboard study indicates that, with the exception of a usually fair to good representation in the Quaternary, planktonic foraminifers are rare or absent in most of the older cored sequences. When present, nannofossils are only moderately to poorly preserved, although a well-preserved late Neogene record was recovered at Site 470. This site also fills the stratigraphic gaps represented by non-recovered intervals in the 1961 drilling of the Experimental Mohole. The nannofossils provide consistent age estimates in much of the recovered sections.

The record of siliceous microplankton is generally fair to good in the intervals in which these microfossils are present. Diatoms are usually common in the middle and early late Miocene of most sites, and the high latitude diatom zonation was applicable for this interval as far south as Site 472. For the same time interval, a good silicoflagellate record was also recovered from Site 472. Both diatoms and silicoflagellates at this site are a mixture of high and low latitude assemblages when compared to higher latitude sites. Like diatoms, radiolarians are also generally common in middle and early late Miocene intervals. However, for radiolarians the tropical to temperate zonation for the Miocene could be applied as far north as Site 467. On the other hand, the high latitude radiolarian zonations of the Quaternary and Pliocene could be used as far south as Site 470.

All groups of microfossils studied suggest increasing water temperatures along our north-south transect at any given time interval. Siliceous microfossils, however, provide best paleoclimatic information in the pre- Pliocene. For example, the overall composition of silicoflagellate assemblages at Site 472 favors relatively cooler conditions in the late Miocene between 7 and 8.5 m.y. At this site cool-water diatoms, specifically Denticula hustedtii, are a common component in early late Miocene between 9 and 10 m.y. Initial scrutiny of the shipboard data does not reveal distinct oscillations of the paleoisotherms or the latitudinal migrations of the eastern boundary current.

Our conclusions are based on shipboard study of core-catcher samples. More detailed shore-based paleontological studies, especially those of siliceous microplankton and benthic foraminifers, may reveal the more subtle changes in the paleoenvironment.

Interesting diagenetic trends partly compensate for the havoc these processes wreak on the microfossil assemblages at the Leg 63 sites. At Site 467, 468, 469, 471, and 473 sediments with abundant siliceous microfossils—diatoms, radiolarians, silicoflagellates, and sponge spicules change to hard, opal-CT porcellanites and porcelaneous claystone with increasing depth of burial. At Site 467 and 469, clayey chalk is the diagenetic equivalent of nannofossil clay and ooze higher in the section.

These diagentic trends match similar transformations in Neogene siliceous and carbonate sediments and rocks in California and elsewhere around the Pacific. Temperature is an important control of the silica transformations, and the high heat flow in the area of the Leg 63 sites serves to accelerate the diagenetic transformations. Downhole logs and seismic reflection profiles clearly outline the diagenetic intervals, since the transformations produce hard rocks with high densities and velocities juxtaposed with soft unaltered sediment. At Site 471, the diagenetic boundary between diatomaceous sediment and porcellanite cuts the stratigraphic boundary, just as the diagenetic front does in Neogene siliceous deposits of the Bering Sea (Creager and Scholl, 1973).

Shipboard paleomagnetic work revealed that paleomagnetic stability ranged from very high (450-800 oersteds median destructive force in the freshest basalt at Sites 470A and 472) to extremely low (18-30 oe in the highly altered diabase of Site 471). Polarity was mixed (e.g., two reversed and one normal unit at Site 470A), and the observed stable inclinations (-53° to

+58°) never closely matched the geocentric axial dipole expectations (38°, -52°) at the five sites (469 to 473) where igneous material was cored. Instead, the inclinations tended to be shallower than expected at the present-day latitudes, suggesting a more southerly origin, which is compatible with inferences based on interpretations of lineated marine magnetic anomalies and "hot spot" traces.

One objective of Leg 63 was to evaluate the oceanic basement ages that had been inferred previously from tectonic models or interpreted from magnetic anomalies. Basement ages based on microfossils at Site 469, 472, and 473 agree well with published interpretations of magnetic anomalies. Basement age at Site 470, located near the old Experimental Mohole, agrees with an earlier interpretation of magnetic data by Atwater (1970) and with a more recent interpretation of magnetic data by Menard, based on newer data published by NOAA. The microfossil age of basement at Site 471 is several million years older than predicted by magnetics and older than more clearly defined magnetic anomalies to the west. These findings suggest that the tectonic history of this part of the continental margin is more complex than previously believed and may involve an abandoned rise crest and a trapped piece of the Farallon plate off southern Baja California.

Locally-derived andesitic and dacitic lapilli tuff and breccia were recovered in middle Miocene sediments at Sites 467 and 468 along the outer edge of the California Continental Boderland. These sites are within 15 km of the inferred paleotrench at the base of the continental slope and thus are much too close to the subduction zone to be attributed to partial melting of subducting oceanic crust. Their age, 10-15 m.y., is also younger than the timing of cessation of subduction which is interpreted to be no younger than the 17 m.y. basement age at Site 469. The young age (10-13 m.y. old at Site 467) and their occurrence at both Sites 467 and 468 and on islands in the borderland indicate that these deposits are widespread and are probably related to the close proximity of the ancestral East Pacific Rise as it migrated southward along the margin.

LEG 64
(Co-Chiefs: J. R. Curray & D. G. Moore)

INTRODUCTION

The Gulf of California has been an objective of deep sea drilling proposals for many years. It has attracted the interest of earth scientists because it may hold the answer to some of the fundamental questions regarding the early stages of formation of ocean basins and passive continental margins, as well as important details of the tectonics of western North America, the origin of laminated diatomaceous sediments, the effect of rapid terrigenous sedimentation on crustal formation, and hydrothermal circulation at a young divergent plate boundary. Drilling in the Gulf on Legs 64 and 65 and part of Leg 63 attacked these questions guided by the IPOD/JOIDES Ocean Crust, Passive Continental Margin, and Ocean Paleoenvironment Advisory Panels, as well as through the Gulf of California inter-panel working group.

The concept of origin of the Gulf of California by separation of Baja California from mainland Mexico can be traced in the geological literature at least back to Wegener. The general configuration of the shoreline, continental margins, and geology appear to match across the Gulf; the axis of the Gulf is seismically active; and the northern end of the Gulf is in some way related to the San Andreas Fault system of California.

In the context of modern global tectonics it is now generally believed that the East Pacific Rise (Fig. 3) enters the mouth of the Gulf and passes into a rectilinear system of short segments of spreading axes offset by short transform faults; the northernmost transform passes this total motion northward into the San Andreas system. This complex system of spreading axes and transform faults is the boundary between the North American and Pacific plates in the Gulf and between the Pacific and Rivera plates at the mouth of the Gulf. It is prominently displayed in the bathymetry and closely matches precisely-positioned earthquake epicenters and microseism swarms. Some of the spreading axes have been further confirmed by very high heat flow values, observations of hydrothermal deposits on small normal faults in the north Guaymas Basin, and seismic reflection records showing thinning, faulting, and deformation of the sediments. Magnetic anomalies off the tip of Baja California demonstrate that this present phase of opening started at about 3.5 to 4 Ma (Larson et al., 1968; Moore and Buffington, 1968).

Drilling sites proposed in the Gulf were clustered into three problem areas or transects to facilitate

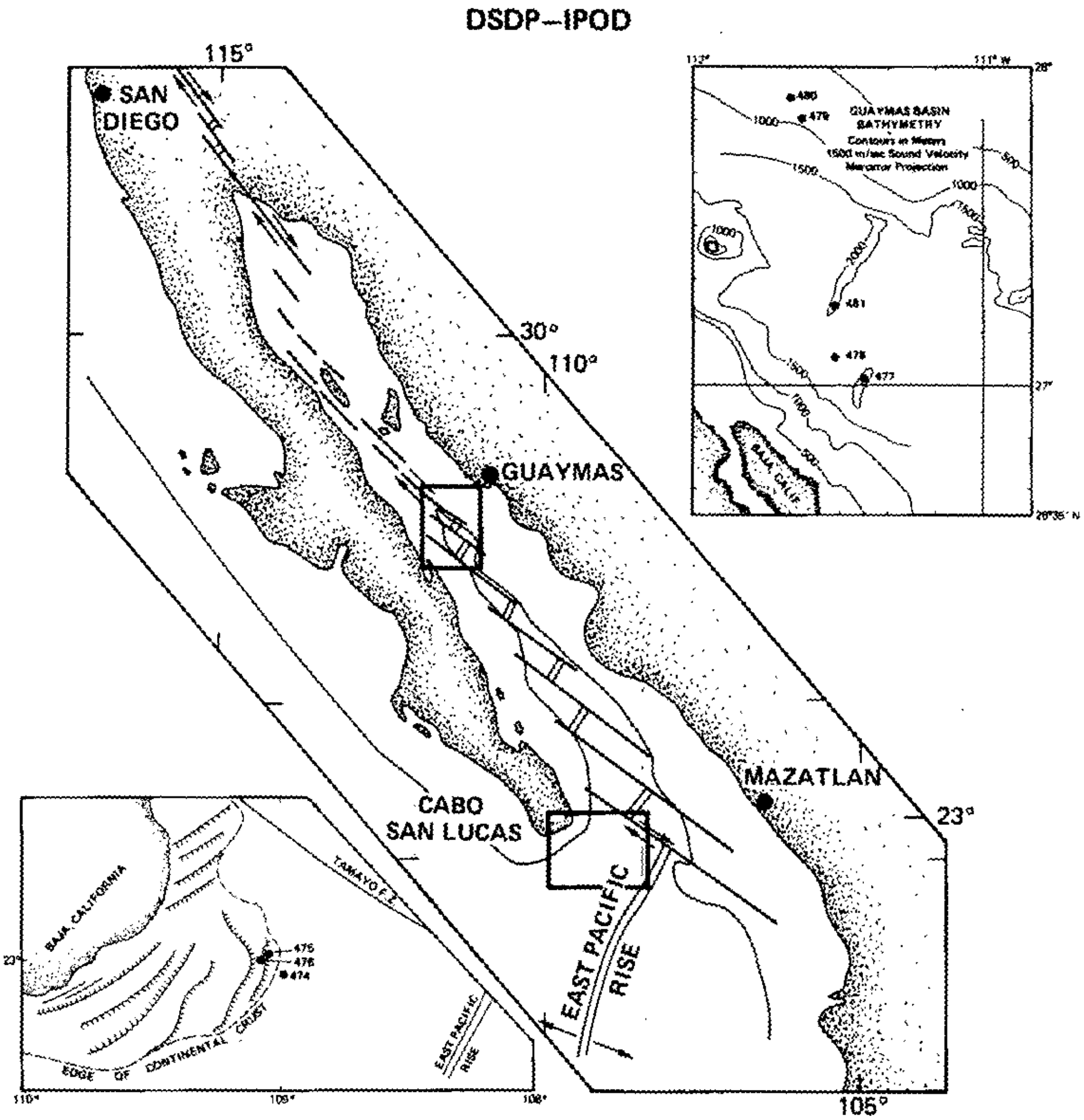


FIGURE 3
Leg 64 Site Locations

information handling and discussion in a relatable manner. The first of these transect areas is at the mouth of the Gulf (Fig. 3), from the crest of the East Pacific Rise, where rapid sea floor spreading is occurring, to the young passive margin at the tip of Baja California (Sites 474, 475, and 476). The second transect area is in the newly formed sea floor of Guaymas Basin in the central Gulf (Sites 477, 478, and 481). The third transect or cluster of sites is on the continental slope off Guaymas in the oxygen-minimum, laminated-diatomite area (Sites 479 and 480). The three problem areas will be discussed separately.

I. PASSIVE MARGIN TRANSECT

Background and Objectives

A commonly accepted model of plate tectonics and sea floor spreading is the concept that ocean basins form by rifting of continents with initial thinning, attenuating, and faulting of the continental crust, followed by separation and drifting while new sea floor forms in the widening linear gap. The continental margin of the tip of Baja California is an example of a youthful stage of an evolving passive margin. The dominant structure is horst and graben, and rotational listric block faulting (Normark and Curray, 1968), much like the structure observed in active rifting areas like the East African Rift system, and similar to the structure inferred beneath the massive sediment columns of the Atlantic. In contrast, the transition from continental to oceanic crust in the Gulf lies only a few hundred meters below the sea floor and is young enough that it has not undergone the modifications which occur with massive subsidence and sedimentation in older continental margins.

The following objectives of passive margin drilling are specifically of importance in this transect:

A. Basement Rocks

1. Delineation of the boundary between "oceanic" and "continental" basement rocks. Site GCA-5 (474) was presumed by geophysical (Larson et al., 1968; Larson, 1972) and bathymetric evidence to lie seaward of the boundary, and Sites GCA-6 (475) and GCA-7A (476) were presumed to overlie continental crust.

b. Composition and characteristics of the "oceanic" and "continental" basement rocks.

2. Nature of the Sedimentary Sectio

a. General lithologic a biostratigraphic faci distribution.

b. Record of Pleistocene se level fluctuations.

c. Nature and age of the oldest sediments on oceanic basement.

d. Diagenesis of both organic and inorganic matter.

3. Evidence for climatic and/or oceanic circulation changes.

4. Evidence relating the history of the proto-Gulf of California. The concept of the proto-Gulf was first developed here for the misfit in reconstructions across the mouth of the Gulf (Moore and Buffington, 1968; Karig and Jensky, 1972; Moore, 1973). Site 473, Leg 63, supports this hypothesis by recovering sediments and oceanic basement 6 m.y. old across the EPR from this area.

Site 474 (GCA-5)

Two holes were drilled at Site 474 at the base of the continental slope southeast of the tip of Baja California. The first was continuously cored to 182.5 m. Hole 474A was offset 300 m to the SE and reached a total depth of 626 m. Two dolerite sills were encountered between 521 m and the first pillow basalt basement at 562.5 m. Sediments were recovered from between these sills and oldest sediment was a small fragment of early Pliocene claystone recovered from beneath the first pillow basalt flow at 572 m. We penetrated 105 m after encountering the first dolerite sill and 63.5 m into the basement, recovering 14.6 m of dolerite above basement and 63.5 m of basalt flows and dolerite sills within basement.

Five depositional units are recognized within the sedimentary section at Site 474 (Fig. 4). The sediment is dominated by hemipelagic muds and a thick sequence of mud turbidites reflecting our position on the lower part of a submarine fan fed primarily by the well-developed submarine canyon system of the SE tip of Baja California. The upper section from 21 to 87.3 m contains redeposited slump debris, flow-turbidite units. The base of this flow is coarse sand and conglomerates. The upper nannofossil-diatomaceous muds contain evidence of warmer, shallower water fauna than occurs in either the sediments above or below th deposit.

Biostratigraphy was determined primarily by nannofossils which persist to basement. Siliceous radiolarians and planktonic foraminifers are preserved only to 275 m in the Quaternary section. Dissolved silica values clearly reflect the abundance of siliceous materials in the upper 275 m. The drop to lower values at 300 m may be related to recrystallization of silica associated with weathering of plagioclase feldspars (source of calcium) and the formation of smectites (sink for Mg). Values of dissolved Ca increase and desolved Mg decrease in this same section. Planktonic foraminifers in the Quaternary sections of this site record shifting of water masses. Most of this section contains a "sub-tropical" population, but in some intervals an apparent increase in the population of species dwelling recently in the California Current is observed.

Ratios of ethane to methane also follow a similar pattern with a normal linear increase (semi-log scale) to about 300 m and then a decrease from the maximum of 8.5 x 10^{-4} to about 11.5 x 10^{-5} in the lower part of the section. Methane values show it to be an essentially constant component of interstitial gas, whereas ethane increases to a maximum and then decreases, reflecting the slower diffusion of ethane from the more indurated sediments below 300 m. The gas in this sediment sequence is of biogenic origin. No typical petrogenic hydrocarbons are present despite the high thermal gradient. The observed increase in the C_2-C_4 hydrocarbons with depth may result from low T decomposition of biogenic organic matter in proximity to the intruded dolerite in the lower sedimentary section. This phenomenon has been observed under similar circumstances in Leg 41.

Physical properties of the sediments reflect a history of compaction and lithification. Strong gradients of increasing bulk density and shear strength, and decreasing porosity in the upper 20 m are normal. From 20 to 100 m all parameters remain relatively constant. Between 100 and 250 m water content, bulk density, and porosity change slowly with increasing overburden pressure. Recrystallization appears insignificant in this interval because biogenic silica and calcareous nannofossils are still present in considerable quantities. From about 200 to 275 m to about 360 m water content and porosity decrease rapidly and bulk density increases from 1.67 to nearly 1.80 g/cm^3. In about this same interval the concentration of dissolved silica is relatively very low signifying that formation of chalcedony as well as authigenic clay minerals may have contributed to lithification of the sediments.

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Eight igneous lithologies are identiws. at Site 474 and placed in five petrolava units. These include several intrusive unalt and a pillow lava sequence. Units 1 and 2 a intrusive olivine dolerite sills within the lower 43 m of the sedimentary section. Unit 3 comprises two distinct pillow basalt flows. Unit 4 is a dolerite sill within the pillow lave sequence, and Unit 5 comprises pillow basa and coarse basalt or dolerite which may be sill. The pillow basalt sequences are dominantly plagioclase phyric with mino olivine phenocrysts. Clinopyroxene is not seen as a phenocryst phase in any of the basalts.

The downhole logging program included temperature, sonic, density, porosity, caliper, natural gamma radiation, and guard (electrical) measurements. Bottom hole temperature measurement by the logging tool yields a heatflow value for this site of 129.8 mW/m^2 (3.1 HFU). Shipboard use has been mainly of the density and sonic velocity logs for correlation with the lithology and seismic reflection records over the site. Correlations are generally good, and some major lithologic changes and depositional events can be observed in the records, principally the redeposited slump-debris flow-turbidite unit. Reflection record suggests the possibility of an additional half km of stratified material below the basement sampled.

Site 475 (GCA-6)

Hole 475 in a slope basin 21 km SE of the tip of Baja California was drilled in a water depth of 2631 m and continuously cored to a depth of 196 m below the mudline. A cobble conglomerate encountered at 148 m eventually stopped the drilling. Above the conglomerate, the drilling operations were routine and an unusually good recovery of 79.6% was obtained. The heat probe was successfully deployed in stiff mud at 110.5 m and again at 148.5 m. Heat flow at this site was calculated as 167.5 mW/m^2 (4 HFU). Drilling time increased sharply from 6 to 8 min/core to 22 to 60 min/core as the conglomerate zone was penetrated. Average recovery decreased to only 5.3%. To avoid drilling conglomerate and to attempt to sample the granite basement, two other holes were drilled at this site upslope of Hole 475. Both of these holes were to be washed to equivalent depth reached in Hole 475. Hole 475A in 2545 m water depth hit a hard layer at 16 m below the mudline, and Hole 475B in 2593 m water depth washed to 76 m before encountering olivine basalt cobbles, petrographically like mid-ocean ridge basalts. These were cored to 96 m total depth with only 3% recovery before caving of the hole forced abandonment of the site.

