# JOIDES Journal

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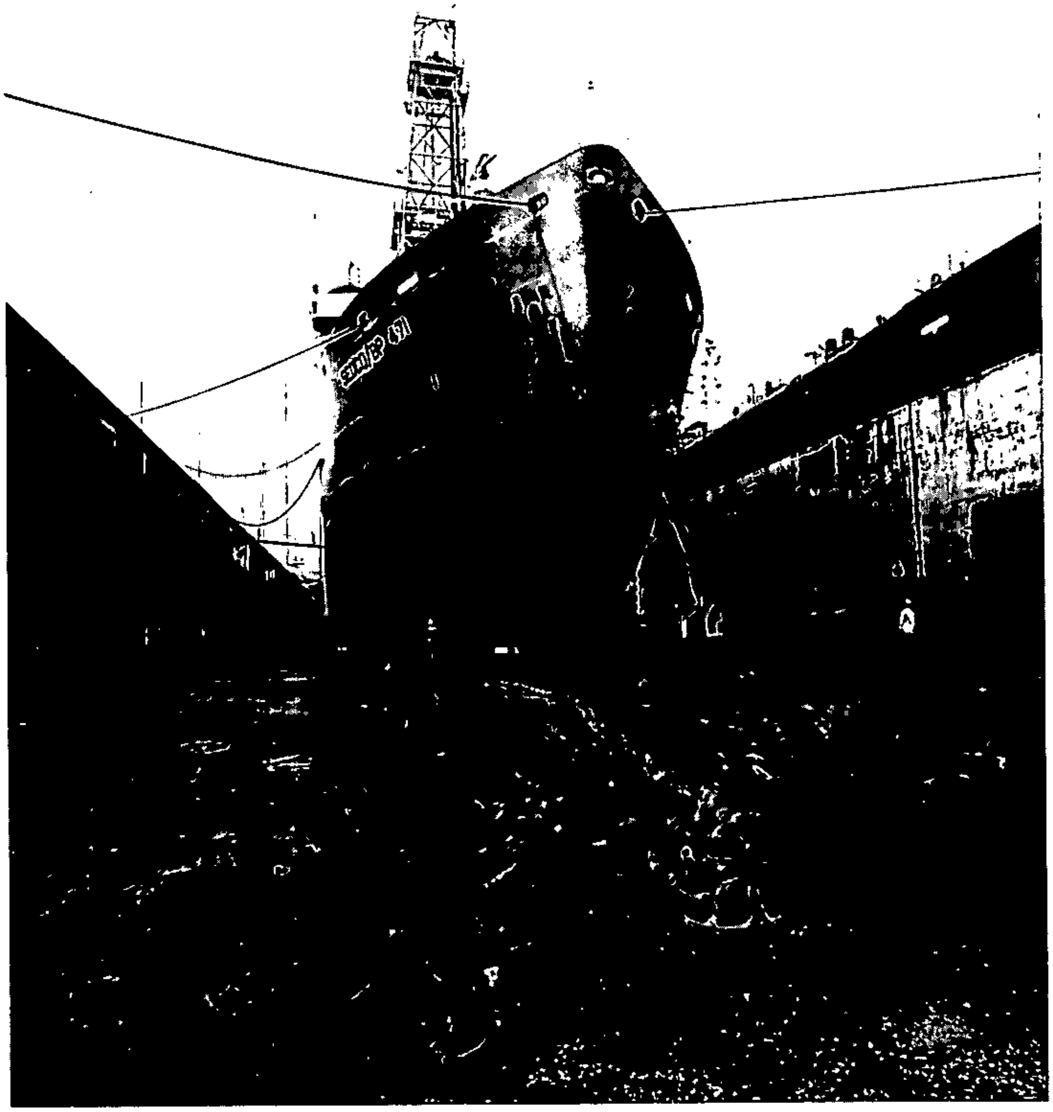

# JOIDES Journal

VOL. XVI, No. 1, February, 1990


## TABLE OF CONTENTS

# FOCUS

The planning structure of JOIDES continues to evolve along with its advisory structure. Let me take a few lines to focus on the Detailed Planning Group, a concept that became formalized at the beginning of 1989 as part of the change from a mixed regional and thematic advisory mode to a thematic one. DPGs should become of increasing importance in the future, and those of you in the JOIDES community have the right to know more about them.

The realization grew that for many complex programs, especially those based on more than one good proposal, neither the thematic panels nor the Planning Committee had the time or expertise for detailed planning of legs. The former regional panels had been the agents for determining what sites best met programmatic objectives, calculated their drilling and logging times, and fit them into legs. That work may now be assigned to DPGs. DPGs will be established and given specific charges by PCOM; their reports, with any comments by thematic panels, will be sent to PCOM for a drilling decision.

The former Central and Eastern Pacific Regional Panel has been acting as a DPG, and under the able leadership of David Rea has carried out PCOM requests in 1989 to turn a number of multi-proposal programs into site-specific legs. It was the Lau Basin Working Group, however, that provided the model for program-specific DPGs rather than regional ones. The Lau Basin WG was assembled from scientists with data and scientific interests in the Lau-Tonga area. They were given a specific task to examine several proposals and revised proposals, involving survey data from five nations, and decide on a one-leg drilling program that best fit the objectives of the regional and thematic panels concerned. The working group, which would have been termed a DPG, had that term been available then, met briefly and successfully.

Sediment-covered spreading centers, although relatively rare, provide the Ocean Drilling Program a unique opportunity to investigate a number of fundamental geologic processes including hydrothermal circulation, sulfide metallogenesis, and crustal formation. These objectives were of sufficient thematic importance that PCOM established a Sedimented Ridge Detailed Planning Group (SRDPG), and charged it with developing a detailed prospectus for drilling at sedimented ridges in the eastern Pacific. The SR-DPG, chaired by Robert Detrick, met 13-15 June 1989 in Ottawa and developed a drilling program that PCOM subsequently accepted. The first of two recommended legs has been placed in the FY91 drilling plan.

With the success provided by these examples, PCOM has now established two additional DPGs, to meet in 1990, report, and disband. One is a Cascadia DPG, charged to examine the competing drilling proposals for the Cascadia accretionary prism, and provide a prioritized plan for drilling; if the highest priorities cannot be accomplished in one leg, the DPG will make suggestions for later drilling. The second is an East Pacific Rise DPG, charged to choose which of two active proposals better meets the criteria established by the earlier East Pacific Rise Working Group, and then to fix the drilling template of this proposed "natural laboratory" to actual sites and prepare a drilling plan.