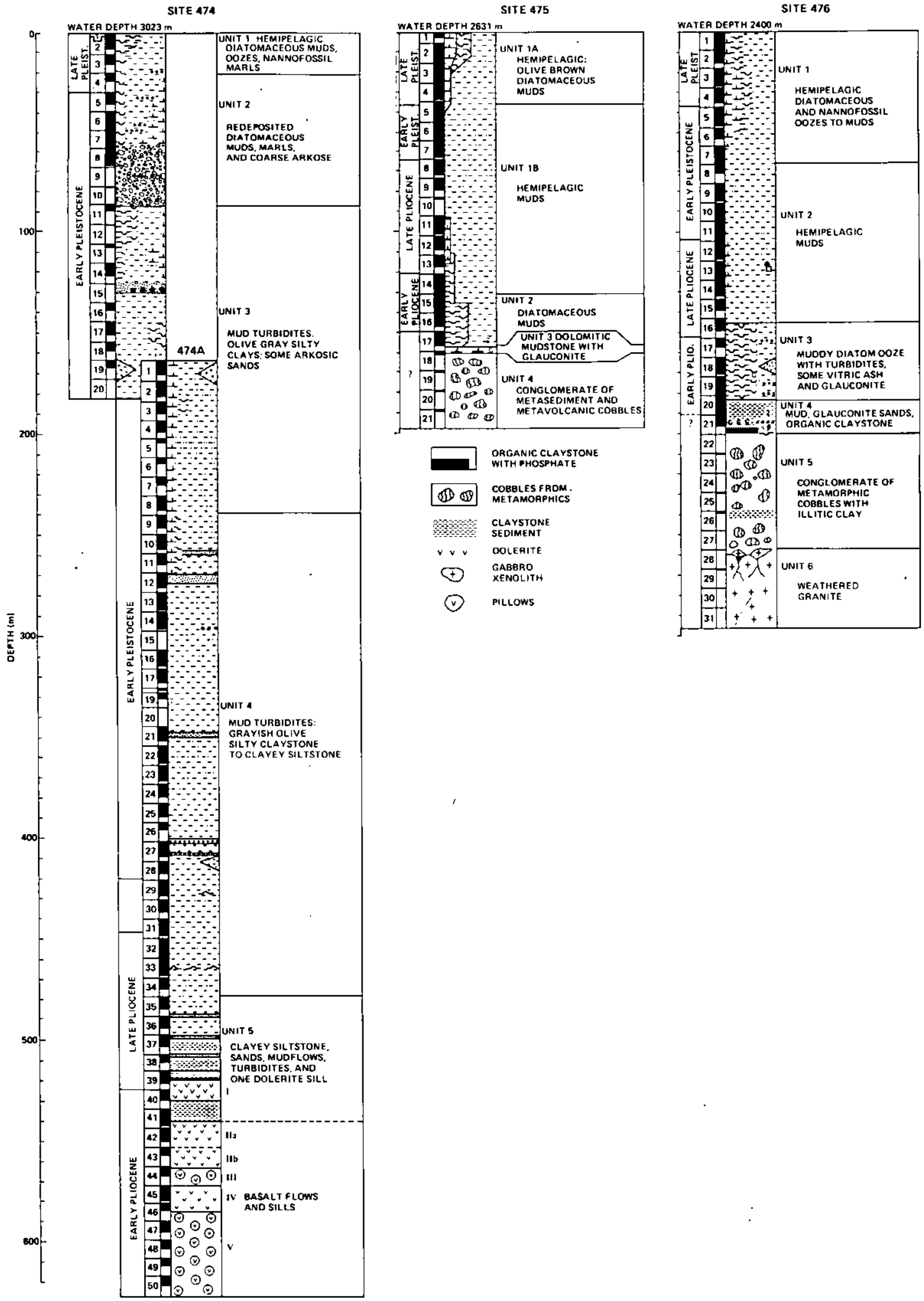

FIGURE 4
Core Lithologies for Gulf of California Passive Margin Sites

Four lithologic units are identified from Hole 475 on the basis of microfossil abundances, sedimentary structures, and mineralogical components. Unit 1 (0-130 m) in Quaternary to late Pliocene hemipelagic nannofossil diatomaceous silty clays to clayey silts deposited at about 80 m/m.y. with a zone (34.5-91.5 m) containing less than 5% fossils deposited at the much slower rate of 20 m/m.y. Unit 2 (130-153 m) is a sequence of mud turbidites underlying a sharp 2-cm sand layer contact. The sequence is late to early Pliocene diatomaceous silty clays with the upper finest grained sequence showing bioturbation. Unit 3 (153-158 m) is the basal stratigraphic sediment unit. It is early Pliocene mostly distal fan or abyssal zeolite bearing-clay overlying dolomitic mudstone of questionable origin. Unit 4 (158-196 m) is a conglomerate of metamorphic rock of diverse lithologies believed to have been deposited subaerially as a braided river mouth.

Organic geochemistry showed hydrogen sulfide present from 11 to 35 m, but in much lower amounts than at Site 474. No hydrocarbon gases were detected. Dissolved Ca goes through a typical minimum in the upper section as $CaCO_3$ precipitation has occurred. Dissolved silica values are high at this site with a progressive downhole increase. Calcium carbonate content is moderate in the upper diatomaceous ooze, but relatively low throughout the rest of the hole. No increase occurred in the lower diatomaceous section, suggesting a lack of calcite microfossil deposition. Comparatively strong gradients in the water content, bulk density, and porosity from 100 m to base of sediments above the conglomerate are apparently not related to sediment composition or interstitial water. The concentration of dissolved silica is high and the sediments become richer in opaline microfossils. This is in contrast to the characteristics of sediments at Site 474 where a correlation between sediment chemistry and physical properties was apparent.

Planktonic foraminifers suggest that a sub-tropical environment has prevailed with periodic incursions of the California Current during Pliocene and Quaternary time.

No sonobuoy record or downhole acoustic logging was available for this site and we were forced to rely on sound velocities measured in the laboratory to calibrate the seismic reflection records with drilling results. The measured velocities were quite low: 1.50 km/s to 100 m, 1.52 km/s from 100 to 150 m, and 1.55 km/s beyond 150 m to base of sediments above the lithified dolomitic unit at the top of the conglomerate. The sedimentary units correlate remarkably well with the reflection record when these velocities are used.

Site 476 (GCA-7A)

Site 476 is the third and most landward site of the 3-site transect across the youthful passive continental margin of the tip of Baja California. The site, about 42 km SE of the tip of Baja California, is on a terrace low on the continental slope in 2400 m of water. The seismic record shows that this terrace overlies one of a series of rotational slump blocks. One hole was drilled to a total depth of 294.5 m and stopped in a basement of deeply weathered granite. No logging was done because the hydraulic bit dropping mechanism failed.

The lithologic section has been subdivided into 6 units. Unit 1 (0-66 m) is Pleistocene nannofossil and diatomaceous ooze to mud. It is apparently a hemipelagic open continental slope deposit and contains some scattered sand layers, perhaps representing winnowed lag deposits related to sea level lowerings. A rate of accumulation of 93 m/m.y. is indicated. Unit 2 (66-145 m) is a late Pliocene silty clay hemipelagic slope deposit with episodic brief periods of winnowing, low carbonate content (generally less than 5%), and reducing conditions within the deposits. Rate of accumulation appears to be from about 37 to 47 m/m.y. Magnesium content starts an unusual increase with depth in this unit. Unit 3 (145-183 m) is early Pliocene muddy diatomaceous ooze with turbidite layers, vitric ash, and glauconite sands. These extensively bioturbated sediments contain low carbonate, varying proportions of silicoflagellates and radiolarians. A 45-cm rhyolitic ash suggests nearby subaerial volcanic activity. These upper continental slope sediments accumulated at about 37 m/m.y. Magnesium continues to increase with depth. Unit 4 (183-199 m) comprises late Miocene-early Pliocene (?) organic claystone, glauconitic sands, and silty clay. This thin unit is suggestive of an isolated shallow bank environment in the oxygen minimum, although because of the limited sample and complexity, our interpretations are equivocal. Unit 5 (199-256 m) is a metamorphic-cobble conglomerate of unknown age. Interpretations of this unit as a continental arroyo, outwash, or alluvial fan environment is based on poor recovery of small cobbles and cored sections of large bounders, generally of metasediment and metavolcanic origin. None are from the underlying granite. Near the base is a silty clay which might be either a continental water-deposited bed or possibly a fault gouge. Unit 6 (256-294 m) is interpreted from limited core recovery as an in situ deeply weather granitic terrain or a deposit of little or no transport. The granite cobbles and fragments represent the unweathered residual knockers of a biotite-hornblende-bearing granite, with up to 40% each of quartz and feldspar and 15% albite. Some constituents are cataclastically deformed. The feldspar in the decomposed granite matrix is sericitized.

Physical properties in these samples are difficult to determine because of severe coring deformation, but water content and porosity trends both reverse their normal downhole decrease with higher values in the diatomaceous ooze of Unit 3, and both bulk density and sound velocity decreases in the same unit. Sound velocity is generally low in Units 1 through 3 at just above water velocity with values of about 1.51 to 1.54 km/s. It increases in Unit 4 to above 1.60 km/s. Granite cobble velocities are 4.0 to 4.9 km/s, but in situ velocity of this weathered zone must be much lower.

Content of organic material is generally low and this sedimentary section would not constitute a good hydrocarbon source rock. The interesting increase in Mg content with depth below about 60 m may be interpreted as an upward flux from weathering of the continental basement and terrigenous constituents of the basalt conglomerates. Most oceanic DSDP sites show a continuing decrease in Mg with depth.

Baja California Passive Continental Margin Transect: Summary and Conclusions

Sites 474, 475, and 476 (GCA-5, 6, and 7A) comprise a transect across the ocean-continent boundary SE of the tip of Baja California where initiation of the present phase of sea floor spreading and opening of the Gulf of California is believed to have begun at 3.5 to 4.0 m.y. Site 474, located at the foot of the continental slope, recovered mainly diatomaceous mud and mudstone turbidites. Oldest sediment was early Pliocene (3.5 to 4.0 m.y.) beneath three dolerite sills and a pillow basalt, below which we drilled an additional 54 m of pillow basalt. Site 475, in a lower slope basin, recovered diatomaceous turbidite and hemipelagic sediments dating back to early Pliocene (4.0 to 4.5 m.y.), overlying 5 m of glauconitic-zeolitic mudstone and a metamorphic cobble conglomerate, which stopped the drilling. Site 476, located in a more open slope environment, consisted primarily of hemipelagic diatomaceous oozes to mudstones dating back to early Pliocene or possibly late Miocene (more than 4 m.y.) overlying 16 m of glauconitic, phosphatic, zeolitic claystone, 57 m of metamorphic cobble conglomerate, and bottomed in a deeply weathered granite.

Rate of sediment accumulation average 158 m/m.y. in Site 474, and about 50 m/m.y. in Sites 475 and 476. The increase in each site during the Quaternary attaining 240 m/m.y. in Site 474.

Structure of this continental margin is dominated by horst and graben and rotational listic faulting. Site 475 and 476 lie in the 2 lowest, apparently most deeply subsided blocks immeditely adjacent to the oldest oceanic crust of the present phase of spreading. The deep weathering of the granite and deposition of the conglomerate is interpreted as most probably subaerial and the glauconitic phosphatic zeolitic mudstone layer as representing an isolated offshore shallow water bank environment. The oldest dated marine sediments over the continental crust are early Pliocene to possibly late Miocene. Oldest sediments over oceanic crust are younger and fit the model of opening of the mouth of the Gulf. It appears that subsidence, accompanied or even preceded by the first block faulting (the rift stage) occurred before sea floor spreading and the present phase of opening of the Gulf (the drifting stage). It is believed this early subsidence was related to the formation of the proto-Gulf of California in late Miocene (Moore and Buffington, 1968; Karig and Jensky, 1972; Moore, 1973; and Leg 63 GEOTIMES).

II. GUAYMAS BASIN SITES

Background and Objectives

The Guaymas Basin (Fig. 3) includes two short segments of spreading axis, separated by a short transform fault, and flanked by long transform faults. These long transform faults presumably separate the ocean crust crested during the present phase of opening of the Gulf from either continental crust or proto-Gulf.

Seismic refraction work by Phillips (1964) shows that the Guaymas Basin lies at the northern extreme of an apparently "normal" oceanic crustal section in the axis of the Gulf. North of this latitude layer 3 (vel. 6.5 km/s) thickens markedly. The extreme is in the northern end of the Gulf where a possible layer 3 lies at a depth of 10 km and mantle lies at 20 to 25 km.

Magnetics in this part of the Gulf cannot be resolved into recognizable oceanic anomalies.

The plate edge—spreading rift and transform system—has been thoroughly studied in the Guaymas Basin. Heat flows are irregular, but generally very high in rifts, in a background of moderately high heat flows from the adjacent basin floor. Values up to and over 1256.1 mW/m^2 (30 HFU) have been recorded in the southern rift. Hydrothermal activity and deposits were observed from a submersible dive along the NW wall of the northern rift (Lonsdale, 1978).

The Guaymas Basin is characterized as having a higher rate of sediment accumulation than the mouth of the Gulf, but considerably less than the extreme rates in the north where the Colorado River delta has apparently filled the structural Gulf to sea level. Study of a piston core from the Guaymas Basin (van Andel, 1964) gave a rate of 2700 m/m.y. No extrusive rocks have been dredged or observed during submersible dives from the rift valleys or basin floors of the Guaymas Basin, although it might be expected that some of the topographic mounds are volcanic. A model of sea floor spreading and crustal formation for this area and the areas of even higher rates of sedimentation to the N is that all volcanics are intruded into the young wet sediments in the rifts rather than being extruded as pillow basalt flows in an open oceanic spreading center (Moore, 1973).

In addition to high rates of accumulation of terrigenous matter, rate of production of biogenic material is also high. This organic matter, rapidly buried and not oxidized, and exposed to the high heat flow values in the basin produce hydrocarbons. One piston core from the north rift showed hydrocarbons as high as heptanes. For geochemists working on the time temperature effects on organic maturation indicators, this area offers an ideal end member combination of high heat flow and very young sediments and organic matter.

Specific objectives of the Guaymas Basin drilling include:

A. <u>Sediments</u>

1. Sedimentary facies and organic constituents.
2. Diagenesis and the effects of early very high heat flow and subsequent moderately high flow.
3. Hydrothermal effects and/or deposits.
4. Evidence for climatic, sea level, subsidence, or other environmental changes.
5. General mode of emplacement—How deep beneath the sea floor will sediments be found? Are they emplaced by lateral infilling within the rift as envisioned by the model and as suggested by the lack of continuity of stratification in the reflection records?

B. <u>Basement and Other Igneous Rocks</u>

1. Intrusions into the sediment column.
2. Depth of pure igneous "basement" as compared to acoustic basement in multi-channel and other seismic records.
3. Composition of intrusive basement and comparison with MORB, especially GCA-1.
4. Mode of emplacement of basement intrusives.
5. Effects of hydrothermal activity.

C. <u>Chronology</u>

Confirmation or denial of tectonic model and predicted age.

<u>Site 477 (GCA-12)</u>

Drilling at this site in the southern active rift of Guaymas Basin was not without technical difficulties and safety concerns for possible pollution problems, the latter eventually causing abandonment of the site. Nevertheless, it was a scientific success and most of the objectives were met. Several previously untested hypotheses were verified. For example, the emplacement of igneous intrusion within very rapidly deposited sediments of late Quaternary age was confirmed by the drilling. This also substantiated the concept that in newly formed basins flanked by large continental sediment supplies, upwelling of magma in response to rifting results in mixing of sediments and igneous intrusive bodies rather than extrusives onto the sea floor as pillow basalts. High heat flows measured at the sea floor and an hypothesis of conductive flow to account for the anomalies was also given added credance by the two downhole T measurements. These showed that the heat flow in the trough is primarily conductive and not an artifact of water convecting through sediments at shallow depths. The measurements also show that the high gradients extend well below the intrusive body penetrated by the drill. The fundamental assumption required of the sea floor spreading hypothesis, that sediments in the rift must be of an age related to the rift dimension spreading rate, was supported, although below an upper sill sediments are not fossiliferous.

The site was, as expected, characterized by exceptionally high heat flow which is responsible for the very young and unusual hydrothermal mineralogy and geochemical properties observed in cores. The effects of this heat flow on the organic constituents was particularly intense and related to the chronology of sill intrusion. Before emplacement of the sill, the lower sediments were subject to high thermal gradients as indicated by fluorescence, C and N contents, and absence of petrogenic gas which was probably removed by hydrothermal circulation. Later emplacement of the dolerite sill imposed a second thermal stress on the sediments above. This resulted in higher concentrations of biogenic hydrocarbon gas (C^1-C^1) below the sill only. The high proportion of CO_2 in the gas below the sill and a second increase in H_2S may also indicate that the C_1-C_4 hydrocarbons could be cracking products of petrogenic gas and liquids, but this is not supported by the puzzling absence of petroliferous odor. It appears that the gas below the sill is both endogenous and thermally derived from primary biogenic organic matter.

Three fundamental lithologic units were recognized (Fig. 5). The youngest (0-58 m) is the section of unaltered diatomaceous turbidites. A dolerite sill lies below (58-105.5 m in Site 477 and 32.5-62.5 m in Site 477A) these sediments and the third and oldest unit (105.5-267 m) comprises a section of altered and indurated diatomaceous turbidites. A high temperature hydrothermal assemblage of minerals found beneath the sill is the first of its kind found in deep sea drilling. This discovery is unique for its shallow (60-260 m), intense alteration of extremely young terrigenous turbidites, mixed with a pelagic rain of reactive opaline frustules, in temperatures presently exceeding 135°C at 260 m. Sediments above the sill remain pristine suggesting that the sill has formed in a closed, or restrictive system.

An expectable result of a combination of high sedimentation rate in a confined rift trough, subject to active intrusion of magmas and tensional faulting, is structural chaos. This expectation was confirmed by attempts at correlation of drilling results with seismic data. Extensive study of the many seismic reflection records taken over or in the vicinity of this site, together with velocity data from downhole logging, revealed no meaningful correlations.

Site 478 (GCA-25)

The section drilled at Site 478 was intended to include about 300 m of the presumed turbidites overlying acoustic basement and the upper part of the acoustic basement. In this way, it was hoped to compare lithologies and properties of the rifting phase to those of the post-rifting basin plain deposits. The site was located on the distal southern edge of a natural levee on the south side of a channel now partially filled and perhaps relict from turbidity current activity of late Pleistocene time.

Total penetration of the drill at this site was 464 m. The upper 342.5 m was predominantly a sedimentary section that we subdivided into three main sediment units (Fig. 5). The lower 121.5 m was a complex intrusion of basaltic to doleritic texture. Unit 1 (0-188 m) is composed of muddy diatomaceous ooze to diatom mud with episodic gray sandy turbidites. Unit 2 (188-260 m) comprises dolomitic sandstones, two dolerite sills with contact aureoles and diatomaceous mudstone. Unit 3 (260-342.5 m) is of uniform diatom mudstone and laminated diatom mud with dolomite overlying siltstone and basal contact zone to the basaltic intrusion below. All of these sequences are considered to be of moderate to very rapid deposition.

This extremely high rate of deposition makes it possible to detect non-steady conditions in the pore water chemistry at the sediments. Using a reasonable diffusion coefficient, one can calculate a mean diffusion length in sections of 30 m over a period of 100,000 years in these sediments. Thus, non-steady state inclinations in the profiles of dissolved calcium, alkalinity, ammonia, and phosphate are well established below about 50 m beneath the sea floor.