We in JOIDES appreciate the work of Dave Rea, Bob Detrick, and their associates, and I hope you join me in sending best wishes for similar success to those who have agreed to serve on detailed planning groups in 1990.

Ralph

Ralph Moberly
Planning Committee Chairman

## JOIDES RESOLUTION OPERATIONS SCHEDULE

### LEGS 129 - 139

| LEG | AREA | DEPARTURE LOCATION | DEPARTURE DATE | ARRIVAL LOCATION | ARRIVAL DATE | IN PORT | DAYS AT SEA* |
|---|---|---|---|---|---|---|---|
| 129 | Old Pacific Crust | Guam | 11/24/89 | Guam | 01/19/90 | 01/19 - 01/23 | 56 |
| 130 | Ontong Java | Guam | 01/24/90 | Guam | 03/27/90 | 03/27 - 03/31 | 62 |
| 131 | Nankai | Guam | 04/01/90 | Pusan, Korea | 06/02/90 | 06/02 - 06/06 | 62 |
| 132 | Engineering II | Pusan, Korea | 06/07/90 | Guam | 08/05/90 | 08/05 - 08/09 | 59 |
| 133 | N.E. Australia | Guam | 08/10/90 | Brisbane, Australia | 10/11/90 | 10/11 - 10/15 | 62 |
| 134 | Vanuatu | Brisbane, Australia | 10/16/90 | Suva, Fiji | 12/11/90 | 12/11 - 12/15 | 56 |
| 135 | Lau Basin | Suva, Fiji | 12/16/90 | Papeete, Tahiti | 02/16/91 | 02/16 - 02/20 | 62 |
| 136 | Engineering 3A (504B) | Papeete, Tahiti | 02/21/91 | Panama | 03/30/90 | 03/30 - 04/03 | 37 |
| | Engineering 3B (EPR) | Panama | 04/04/91 | San Diego | 05/16/91 | 05/16 - 05/20 | 42 |
| 137 | Sedimented Ridges 1 | San Diego | 05/21/91 | Victoria, B.C. | 07/22/91 | 07/22 - 07/26 | 62 |
| 138 | E. Equat. Pac. Neogene | Victoria, B.C. | 07/27/91 | Panama | 09/25/91 | 09/25 - 09/29 | 60 |
| 139 | 504B or EPR-1 | Panama | 09/30/91 | Panama | 11/29/91 | 11/29 - 12/03 | 60 |

Revised 12/12/89

*Schedule subject to change pending detailed planning after Leg 135

# LEG 128: JAPAN SEA II SITE REPORTS

INTRODUCTION

Leg 128 began on 21 August, 1989, with a port call in Pusan, South Korea, and ended on 16 October in Pusan. The following site summaries were prepared by *JOIDES Resolution* Co-Chiefs Drs. Jim Ingle and Kiyoshi Suyehiro. Dr. Marta von Breymann was the ODP/TAMU Staff Scientist for Leg 128. The unifying objectives for drilling in the Japan Sea were to assess the style and dynamics of rifting and marginal sea formation in a continental arc setting and to decipher the parallel paleoceanographic evolution of the sea.

Site Summary, Site 798

Hole 798A
Latitude: 37° 02.30' N
Longitude: 134° 47.98' E
Water Depth: 906 m

Hole 798B
Latitude: 37° 02.31'N
Longitude: 134° 47.98'E
Water Depth: 911 m

Hole 798C
Latitude: 37° 02.31'N
Longitude: 134° 47.98'E
Water Depth: 911 m

The specific objective at Site 798 (proposed site JS2), located atop Oki Ridge, was to recover an upper Neogene paleoceanographic reference section thought to have been deposited above the local CCD in a setting isolated from rapid accumulation of coarse terrigenous sediments. The principal results at Site 798 were as follows:

(1) A 517.9-m-thick mid-Pliocene through Holocene sequence of diatomaceous and terrigenous clays, claystones and oozes was recovered, which contains an expanded record of paleoceanographic events in the Japan Sea for the past 3 m.y. The lower Pleistocene through Holocene portion of this sequence is characterized by a visually striking series of lithologic cycles involving the repeated appearance of laminated organic-rich subunits alternating with homogeneous to bioturbated terrigenous-rich subunits. This pattern likely reflects major changes in water mass character, productivity, windborne transport of fine-grained terrigenous sediment, and associated depositional responses controlled by glacial-interglacial climatic cycles involving repeated eustatic isolation of the Japan Sea from the open Pacific. The carbonate-poor character of the Pliocene portion of this section may reflect uplift of the sequence above the local CCD during Quaternary time and/or diagenetic history of these sediments.

(2) Well preserved ash layers in this section provide an unusually detailed and well calibrated record of Pleistocene and mid-Pliocene volcanism in the adjacent Japanese arc. A mid-Pliocene pulse of volcanism is represented by a series of ashes in lithologic Unit III with no ashes present in upper Pliocene and lowermost Pleistocene sediments. Ashes appear again at 210.3 mbsf (~1.7 Ma) and rapidly increase in frequency and thickness in overlying sediments with an apparent peak in volcanic activity ~600 Ka. The number and thickness of ash layers decrease in uppermost Pleistocene and Holocene sediments with the youngest ashes present in this sequence likely correlative with previously well dated eruptions in this area.

(3) A series of whole-round bacteria samples was collected at depths of 0 to 495 mbsf using special techniques to prevent contamination. This is a pioneering study aimed at quantifying the role of bacteria in diagenesis by measuring their activity and biomass at greater depths below the sediment/water interface than heretofore attempted.

Site 798 is located in a small fault-bounded and sediment-filled depression on the mid-portion of Oki Ridge. The site was confirmed by two *JOIDES Resolution* seismic lines. Line 128-1-A, bearing 123°, parallels Japan Geological Survey (GSJ) seismic line GSJ-GH8604, originally used to locate proposed site JS2. After confirmation of the site, line 128-1-B, bearing 250°, was taken as transit to start line 128-1-C, bearing 35°, which subsequently crossed site JS2 where the beacon was dropped. The final drilling position was adjusted to avoid a sharp depression in the sediment cover seen on the 3.5-kHz record immediately after dropping the beacon.