Comparison of this site 12 km out on the flank of the axis of rifting to Site 477 in the present rift reveals some rather strong contrasts, suggesting that drilling stopped short of penetration into a true Guaymas rift-type section. Physical properties measurements show that if contact zones with the dolerite sills are excluded, the sediments in Hole 478 are no more compacted than those of our more normal sections at Sites 474A through 476. The gradients of physical properties with depth are much lower than those measured in the southern Guaymas Basin Rift. Studies of the mineralogy of the sediments also suggest that the sediments recovered from Site 478 were warm, but never very hot. If our assumption that a high T regime existed at the time of zero age of the crust at this site is correct, then the existence of deeper sediments below the lowest thick sill drilled is required. Organic geochemistry also shows that the contacts of intrusive bodies we penetrated record that their high T influence was limited to the immediate contact proximity (a few cm). Lower temperature thermal gradients of the intrusive expelled petroliferous organic matter from the sediment, but left behind viable organic matter and the sediment between the intrusions was not completely pyrolized. Finally, the age of the sediments intruded by the igneous bodies was, by nannofossil assemblages and diatom extinction datum, about 260,000 years old; well short of the 400,000 year age required by extrapolation of the 3 cm/yr half rate of measured spreading. In summary, the age, the thermal history, and physical properties of the sediments penetrated all suggest the probability of an extensive sediment section below the lower igneous intrusion.

Tentative correlation of lithology with available seismic data is hampered by the lack of reliable velocity data. Nevertheless, it is relatively clear that the lower intrusion, drilled into 121 m without fully penetrating, can be equated to the "acoustic basement" of the 24 channel seismic record of the SIO site survey. If this correlation is correct it has important implications on the timing of intrusive events and genetic processes involved in developing the abnormally thick intermediate layer overlying layer 3 in the Guaymas Basin, and perhaps in similar sections of very young ages. Thermal histories of the intrusive units encountered demonstrate that the process of intrusion of magma into rapidly deposited sediments is not limited to a narrow zone corresponding to the average 3 km width of the present rift troughs. Similarly, the time of intrusion is not restricted to the first 50,000 years of rifting represented by the modern troughs, but apparently spans a much longer time of at least 140,000 years and possibly as much as 200,000 years.

Site 481 (GCA-30)

Drilling at Site 481 in the SW part of the northern rift of Guaymas Basin was a second attempt to drill into an active spreading rift. Our first attempt at Site 477 was located in a high heat flow zone of the southern rift where heat flow was believed to be largely conductive. Heat flow in the northern rift is very spotty and although high in places, it is generally lower than that of the southern rift and believed to be largely convective. Site 481 is located near where a submersible dive allowed observations of hydrothermal deposits on the rift flank above a fault scarp. The site has thus become known as the "hydrothermal site," although objectives were essentially the same as those for Site 477.

Seismic reflection studies show that this site, like that in the S rift, is characterized by a general lack of coherent reflections in the rift and general difficulty in correlating lithologic with seismic. The rift flow changes from flat ponded sediments to very irregular hummocky topography in a distance of less than a kilometer.

Two holes were drilled at this site. Hole 481P is a series of 11 HPC samples from 0-52 m. These were recovered to allow detailed studies of early changes in physical properties and chemistry in the shallow section. Hole 481A was washed to 42 m and then continuously cored to 384 m. Recovery was 56% through Core 30 at 327 m. Below 327 m to total depth the alternating thin sills and baked sediments reduced recovery to one meter. The hole was finally stopped by a clogged bit and float valve in these rocks at 384 m.

One sediment unit comprising two types of turbidites (type 1 and type 2), mass flows, laminated sediments, and "host" or "background" sediments was defined. In addition, four complexes of sills and/or flows were recovered. The sediment types within the one unit alternate with depth. The subdivision between turbidite type 1 and 2 is based primarily on relative amounts of biogenic versus terrigenous components. Type 1 turbidites have fewer terrigenous components, are mainly hemipelagic; upward grading from sand or silt is a result of differential settling velocities. Type 2 turbidites appear to have a more distant source, grading is less pronounced, generally no basalt sands are present, and shallow water components are evident. Turbidites of type 2 have less water, higher bulk density and sonic velocity, and somewhat lower shear strength than do type 1 turbidites or mass flows. Three mass flows were recovered at 33.8 to 34.5 m, 268-279 m, and 289 to 317 m. No grading or basal sands are observed in these and convolute bedding is present. They are composed mainly of terrigenous material with some clasts. Laminated sediments were first encountered at 241 m; they increase in frequency with depth and are intercalated between turbidite and mass flows. Most are diatomaceous ooze and mudstone.

Moderate to well-preserved siliceous and calcareous microfossils are present through the section cored, but radiolarians and foraminifers are common only in the upper 150 m. The planktonic foraminifers indicate that a warmer pelagic environment has prevailed during the upper 40 m of deposition. Oldest sediments cored have a mixture of calcareous nannofossils of Zones NN-21/20. The sediments are above the Nitzschia fossilis diatom extinction level dated to occur about 0.26 m.y. in the Pacific. No depositional rates were calculated as no fossil boundaries were crossed, but the rate is presumed to be very high (greater than 1000 m/m.y.) and all deposition is within latest Quaternary. These very high sedimentation rates have resulted in very high values of alkalinity and ammonia in interstitial waters, with consequent complex distributions of dissolved Mg.

Four distinct igneous bodies were sampled at Hole 481A. Forty-six percent of Unit 1 was recovered. It consisted of 18 individual intrusive units between 0.23 and 2.25 m thick. Sediment intercalations were common. Units 2 through 4 were drilled with great difficulty and only about 1 to 5% recovery. These rock units are all similar vesicular basalt and are separated by sediment sequences. They are believed to be thin extrusive basalt flows or intrusives from a gas or water-rich magma.

Contact zones between sediment and igneous sills and/or flows are represented by several pieces of strongly baked sediments intercalated between the igneous Units 1 and 2. Contacts were not parallel to bedding and two have contorted sediments in the vicinity of the contact. These observations suggest that the sills intruded into cold and rather soft sediments unlike those of Site 478. One true contact was recovered above igneous Unit 1 and 169.7 m. The altered zone shows the following features:

1. Induration increases abruptly at 41 m above the sill as shown in the density log and measured physical properties;

2. Colors change to olive-black to brownish-black as a result of baking of organic matter;

3. Clays become strongly fissile;

4. Sand layers may be cemented by silica; and

5. Dissolution of diatom frustules starts at about 38 m above the sill. All diatoms are dissolved at 20 m above the sill.

Released silica formed cement and authigenic quartz crystals. Large increases in dissolved chloride are also observed. These are presumably a result of intensive hydration of the sills during alteration to zeolites and/or smectites. The dissolution of calcareous nannofossils is observed in a 7 m thick zone above the sill indicating that solutions involved in sediment alterations were not acidic as in convective hydrothermal systems at ridge crests, but were probably heated pore waters. Sands, the most porous sediments, were most strongly affected by these pore water hydrothermal fluids and probably acted as conduits through which the solutions flowed to escape.

Organic geochemical parameters preserve the temperature history of the sill intrusions and allow some reconstruction of geologic history. The upper sill was intruded while 60 m less sediment was present than now exists based on upper limit of expulsion of petroliferous material. Subsequent deposition of immature sediment was continued. Based on C_2-C_5 hydrocarbon content, this sill intrusion may have happened in three pulses. A minor sill at 335-340 m also intruded into sediments distilling petroliferous material upward. High T influence of the sills was limited to thir immediate proximity (about 10 m for the upper sill and 5 m for the lower). Lower T influences did not expel all petroliferous material from between the sills and some viable carbon remains. The gases of sediment section sampled consist predominantly of biogenic CH_4, CO_2, and H_2S with traces of C_2H_6. In the zone between the sills a large thermogenic component is superimposed on the biogenic.

II. VARVED DIATOMITE SITES

Background and Objectives

The Guaymas Basin is an area which has high organic productivity with strong diatom blooms generally extending somewhat randomly throughout the year, although there is apparently some tendency for increased numbers of the blooms on the mainland side in the winter and spring with northwesterly winds. The basin also received a large input of terrigenous sediment from major rivers on the mainland flank, especially the Yaqui. Rains are highly seasonal, concentrated during most years in July, August, and September, although rarely the area receives some of the winter rains in December and January, typical of southern California. The result of these two seasonally influenced sources of sediment is the position of alternating laminae of diatom-rich layers and terrigenous-rich layers into laminae or varve pairs.

The other environmental factor contributing to the formation of these laminated sequences is preferential preservation in the strong oxygen minimum between about 300 and 1400 m. Essentially the same seasonal sediment supplies are delivered to the slopes and to the basin floors, with the exception of additional turbidite supply to the basin floors, especially during times of lowered sea level. Benthic organisms destroy the laminations above and below the oxygen minimum but not within it.

Detailed sampling and study of these laminated sequences of sediment therefore offers the possibility of gaining information and insight into varying environmental conditions such as climatic changes and cycles and changes in circulation patterns, depth of oxygen minimum, sea level, and floral and faunal assemblages. Sampling of a sufficient thickness of a laminated sequence will furthermore make some study of diagenetic changes and lithification possible.

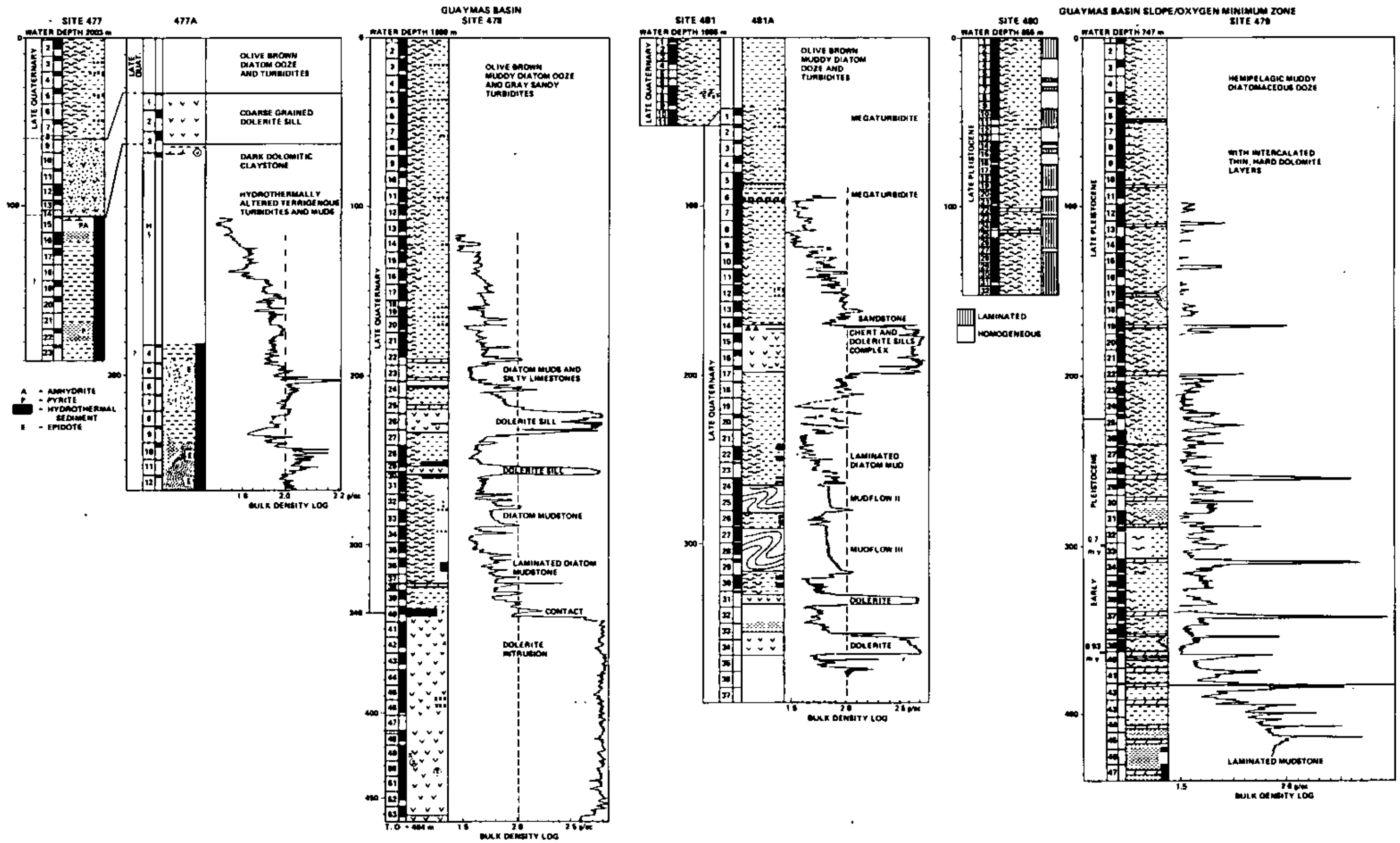

FIGURE 5
Core Lithologies from Guaymas Basin Sites

A secondary objective of this pair of sites was to attempt to gain structural information bearing on the history and origin of the proto-Gulf in the central Gulf region. Moore and Buffington (1968) and Moore (1973) first pointed out that the Gulf is not closed in a reconstruction by taking out the sea floor apparently formed during the past 4 m.y. A marine basin of moderate water depth prior to that time is indicated by such a geometric reconstruction, by evidence from surrounding land geology and well information, and by structure and dredge samples from escarpments along the margins of the new basins. An excellent example of such a presumed proto-Gulf remnant lies along the mainland side of the Guaymas Basin.

Sites 479 and 480 (GCA-29 and 27)

Site 479 lies on a marginal plateau, above the escarpment of the transform fault bounding the NE on Guaymas Basin (Fig. 3). This plateau is presumed to overlie proto-Gulf sediments and basement. Part of the sediment section could be penetrated, although drilling was restricted to the thickest part of the section in the axis of a syncline, and basement could not be reached. This site, and Site 480, lie in the oxygen minimum where piston cores had previously recovered laminated (varved?) diatomaceous sediments.

Only Quaternary sediments were recovered in these two holes, and despite great difference in degree of disturbance, it was concluded that the upper 152 m is duplicated in the two holes. Sand, limestone, and ash layers appeared correlative. The column is divided into three units which do not differ greatly in lithologies (Fig. 5). The first unit (0-250 m) consists of rythmically alternating laminae or varves of muddy diatomaceous ooze, with sparse layers of calcareous diatomaceous mudstone and sands. The second unit consists of the same muddy diatomaceous ooze varves, but with more frequent layers of calcareous mudstone. The third unit (355-440 m) consists of diatomaceous silty claystone to claystone with frequent interlayers of calcareous diatomaceous mudstone. The three units are very similar, differing mainly in the proportion of calcareous mudstone layers and in the relative abundance of diatoms, probably a function of diagenesis and consolidation. These sediments are mainly hemipelagic slope deposits, although a minor portion of turbidites is also present.

These units can be correlated with the seismic reflection survey of the region of the two sites. The seismic section displays several reflecting horizons, some of which represent either erosional or onlap unconformities that can be related to the section recovered by drilling. Significant changes in geochemical and physical properties also occur across these unit boundaries. The C_2/C_1 ratio increases sharply at the 250 m level and decreases at approximately 355 m. Propane and iso-butane reach maxima at about this latter level but iso-pentane continues to increase below that depth. These data indicate that at greater depth the higher weight hydrocarbons (greater than C_5) would be encountered and that the C_3-C_5 hydrocarbons had diffused or distilled upward from below. These and further anticipated increases led us to our decision to terminate Hole 479 at 440 m. Heat flow measured in Hole 479 was 97.7 mW/m^2 (2.36 HFU).

The high sedimentation rates of organic carbon-rich and siliceous sediments lead to high alkalinities and the highest ammonia concentrations (27 mM) recorded to date, the latter peaking at bout 250 m. Decrease in dissolved Mg concentrations suggest uptake into carbonate sediments and dolomitization of nannofossil carbonates at 70 m, and dolomites occur below this depth. Dissolved silica increases with depth to about 360 m and decreases rapidly below this depth, correlating with disappearance of diatoms and increasing silicification of the sediments.

Sediments from these holes have unusually high water contents (about 80% near the sea floor), and porosities (about 90%) and low bulk densities (1.1 g/cm^3). These change rapidly with depth and level out between about 80 and 350 m. Varved sediments at 350 m still have water contents and porosities of 55 to 60% and 70 to 80%, respectively. From 340 to 380 m, the depth range of an important unconformity, there is a zone of even higher water content and porosity and lower bulk density, but below this level they decrease and increase more rapidly as expected.

Hole 480 was the first field test of the newly-developed Serocki-Storms-Cameron hydraulic piston corer. This test was an unqualified technical and scientific success. Recovery for the 152 m section averaged 80%, although it was generally about 90%, with zero or near zero recovery in a few sections now believed to be sands. The result was recovery of a unique set of almost undisturbed cores of the laminated (varved?) diatomaceous sediments previously sampled here in the oxygen minimum only in the upper few m by normal gravity and piston cores.

Origin of these varves had been previously debated in the literature, and the debate has continued aboard GLOMAR CHALLENGER, this time based on a much longer record, although with only minimal study because of our self-imposed restrictions on sampling.

Two principal environmental controls have been responsible for formation and preservation of the laminations, which are believed most probably to be varves or annual laminae couples. First is a seasonal fluctuation in type of sediment deposited, and second is the oxygen minimum which limits the number of burrowing organisms.

The laminae couples or groups are a dark laminae containing generally more than 60% clay and less than 20% diatoms, and a light colored laminae which is greater than 60% diatoms. One seasonal influence is rainfall, concentrated in the drainage areas for this part of the Gulf in July, August, and September, with a minor mode in November and December. The second seasonal influence is the wind system, which controls upwelling, one of the major controls over diatom and silicoflagellate blooms. Upwelling and blooms on this NE side of the Gulf should occur with the prevailing northwesterly winds from about November through April. At first examination, these influences would appear to be in phase to produce the observed laminae pairs: the dark layers during the rainy season and the light layers during the upwelling-bloom season. This case occurs in many couples. Detailed observations of the flora from other couples, however, appear to contradict this simple explanation, because the species believed to be characteristic of blooms occur predominantly in the dark layers, and the light colored layers are commonly almost mono-specific of oceanic forms. Origin of the varves remains an open question awaiting more detailed studies.

Sequences of varves alternate with homogeneous sections of the cores. It is assumed that these homogeneous sections may represent bioturbated zones from times when the oxygen minimum did not impinge on the sea floor, but a final interpretation must await shore-based studies with x-radiographs of the cores. A possible explanation is that the periods of migration or destruction of the oxygen minimum coincide with glacial low stands of sea level, and correlate with global climatic curves. Two different possible chronologies were estimated of the varved and homogeneous sections based on different assumptions. Direct varve counts appear to give higher rates of sediment accumulation than paleontological zonation boundaries, but either chronology can be forced to fit curves from plots of glacial versus interglacial stages, sea level fluctuation, and oxygen isotope curves. Several possibilities occur to us as explanations for the difference between the two chronologies. The "varves" may not represent a strictly annual cycle. For instance, we may not be able to differentiate the very fine laminae deposited during periods of drought. A second possibility is that the homogeneous sections might represent periods of much slower rate of sediment accumulation. If these are periods of lowered sea level, it might be expected that they represent higher sedimentation rates. A third possibility is that significant amounts of section are missing at some of the unconformities distinguished in the seismic reflection records.

The unconformities in the seismic records are related to uplift associated with the transform fault. Some of them show onlap relations of the overlying strata only, while a few of them show truncation and erosion of a part of the underlying section. It cannot be estimated how much removal of section might have occurred, but it is judged that it could not have been very much because neither site is located on the uplifted flank of the syncline above the fault.

Two of the objectives of these sites were accomplished, namely sampling of the varved sediments and dating the folding and uplift. The important objective of learning about the nature and history of the proto-Gulf could not have been accomplished at this site without much deeper penetration into the sediment section than safety would permit.

SUMMARY OF PHYSICAL PROPERTY MEASUREMENTS ON LEG 64

At all holes of Leg 64, including the piston coring, physical properties were measured. They comprised the determination of about 340 water contents, 340 porosities, and 365 bulk densities. Furthermore, 100 special cylinder samples were taken for additional water contents, porosities, and bulk densities as well as for shrinkage at 110°C (as an indicator of early diagenesis), which has not been determined on previous legs. About 110 measurements of vane shear strength have been carried out, part of them with high-capacity, hand-operated vane testers.

About 70 measurements of sonic velocity with the Hamilton Frame on soft sediments or mudstone, as well as about 70 measurements on hard rock samples, yielded results, but many measurements on sediments containing gas were in vain.

The well-preserved cores offered an opportunity to compare physical property measurements on these cores with those of the standard drilling method. In general, the results appear to agree fairly well. Similarly, the results of laboratory density measurements in most cases are in good agreement with those by GRAPE if the cores are well preserved and in situ measurements by logging. Serious problems for the measurement of sound velocity, both in situ and in the laboratory, arose from sediments rich in gas.

The physical property data, as yet only partly established, rendered information to the following problems:

1. General trends of physical property change versus depth in highly porous Pliocene to Quaternary sediments, mainly rich in diatoms. A distinct relationship between the compostion of the sediment, depth range, and physical properties was established. Diatomaceous varves and mud turbidites deviate considerably from the average values.

2. The physical property data were useful for the interpretation of seismic records and the recognition of unconformities (at Sites 476 and 479).

3. At four holes, where basaltic sills were encountered at different depths, physical properties of the neighboring sediments were found to be strongly affected by the magmatic intrusions. This observation led to the hypothesis that the intruding magma expells about the same amount of pore water as necessary for the emplacement of the sill without uplifting the overlying sediments. The expelled pore water initiates hydrothermal activity and delivers most of the material to be found as precipitates at the sea bottom.

SUMMARY OF INTERSTITIAL WATER CHEMISTRY ON LEG 64

Analyses for alkalinity, dissolved calcium, magnesium, ammonia, phosphate, and silica were carried out on a total of 153 samples on a total of 7 sites. This sampling density was required, especially because of the high sedimentation rates in the Gulf with their consequent complex patterns in interstitial water chemistry. Generally very high values of alkalinity and dissolved ammonia were observed, especially in the upper sections of the sediment columns. Typically this resulted in decreases in dissolved calcium (carbonate precipitation) and complex distributions of dissolved magnesium as a result of ion exchange processes with ammonia.

Influence of igneous rocks was observed in most sites, with resultant decreases in magnesium and increases in calcium, with the exception of Site 476, where magnesium appears to emanate from granitic basement.

Hydrothermal activity in Site 477 is reflected in a large increase in dissolved chloride with depth (14%), with the concentration depth profile implying an upward advective influence. This would be consistent with steam formation in the underlying sediments and the consequent concentration of dissolved solutes.

In Site 481 a recent basaltic sill intrusion has resulted in large increases in dissolved chloride near the sill, presumably as a result of intensive hydration of the sill during alteration.

In the rapidly deposited sites of the Guaymas Basin area, minima in dissolved chloride may indicate changes in sea water salinity during the last 200,000-300,000 years, but this needs further verification from other dissolved constituents.

SITE REPORTS

Leg 64

Co-Chief Scientists J. Curray and D. Moore report:

Sites:	479 (GCA-29)	Lat:	27°50.76'N
		Long:	111°37.49'W
		Water Depth:	747 m
	480 (GCA-27)	Lat:	27°54.10'N
		Long:	111°39.34'W
		Water Depth:	655 m

Paired Sites 479 and 480 lie on the NW continental slope of the Guaymas Basin within the oxygen minimum zone and over the presumed proto-Gulf of California sediments and crust. Site 480 is 7 km NW of Site 479.

Site 479 was located, by a predrilling survey, in the axis of a syncline above the scarp of a transform fault. The drilled section outcrops at sea floor. The objectives were to sample proto-Gulf sediments and date unconformities and folding.

It was cored to 440 m, all in Quaternary sediments, with 62% recovery. The lithology is all muddy diatomaceous ooze with alternating sequences of varves and homogeneous, probably bioturbated zones. Three lithologic units were distinguished largely on the basis of diagenesis and degree of consolidation. These correlate with sections between unconformities in the seismic reflection records. It was concluded that all uplift and folding within the past 1 Ma is related to the transform fault. Drilling was terminated at 440 m because of gas pressure, an increasing ethane/methane ratio, and an increase of hydrocarbons in gasoline range. Heat flow showed 93.81 mW/m^2 (2.36 hfu).

The Site 480 objective was to test the DSDP Serocki-Storms hydraulic piston corer and to sample the upper part of the varved sequence. The piston corer was an unqualified success with a total of 152 m penetration, an ave. 80% recovery and about 90% recovery for most of the section. Core disturbance was minimal and the varved sequence recovered is believed to be potentially so valuable for studies of paleoclimatology that shipboard scientists refrained from sampling in order to preserve cores for shore-based varve studies requiring intact working halves of cores.

Site:	481 (GCA-30)	Lat:	27°15.18'N
		Long:	111°30.46'W
		Water Depth:	1,998 m

Site 481 lies near the SW end of the north spreading rift of the Guaymas Basin where hydrothermal deposits were observed from a submersible. Hole 481 was drilled with DSDP Serocki-Storms piston corer to 52.25 m. Hole 481A was drilled with standard coring equipment at the same location and water depth to 384 m with 40% overall recovery, and about 33% in igneous rocks. One sediment unit was defined with four alternating lithologies; two types of turbidites, mass flows, and laminated sediments. Four sills or sill groups, basalt to dolerite to gabbro in texture, occur below 169 m. The hole was terminated at 384 m in basalt because of a clogged bit. All were penetrated so accumulation rates could not be calculated, but were judged to exceed 1,000 m/Ma. Heat flow is about 334.96 mW/m^2 (8 hfu). Low levels of thermogenic hydrocarbons up to heptanes were recovered. Some of the highest alkalinites in pore water in DSDP history were also found. Less hydrothermal mineral alteration was found than in Site 477.

Leg 65

Co-Chief Scientists P. Robinson and B. Lewis report:

Site:	482 (GCA-1)	Lat:	22°47.38'N
		Long:	107°59.60'W
		Water Depth:	2,998 m

Site 482 is located in a sediment filled valley about 12 km from the rise axis with an expected age of 0.5 Ma, a site surveyed heat flow of 502.44 mW/m^2 (12 hfu) and a predicted sediment thickness of 144 m. Two single bit holes into basement were completed. Hole 482B penetrated 137 m of sediment and 47 m of basalt. Hole 482C was logged and the H.I.G. seismometer was successfully deployed in this hole. Downhole temperature measurements at 60, 80, and 120 m in the sediments give a gradient of 67°C/100 m and an inferred basement temperature of about 90°C in excellent agreement with the surface heat flow measurement. The sedimentary section at this site consists of hemipelagic silty clay with a few occurrences of fine-grained turbidites, all of late Quaternary age. In Hole 482B, the lower 3.5 m of sediment overlying basalts are indurated. Thin (18-60 cm) indurated silty clays occur between basalts at 193 and 224.5 m subbottom. In Hole 482C, a one-meter thick zone of dolomite was found just above the basalt which appears to be the result of hydrothermal diagenesis of the sediment.

The basalts are massive and generally fresh with smectite and sulfide-filled cracks. Cooling units can be correlated between Holes 482B and 482C, both petrologically and magnetically. Although the basalts are generally fresh, there is a suggestion of an increasing grade of hydrotherm...

alteration going from Hole 482B to Hole 482C as evidenced by the appearance of actinolite, chlorite, and possibly epidote group minerals near the top of Hole 482C. Basalt core recovery in these holes averaged about 55%. The average inclination of the remanent magnetization of the basalts in Hole 482B is 38.9°C, which is within a few tenths of a degree of the predicted dipole value for this site. No reversely magnetized samples have been found. Shipboard basalt wave velocities average 5.6 km/s. It is tentatively infered that the identification of shear waves and the relatively high P velocity observed in the site survey is consistent with the massive nature of the basalts. A re-entry hole (482D) was attempted 100 m east of Hole 482C. The cone and casing wouldn't jet in. The hole was abandoned when the cone tipped over during a second reentry attempt.

Site: 483 (GCA-3) Lat: 22°52.99'N
Long: 108°44.84'W
Water Depth: 3,094 m

Re-entry hole 483B was drilled to a subbottom depth of 257 m; 157 m was in basement, with a 48% recovery. Only 19 m of sediment were cored above basement consisting mostly of hemipelagic claystones. The upper 40 m of basement consists of interlayered massive basalts, interpreted as flows, and interbedded hemipelagic sediments. These basalts are medium- to coarse-grained, aphyric, and chemically primitive. The lower 117 m of basement consists of interlayered pillowed and massive basalts with minor sediment intercalations. These basalts are commonly porphyritic and more fractionated than those above. The alteration of the basalts is weak to moderate and mostly low T. There is one small patch of higher T alteration. There was no paleomagnetic data for this hole. Basement physical properties are similar to those of Site 482 with an average compressional wave velocity of 5.9 km/s. Drilling conditions in Hole 483B were good to excellent and recovery was good. The hole was abandoned after the bit and bit sub broke off and jammed in top of casing.

Site: 484 (GCA-11) Lat: 23°11.32'N
Long: 108°23.62'W
Water Depth: 2,906 m

Site 484 is located on a small highly magnetic diapir in the Tamayo Fracture Zone. Hole 484A was drilled in a sediment pond perched on the top of the diapir. 60 m of sediment were drilled above basement, consisting mostly of hemipelagic clays with a zone of sandy and silty clay of probable turbidite origin at the top. Basement was very hard to drill because of the low weight on the bit. The hole was abandoned when the ship's positioning system failed and the outer core barrel unscrewed.

Site: 485 Lat: 22°44.95'N
Long: 107°54.21'W
Water Depth: 2,996.5 m

Site 485 was located in a sediment-filled pond about 20 km east of the rise axis with a magnetic basement age of about 0.8 Ma. Hole 485 penetrated 50.5 m of hemipelagic clay before being terminated because of a bent heat flow probe.

Hole 485A penetrated 331 m sub bottom, 177.5 m into basement. The sedimentary section consists of hemipelagic silty clay with some silty clay and sandy silts in the lower part. All sediments are Quatenary but the age immediately above basement was not determined.

The basement consists of interlayered massive basalts and sediment. Some basalt layers have probable intrusive contacts and very coarse-grained textures. Most basalts show low T alteration. Coarse "gabbroic" units show deuteric alteration. Basalt compositions are similar to those at Sites 482 and 483.

Sediment physical properties vary monotonically from the mudline to the top of basement. The wet bulk density varies from 1.4 to 2.1 g/cc, compressional wave velocity from 1.5 to 2.2 km/s and porosity from 75% to 42% with the higher densities and velocities and lower porosities from sediments within basement. Basalt physical properties vary with degree of alteration. Wet bulk density varies from 2.80 to 3.02 g/cc, compressional wave velocity from 5.0 to 6.2 km/s and porosity from 1% to 8%.

Natural gamma, density, variable density, gamma neutron, differential temperature, guard, sonic and caliper logs were carried out in Hole 485A. An oblique seismic experimnt was conducted using a downhole seismometer and a separate shooting ship, the KANA KEOKI.

Leg 66

Co-chief scientists C. Moore and J. Watkins report:

Site: 486 (M-1b) Lat: 15°55.37'N
Long: 99°08.1'W
Water Depth: 5,157 m

Site 486 was located in the axis of the Middle America Trench about 190 km southeast of Acapulco, Mexico. Two holes were drilled, Hole 486 in 5157 m water depth and Hole 486A in 5152 m water depth offset 1 km to the SW. Hole 486 was abandoned after penetrating 38 m with a recovery of 12.5 m of quartzose sand, silt and mud of middle and upper Pleistocene age. Hole 486A was abandoned after penetrating 22 m with a recovery of 3.5 m of similar lithologies including 0.2 m of coarse sand. Graded bedding, mud clasts and vertical alteration of sands and silts suggest turbidite deposition. The cores were too distributed to show fine structures. One mud clast of late Miocene age is thought to be a rip-up clast. The cored sands represent the coarsest material ever recovered from a trench floor by the GLOMAR CHALLENGER. The site was abandoned due to drilling difficulties in sandy sediments.

Site: 487 (M-2a)	Lat:	15°51.21'N
	Long:	99°10.52'W
	Water Depth:	4,777 m

Hole 487 (M-2a, oceanic crust reference hole), was drilled and recovered 2 m of basalt after penetrating 171 m of sediments ranging in age from Pleistocene to late Miocene. Total penetration depth was 181 m. The sedimentary units are as follows: Unit 1, 115 m of green to gray mud deposited at 135 m/m.y. in the upper part decreasing to 9.2 m/m.y. near the base of the unit. A high content of quartz, feldspar and displaced faunas indicate derivation from the Mexican continental margin, possibly as distal, dilute density currents. Plate reconstruction suggests the green-gray mud may have begun to accumulate within 100 km of the continental margin. Unit 2, 55 m of upper Miocene-Pliocene brown pelagic clay deposited at 3.1 m/m.y. in the upper part and 30.7 m/m.y. in the lower part. The lower part was probably deposited near the ridge axis while the upper part was deposited on the flanks of the East Pacific Rise. The brown pelagic clay units probably accumulated below the CCD. Magnetic anomalies and present-day convergence rates suggest deposition at distances of 100-500 km from the trench axis.

Site: 488 (M-3a)	Lat:	15°57.10'N
	Long:	99°01.66'W
	Water Depth:	1,171 m

Site 488 was drilled at the toe of the accretionary wedge on the crest of the first ridge landward of Middle America Trench. The hole penetrated 428 m and recovered 46 cores comprising two lithologic units. Unit 1 consists of 313 m of lower-middle to upper Quaternary muddy silt and mud with local thin silt and sand beds in the lower portion. Unit 2 extends from 313 to 428 m and is composed of lower-middle Quaternary sands, pebbly sands, and mudstone. Although recovery was poor, drilling rates suggest sand bed thicknesses ranging from 8 m at the top of the thickening-upward sequence in Unit 2. We interpret Unit 1 as slope sediments that accumulated during the uplift and deformation of the trench deposits that comprise Unit 2. The lower portion of the slope deposits (Unit 1) are moderately deformed with dipping beds and zones of stratal discontinuity. Dips of 40° to 50° are common in Unit 2. Paleomagnetically oriented cores in Unit 2 indicate the bedding dips northeastward as do the reflectors on the UTMSI multichannel profiles through the site. A density anomaly in the zone of complex deformation at 240 m suggests thrust faulting but associated stratigraphic and seismic evidence is ambiguous.

Site: 489 (M-4c)	Lat:	16°16.19'N
	Long:	99°01.13'W
	Water Depth:	1268.5 m

Hole 489A penetrated 302 m of lower Miocene and Quarternary sediments and bottomed at 327 m in schistose and gneissic continental basement of probable pre-Tertiary age. The sediments consisted of 7 m of Quaternary muddy silt, 77 m of lower Miocene muddy silt grading into muddy siltstone near its base, 28 m of lower Miocene mudstone, and 188 m of lower Miocene muddy siltstone. The base of the section contained calcareous sandstone, bivalves, corals, muddy siltstone, and a sandy micritic limestone layer. The data suggests that the sea transgressed outcropping gneissic and schistose basement in early Miocene as the continental margin began to subside. Subsidence continued during the remainder of the early Miocene with Site 489 passing through the CCD in late-early Miocene. A variable amount of subsidence in the early Miocene is inferred depending upon the local depth of the CCD. Induration of early Miocene sediment suggests that they were, at one time, buried much deeper than at present, being uplifted and eroded, possibly subaerially, during the middle to late Miocene and Pliocene hiatus.

Site: 490 (M-4a)	Lat:	16°09.56'N
	Long:	99°03.34'W
	Water Depth:	1777 m

Hole 490 penetrated 588.5 m before bottoming in muddy siltstone of late Miocene age. The cores included 142 m of Quaternary mud, 256 m of horizontally bedded(?) Pliocene-upper Pliocene muddy siltstone, and 190 m of uppr Miocene(?)-Pliocene fractured muddy siltstone with inclined bedding. Slickensided faults in the lowermost unit indicated dip slip movement. The lowermost sediments were deposited below the CCD. The site rose through the CCD in Pliocene and Quaternary time. Sediments in Hole 490 probably belong to the transition zone between continental crust drilled at Site 489 and the accretionary wedge drilled at sites seaward of Site 490. The site was probably uplited by underplating after the onset of subduction. Paleomagnetic restorations suggest that small-scale normal faults strike perpendicularly to the trench axis. This faulting was probably caused by differential uplift of adjacent blocks of continental basement.

SHIPBOARD SCIENTIFIC STAFFING

Leg 66

C. Moore	Co-Chief Scientists	USA	Univ. of CA—Santa Cruz
J. Watkins		USA	Gulf R & D Co.
T. Shipley	Staff Scientist/ Geophysicist	USA	Deep Sea Drilling Proj.
N. Lundberg	Sedimentologist	USA	Univ. of CA—Santa Cruz
N. Niitsuma	Sedimentologist/ Paleomagnetist	Japan	Shizuoka University
G. Moore	Sedimentologist	USA	Scripps Inst. of Ocean.
J. Stephan	Sedimentologist	France	Univ. Pierre et Marie Curie
K. McMillen	Paleontologist (radiolaria)	USA	University of Texas
A. Butt	Paleontologist (foraminifera)	FRG	Universitat Tubingen
H. Stradner	Paleontologist (nannofossil)	Austria	Geol. Bundesanstalt
B. Didyk	Organic Geochemist	Chile	Empresa Nacional del Petroleo
J. Leggett	Phy. Prop. Spec./ Sedimentologist	U.K.	Imperial College of Sci. and Tech.
L. Shephard	Phy. Prop. Spec.	USA	Texas A&M Univ.
F. Beghtel	Petroleum Geologist	USA	Phillips Petro. Co.