The sedimentary section cored at Site 798 consists of mid-Pliocene through Quaternary fine-grained pelagic and hemipelagic diatomaceous and terrigenous sediments including discrete ash layers. Based upon initial core descriptions, the section was divided into three units as follows:

➡Unit I: (0-20 mbsf; Holocene-upper Pleistocene) Silty clay with calcareous and biosiliceous intervals. This unit exhibits decimeter to meter-scale cycles, each consisting of laminated organic-rich sediment and an overlying homogeneous and/or bioturbated subunit of terrigenous sediment. Thin volcanic ashes also occur in this unit.

➡Unit II: (20-330 mbsf; upper Pleistocene to upper Pliocene) biosiliceous clays and oozes with abundant ash layers up to 20 cm thick. Well preserved diatoms are the major component of the biosiliceous sediments. Foraminifer- and nannofossil-rich intervals are common to a depth of 180 mbsf with preservation of carbonate decreasing below this depth and absent or poorly preserved below 250 mbsf. Well developed laminated/ homogeneous/bioturbated cycles similar to those present in Unit I continue to a depth of 150 mbsf. A dolomite-cemented horizon at least 25 cm thick is present at the base of Hole 798A (143 mbsf). Dolomite nodules and fine rhombs are also present below a depth of 150 mbsf in Hole 798B. The frequency and thickness of ashes increases upsection within this unit.

➡Unit III: (330-517.9 mbsf; upper to mid-Pliocene) Indurated silty clay including biosiliceous units, glauconitic sandy siltstone, and discrete ash layers. Diatom preservation and abundance decrease downcore. Fine-grained matrix material of volcanic glass and/or precipitated opal-A generally increases downcore. The homogeneous/laminated cycles common in Units I and II are absent in this unit. Ashes up to 15 cm in thickness are present below 400 mbsf. The lower 20 m of this unit are distinguished by bioturbated glauconitic siltstones.

Sediment ages are well constrained by diatom biostratigraphy to a depth of 440 mbsf with age diagnostic silicoflagellates and ebridians present to 344 mbsf. Diagnostic calcareous nannofossils are present to a depth of 191 mbsf with planktonic foraminifers present to 249 mbsf; rare isolated occurrences of calcareous microfossils are present below this depth. A good paleomagnetic signature is present to a depth of 305 mbsf with clear recognition of the Brunhes, Matuyama (including the Jaramillo and Olduvai events), and top Gauss. Using combined microfossil and magnetic data yields an average sediment accumulation rate of 119 m/m.y. for Unit I, II and III with no indications of significant deviations from this rate within this section.

The relatively high sedimentation rates together with high organic-carbon accumulation at this site are responsible for the very high concentrations of organic metabolites recorded, with alkalinity reaching 76 mM, and phosphate 290 mM. Sulfate is depleted, with measured values lower than 0.1 mM below 25 mbsf; further decomposition of the organic matter proceeds by carbonate reduction and methanogenesis, which in turn leads to very high concentrations of organic methane. Carbonate diagenesis in this high-alkalinity environment results in dolomitization that removes dissolved calcium and magnesium from pore waters. A dolomite-cemented horizon encountered at the base of Hole 798A (143 mbsf) is coincident with recorded decreases in pore water $Mg^{++}$, $Ca^{++}$, and alkalinity.

Variations in carbonate and organic carbon content allow this sequence to be divided into two sections. Section 1 extends from 0 to 140 mbsf and is characterized by high-amplitude carbonate variations/cycles between 1 and 35% and high organic contents ranging from 0.8 to 5%. These patterns match the lithologic cycles common to Units I and II. The lower section extends from 140 to 517.9 mbsf and is marked by both decreased carbonate (0-7%) and decreased organic carbon (0.3-2.7%). Based on hydrogen index values and C/N ratios, the organic matter in this section is a mixture of keragen type II (marine) and type III (terrigenous) with a dominance of type II. Hydrocarbon gas measurements were made by both headspace and vacutainer analysis. Elevated concentrations of hydrocarbons ($C_2$-$C_5$) were detected below 490 mbsf in Hole 798B. Drastic decreases in the $C_1/C_n$ ($n \geq 2$) ratio and increases of $C_n$ ($n>2$) at 510 mbsf precluded further drilling in Hole 798B with termination at 517.9 mbsf. Because of the immaturity of the organic matter at this site, these hydrocarbons have probably migrated from other source rocks in this area.

Three seismic intervals can be recognized in the sediment-filled basin cored at Site 798. From top to bottom these units include (1) an upper moderately stratified unit with regular transparent intervals and isolated thin but very strong reflectors, (2) a weakly stratified interval that displays some structural deformation, and (3) an unstratified and acoustically opaque unit representing acoustic basement. Interval 1 corresponds to lithologic units I and II with the upper portion of interval 2 represented by Unit III.

Four successful logging runs were completed: (1) sonic/seismic stratigraphy, (2) formation microscanner, (3) lithoporosity/density, and (4) geochemistry. Cyclic lithofacies within Units I and II are clearly recorded in the logs and will provide an additional means of analyzing these features. Two runs of successful temperature measurements were made with the Uyeda temperature probe down to 130 mbsf in Hole 798A and to 110 mbsf in Hole 798C. The average temperature gradient is 119°/km. The heat flow value is about 107 mW/$m^2$ based on thermal conductivity measurements.

Whole-round samples for analysis of bacteria were successfully collected from APC cores taken between 0 and 495 mbsf in Hole 798B, with the upper portion of this hole dedicated to this task. Special techniques were used to prevent sample contamination, including use of a sterile core cutter. The aim of this investigation is to quantify the role of bacteria in diagenesis by measuring their activity and biomass distribution with depth below the sediment/water interface. Laboratory studies will include direct bacterial counts and analysis of bacterial composition, bacterial activity (sulfate reduction, methanogenesis, etc.), and bacterial lipids. The bacteria samples were offloaded from the ship three days after collection *via* a specially chartered vessel.

Site Summary: Site 799

Hole 799A
Latitude: 39° 13.22'N
Longitude: 133° 52.01'E
Water Depth: 2084 m

Hole 799B
Latitude: 39° 13.19'N
Longitude: 133° 52.01'E
Water Depth: 2084 m

Hole 799C
Latitude: 39° 13.20'N
Longitude: 133° 52.00'E
Water Depth: 2084 m

Site 799 (proposed Site J2a-1) is located in the southern Kita-Yamato Trough, a feature thought to be a failed rift within the larger Yamato Rise in the south central Sea of Japan.

Hole 799A was spudded with the APC and excellent APC cores were recovered to refusal at 184.1 mbsf. Heat flow was measured every two cores after Core 128-799a-5H and all cores were oriented starting with Core 128-799A5H. XCB coring was halted at point of refusal at a depth of 468.7 mbsf (the total depth of Hole 799A). Hole 799A was conditioned for logging and four logging runs were made between 105 and 456 mbsf: sonic/seismic stratigraphy, formation microscanner, lithoporosity, and geochemical. When Hole 799A was completed, the ship moved 20 m north to spud Hole 799B. This hole was drilled, cased, and cemented to a depth of 435.5 mbsf in preparation for return to Site 799 after reoccupation of Site 794.

Hole 799B was reentered and coring was resumed on 2 October. RCB coring effectively commenced at 489.6 mbsf. Core recovery in this hole was variable, with poorest recovery in Miocene sediments containing dolomitic layers. Site 799 sediments included laminated organic-rich intervals, and hydrocarbon gases were encountered in both Holes 799A and 799B. $C_1/C_2$ ratios decreased slowly to 1059 mbsf in Hole 799B, at which depth propane, iso-butane, and n-butane increased rapidly. A sample collected from Core 128-799B-65R exhibited a slow, pale yellow-white fluorescence and left an amber-colored residual cut; Core 128-799B-66R exhibited a similar fluorescence. Based on these observations, drilling in Hole 799B was terminated at 1084 mbsf, and the hole was left filled with cement.

Hole 799C was drilled without coring to 230 mbsf for tests with the sonic core monitor (SCM) to 252.2 mbsf. After finishing in Hole 799C a post-site survey was conducted on the Kita-Yamato Rise. The specific objectives at Site 799 were: (1) to determine the depositional and tectonic history of the Kita-Yamato Trough, thought to be a sedimented failed rift and a typical environment for deposition of massive sulfide mineralization in a rifted continental arc setting, comparable to the geologic setting of the well known Kuroko deposits of Japan; and (2) to obtain information on the paleoceanographic history of the trough and larger Yamato Rise in the central Japan Sea.

The sedimentary column at Site 799 can be divided into five lithostratigraphic units:

➡Unit I (0-170 mbsf; Quaternary to Upper Pliocene) is dominated by clayey diatomaceous sediments with vitric ashes and foraminifer-rich sands; evidence of slumping and soft deformation is common along with turbidite sands and some intervals of light-dark rhythmic bedding.

➡Unit II (170-457 mbsf; Pliocene and Upper Miocene) is primarily composed of diatomaceous ooze and diatomaceous mixed sediments; dolomite beds are prominent between 247 and 394.6 mbsf.

➡Unit III (457-800 mbsf; Upper to Middle Miocene) begins with a major diagenetic boundary marking the opal-A/opal-CT transition and the occurrence of siliceous claystone and porcellanites with intercalated beds of authigenic carbonates dominated by dolomites; sediments in the upper part of this unit are laminated whereas the lower potion is bioturbated.

➡Unit IV (800-1020 mbsf; Middle to Lower Miocene) is predominantly finely laminated to thinly bedded siliceous claystone and porcellanite with interlaminated carbonate-rich laminae, lenses and nodules of dominantly dolomitic composition with minor quartz silts, sands and glauconitic sands; a prominent 24-m-thick rhyolitic tuff breccia occurs near the base of this unit.

➡Unit V (1020-1084 mbsf; Lower Miocene) consists of siliceous claystone and claystone with silt including intercalated coarse-grained sand and sandstones of turbiditic origin.

Principal results are as follows:
(1) Pre-drilling seismic estimates of the thickness of sediment in the Kita-Yamato Trough indicated that up to 1300 m of Miocene to Holocene sediments might be present in this narrow, deep graben structure. Drilling in the axis of the trough penetrated 1084 m of lower Miocene through Holocene sediments before increases in hydrocarbon gases and a fluorescent cut hydrocarbon show caused drilling to be halted. Post-drilling vertical seismic profile (VSP) analysis indicated that acoustic basement was present about 120 m below the base of Hole 799B (1084 mbsf T.D.) indicating a total sediment thickness of about 1300 m as predicted.

(2) The sedimentary column at Site 799 can be divided into five lithostratigraphic units corresponding to variations in composition and depositional style and major post-depositional diagenetic changes. Benthic foraminifers indicate that the entire sediment column at Site

799 was deposited at lower to middle bathyal water depths approximately equivalent to the present water depth at this site (2084 m). Coarse turbidite sands mark early Miocene deposition in the trough area and indicate close proximity to an insular or continental littoral area. Miocene and upper Miocene intervals are dominated by siliceous claystones, porcellanites, and biosiliceous sediments including common authigenic carbonate layers and nodules indicating high surface productivity of both siliceous and calcareous plankton during this period. Significant thicknesses of laminated sediments rich in organic matter indicate episodic deposition under low-oxygen bottom water masses. Lower Pliocene sediments are rich in diatoms with greater amounts of fine-grained terrigenous sediment appearing in the upper Pliocene through Pleistocene section accompanied by slump deposits, redeposited foraminiferal sands and volcanic ashes. There are hints of a causal relationship between the appearance of the slump deposits and the occurrence of volcanic ashes.

(3) The opal-A/CT transition occurs at about 435 mbsf and forms a major lithologic and geochemical boundary, with the opal-CT/authigenic quartz transition occurring between 545 and 585 mbsf. These diagenetically altered sediments are manifestations of the common to abundant deposition of biosiliceous sediments in the Site 799 area beginning sometime in the early Miocene and continuing through the Pleistocene. The biocarbonate fraction also experienced rapid alteration with depth, with abundant dolomite beds and nodules present below 220 mbsf.

(4) Most of the sediment recovered in the Site 799 column contain abundant organic carbon (0.25-5.66%), reflecting both high productivity in the Yamato Rise area and episodes of enhanced preservation owing to oxygen-deficient bottom water, as emphasized by thick intervals of laminated middle and upper Miocene sediments. Significantly, terrigenous organic matter is an important component in the rapidly deposited lower Miocene turbidite units at the base of this sequence.

(5) Rough estimates of the subsidence i the Kita-Yamato Trough sequence suggest that differential subsidence can account for the 1300 m of sediment filling the trough. Sedimentary and structural evidence point to episodic extensional tectonism in this area.