Leg 67

R. Von Huene	Co-Chief Scientists	USA	U.S. Geological Survey
J. Aubouin		France	University Pierre et Marie Curie
W. Coulbourn	Staff Scientist/ Sedimentologist	USA	S.I.O.
J. Azema	Sedimentologist	France	University Pierre et Marie Curie
R. Hesse	Sedimentologist	FRG	Technische Universitat
T. Shiki	Sedimentologist	Japan	Kyoto University
S. Cowan	Igneous Petrologist	USA	Univ. of Washington
W. Harrison	Organic Geochemist	USA	Univ. of Oklahoma
J. Curiale	Organic Geochemist	USA	Univ. of Oklahoma
R. Faas	Phy. Prop. Spec.	USA	Lafayette College
C. Dengo	Phy. Prop. Spec./ Sedimentologist	USA	Texas A&M Univ.
J. Ladd	Paleomagnetist	USA	Univ. of Texas
J. Westberg	Paleontologist (Radiolaria)	USA	S.I.O.
N. Muzilev	Paleontologist (Nannoplankton)	U.S.S.R.	Geological Inst.
P. Thompson	Paleontologist (Foraminifera)	USA	LDGO

Leg 68

J. Cann	Co-Chief Scientist	U.K.	The University—Newcastle-upon-Tyne
M. Langseth	Co-Chief Scientist	USA	Lamont-Doherty Geo. Obs.

Leg 69

D. Cronan	Co-Chief Scientist	U.K.	Royal School of Mines
R. von Herzen	Co-Chief Scientist	USA	Woods Hole Ocean. Inst.

REPORT FROM IPOD SITE SURVEY MANAGEMENT

DATA BANK

The following data have been received:

I. MID-AMERICA TRENCH-GUATEMALA AREA—From J. Ladd, University of Texas Marine Science Institute

A. 21 multi-channel seismic profiles (sepia ozalids) of lines off Guatemala; Data Bank #s 816 and 831.

B. Contoured bathymetry, large-scale paper ozalid; Data Bank #817.

C. Contoured magnetics, large-scale paper ozalid; Data Bank #817.

D. CDP tracks, IDA GREEN 24, page size; Data Bank #818.

E. Track chart, IDA GREEN 29, page size; Data Bank #819.

F. Navigation, IDA GREEN 24 and 29 with refraction lines and stations, page size; Data Bank #820.

G. Data sheets for Leg 67 data package.

H. Computer tape of navigation of IDA GREEN 24-3 and 24-4.

II. MID-AMERICA TRENCH-MEXICO AREA—From T. Shipley, University of Texas Marine Science Institute

A. Computer tape of navigation, magnetics and bathymetry for IDA GREEN 29-2 and 2903.

B. Data sheets and other material for Leg 66 safety package.

III. EMPEROR SEAMOUNT AREA—From T. Chase, U.S.G.S.

A. Navigation plots plus microfilm of bathymetry, uniboom, sonobuoy, etc. of LEE 8-76.

IV. EAST ATLANTIC OFF NORTHWEST AFRICA (Short-site proposals)—From M. Sarnthein, University of Kiel

V. Preliminary Science Report for CONRAD 21, Leg 17—comments on heat flow, seismics, OBS, sonobuoy, impact on DSDP drilling plans, etc. from M. Langseth, Lamont-Doherty.

VI. "A Geophysical Atlas of the East and Southeast Asian Seas," a series of 7 maps—SEATAR, from D. Hayes, Lamont-Doherty; Data Bank #832.

VII. Data collected aboard R/V THOMAS B. DAVIE (University of Cape Town) for site survey on Walvis Ridge from P. Rabinowitz. It has been deposited at the IPOD Data Bank for processing, archiving and dissemination.

VIII. Thesis work done at AT-8 by Douglas Varchol of Penn. State (soon to be a Technical Report from RSMAS) from M. Ball, U.S.G.S. (Woods Hole).

IX. Position. of Atlantic site MAU 5 indicated on Vema 32, Leg 5 track chart and profiler record from M. Sarnthein, University of Kiel, Germany.

SITE SURVEYS

P. Rabinowitz completed site survey work aboard University of Capetown research vessel THOMAS B. DAVIE, on Walvis Ridge for South East Atlantic drilling in March. Six drill sites were surveyed: SA 1-6.

UTMSI, R/V IDA GREEN is doing site survey work in the South East Atlantic.

OTHER INFORMATION

Computerized track charts have been prepared of all United States site surveys for inclusion in the IPOD Data Bank Catalogue Book and JOIDES Panel distribution.

The EXCOM approved the preparation of the IPOD Site Survey Books.

A special volume of "Marine Geology" which will focus on site surveys in different parts of the world is being edited by P. Rabinowitz of Lamont Dohery and B. Lewis of the Univ. of Washington. Manuscripts for this volume are now in the process of being reviewed.

IPOD AVAILABLE DATA*

Introduction

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

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

Physical Properties and Other Quantitative Core Data

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

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

Aids to Research

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

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

A computer-generated Keyword Index has been developed to retrieve information relating to current research on core material after an initial shipboard description has been prepared. The Index aids in planning future investigations by enabling scientists to know what studies are currently in progress, and will help in preventing duplication of research. The data base is constructed from the sample request and bibliography files of DSDP, and is updated every six months. (Index requests should be addressed to Trudy Wood**, and requests for core samples should be addressed to the Curator**.)

DSDP Core Photographs

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

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

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

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

DEEP SEA DRILLING PROJECT—DATA BASE STATUS

GENERIC DATA FILE	COMPLETE THROUGH LEG	STORAGE MEDIUM	COMMENTS
CARBON CARBONATE DSDP Shore Lab	59	FT	No carbonate for Leg 46
CHEMISTRY Water content/ Shipboard Lab	64	FT	No chemistry for Leg 41
DEPTHS From underway recording	65	FT	
GRAIN SIZE (Sand/Silt/Clay) DSDP Shore Lab	59	FT	No grain data for Leg 16
G.R.A.P.E. (Gamma Ray Attenuation Porosity Evaluator) Points taken on board. Data processed and edited onshore.	52	FT	G.R.A.P.E. data were not collected on Leg 46: Leg 45 G.R.A.P.E. is not complete.
SCREEN Output from JOIDESSCREEN. Computer-generated lithological classifications. Includes basic composition data, average density, and geologic age of classified layer.	44	T	Leg 38 SCREEN file has not been created yet.
SMEAR SLIDES Shipboard observations	44	FT	
SONIC VELOCITY On board ship-Hamilton Frame method	65	FT	There are no SONIC data for Legs 1 and 2.
VISUAL Shipboard observation	44	FT	

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

Bathymetry	Legs 07-09 13-56 61-63	FT	
Magnetics	Legs 07-09 12-63	FT	
Navigation	Legs 03-63	FT	
Seismic	Leg 65		

T=magnetic tape
F=microfilm

DRAFT REPORT
EXCOM
6-7 April, 1979—Houston

ACTION ITEMS

I. SHIP MOTION ON LOGS

Ship motion does reduce log quality but generally little important information is lost. The logging tool normally moves roughly with the ship, with amplification or damping depending on the elastic response of the cable. However, the logging rate is usually faster than the ship vertical motion so the tools move continuously with little loss of vertical resolution. There is a problem in directly corellating the fine details of successive logs and the core log. This is true on land without ship motion and a natural gamma log is normally part of each logging tool to provide a common depth reference. The February JOIDES Journal figure from Leg 60 illustrates the problem of depth reference (+/- several m) with three successive density logs (this log is rather sensitive to hole conditions so there is some real variability depending on the tool orientation). The depths have not been adjusted using the simultaneous natural gamma logs.

II. PANEL REORGANIZATION

The revised JOIDES Advisory structure proposed by PCOM was discussed. It was felt that responsibility in the revised structure should be more focused. An ad hoc subcommittee of the EXCOM and PCOM will meet to further discuss the reorganization.

III. IPOD DATA BANK PUBLICATIONS

The EXCOM accepted the recommendation to publish the site survey data in the four-volume form subject to determining a cost effective quantity. (See PCOM meeting for details.)

It was suggested that the Government Printing Office print and distribute this data. These publications will be announced in the JOIDES Journal.

IV. SPONSORSHIP OF SYMPOSIA

The EXCOM adopted the following policy on symposia:

1. JOIDES encourages the presentation of drilling results at symposia.
2. Oral presentations are encouraged at any time, especially soon after the completion of a leg.
3. Written transactions of a symposium should be published in accord with the publication policy of JOIDES, which limits written publication of results during a defined time period immediately following a drilling leg.

Furthermore, EXCOM delegates implementation of this policy to the PCOM.

STATUS OF DRILLING OPERATIONS

The year began with $15.8 M for operations. An additional $0.4 M has become available for logging and other items.

The hydraulic piston corer (HPC) recovered several undisturbed finely laminated cores from Leg 64. Because of this success, both industry and the scientific community have expressed interest in its further use and development. Plans are in progress to modify the HPC to enable it to take longer cores, oriented cores, and for use with both a special bit and without any bit.

Two downhole experiments were undertaken on Leg 65, a downhole seismometer and an oblique seismic experiment.

FUTURE PLANS

I. 1981-83 CHALLENGER PLANS

A budget for an 1981-83 CHALLENGER extension was submitted to NSF as part of the Director's Review on 2 April. It was noted at that time that the Executive Committee had not approved this extension. Since this is the time when EXPLORER conversion will be underway at considerable expense, the $51 M required for this proposed extension would create a large increase in the budget. Further, as the EXPLORER is owned by the United States, the non-U.S. countries would not be expected to contribute to the conversion. The Executive Committee postponed to the next meeting action on whether or not it would formally approve this CHALLENGER extension. It was noted that a complete 1981-83 CHALLENGER proposal must be at NSF by 1 September for it to be considered.

The PCOM was requested to assemble, by August 1, plans for continuation of drilling with the GLOMAR CHALLENGER for the 1981-83 period.

II. EXPLORER OPERATIONS

Engineering reviews and studies are in progress. Donhaiser engineers are currently testing the EXPLORER station-keeping ability. DSDP is planning to measure the stress at the top and bottom of the CHALLENGER drill string during Leg 68 or 69. Part of the difficulty in the current engineering studies is that when the EXPLORER is converted to a drill ship, its weight and hull shape will be changed.

It is not clear if the EXPLORER's excellent hydraulics and power distribution need modification and whether a partially bouyant rather than a fully bouyant riser is best. These subjects require significant engineering studies. It will be necessary to have instantaneous monitoring of the bottom hole conditions and to monitor the BOP through remote sensing.

The Marine Board Committee (Hocott, NRC) is concerned that abandonment procedures be developed for the long riser. Furthermore, there are strict regulations for drilling in U.S. and other national offshore waters and these would have to be followed. These regulations should be included in a safety program.

This Committee (NRC) will hold two workshops; a June workshop on coring, and a September workshop on marine risers. NSF will try to facilitate more exchange between the science community and the engineering study groups. The final report from the committee is expected in about a year.

The Marine Board Committee (Hocott, NRC) will be asked to discuss the restrictions on GLOMAR EXPLORER drilling as they now see them at the next EXCOM meeting. Maxwell will write a letter to this effect and also offer the services of the JOIDES organization to the engineering studies.

If the program is approved, 1 October, 1980 is the date to begin engineering for the EXPLORER conversion.

U.S. PROGRAM EVALUATION

The Blue Ribbon Panel chaired by Guy Stever met March 16, 1979. Bill Hay attended and presented the scientific program for the EXPLORER. They will hold two more meetings before May, when their final report is due.

Frank Press, Director of the Office of Science and Technology, convened a meeting on 26 March, 1979 to which a broad cross section of the geological community was invited. Both international participation and the resource evaluation potential of the program were emphasized.

The NSF Director's Review was held April 2. Plans were generally positively received. It is clear, however, that the initiation of an EXPLORER program will depend upon:

1. International cooperation.
2. U.S. interagency cooperation, particularly with DOE and USGS.
3. A well-developed science program.

Concern was expressed that with the increased interest by various groups including intergovernmental, governmental and others, there must be assurance that the scientific integrity of the EXPLORER program be maintained. In order that this concern be made known, the following resolution was passed:

The JOIDES Executive Committee recognizes that arrangements among and within nations for the planning, management, and conduct of the ocean margin geological and geophysical program (GLOMAR EXPLORER) are now under discussion. The Committee urges that national representation in the directing bodies continue to be from the scientific groups most directly concerned with the program to insure the scientific integrity of the proposed efforts.

SITE SURVEY COMMITMENTS

Planning for CHALLENGER and EXPLORER drilling requires extensive international regional geophysics and site surveys. These operations have been difficult to coordinate. Methods for scheduling ships and collecting and distributing data vary in different countries. Also, some of the data is of a proprietary nature. This situation makes it difficult for the Site Survey Panel to coordinate site surveys. National representatives were asked to keep the JOIDES Site Survey Panel informed of planned and completed site surveys.

JOIDES OFFICE ROTATION

The JOIDES Office will rotate in July, 1980. Following the established rotation (EXCOM minutes of June, 1975), the next two institutions to receive the JOIDES Office will be SIO and Miami in that order. When the EXPLORER program begins, a new sequence and/or management program will be considered.

SAFETY PANEL REVIEW

A memorandum from the Chairman of the Safety Panel to the Chairman of the Executive Committee was distributed and several problems were addressed.

The EXCOM endorsed the following Safety Panel recommendations as put forth in the Safety Panel Memorandum:

1. That the Safety Panel be expanded in size as indicated.
2. That the Safety Panel's review procedures be initiated before site specific surveys are undertaken.
3. That changes in the Safety Panel's final site review process be approved with the following provisions:
   a.) As soon as an updated Safety Manual is provided by the Safety Panel it will be disseminated.
   b.) Negotiate with SIO over the desirability/ feasibility of Cruise Operations Manager being present at Safety review meetings.
4. That the Chairman of the Safety Panel be invited to next EXCOM meeting to discuss changes in the Panel's mandate and the safety matters.

The EXCOM commended the Safety Panel for its excellent performance to date and the EXCOM reaffirmed that the drilling program must strictly adhere to the recommendations of the Safety Panel.

DRAFT REPORT PLANNING COMMITTEE 5-8 March, 1979—S.I.O.

This meeting of the Planning Committee was the annual meeting with Panel Chairmen as guests.

REPORT FROM DSDP

I. LEG 64

A. Science Operations

Leg 64 was very successful. Three different areas were sampled.

1. The ocean-continent transition. Highly weathered granites in a deep water environment which had undergone subsequent subsidence history were recovered at Site 476. The oldest sediments were lower Pliocene/upper Miocene. The oldest sediment at 474 was early Pliocene overlying basalt pillow lavas. Metaconglomerates were recovered from 475.
2. Guaymas Basin Active Rift. The high sedimentation rate at the spreading center caused sill injection rather than pillow basalt formation.
3. Guaymas Slope. The hydraulic piston corer was used, and varved diatomaceous sediments were recovered.

B. Hydraulic Piston Core (HPC-15)

The success of the DSDP hydraulic piston corer (HPC-15) was acclaimed. This was developed at DSDP primarily by M. Storms and operated on Leg 64 by D. Cammeron. Information about the HPC-15 was distributed. It is capable of recovering up to 200 m of relatively undisturbed sediment in 4.4 m length, 2 1/2 inch diameter cores, using the standard CHALLENGER plastic core liner, and can penetrate sediments with sheer strengths in excess of 1,000 g/cm . It was suggested that the HPC-15 might be successfully utilized on the SEAPROBE.

Some of the piston cores were displayed. The most immediately useful addition to the corer would be an orienting device. Serocki thought this would probably be feasible.

An ad hoc committee consisting of H. Schroeder, T. Moore, W. Reidel, K. Kelts, and D. Moore was formed shortly after the conclusion of Leg 64 to discuss:

1. Sampling procedures which are necessary to preserve the varved laminae.

2. Distribution policy.

A person working with A. Suttle at U. Texas, Dallas, has made 1-.5 cm thick slabs from other cores leaving most of the core intact. The magnetics and detailed studies of the laminae could all be done from the first slab. Cross radiographs and continuous strip photographs will be taken of the split cores. The committee will review individual requests, but the distribution authority will remain with NSF.

The widespread interest in hydraulic piston coring was evidenced by the many and varied proposals for its use submitted by panel chairmen and PCOM members. The HPC-15 will be used in the Costa Rica Rift area. It contains a pressure relief valve which should insure against damage in the event that clathrates are encountered and start to generate high gas pressures on deck.

A letter proposal from J. Hays, N. Opdyke, J. Imbrie, W. Broecker, W. Ruddiman, A. McIntyre, and R. Heath was distributed. To fully evaluate the value of the hydraulic piston corer, they recommend that it be tested in an area of known stratigraphy. They propose that three parallel 100m staggered sections be drilled in the Caribbean, near Site 154, when the CHALLENGER is in transit between Legs 69 and 70. This proposal will be discussed and decided upon at the July PCOM meeting.

II. LEG 65

Leg 65 drilled several holes at GCA-1, Site 482. Two single bit holes penetrated basement. After penetrating 92m of basalt at 482B, the pipe stuck, and the hole had to be terminated. Hole 482C encountered a 193 m thick zone of dolomite above basalt, penetrated basement, was logged, and the H.I.G. seismometer was successfully deployed. The basalts appear fresh with an increasing grade of hydrothermal alteration eastward from 482B to 482C. Hole 482D was started 100 m east of Hole 482C. A reentry was attempted but the cone and casing wouldn't jet in; a second attempt tipped the cone over. The ship then moved to GCA-3 (483). The hole was drilled to a subbottom depth of 257 m with good recovery. GCA-11 (484) was drilled on a small magnetic diapir in the Tamayo Fracture Zone. Cone and casing were set for a reentry, but a failure of the resistor caused the ship to move at a critical period during the reentry and the hole was lost. A mirror image site to GCA-1 (485) was attempted.

At site 485A, 331 m subbottom were penetrated and the OSE was successfully completed.

III. MINI-LEG

The idea of a mini leg to run the various geophysical and downhole experiments was conceived during Leg 64. An oil leak in the thruster required an emergency return to the shipyard for repairs causing the loss of 10 days, and shortening both Legs 64 and 65. Five experiments were being planned:

1. The Soviet downhole magnetometer,

2. The Oblique Seismic Experiment (OSE),

3. A hydrofracture experiment,

4. A resistivity experiment, and

5. The H.I.G. downhole seismometer.

It was decided to accommodate the first four of these experiments in a single "mini" leg between Legs 65 and 66. However, because of time constraints on the shooting ship, the OSE aided by the R/V KONA KOEKI was done at the end of Leg 65, leaving three experiments to be accommodated.

The requirements for the remaining experiments were discussed. The hydrofracture experiment can be done in two stages, starting with a feasibility stage to test the Lynes packer. This does not require a deep or re-entry hole. The complete experiment could require viewing the fractures with a downhole televiewer, and does require a re-entry hole. The hydrofracture experiment is not compatable with other downhole experiments. The fracturing may collapse the hole. The deeper the hole used for the resistivity experiment, the more information that can be gathered.

On 5 March the Planning Committee decided the downhole experiments were sufficiently important, that to insure their success, the mini leg should be 10 days instead of the initially scheduled six.