(6) Although drilling at Site 799 did not encounter direct evidence of massive sulfide deposition or metalliferous hydrothermal deposits (we did not expect to encounter any sulfide deposits, even if they exist in the trough, owing to the statistically low chance of hitting such a relatively small mass), the middle and lower Miocene portion of the column includes lithologies correlative with those found associated with the Kuroko failed-rift massive sulfide deposits of northern Honshu (Daijima and Nishikurosawa formations). Lithologies analogous to the Kuroko deposits also include a 24-m-thick altered rhyolite tuff and tuff breccia in the lower Miocene interval of Hole 799B.

A post-drilling seismic reflection survey of the Kita-Yamato Trough will, after analysis, allow Site 799 to be placed in a detailed structural context, enhancing the value of this site in terms of characterizing the failed-rift back-arc environment.

<u>Site Summary: Site 794 Revisited</u>

Hole 794D
Latitude: 40° 11.38'N
Longitude: 138° 13.93'E
Water Depth: 2809 m

Hole 794E
Latitude: 40° 10.50'N
Longitude: 138° 13.92'E
Water Depth: 2812.5 m

Site 794 (proposed site J1B-1) was first drilled during Leg 127, with a 543-m-thick sequence of mid-Miocene through Quaternary sediments recovered in Holes 794A and 794B. Leg 127 drilling at Hole 794C bottomed in a dolerite sill at 653.7 mbsf, with this latter hole scheduled for reentry during Leg 128. However, the original schedule for Leg 128 was rearranged to accommodate a stuck bottom-hole assembly in Hole

794C and a pre-scheduled rendezvous with two Ocean Research Institute (ORI) ships at Site 794. Because of these events, Site 794 was occupied twice during Leg 128, with drilling at Site 799 taking place between the two visits. The initial visit to Site 794 resulted in the drilling of Hole 794D to a depth of 666 mbsf and recovery of a sequence of lower Miocene (?) gabbro, dolerite, and a thin layer of clay between 573 and 666 mbsf. Hole 794D was cased and prepared for reentry during our second visit to this site. Site 794 was reoccupied as planned in order to (1) conduct downhole geophysical experiments in coordination with the two supporting vessels (*Tansei-maru* of the University of Tokyo, ORI and *Kaiko-maru-5*, chartered by ORI), and (2) attempt deeper penetration in Hole 794D in order to realize the principal objective of reaching basement at Site 794, located near the juncture of the Yamato and Japan basins.

The principal results obtained by the drilling of Holes 794D and 794E were as follows:

(1) Rotary coring resumed in Hole 794D at 667 mbsf and ended at 734 mbsf with recovery of 8 cores. When combined with earlier coring in Hole 794D, this amounts to a total of 154 m of penetration into igneous rock. The rocks recovered in the second phase of coring in Hole 794D allow the igneous sequence to be divided into three additional units beyond those originally recognized in this hole, with a resulting change in unit numbering from the original scheme. Lithologies recognized *via* shipboard examination and analysis are as follows: Unit 7 (Cores 128-794D-12R through -15R) Aphyric dolerite; Unit 8 (Cores 128-794D-16R through -18R) Aphyric basalt; and Unit 9 (Cores 128-794D-19R and -20R) Olivine dolerite. Previously assigned units 6 and 7 have been combined to form Unit 6. Previous Unit 8 is now Unit 7. The units can be grouped into four dolerite sills (units 1, 3, 4 and 9) and four dolerite basalt flows (units 2, 6, 7 and 8). Rocks in Unit 7 and below have negative magnetic polarity.

(2) Planned logging runs were reduced to one seismic-stratigraphic suite through the entire igneous rock section and a formation microscanner run (561-593 mbsf) shortened because of hole bridging. Logging data assisted in defining lithologic units and added details otherwise unavailable owing to poor recovery in the igneous sequence. Logging data were also used to determine the installation depth of the downhole seismometer.

(3) Installation of the digital broad-band three-component downhole seismometer was started after completion of logging attempts. Drill pipe was lowered to near total depth to avoid the bridging problem. After testing the seismometer, the cable was cut, drill pipe was tripped out of the hole, and the cable was spliced prior to starting observation. *JOIDES Resolution* shifted 1.5 km from Hole 794D to begin the experiment. A real-time, 48-hour, controlled-source experiment was initiated with *Tansei-maru* shooting airguns in two circles and two cross lines around *JOIDES Resolution*. The data were successfully recorded digitally with the exception of data from one horizontal component. *Kaiko-maru-5* arrived at the site about 1.3 days late, owing to storm and engine trouble. The logging cable was passed from the *Resolution* to *Kaiko-maru-5* to accomplish its task of deploying seafloor recording and retrieval units. By 30 September the seafloor units were deployed and long-term observations were started.

(4) After passing the seismometer cable to*Kaiko-maru-5*, dedicated Hole 794E was drilled (no coring) to conduct the oblique electric resistivity experiment. *Kaiko-maru-5* acted as the source ship, supplying electric current of 20 A and 100 V over the sea water column at various distances from *JOIDES Resolution*, which held the observing electrode cable in Hole 794E. Measurements were made at distances of 1 to 7 km in two directions, N60°E and N30°W, completing this experiment.

# LEG 130 PROSPECTUS: ONTONG JAVA PLATEAU

ODP Leg 130 will drill a transect of four sites traversing the top and slope of Ontong Java Plateau to obtain a detailed Neogene stratigraphic record; additional sites atop the plateau will address questions relating to the origin of the plateau and its Cretaceous/Paleogene history. Leg 130 is currently scheduled to depart from Guam on 24 January 1990, returning to Guam on 27 March 1990.

Leg 130 Co-chiefs are Dr. Loren Kroenke (HIG) and Dr. Wolfgang Berger (SIO). Dr. Tom Janecek is Staff Scientist for Leg 130. A complete scientific prospectus (ODP Scientific Prospectus No. 30) is available from ODP/TAMU.

INTRODUCTION

One of the more intriguing results of recent central equatorial Pacific drilling is the identification of a series of seismic reflection horizons that are synchronous over a large area of the central equatorial Pacific seafloor. These events apparently correlate with major reorganizations of the oceanic circulation system that are the result of fundamental tectonic, climatic, and oceanographic processes (e.g. the initiation of northern hemisphere glaciation, the closing of the Tethys, ice buildup in Antarctica, the opening of the Drake Passage, etc.; Mayer et al., 1985; 1986). Even more intriguing is the apparent correlation of these seismic events with basin-wide hiatuses (Keller and Barron, 1983), and possibly with "sea-level" events seen in continental margin sections (Vail et al., 1977).

The specific response of the central equatorial sediment system to these major paleoceanographic events is the increased dissolution of calcium carbonate. The seismic horizons are the direct result of impedence contrasts caused by this carbonate dissolution, as are many of the widespread hiatuses. While discrete periods of increased carbonate dissolution create events that are useful from a seismic or stratigraphic perspective, the complete removal or severe compression of the section that results from this dissolution makes the detailed evaluation of paleoceanographic indicators at these critical times virtually impossible. Thus while we have clear evidence for a series of global paleoceanographic events, the nature of their expression in the central equatorial Pacific (as dissolution events) precludes the examination of many of the key parameters (e.g., isotopes, faunal changes, chemical tracers, etc.) that can provide the basis for understanding the nature of paleoceanographic change.

In order to obtain a detailed stratigraphic record across these critical intervals, as well as to provide critically needed insight into the nature of vertical oceanic gradients and their linkage to climatic parameters, a drilling program is proposed that takes advantage of the unique geological characteristics of the Ontong Java Plateau to address these issues directly.

In addition to these Neogene objectives, it is proposed to address a number of key questions relating to the origin of the plateau and to its pre-Neogene paleoceanographic history. Recovery of the Cretaceous-Paleogene sedimentary section on the Ontong Java Plateau is important because it records the early history of the plateau. In addition, the Ontong Java Plateau is one of the few locales in the Pacific where it is possible to recover a southern-hemisphere, mid-latitude, intraoceanic carbonate record. The Neogene and pre-Neogene objectives have different requirements in regard to site selection because the thickest Neogene sediments occur on the edges of the Ontong Java Plateau where older sediments are usually missing or incomplete (DSDP Sites 288, 289, and 586; Figure 1).

The crust of the Ontong Java Plateau is of continental dimensions. Deep drilling into the basement may help settle the oceanic vs. continental crust controversy for this plateau. Radiometric dating of and paleomagnetic data from the basement samples also would help answer important questions regarding

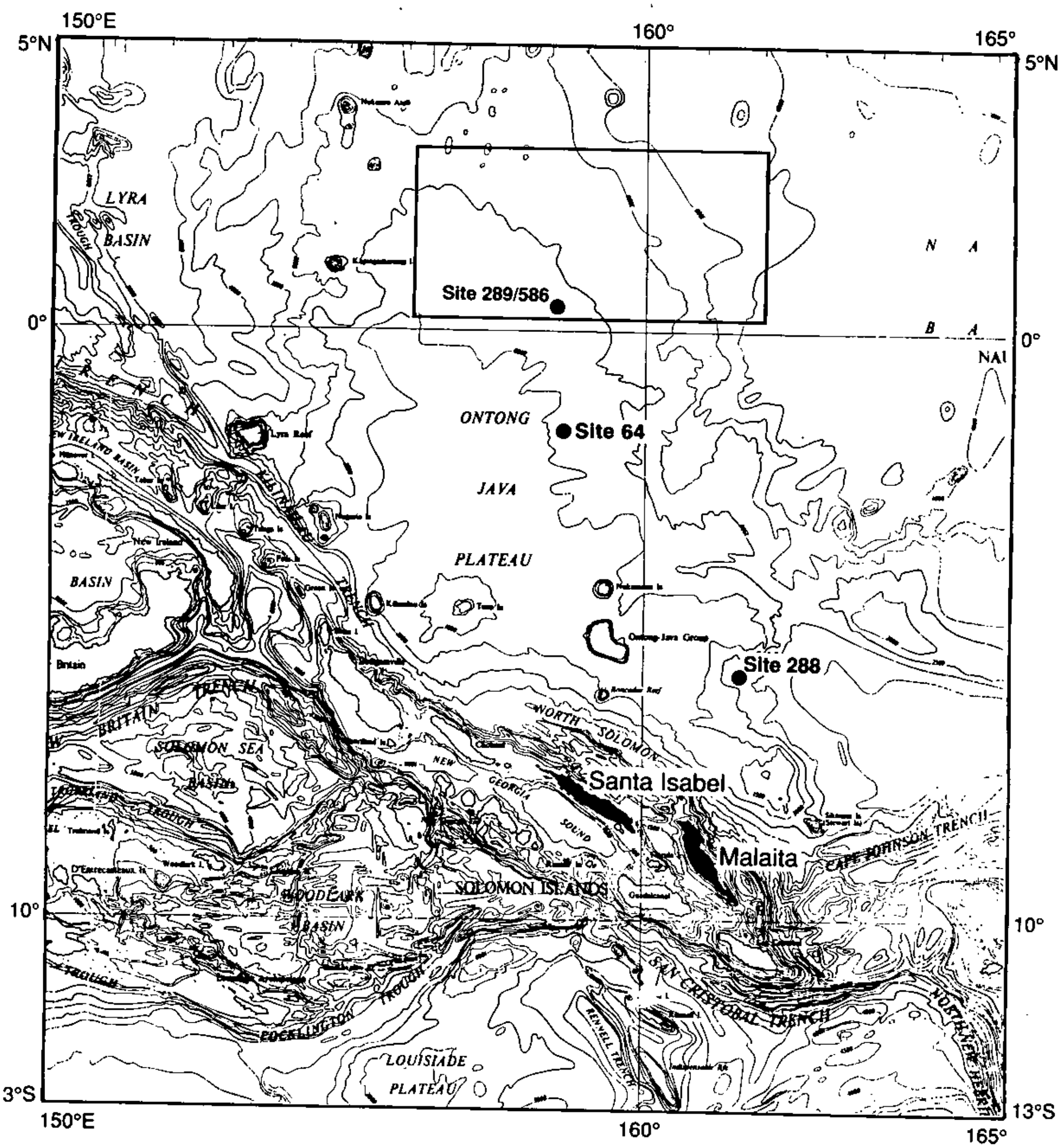


Figure 1. Bathymetry (in meters) of the southwestern part of the Ontong Java Plateau, showing the location of DSDP Sites 64, 288, 289, and 586, and the location of Malaita and Santa Isabel. Box shows location of Leg 130 drilling.

regarding the age of the plateau and its migrational history.