On 7 March DSDP received word that the Mexican government was no longer granting or extending permission for research vessels to operate in their waters. The CHALLENGER had permission to operate only until the end of April. The chances of getting an extension were questionable, and the results of an extension request would not be known until very late. If the extension request was denied, Leg 66 would be reduced to 30 days. In light of this new development, the PCOM decided to perform the experiments at EP-1 at the beginning of Leg 68, with a ferry boat staff transfer there.

Generally speaking, the cost of the ferry boat should be borne by the experimenters. The NSF program plan requires that DSDP not spend money on experiments other than drilling. This policy and the role of ancillary science will be discussed at the July PCOM meeting.

STATUS OF PLANS THROUGH 69

I. LEG 66

Leg 66 will drill two transects across the Oaxaca Trench. This margin is characterized by a narrow shelf underlain by continental crust, a 10 km ocean-continent transition zone, and a steep, narrow slope underlain by oceanic crust. Several proposed sites had to be moved or had penetration restrictions placed on them by the Safety Panel.

No downhole experiments are planned.

II. LEG 67

Leg 67 plans to drill a transect off Guatamala. The co-chiefs endorse the emplacement of the H.I.G. seismometer during Leg 67, possibly utilizing a shuttle ship to transfer staff.

III. LEGS 68-69

These two legs are scheduled for the Costa Rica Rift (68) and Galapagos Mounds Area (69). Sites were approved by the Safety Panel, although some with limited penetration. A group of alternative sites for Leg 69 and EP-1 will be reviewed at the next Safety Panel Meeting. If problems are encountered with drilling in the mounds area, drilling will also be attempted N and S of the mounds. If 68 drills a good hole, 69 will log it once its temperature has equilibrated (probably several weeks lag time).

Downhole experiments are an integral part of Legs 68/69. The hydrofracture experiment is planned for two and possibly three different sites. The "mini-leg" portion of Leg 68 was previously discussed . The OSE is planned again on Leg 69. R. von Herzen, a Leg 69 co-chief, has been in contact with scientists involved with the Galapagos submersible program. Two transponders have been deployed in the mounds area. It is hoped that the CHALLENGER drilling can be coordinated with the transponder location.

SOUTH ATLANTIC PLANS

I. LEG 70—MID-ATLANTIC RIDGE

OCP objectives are being met. All sites will be within the same crustal segment between two transform fault zones. The sites are planned systematically to yield crustal, spreading rate, and paleoenvironmental information.

II. LEG 72—ANGOLA BASIN

Site III-I in the Cape Basin had been proposed to study the Cretaceous anoxic event, but it was discovered that the anoxic sediments may be missing at that site. Accordingly, Site I-5 in the Angola Basin has been substituted for Site III-I.

III. SOUTH ATLANTIC SITE SURVEYS

Texas (MSI) will do the site surveying for the Mid-Atlantic Ridge (SA-IV) and Angola Basin sites, and probably the Cape Basin Site SA-III, 2. The Walvis Ridge sites will be surveyed by the Un. of Cape Town's ship the THOMAS DAVIE.

STATUS OF ENGINEERING STUDIES

I. INTRODUCTION

C. Hocott, Chairman of the NRC Engineering Study, reviewed the Committee's progress. They were charged with examining the engineering considerations for drilling into the deep ocean for scientific purposes.

An interim report, "Engineering for Deep Sea Drilling for Scientific Purposes," was issued and is available from the Marine Board, Assembly of Engineering, NRC, 2101 Constitution Avenue, Washington, D.C. 20418. A final report will be issued in the fall.

II. ENGINEERING SUMMARY

A. Platform Considerations

The NCR study shows that the EXPLORER is the logical platform choice, pending information on operational performance.

B. Drilling Technology

This subject has received the major thrust of the committee's attention, particularly riser and well control. Specifications requested for EXPLORER drilling represent state of the art (but not state of practice) technology. Therefore, although there are no technological barriers to the requests, cost overruns and time slippages are inevitable. Presently only three wells have been drilled deeper than 4,000 ft. There is also the question of using a bouyant vs. a nonbouyant riser, with the former being generally more favorably viewed. Coring considerations have not been fully investigated.

C. Engineering Systems Management

A full year of systems engineering planning should be done well in advance of the EXPLORER program to correlate it with the scientific program. This involves items such as technology development and program planning, management, and operations. Previous technical assessments have devoted more effort to hardware and development of drilling systems than to systems engineering.

D. Safety and Environmental Considerations

Safety hazards and environmental risks have been considered insofar as these could pose major threats to the proposed program. Estimating these risks depends to some extent upon program plans. In this light, more evaluation needs to be done in the areas of well control and well structure, consisting of risers, wellheads, blowout preventers, and instrumentation.

E. Geophysical Survey Considerations

Geophysical investigations would be required to detect faulted and overpressured areas. The physical characteristics of the ocean floor are important for the success of the deep riser. The engineering systems manager would use seismic profiles to determine drilling specifications, e.g. where to set pipe and width of drill string.

III. DISCUSSION

After Hocott's description of the NRC committee's work, discussion developed among PCOM, Panel Chairmen, DSDP, and Donhaiser Marine, Inc. The need for engineering and scientific planning to go hand in hand was emphasized. Some points raised in the discussion follow.

Station-keeping tests are currently underway by Donhaiser Marine, Inc.

The riser is sensitive to water currents. The strengths of the currents should be known, to make sure that the riser can withstand current induced stresses.

The EXPLORER will receive Class A ice strengthening, which is for floating ice. This would be for riserless drilling, since the problems involved in setting a riser in an ice environment make it very risky.

The possibility of using a limited or shorter riser for some of the early drilling planned for the Pacific was discussed.

STATUS OF PROGRAM PLANNING, FY '80+

I. EXPLORER ENGINEERING REVIEW AND RISER TECHNOLOGY

A. Planning Chart

Heirtzler drew a 1978-89 general planning chart including timing for site surveys, CHALLENGER use, EXPLORER engineering, EXPLORER operations, and environmental studies. Copies of last year's (1978) Director's Review Plan were distributed to those who had not received it.

B. EXPLORER Engineering

Until certain engineering problems are resolved, it is not known whether EXPLORER could start riserless drilling in late 1982 or early 1983.

To begin an EXPLORER program in late 1982 or early 1983, the following schedule should be followed:

1. During FY '80, EXPLORER design and engineering analysis should be completed.

2. Securing the contracts for the engineering design of the riser and vessel conversion.

   a. Engineering for the conversion should take approximately one year, and go out for bid in October, 1980.

   b. Unless there is a large price discrepancy between East and West coast shipyards, the conversion will probably take place on the West coast. Because of EXPLORER's draft and beam, it can be accommodated by only a few shipyards. It is anticipated that contracts will be let in early 1981.

   c. DMI estimates that the complete nonriser EXPLORER conversion, including super drilling, long sea duration, high-latitude capabilities, and capacity to stow risers in excess of 12,000 feet (3600 m) should take approximately 16 months. If the conversion begins in early FY 1981, it should be completed in early CY 1982, and sea trials finished by mid to late CY 1982.

C. Riser Technology

1. Although a 12,000 foot (3600 m) riser is technically possible, many of the cost and risk factors have not been worked out. The very earliest such a riser could be anticipated would be late 1983 to early 1984. If funding and enough lead time were available, the EXPLORER could be equipped with a limited riser (4,000-6,000 ft.) as soon as she comes on line. Different riser designs are used for different water depths, and it is not a simple matter of extension. In addition, the dynamics of the riser system must take into account the effects of the vessel on the riser and vice versa, current profiles, surface current velocities, and wind and wave characteristics. The information is needed to establish operating limits, stationkeeping abilities, and down time. DSDP questioned the lead time and availabiity of such a riser. DMI felt that it might be best to have a year of riserless drilling as part of the initial shakedown.

2. The dollar cost per unit of science was discussed. Risers cost approximately $1,000 per foot. Therefore a 4,000 foot riser would cost $4 M. Added

on to this would be the cost of a complete BOP and well system, mud system maintenance, and expanded crew. Operating costs would run more than 50% higher with a riser.

II. 1981-1983 CHALLENGER PLAN

In light of the 1-2 year hiatus in drilling between the end of the 1979-81 CHALLENGER extension and estimated beginning of the EXPLORER program, the PCOM decided to prepare a 1981-83 proposal. The outline of this will be submitted with the Director's Review. The proposed extension will include use of the hydraulic piston corer, studies of the geochemical boundary in the Atlantic, drilling the Barbados Trench, and other important problems requiring CHALLENGER drilling.

PANEL REPORTS

I. GENERAL

Heirtzler went over items that panel chairmen should be aware of, including mandates, and distinguishing the responsibilities of regular and exofficio members.

II. MINUTES

Communication between panels, working groups, and committees was discussed. Panel minutes should be distributed shortly after the meeting, to members of the panel, all panel chairmen, and the PCOM. The JOIDES Office will assist in this distribution. PCOM Minutes will be distributed in draft form to PCOM, EXCOM, and Panel Chairmen. EXCOM draft minutes are now distributed to EXCOM and PCOM. The EXCOM will be asked to expand their distribution to include Panel Chairmen.

III. MEETINGS

Panel meetings should be requested 3-1/2 to 9 months in advance. The 3-1/2 months lower limit is necessary for Soviets to attend. Meeting requests to the JOIDES Office should include dates, location, attendees, and an agenda.

IV. PANEL REPORTS

A review of the status of each panel was given by the Panel Chairman or representative. Details of panel activities are given under Panel Reports elsewhere in the JOIDES Journal.

IPOD DATA BANK REPORT

I. IPOD DATA BANK CATALOGS

IPOD Data Bank catalogs were distributed for inspection. These consisted of 8-1/2 x 11 inch navigation plots of all the U.S. institutional site survey tracks undertaken during 1975-1978, and tabular listings of the types of data archieved for each site from both U.S. and non-U.S. institutions. The navigation and underway geophysical data collected during the cruise are in digital form in the IPOD Data Bank. It was asked that the principal investigator for each survey be listed. Dredge-haul data is not received by the Data Bank, therefore dredging information is not listed. These booklets could be used by investigators requesting data.

II. IPOD DATA BANK PUBLICATIONS

EXCOM requested the IPOD Data Bank to supply PCOM with a complete folio mock up along with a budget and rationale for distribution. The IPOD Data Bank initially investigated producing folios which would consist of an average of eight large (23" x 29") maps per site giving navigation, topography, magnetics, gravity, sediment isopach, etc. The printing costs for 1500 copies (same number as I.R.'s) would be $2,600 with overhead.

Instead of the individual site folios proposed initially, the IPOD Data Bank now proposed that data be available in three documents. The first part would consist of Data Bank Catalogs. The second part would consist of an 8" x 11" site survey book listing all of the data for each site surveyed (an estimated 20 pages/site). If investigators require more detailed information, they could request an ozalid copy of the original which would be reproduced at cost by the IPOD Data Bank.

The PCOM recommended to EXCOM that 300-400 copies of the IPOD Data Books be printed.

In keeping with the EXCOM request, the PCOM requested that the IPOD Data Bank investigate the total cost to prepare, produce, and distribute the site survey books and recommend a rationale for distribution. The IPOD Data Bank was asked to prepare this in time for the April EXCOM meeting.

DRAFT REPORT
INFORMATION HANDLING PANEL
9-11 January, 1979—Boulder

The IHP met at Boulder to consider the first steps in the sharing of data with the National Geophysical and Solar Terrestrial Data Center (NGSDC) of the Environmental Data and Information Service (EDIS) of NOAA. The IHP expressed their pleasure with the GRAPE computer work, the current status of the quantitative data, and the improved computer programs for data manipulation. Dissatisfaction, however, was expressed with staff cutbacks coupled with continuing work on items which the IHP has given low priority. This has resulted in a slowdown of some of the basic functions of the Information Handling Group (IHG). The IHG's report to the IHP shows slow progress on the paleo data base and hard-rock data base. There is no index for Volumes 1-44 and the IR errata volume has not been published. The IHP reiterated that encoding of the scientific data bases is a task of highest priority. At the present pace there is no chance of bringing the data bases up to date by October, 1979, as recommended by the PCOM.

At least as early as 1971, consideration was given to the necessity of ultimately placing the data in a national archive. In November of that year a representative from NODC attended an IHP meeting. It was mutually agreed at that time, that there was no reason to begin transfer of DSDP data to NODC. However, it was agreed that IHP and DSDP would keep a close personal contact with NODC. Since 1975 an NGSDC person has been a regular member of IHP.

NGSDC will have the long-term responsibility of storing and disseminating DSDP data. This function will begin by sharing those data files which are in good shape.

Inasmuch as NGSDC now carries the GLOMAR CHALLENGER underway geophysical data, and that responses to requests for these data relieve some of the work load from the IHG, the IHP recommends the sharing of other DSDP data files with NGSDC. This sharing will be the first step toward satisfying long-term archival requirements. Further, it will enhance the value of the NGSDC total data set, increase the publicity about the availability of DSDP data, and increase the user group of these data.

The IHG will decide, in conference with NGSDC, which files (e.g., carbonate, grain size) are sufficiently well checked and validated that they may be shared. This recommendation is made the spirit of increasing the availability a usefulness of the data to the scientifi community and with the understanding that i will not detract from DSDP informatio handling activities.

This means that there will be two parallel sources for some of the data. In general, DSDP service is free (if not a large search) and NGSDC charges for its service. There was no firm decision about how this would be handled; probably new requests would be referred to NGSDC. Special searches, requiring the unique programs at DSDP would, of necessity, have to be done by IHG.

Another item of concern is that DSDP will not be aware of data requests and the research for which the data are requested. NGSDC can ask receivers of data to inform DSDP of its intended use.

Investigators receiving DSDP data should be requested to submit a brief summary of the research in which the data will be used. This will permit the inclusion of data requests in the Keyword Index in the same manner as sample requests.

It was also proposed that the DSDP Keyword Index on fiche be advertised and offered by NGSDC at cost, and be sent to persons who request data as is now done to those who request samples.

The IHP also recommended that the PCOM should encourage all holders of site survey data to submit such data (when not protected by proprietary interests) to central archives as soon as practical.

Last year the IHP encouraged the transfer of the complete DSDP data base to the U.S.S.R. The request is to transfer the material by leg. It will take considerable time and money at DSDP to sort the data by leg rather than to transmit property files. The IHP feels that costs for this should not be absorbed by the already short IHG budget.

The U.S.S.R. also asked for means of access to processed data or results from work done outside of the strict confines of DSDP. Scientist-to-scientist contacts must be used for such data. DSDP personnel might help to make such contacts but should not act as broker in the transactions.

Beyond the area of data transfer, DSDP has also received a letter suggesting an exchange of software, data analysis results, and publications about software and data. The U.S.S.R. would make comparative studies of DSDP data and U.S.S.R. continental geology data. The IHP will respond to his letter and stress the importance of reciprocity.

Despite the various articles that have described the availability of DSDP data, it appears that the general geological community is still not aware that these data are available for research studies.

The IHP recommends that the paragraphs of the DSDP Sample Distribution Policy referring to data availability should be excised and rewritten as a separate section relating to data availabiity and method of distribution. This section should be published in the Initial Reports with an equally prominent heading as the Sample Distribution Policy.

In addition, a statement of the status of available data should be appended to each leg report as it appears in GEOTIMES and a similar statement should be published periodically in EOS and in other journals as convenient.

The technique manual was discussed. The IHP holds that the changes which have occurred in analytical technique are more important than changes in data handling procedures. It has been planned that the IHG would append detailed descriptions of data manipulation to each technique chapter of the manual.

Concern was expressed that a very important part of DSDP data—the documentation of data-gathering and data-processing techniques—is not readily available to the scientific community. The IHP urged that the SP4 proceed forcefully with the completion and publication of the techniques manual. As an interim measure, DSDP staff will add references of the best currently available explanations of techniques to existing data-file documentation.

Work is completed on the errata for IR Volumes 1-34 and is ready for final review and publication. The IHP recommends that an informal booklet with this errata be published immediately and a more formal publication be made after errata is collected through Volumes 44.

The IHP asked the IHG to estimate the amount of work needed to collect and encode site survey core data and relate them to drill sites. For this work it would be necessary to develop an equivalency table for all of the various designations that have been assigned to a set. No more than a month's time was to be spent on this estimate and no substantive work was to proceed without Panel review.

The task would require about 26 work weeks of a geologist's time. In light of the shortage of personnel at DSDP, the IHP recommends that no action be taken. Scientists desiring information on deep sea cores taken within DSDP site survey areas should obtain this information from the NGSDC data files on cores.

There was a discussion about whether the IHG should keep a record of those users who have received data so that updates could be automatically sent to them. The Panel feels that this would be too great a task for IHG at the present time and should not be done. It would be reasonable to publish an advertisement or flyer from time to time indicating what additional data have been added and what corrections have been made. Such information can be part of the status report on available data.

Several suggestions were made relative to additional services which could be provided by IHG. The one which elicited the most discussion was the idea of tagging the data with certain derived values (e.g., paleo-depth, paleolocation) using alogorithms which produce commonly accepted interpretations. It was even considered that a choice of several interpretations might be offered.

The Panel feels that, at this time, IHG cannot take on such a task. As indicated earlier, the concentration of effort must be on the primary data bases. The IHP believes that such derived data should be published by the originator and that he/she should make the necessary computer programs available to others.

The Master Core Environment (MCE) file is not up to date. The information in this file (depths, locations, etc.) would be necessary to develop any tagging of paleo-interpretations. To bring this file (which is, in a sense, another primary data file) up to date will require about one month's work. After that, each leg will require one or two days' work. NGSDC may be able to assist in this work.

The IHP recommends that the IHG should provide software services beyond routine DSDP activities only to the extent that the resulting services do not detract from the fulfillment of basic IHG responsibilities and will enhance the usefulness of the data bases for a wide range of users. Implicit in the performance of such software services is an assumption that this software will be immediately available to the entire scientific community.

DRAFT REPORT
OCEAN CRUST PANEL
26-28 February, 1979—Palo Alto, CA

PANEL REPORTS

I. ACTIVE MARGIN PANEL

The AMP requested that the OCP consider what type of drilling targets should be planned to examine petrological, crustal, and volcanological processes in active margins. The OCP recommended that the group of Leg 59 and Leg 60 petrologists, who would be attending the Leg 60 post-cruise meeting, prepare recommendations based on their recent drilling experience.

II. SITE SURVEY PANEL

Working groups desiring site surveys are to present oral and written reports on their specifications for site surveys.

DSDP IGNEOUS ROCK DATA FILE

I. DATA BASES

Five hard rock data files have been established. They are visual descriptions of igneous rocks, thin-section descriptions, chemical analyses (minor elements), chemical analyses (major elements), and paleomagnetic measurements. Action on the isotopic ratios and geologic ages files has been postponed.

The panel recommended that future contributors to the data files send their data to DSDP on punch cards to relieve the workload on the Igneous Rocks Data Base group at DSDP.

II. LABELLING PROCEDURE FOR IGNEOUS ROCKS

Shipboard igneous rock labelling procedures were reviewed. OCP recommended that DSDP investigate the purchase of numerically ordered pre-printed labels, which would shorten the time for labelling considerably.

III. HOT AIR DRYING

Additional comments on hot-air drying of igneous rocks on the CHALLENGER were considered. Letters on the subject were read to the panel. OCP insists that hot-air drying must stop and recommends that DSDP conduct a test to see whether using the hot-air driers on shrink tubing will affect rock magnetic properties.

1979-1981 DRILLING PROGRAM

I. SOUTH ATLANTIC

The OCP received a background document on the composition of basalts from the Mid-Atlantic and Walvis Ridges.

MAR basalts near the proposed Miocene and younger transect have MORB characteristics. Data from Walvis Ridge and Sao Paulo Ridge-Rio Grande Rise are sparse, but trends look alkalic. Results from Tristan de Cunha, appear to reflect what may be a pristine undepleted mantle source never before tapped (one of few oceanic islands to show no depletion in radioactive elements). A recent Seabeam-Gloria survey of Walvis Ridge west of Valdivia Bank showed, surprisingly, neither "fracture-zone" nor "ridge-crest" trends. Instead, topography was complex and thickly sedimented.

OCP reiterates its interest in basement penetration at all targets in the South Atlantic, and urges that these Legs have adequate staffing for petrology. A document will be prepared discussing the significance of the Walvis Ridge problem based on Tristan de Cunha data.

II. PROPOSED NORTH ATLANTIC GEOCHEMICAL TRANSECT

Information relating to the proposed N. Atlantic geochemical provinces drilling was presented. The OCP re-affirmed the desirability of completing its original transect by drilling in survey areas AT-3 and AT-4. It was also decided that to complement the E-W traverse, a north-south transect was needed on approximately 60 to 70 m.y. old crust. A series of holes starting at 10°N and ending at 40°N was endorsed with specific locations awaiting better geochemical vs. geographic location data. A document outlining the known geography of the less depleted N. Atlantic province will be prepared for the next meeting to serve as a basis for site selection.

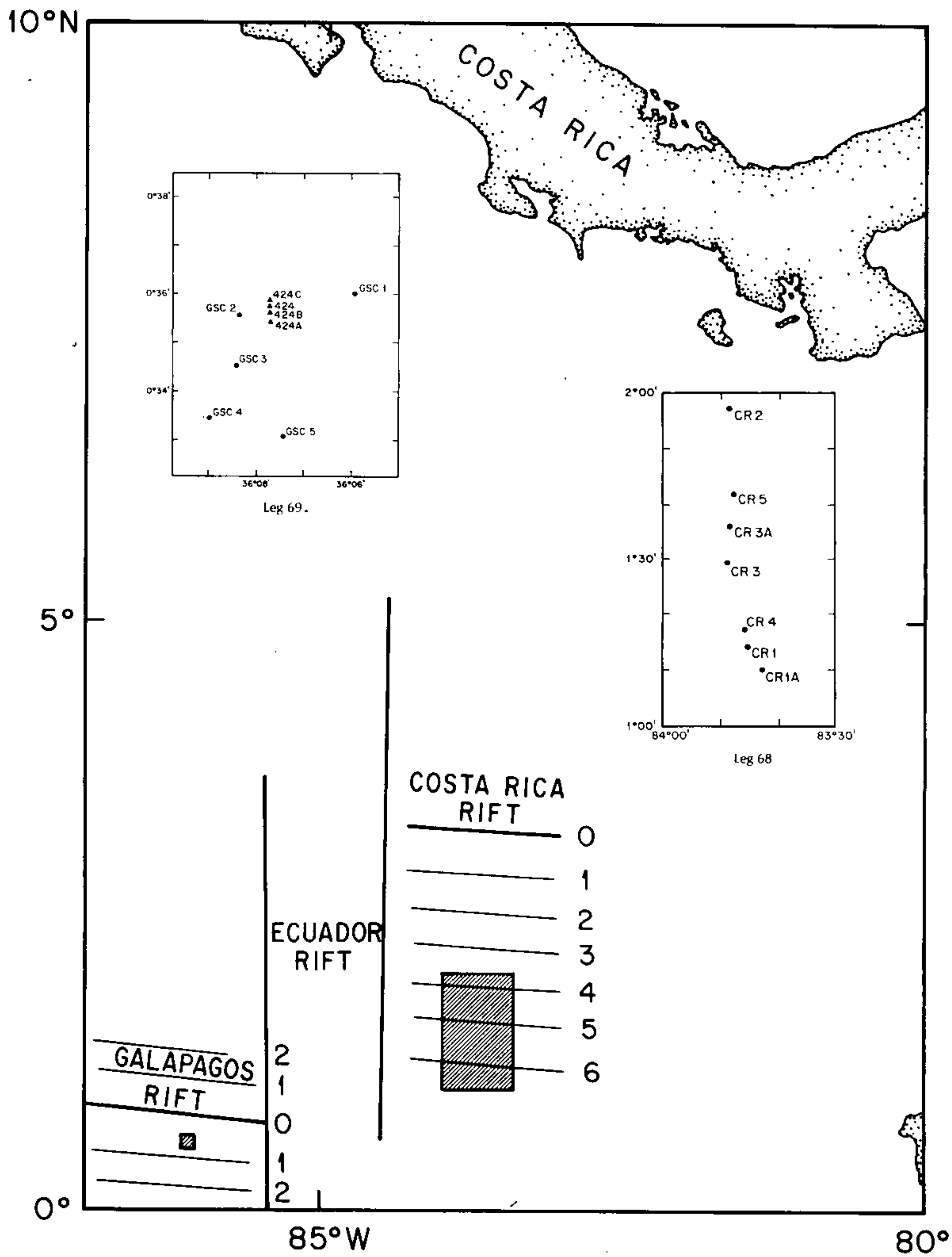

FIGURE 6
Site Locations Planned for Legs 68 and 69

III. Plans for Legs 68 and 69

Results of the Costa Rica Rift survey were presented. Targets were selected in an area of uniform heat flow on crust of latest Miocene age, and in an area north of there on younger crust with scattered heat flow. The two regions appear to reflect the transition from a convective circulation pattern of sea water in the crust (scattered heat flow). Several additional targets were mentioned.

The problem of the mounds as viewed by Leg 54 scientists was summarized. It was recommended that a reference sediment section be drilled away from the mounds to the east, or at the mirror image location 22 km N of the Galapagos Rift. The problem of back-up sites was considered at length. General approval was given for using Leg 69 targets as back ups for Leg 68 and vice-versa. (See Fig. 6 for present site locations.) It was also recommended that Leg 69 back up sites include:

1. An area of high heat flow north of the Galapagos Rift for reentry.
2. Other areas of high heat flow.
3. Additional single bit targets in the mounds.

Additional back-up targets on the Carnegie Ridge and in the Ecuador Fracture Zone were also discussed.

Plans for downhole experiments on Legs 68 and 69 were reviewed.

GEOTHERMAL WORKING GROUP

The Chairman of the Geothermal Working Group recommended that the the Geothermal Working Group, its work complete, disband. The OCP thanked the chairman and approved his proposal. The OCP feels, however, that many GWG programs, especially the emphasis on downhole instrumentation, be applied in future deep crustal holes and holes drilled under the aegis of other panels. The Downhole Measurements Panel should assume more responsibility here.

I. CONSIDERATION OF LONG-RANGE DRILLING PROPOSAL

Targets for LTP-1, the deep reentry target in the Pacific were discussed. It was recommended that the target be moved to the North Pacific for the following reasons:

1. The South Pacific (previous target) has thin sediments, poorly defined anomalies, a ridge-crest jump complication, and would have to be operated from Tahiti, a formidable undertaking for GLOMAR EXPLORER.
2. The North Pacific has distal turbidite muds of sufficient thickness, good surveys, and sufficiently high paleolatitude. Weather will not be much of a factor with GLOMAR EXPLORER, and wouldn't be any worse than the closest reasonable South Pacific target. In the North Pacific, logistics will be from the west coast. A tentative target at 141°W, 46°N was approved by the OCP.

II. ATLANTIC FRACTURE ZONE PROPOSAL

A proposal to drill the Romanche Fracture Zone was considered. The panel appreciated the proposal, but feels that a drilling program can only follow a program of detailed near-bottom observations and geophysical measurements.

DRAFT REPORT
ACTIVE MARGIN PANEL
25-27 January, 1979—S.I.O.

I. PROGRAM STATUS (Results and Plans)

The new hydraulic piston corer was successfully used on Leg 64. Eighty to 90% recovery of 180 m of undisturbed varved sediments was achieved. The HPC may be used to increase recovery in unconsolidated zones of active margins.

Riser length on the EXPLORER may be extended to 5.5 km, and riser with BOP may be extended to 4 km because of greater ship stability than anticipated.

II. CARIBBEAN INTERESTS

A. Barbados Trench

The Caribbean Working Group, reflecting passive margin interests, has given a low priority to drilling seaward of the Barbados Trench. This is an important AMP target. IPOD drilling has so far failed to penetrate a "classic" accretionary prism or a mega-shear zone and here, both of these objectives are within CHALLENGER drillstring length. The Barbados sites are very attractive in being on an intra-oceanic arc with a well-developed accretionary prism. Trench and deep ocean sediment flowing north from South America is mainly a turbidite whereas material on the slope is mainly ooze and arc derived clastics. The deep ocean sediment is unusually thick to be associated with an intra-oceanic arc and if accreted, it should give an expanded chronologic record of arc related events. This transect is considered to rank in importance with first drilling of magnetic anomalies.

B. Yukatan Basin

The Yukatan Basin (CAR-7) site is also an important priority of the AMP. This site should provide reference data needed to decipher the complex evolution of rotating micro-plates in the middle America region.

III. REVIEW OF AMP OBJECTIVES

A. Structural Evolution of the Forearc Region

The tectonic structure of the forearc region must reflect the first-order effects of plate convergence such as the shear along the thrust zone separating one plate from the other, the transfer of oceanic material from the lower plate to the upper plate, and metamorphism. CHALLENGER drilling has not yet sampled material that clearly came from the oceanic plate and was accreted to the continent, nor has the megathrust between the plates been penetrated. Drilling has demonstrated that the spectrum of possible structures is broader than expected. Thus, it is necessary to sample and study representatives of major arc types from intra-oceanic (Mariana) through intermediate marginal arcs (Japan) to continental types (Peru-Chile) to define the scope of structural variation in the forearc. Key structural targets for forearc drilling include the thrust zone between plates, imbricate thrust slices that form inclined reflectors within accretionary prisms, and the basement substratum of the forearc belt where accretion is minor.

B. Sedimentary Sequences in Modern Trench and Deep Forearc Basins

Sedimentary environments interpreted from the study of exposed rocks that were once deposited along ancient active margins are important to the fundamental knowledge of large parts of the continents. However, many of the criteria for interpretations of environments have yet to be grounded by study of modern analogies. Modern trench and deep forearc sequences are commonly buried below Holocene sediment that is not easily penetrated by standard oceanographic sampling techniques. Sampling of these sequences requires drilling.

Three main settings should be sampled by drilling:

1. Trenches.
2. Slope aprons.
3. Forearc basins in deep water.

The sediment that fills the axis of some trenches is inferred to have a distinct lateral facies pattern and vertical sequence.

This fill may represent an important part of the material incorporated in the accretionary prism of the continental slope. The study of undeformed trench fill is needed to interpret deformed samples from the slope and to establish whether there are criteria that distinguish trench deposits in ancient margins.

The slopes of some trenches have sediment aprons which may become involved in the process of accretion or margin deformation. Slope sediments are found in outcrops of deformed rock from ancient margins but they are difficult to distinguish from trench or forearc basin deposits. Appropriate selection of sites on trench slopes can provide tests of various kinds of slope sediment.

Some forearc basins on the continental shelves of convergent margins are thought to first have formed on the trench lower slope and then have been uplifted to their present depths. Others may contain shoaling upward sequences that record basin filling. The succession of facies developed at various water depths can be studied in drill cores. In addition, the sediment sequence should contain a record of the rocks exposed on the arc and a history of volcanism. Study of the detritus preserved within forearc basins may be one of the most efficient ways to chronicle time-dependent trends in the geologic evolution of active margins.

C. Evolution of Collision Margins

Collision margins may be the tectonic environment of obduction, an inferred tectonic process that provides subaerial exposure of the rocks from ancient convergent margins. The magnitude of vertical motion that brings rocks from 20 to 40 km in the earth and exposes them on the surface is difficult to place into a tectonic system that is dominantly driven by horizontal tectonic forces. This has prompted the debate about the origin of ophiolitic sequences, which centers about their origin as oceanic crust or parts of a backarc sequence. In other instances, ocean closure has drawn a passive margin against, and partly beneath an active margin.

Here drilling can establish the nature of the evolving structure that represents the nacent stages of a mountain belt.

D. Evolution of Island Arc Magmatism

The aerial exposures of island arc rock reveal only part, and generally the latter part, of the sequence of island arc magmatism. To recover rock in an intermediate or early stage of arc evolution requires drill sampling on the outer parts of the forearc area. The sequence of forearc sediment may also contain a history of arc magmatism. The petrology of island arc rock must somehow be related to rates of subduction, the composition of incoming materials, migration paths whether through continental or uplifted oceanic crust, and associated backarc processes. Island arc magmatism may involve processes leading to the development of metallogenic ore deposits.

E. Evolution and Origin of Backarc Basins

It has been assumed that backarc basins of the north and west Pacific originate from plate convergence along active margins because they are found adjacent to the magmatic arc, but just how they are linked to the process of convergence is not known. Two modes of origin should be tested:

1.) Backarc spreading akin to mid-ocean spreading.

2.) Entrapment of oceanic crust by formation of an island arc.

The origin of the Philippine Sea by spreading has been confirmed by IPOD drilling in 1978. However, this should now be tested in a proposed spreading backarc basin with thick sediment like the Sea of Japan, where a record of evolution is preserved in the sediment fill. The origin by entrapment is less certain since it has been proposed from studies based largely on geophysics. It is likely that this mode of origin will not be established with any greater certainty until rocks of the basement have been sampled and dated.

F. Site Selection Recommendations

In light of the discussion of AMP objectives, the following specific recommendations were made:

1. Sedimentation across active margins be made a specific objective of the AMP, with emphasis on the deep forearc basins. The objective is to look at facies and sequences in a variety of modern environments to see if distinctive criteria can be found that will aid in interpretation of rocks from ancient margins.

2. Studies of igneous and metamorphic rock in the arc and forearc regions be emphasized. This might be accomplished by sampling intra-oceanic arcs in various stages of evolution. Concentrated sampling should be done in a well-controlled area rather than sampling from a variety of areas.

3. Metamorphic processes in island arc areas be emphasized.

4. Knowledge of backarc basins is important but it has progressed farther than other original AMP objectives through recent IPOD drilling. Therefore, this objective now has a lesser priority than it had previously. The Sea of Japan backarc drilling is retained as a high-priority target because of its additional importance in interpreting the Japan Trench transect. The Bering Sea is also an area where sampling will achieve more than just a backarc objective.

IV. SUMMARIES OF CURRENT RESULTS IN PRIMARY AMP AREAS

A. Review of mid-America data brought out the desirability of staying out of a possible transverse fracture off Guatemala. Off Oaxaca it was noted that the age and volume of accreted material may help interpretation of possible crustal disposal, or transforming of a large part of the continent northward.

B. The extensive data base and proposed sites selected by the Japanese IPOD group were presented for the Sea of Japan program.

C. Advanced processing and interpretation of multichannel data off Peru and Ecuador were reviewed. A zone of transition from rocks with continental affinities to rocks with oceanic affinities was outlined as a critical sampling target.

D. Focus of a future Mariana sampling program was placed in the forearc area and also on the lower slope of the trench where a longer drill stem is required.

E. There seemed to be different interpretations of data in the Banda-Sunda area although everyone agreed that it is an important area to investigate with regard to collision margins. A working group chaired by Audley-Charles and including Karig and Dickinson will be formed. It will be recommended that an Indonesian-Philippine super panel is needed for this area. Coordination should be established with the SEATAR program. Many of the holes will need to be drilled with a riser.

F. The New Hebrides are unique. They are about 5 m.y. old in the south and subduction has been initiated along a fracture zone. Much French data is still unpublished but the area appears to be well covered by marine geophysical data.

G. Oregon and Washington margins, although worthy scientific targets, are more of a target of opportunity since they are near the shakedown area for GLOMAR EXPLORER.

H. A catalogue of problems in the north Pacific that require drilling to be solved was assembled by Dave Scholl and his colleagues.

I. The Oman area was added to the list of target areas because it presents a unique area to study an obducting ophiolite slab and the controversy regarding the origin of ophiolites might be settled.

V. EXPLORER PROGRAM

Three informal working groups have formed in response to AMP consideration of areas for GLOMAR EXPLORER type drilling. One group in the U.S. has written a document on the north Pacific. Two groups in Great Britian have formed: one considering the eastern Meditterranean chaired by Prof. G. Kelling, and another considering the Oman area chaired by Prof. D. Whitbread. The AMP encourages these panels to provide added expertise in considering these important areas.

DRAFT REPORT
OCEAN PALEOENVIRONMENT PANEL
28-29 October, 1978—Toronto, Canada

I. REVIEW OF PAST ACTION ITEMS

A. Caribbean

OPP recommends a series of sites to recover the Neogene record where windows in the basalt can be found. K. Hsu and I. Premoli Silva will revise site planning and receive input from the AMP. Hsu will contact the Caribbean Working Group and organize a meeting with the objectives of recovering the Neogene record and prebasalt sediments. Hsu will keep the site files up to date and will contact SCP Chairman Benson with regard to site selection objectives.

B. GEOTIMES Article

Lancelot has figures for the article and will handle the necessary redrafting. Following panel discussion, the manuscript will be amended to emphasize the need for Cretaceous and Cenozoic sites in the Pacific after the disappointing recovery on Legs 61 and 62.

II. REPORT FROM SOUTHEAST ATLANTIC WORKING GROUP

A. There are three major objectives for this program:

1.) Mid-Cretaceous anoxic events, drilling in the Cape and Angola Basins (Sites SA 1-1, 3-1).

2.) Ocean gradient study across Walvis Ridge. A series of single bit holes to basement.

3.) Tertiary oceanography. Ridge transect (SA 1-2) plus holes in Angola and Cape Basins.

B. Seismic Surveying needs for these areas was delineated.

1.) In South Atlantic ridge transect, a good survey is needed to locate sites in same transform block and to locate the Braarudosphaera chalk near Leg 3, Site 17 and trace the reflector into the Angola Basin.

2.) Detailed seismic stratigraphy is needed across the Walvis Ridge to identify the Cretaceous-Tertiary boundary.

3.) Cape and Angola Basin sites need detailed surveying. Sites are still undetermined as the final position will depend on best recovery, removed from terriginous sources as far as possible, and to satisfy the needs of the OGP where possible.

III. PCOM RELATED ACTION ITEMS

A. The OPP recommends that the Co-Chiefs on each leg should be charged with the responsibility of making arrangements for grain size and carbon carbonate analyses while the DSDP sediment lab is closed.

B. The OPP endorses the value of the Initial Reports in its present format and urges the project to retain this format following a review of contribution requirements and production practices.

IV. REVIEW OF RECENT LEG RESULTS

A. Leg 62

The panel discussed the losses in OPP objectives in both the Leg 61 and 62 programs. These included the Early Cretaceous and Jurassic goals of Leg 61 and both the Neogene history of the Mid- Pacific and the Gulf of Alaska on Leg 62.