## GEOLOGICAL SETTING

The Ontong Java Plateau (Figure 1) is a broad, elevated area in the western equatorial Pacific with its shallowest regions above 2000 m and its flanks reaching depths in excess of 4500 m (over a lateral distance of less than 700 km). With an area of 1.5 million $km^2$, it is the largest of the "classic" Pacific plateaus. The Ontong Java Plateau has a crustal thickness on the order of 40 km and yet is in isostatic equilibrium. While crustal seismic velocities are in the range of oceanic crust (Hussong et al., 1979), the make-up of the plateau is still controversial, with a persistent minority (e.g Nur and Ben Avraham, 1978) arguing that it is continental in origin (like Rockall Bank). The central portion of the plateau is surmounted by several atolls, underlain by more than one kilometer of flat-lying, well stratified Mesozoic and Cenozoic sediments (Kroenke, 1972).

Four DSDP sites (rotary-drilled Sites 64, 288, 289, and piston-cored Site 586) have been drilled on the plateau. The most continuous deep sampling of the plateau was at Site 289 (Leg 30) near the crest of the Ontong Java Plateau in a water depth of 2206 m. Site 289 terminated at 1271 mbsf in pre-early Aptian tholeiitic basalt with vitric tuff directly overlying the basalt. Above the tuff are 1260 m of Campanian to Pleistocene biogenous sediments; from 1262 to 969 mbsf are Lower Cretaceous to upper Eocene radiolarian-bearing limestones, nannofossil-foraminifer chalks, and nodular cherts; and from 969 mbsf to the seafloor are upper Eocene to Pleistocene nannofossil-foraminifer chalks and oozes. Sediment recovery was 56% at this site. A number of unconformities were found in the oldest part of the section, but from the lower Oligocene to Recent, the section is continuous, with diverse and well preserved microfossils indicating deposition above the calcite compensation depth, or CCD (Andrews, Packham, et al., 1975).

Site 586, a piston-cored site located very close to Site 289, was aimed at providing a high-resolution record of the upper part of the section. Coring was quite successful at this task, recovering 300 m of well preserved Neogene nannofossil chalks and oozes. The first chalks appeared at about 260 mbsf, and coring was stopped in sediments of late Miocene age (foraminifer Zone N-16). Sedimentation rates were variable, ranging from 13 to 40 m/m.y., with most of the section having accumulated at the higher end of the range. One of the most surprising results of this site was the discovery of evidence for the nearly ubiquitous mechanical transport of the recovered materials. Despite this sedimentological evidence, the biostratigraphy of the section is nearly continuous (Moberly, Schlanger, et al., 1986).

Based on these drilling results and tectonic reconstructions of the area (e.g. Kroenke et al., 1986), a provisional history of the plateau can be constructed. The plateau probably originated about 160 Ma along a WNW-oriented ridge. Pelagic sediments blanketing the plateau record a shift from Austral to Tethyan assemblages at about 100 Ma, reflecting the northward motion of the plateau. The bathymetric relationships extant on the plateau today appear to have remained constant throughout its history (Resig et al., 1976). In late Oligocene to early Miocene time the southwestern part of the plateau entered the North Solomon Trench, resulting in the intrusion of dikes and sills into the region. Subduction ended in early Miocene (about 22 Ma), when the convergent boundary shifted. Subduction resumed south of the Solomon Islands in late Miocene, forming the San Cristobal Trench. During this episode, overthrusting, uplift and folding of the oceanic crust resulted in the emplacement of ophiolites on the islands of Malaita and Santa Isabel. This overthrusting is probably still occurring.

## NEOGENE DEPTH TRANSECT

The major objective of the Neogene portion of Leg 130 is to drill four sites on a depth transect from the top to the slope of the Ontong Java Plateau to collect a series of continuous sedimentary sequences. The study of sediments from this transect will produce:

•High resolution stratigraphic records across intervals of major paleoceanographic changes by evaluating variations of primary paleoceanographic indicators (isotopes, carbonates, biota) during Neogene time.

•A detailed record of vertical oceanic gradients and their relationships to climatic parameters and bottom-water properties.

•A detailed sedimentary record to better understand the nature and role of carbonate dissolution in the deep sea and to attempt to quantify amounts of dissolution.

•A high-resolution sedimentary record completing a global network of equatorial depth transects in order to better understand basin-basin fractionation and biotic evolution as well as part of a comparison with marginal transects for basin-shelf fractionation.

•A sedimentary record to understand the origin of seismic events on oceanic plateaus, and to compare them with seismic horizons in oceanic basins.

The accumulation of pelagic carbonate sediments in open-ocean environments is primarily dependent on the rate of production and dissolution of formaninifers and calcareous nannoplankton. Productivity is determined by the availability of nutrients which, in turn, depends on the rate of supply of these elements from continental runoff and ocean circulation (e.g. vertical mixing, upwelling). In general, the rate of dissolution of calcium carbonate sediment is a function of the degree of calcite saturation in sea water at the sediment/water interface. Averaged globally, the degree of calcite saturation varies in order to balance the total carbonate budget by setting the appropriate rate of dissolution. The oceanic circulation, and the underlying causes for its development and change, are therefore key factors among the dissolution-related parameters.

Several aspects of the Ontong Java Plateau's history render it most suitable for the proposed detailed paleoceanographic studies. First and foremost is the remarkable combination of bathymetry and geographic location. Straddling the equator, the plateau is now, and has been for most of its history, located in a region characterized by the relatively high production of biogenous sediments. More importantly, the topographic relief of the plateau has resulted in the accumulation of thick sediments deposited in shallow water that have not been subjected to pervasive dissolution in close proximity to sediments deposited in deeper, hence more corrosive waters. A series of equatorial drill sites that runs from the top of the plateau to near its base would traverse nearly 2000 m of depth range in a relatively small geographic area (sampling sediments exposed to both upper and lower deep waters). The sediments sampled would have been produced under the same surface water conditions, and thus the same pelagic rain. This depth interval (approx. 2200-4200 m) is the range over which modern dissolution gradients are the steepest. Thus the bathymetry and geography combine to eliminate many of the variables normally associated with pelagic sedimentation (i.e. productivity and latitudinal gradients) and create a nearly ideal natural laboratory for evaluating the vertical distribution of a range of oceanic parameters.