FUTURE OPP SCIENTIFIC OBJECTIVES

OBJECTIVES	NEEDS	CHALLENGER	EXPLORER W/O RISER
North Pacific			
California Current Site, Santa Lucia Bank		X	
EPG Cape Mendocino, gyre geography	Site Survey	X	
Two offshore sites remaining from Leg 62 program		X	
Three Gulf of Alaska sites remaining from Leg 62 program		X	
Hess Rise Neogene objectives		X	
Bering Sea Abyssal plain		X	
Site 192 redrill for Cenozoic objectives		X	
Gulf of Alaska Margin	Site Survey		X
Bering Sea Margin	Site Survey		X
Shatsky Rise	Site Survey		X
Western Pacific			
Old crust in area South of Japanese lineations (Leg 61 objectives)	Regional and Site Surveys		X
Samoa Gap (Tertiary)			X
Mariana Basin old crust	Regional and Site Surveys		X
Atlantic Margin Program			
Blake Plateau and sea ward sites	PMP	X	X With and w/o Riser
Nova Scotian Margin	PMP	X	
Indian Ocean			
Somali Basin	Regional and Site Surveys		
Chile Rise, N. 50° S.	Regional and Site Surveys	X	
Agulhas Plateau	Site Survey	X	
Site 249 Mesozoic record	Site Survey	X	
Mediterranean			
Mediterranean program through evaporates (endorse program)			

B. Leg 63

The OPP proposes that logging be included and justified in each original site proposal and that any conflict of interest between a decision to log or core be resolved by the Co-chief scientist with regard to the general objectives of the leg and site. In addition, the OPP recommends that the remainder of Leg 63 be carefully evaluated with regard to logging and coring objectives. The panel regards the logging of EP3, EP8, and GC9 to be of low priority and should be seriously evaluated if it precludes completing the site objectives.

V. REVIEW OF NORTH ATLANTIC PROGRAM

The panel discussed the need for a continuous Cenozoic section for recovery of Mesozoic sediments in the Rockall and Labrador Sea areas, and Jurassic recovery off the Moroccan coast.

Lancelot and Jenkyns will coordinate OPP and PMP objectives in the North Atlantic. Sarnthein will document Cenozoic sites off North Africa.

VI. MESOZOIC PACIFIC PROGRAM

In view of the need for delineating the future needs for Mesozoic programs, a Mesozoic Working Group was established to work on programs in the Pacific, Arctic and Atlantic Oceans.

VII. FUTURE CHALLENGER-EXPLORER PROGRAMS

The panel reviewed the needs for future CHALLENGER and EXPLORER programs and the needs for additional data objectives were defined. (See table, page 49.)

DRAFT REPORT
POLLUTION PREVENTION AND SAFETY PANEL
8-9 February, 1979—SIO

The JOIDES Safety Panel met to review sites for Legs 66, 67, 68, and 69.

Leg 66

M-1a — Recommend drill site be moved 1 km seaward along Line MX-16 to get off the anticlinal structure. Penetration limited to 760 m.

M-1b — Approved. Penetration limited to 750 m.

M-2a — Approved. Penetration limited to 500 m.

M-3a — Approved. Penetration limited to 1,380 m. All drilling precautions to be observed.

M-3b — Approved for drilling to a depth of 1,000 m with normal precautions. If drilling proceeds beyond that depth, extra precautions should be taken in approaching the BSR, the testing program using the Pressure Core Barrel should be started, a careful hydrocarbon monitoring program should be followed for all cores, and drilling should be stopped immediately if:

(1) Cores obtained with the Pressure Core Barrel confirm the presence of methane hydrate, or contained measured volumes of gas greater than 80 times the volume of sediment; or

(2) the Pressure Core Barrel fails to function, but regular coring shows greater than normal amounts of hydrocarbons or indicates the presence of methane hydrate; or

(3) coring yields evidence of hydrated gas, and bottom hole temperatures and pressures approach values at which gas hydrates change to free gas.

M-3c — Move to Depth Point #690, Line MX-16 for safer structural position. Approved to depth of 600 m with normal precautions. Extra precautions should be exercised if drilling proceeds below that depth, and a testing program using the Pressure Core Barrel should be started. Drilling should be stopped immediately if any of the conditions listed for M-3b are encountered.

M-3d — Approved to depth of 200 m with normal precautions. Extra precautions should be exercised if drilling proceeds below that depth, and a testing program using the Pressure Core Barrel should be started. Drilling should be stopped immediately if any of the conditions listed for M-3b are encountered.

M-4a — Approved. Penetration to single-bit destruction unless acoustic basement proves to be sedimentary rock or abnormal hydrocarbon indications are encountered. In either event drilling is to be stopped immediately.

M-4b — Penetration to single-bit destruction with restrictions as stated for M-4a.

M-4c — Penetration to single-bit destruction with restrictions as stated for M-4a.

M-4d — Penetration to single-bit destruction with restrictions as stated for M-4a.

M-5a — Move Site to SP #1950 on Line MX-13. Approved for re-entry with penetration limited to 1,500 m, unless abnormal amounts of hydrocarbons have been encountered.

Leg 67

Sites G-1b, 2b, 2c, 4a, 5a, 6a, and 7a were reviewed and approved as proposed; drill to single-bit destruction. Sites G-3b, 9a, and 10a were approved by the JOIDES Safety Panel, but were later disapproved by the SIO Safety Panel.

Leg 68 (Costa Rica)

CR-1 — and CR-1a — Approved for re-entry; penetration limited to 1,000 m.

CR-2 — Approved; penetration limited to 800 m. Approval also given to drill at any point along Seismic Line 2525 within 5 km of the approved CR-2 location.

CR-3 — Approved; penetration to 800 m. Approval also given to drill at any point along Seismic Line 2528 within 5 km of the approved CR-3 location.

CR-3a— Approved; penetration limited to 800 m.

CR-4 — Approved; penetration limited to 700 m. Approval also given for drill at any point along Seismic Line 2553 within 5 km of the approved CR-4 location.

CR-5 — Approved; penetration limited to 800 m.

Leg 69 (Galapagos)

Drilling approved for any sites within an area bounded by:

Latitudes: 0°32'N-0°38'N and
Longitudes: 86°04'W-86°10'W

where sediment thickness is 100 m or less. Approval also given for one re-entry site where drilling conditions are found to be satisfactory for this purpose. Normal drilling procedures and normal abandonment procedures are to be followed.

DRAFT REPORT
SOUTHEASTERN ATLANTIC WORKING GROUP
10 January, 1979—Paris

This meeting was held to pinpoint the more exact location of the proposed Southeastern Atlantic drill sites. An outline of the sites in areas SA I, II, III, and IV was presented.

Mid-Atlantic Ridge Sites

Discussions clarified the fact that planning has taken OCP interests into account . All sites will be within the same crustal segment between two transform fault zones. Sites are planned systematically to yield information of spreading rates and other information useful to OCP.

Sites SA IV-1 and 3 will be drilled on Anomalies 5, 5a, and 5b as originally planned. Sites IV-4, 5, 6, and 7 will be drilled on Anomalies 13, 16, 18, and 21 (instead of 13, 18, 20, 21 as originally planned). The minor change is made to assure that a good late Eocene section is obtained to investigate the significant paleoceanographical changes during that time.

Angola Basin Sites and the Problem of the Cretaceous Anoxic Events

It was suggested that the proposed location of SA I-1 be shifted from 19°25'S, 08°05'E (original) eastward to 19°10'S, 09°30'E (new). Seismic profiles were studied. This proposal was not accepted because:

1. The new location was within 200 miles of the coast, and

2. The new location would require drilling to 1,800 m or about

twice the time required to drill the original location. The W.G. agreed that the Site SA I-1 should be moved as far east as possible if,

a. A location was more than 200 sea miles from the coast, and if

b. The basement depth there is less than 1,200 m. However, there is no site-survey time for reconnaissance surveys. The site has to be decided before site surveys begin. In view of this fact, Site SA I-1 will remain in its original location of 19°25'S, 08°05'E, unless a location which meets the two specifications is around after a study of existing profiles.

A new site, I-5 in the Angola Basin at the mid-slope of the Walvis Ridge (paleodepth 2,000 m), was proposed to study the mid-Cretaceous anoxic events. In light of the OPP mandate to only consider alternate locations, not additional proposals, it was suggested that the new Site I-5 be drilled as an alternate proposal to old site SA III-1.

Site III-1 was originally proposed because it was thought to be the only place where Aptian sediments in the Cape Basin could be sampled at a basinal setting. The Working Group reevaluated the position of III-1, and came to the conclusion that the age of the oceanic crust there is probably not Aptian, but Lower Albian, even if the anomalies are correctly identified. The only sapropelic event there is the one dated at Site 361 which ranged from Aptian to early Albian; the Late Cretaceous event is probably absent in the Cape Basin. Even if the most optimum results are obtained, only a small part of the sapropelic section would be recovered. It is possible that the crust is even younger than Lower Albian, and that the objective is too deep to be reached with the alloted time of 12-15 days of drilling.

The Working Group recommends that Cape Basin Site III-1 be dropped in favor of new Angola Basin Site I-5. A written vote will be taken from OPP members.

Walvis Ridge Sites

The Walvis Ridge traverse was presented. The posssibility of moving the profile eastward to penetrate older crust was considered. However, no profiles are known to the east which indicate the same optimum situation necessary for meeting the objectives. The site surveys will probably be carried out by a South African institution. New proposals, forthcoming before the time of site-surveying will be evaluated by Shackleton. If no new proposals are satisfactory, the Walvis Ridge sites will remain where they are. There was some discussion if Site II-6 should be located a little higher up toward to ridge to avoid possible thick basinal turbidites, but a reexamination of the profiles found no particular ponding of turbidites at the proposed location.

Multi-channel seismic profiles of the Walvis Ridge were presented. The presence of reflectors within the Walvis Ridge basement was noted. The W.G. members agreed that the problem may be interesting, but does not constitute a part of the OPP objectives in the Walvis Ridge region. A proposal to investigate the nature of reflections within the basement should be initiated by OCP or PMP. It was also mentioned that other regions with similar reflectors might be better places to investigate this problem.

Future Plans and Staffing

The Univ. of Texas (MSI) will do the site surveying for the Mid-Atlantic Ridge (SA-IV) and Angola Basin sites, and probably the Cape Basin Site SA III-2. They will start in February. A South African group will do the Walvis Ridge site surveying (SA II-, 1-6).

The Mid-Atlantic SA-IV sites might be drilled during Leg 70. The Walvis Ridge SA-II and Cape Basin SA III-2 sites should be drilled during Leg 71, and the Angola Basin sites (SA-I, 1, 2, and 5) should be drilled during Leg 72.

Staffing recommendations were made and sent to DSDP.

The working group will meet again in early September. Site proponents for various sites should prepare to meet with the Safety Panel (PPSP) in October.

1979-1980 APPROVED JOIDES MEETINGS

PANEL	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June
EXCOM			14-16 Reykjavik			26-30 USSR							
PCOM		16-18 July			22-24 Moscow				25-29 Wash, DC				
DMP													
IHP													
IGP	4-6 SIO												
OCP													
AMP				5-7 SIO									
PMP	11-14 Oslo												
OPP				5-6 Barbados									
OGP				24-25 Bristol									
PPSP													
SP4						2-3 SIO							
SSP													
SCP	28-29 Wash, DC												
Ad hoc/ W.G.	20-22 SIO												

NEWS ITEMS AND ERRATA

HYDRAULIC PISTON CORER (HPC-15) SYSTEM DESCRIPTION

I. GENERAL

A protype piston corer has been developed and tested successfully on Leg 64 in the Gulf of California. It is capable of recovering undisturbed cores 14'7" (4.4 m) in length and 2.5" (6.35 cm) in diameter. The piston corer is lowered and retrieved through the drill string. Thus by repetitive operation in the same hole, high-quality cores may be taken in 4.4 meter increments through the unlithified interval.

These specifications summarize the HPC capability. Details on equipment, operation and a test report are included in the following sections.

II. PENETRATION LIMITS

The HPC has recovered a nearly continuous section totaling 152 m of undisturbed laminated core at Site 480 in the Gulf of California. Maximum shear strength of the recovered material is about 1.02 tons/ft^2 (1000 g/cm^2). The system is designed for total subbottom penetrations approaching 650 ft (200 m).

III. BITS

A special 11.5" O.D. bit with a 3.6" core throat opening is required. Coring with the HPC must be discontinued when the sediments become too indurated. The HPC system is not designed for drilling and coring in indurated material.

IV. CORE LINER

Core is received in the standard sized butyrate core liner.

V. OPERATIONS TIME

Wireline retrieval and lowering speeds average 350 ft/min (110 m/min). This compares with conventional wireline trip times of approximately 500 ft/min (150 m/min). On-deck turnaround time is 20 minutes with a single barrel and actuation time is approximately 15 minutes. Two HPC barrels are available. Using both barrels in an alternate fashion, the cycle times for a 10,000 ft (3,050 m) hole may be compared as follows:

	HPC-15 (15' CORE)	CONVENTIONAL CORE BARREL (30' CORE)
Free Fall Down Hole	N/A	20 min
Wireline Time In	25 min (140 ft/min)	20 min
Actuation/Coring	15 min	15 min
Wireline Time Out	30 min (320 ft/min)	20 min
On-Deck Turnaround	5-10 min	5 min
	75-80 min	80 min

NOTES/COMMENTS

1. After approximately 10 runs, 2-3 hours on each barrel will be required to redress major seal assemblies.

2. The HPC operation does require tripping the drill string to provide the proper bottomhole assembly (BHA). The HPC is not compatible with the conventional BHA.

3. Additional operational use under varying drill string length and weather conditions is required to more adequately determine HPC capabilities and areas for design improvements. Designs for longer cores and improved seal performance are being studied to improve the overall rate-of-advance of the HPC operation. On Leg 67 an attempt will be made to obtain oriented hydraulic piston cores.

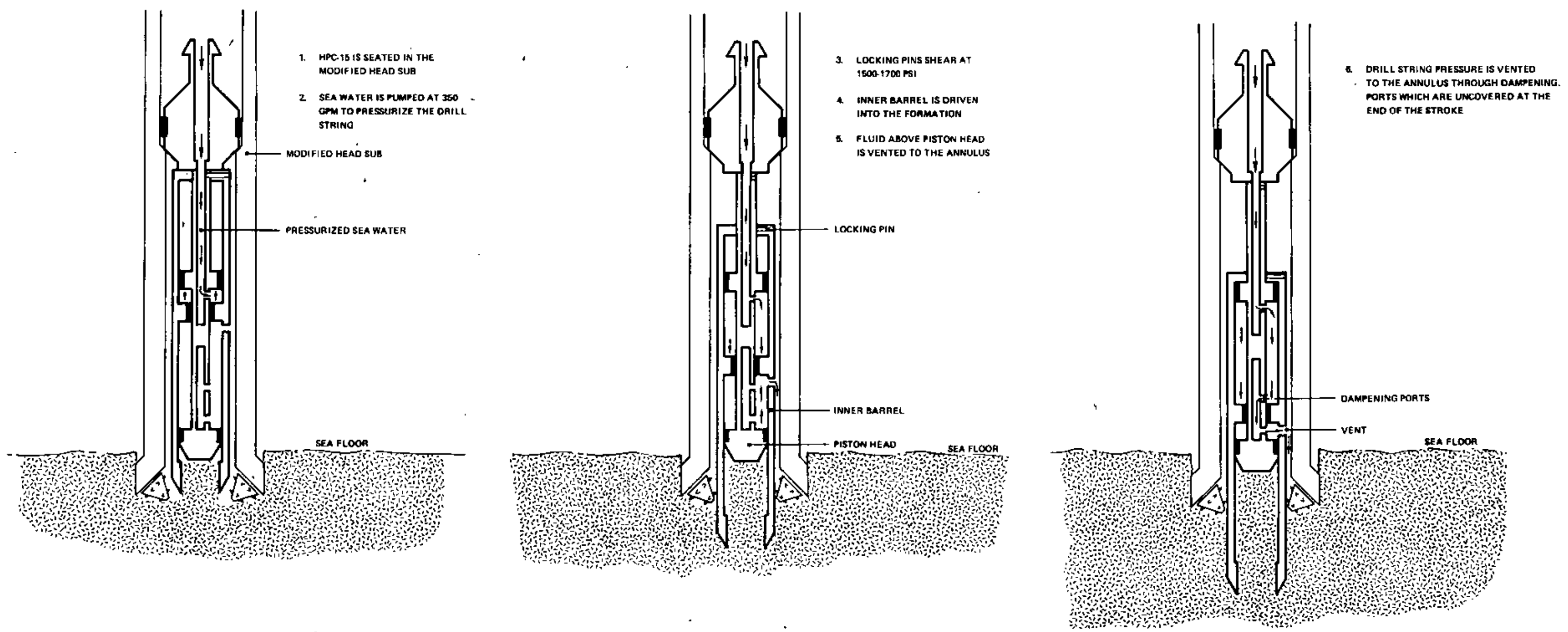

FIGURE 7
Operational Schmatics for the Operation of the Hydraulic Piston Corer

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PUBLICATION HISTORY

Volume I of the JOIDES Journal was composed of the following issues:

May, 1975	Edition 1975/1
August, 1975	Edition 1975/2
November, 1975	Edition 1975/3

Volume II of the JOIDES Journal was composed of the following issues:

March, 1976	No. 4	1976/1	Special Issue: Manual on Pollution Prevention & Safety
April, 1976	No. 5	1976/2	
September, 1976	No. 6		

Volume III of the JOIDES Journal was composed of the following issues:

January, 1977	No. 1		
September, 1977	No. 2		
October, 1977	No. 3	Special Issue:	Initial Site Prospectus; Supplement Number One Distributed in April, 1978.

Volume IV of the JOIDES Journal was composed of the following issues:

February, 1978	No. 1
June, 1978	No. 2
October, 1978	No. 3

To date, Volume V of the JOIDES Journal is composed of the following:

February, 1979	No. 1
June, 1979	No. 2

BACK ISSUES

Copies of the following back issues of JOIDES Journal are available from the JOI Inc. Office:

November, 1975	1975/3		
March, 1976	No. 4, 1976/1	Special Issue:	Manual on Pollution Prevention and Safety
September, 1976	No. 6		
January, 1977	Vol. III, No. 1		
September, 1977	Vol. III, No. 2		
October, 1977	Vol. III, No. 3	Special Issue:	Initial Site Prospectus
February, 1978	Vol. IV, No. 1		
April, 1978	Supplement Number One (For Special Issue published October, 1977; Volume III, No. 3)		
June, 1978	Vol. IV, No. 2		
October, 1978	Vol. IV, No. 3		
February, 1979	Vol. V, No. 1		
June, 1979	Vol. V, No. 2		

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The purpose of the JOIDES Journal is to serve as a means of communication among the JOIDES Committees and Advisory Panels, the National Science Foundation, the Deep Sea Drilling Project, and interested earth scientists.

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Additional copies of this issue and available back issues should be requested from: Joint Oceanographic Institutions Inc., 2600 Virginia Avenue, N.W., Suite 512, Washington, D.C. 20037; telephone number: (202) 333-8276; cable address: JOIINC.