It would be easy to justify such an experiment even for just the modern ocean. The collection of a series of surficial samples to investigate the modern distribution of sediment properties as a function of depth and relate them to modern watermass distributions and ocean chemistry would be extremely useful (e.g. Berger et al., 1987). Another unique aspect of the Ontong Java Plateau, however, allows this same experiment to be carried out for a large portion of the Cenozoic. Unlike many other Pacific plateaus which at some point in their history appear to have been at or above sea level, the Ontong Java Plateau seems to have remained at a fairly constant depth throughout its 100 my history (Andrews, Packham et al., 1975; Hughes and Turner, 1977). The reason that this immensely thick crust has remained at a constant depth for so long is unclear; the answer to that question may be an interesting byproduct of Ontong Java drilling.

Whatever its cause, this relative stability suggests that any given site on the plateau should have a fairly constant paleobathymetry and that most of the plateau has remained above the CCD for at least 30 million years. Given these factors, a depth transect of continuously cored drill sites will allow the relatively simple construction of the time and depth history of oceanic variability in the western Pacific Basin. It will be possible to establish not only the dissolution history of a given site but also, more importantly, the history of dissolution gradients through time. Similarly, time series of gradients of all measurable occeanographic parameters (isotopes, carbonates, trace elements, etc.) can be determined. The result will be a two-dimension picture of the response of ocean chemistry and watermass structure to climatic and tectonic forcing.

A careful selection of sites with no obvious evidence of current activity, will allow control for all variables and for assessing the effect of dissolution on the primary sediments. The Ontong Java Plateau depth transect would therefore become a natural laboratory and complement other equatorial depth transects (Atlantic, Indian and Eastern Pacific oceans) to give a global scale to paleoceanographic research.

## PALEOGENE/CRETACEOUS SEQUENCES AND BASEMENT

Major hiatuses were encountered in the Late Cretaceous/Paleogene sediments recovered at DSDP Sites 288 and 289. Yet many of the the unconformities at Site 288 do not correlate with those at Site 289 (or the shallower, spot-cored Site 64), implying that they record local events of limited areal extent (Andrews, Packham et al., 1975). (Note that Site 288 is situated on the sloping southern flank of the Ontong Java Plateau, and Site 289 is near the head of a large submarine canyon, as shown in Figure 1.) Drilling at other locations atop the plateau is highly likely both to recover some of the key sections either missing or poorly preserved at DSDP sites, and to permit differentiation between regional and local unconformities. The Cretaceous/Paleogene section is important because it records the early history of the plateau and provides a reference for southern hemisphere paleoceanography.

### Sedimentological Objectives:

Drilling and sampling Cretaceous and Paleogene sediments on the Ontong Java Plateau will allow us to:
•Fill critical gaps in Cretaceous biostratigraphy and paleo-biogeography.
•Determine the original basement depth of the plateau and subsequent bathymetric change.
•Determine the nature and extent of Cretaceous anoxic events in the South Pacific to increase our understanding of mechanisms leading to the deposition of ocean-wide carbon-rich sediments.
•Recover a well preserved Cretaceous-Tertiary boundary in order to gain insight into the causes of mass extinctions.

The Ontong Java Plateau is one of few locales in the Pacific where it is possible to recover a southern hemisphere, intraoceanic biostratigraphic record preserved in Mesozoic carbonates. Because the plateau migrated northward from southern mid-latitudes (Hammond et al., 1975), Cretaceous microfossil assemblages reflect a change from Austral to Tethyan provincial affinities in mid-Cretacous time (Scheibnerova, 1974). With better resolution of this interval, a boundary point for the Austral realm in the Pacific can be established.

The nature and characteristics of benthic foraminiferal assemblages at a site primarily reflect paleodepths, whereas planktonic assemblages record water-mass characteristics and evidence relating to the lysocline or CCD. Thus estimates can be made of both original basement depth and subsequent bathymetric and oceanographic changes. Establishing whether or not Cretaceous carbonate-rich sediments are present on the Ontong Java Plateau can give a substantially broader perspective to planned Shatsky Rise drilling.

Lithosphere Objectives:

Drilling into basement on the Ontong Java Plateau will allow us to:

•Determine the nature of the crust on Ontong Java Plateau, settling the oceanic vs crust controversy and *establishing* the lithology, petrogenesis and sources of Ontong Java crustal material.

•Determine basement age and paleolatitudes of the plateau in order to understand its origin.

•Compare the basement composition of the Ontong Java Plateau to that of extensive "mid-Cretaceous" volcanic events of the Pacific in order to gain insight into the origin of both features.

None of the old, intraoceanic Pacific plateaus (OJP, Manihiki, Shatsky Rise, Hess, Magellan) are well understood. The Ontong Java Plateau is an end member of this group. The crust of the high plateau is of truly continental proportions (about 40 km thick; e.g. Hussong et al., 1979). Even on the edges of the Ontong Java Plateau the crust is still well within the continental range (~30 km, for instance, near the island of Malaita; e.g. Nixon and Boyd, 1979; Kroenke, 1972, and unpub. data). If there is continental crust within any of the large Pacific intraoceanic plateaus, the Ontong Java Plateau, with the thickest crust, would seem the most favorable place to find it.

Age information on a deep basement hole can be obtained from radiometric dating, possibly from microfossils in sedimentary layers interbedded with igneous rocks, and the M-series magnetic-polarity record. In conjunction with age dating, paleomagnetic measurements on basement rocks will provide important insights on the paleolatitudes of the Ontong Java Plateau during the period of crustal formation. Existing data from sedimentary records at DSDP Sites 288 and 289 indicate substantial translation of the Ontong Java Plateau from higher southern latitudes to its present equatorial location (Hammond et al., 1975). New results from a deep basement section would reveal the earlier migrational history of the plateau, which is essential to testing the currently debated hypothesis that the Ontong Java Plateau formed above a ridge-centered Louisville hotspot (Mahoney, 1987; Gordon, R. and Henderson, L., 1987, pers. comm.).

Unlike other Pacific plateaus, part of the Ontong Java Plateau basement and sedimentary section can be studied on land, on the islands of Malaita and Santa Isabel. There, samples larger than drill-core diameter can be obtained, and local field relationships can help guide interpretation of drill-hole data elsewhere on the plateau. Evidence that Cretaceous crustal basement on these islands forms part of the Ontong Java Plateau is strong and includes the thick crust in the vicinity, the continuity of seismic reflectors with those on Ontong Java Plateau, and the remarkably similary stratigraphy on Malaita and Sites 288 and 289 (e.g. Kroenke et al., 1986).

## GEOPHYSICAL SURVEYS AND SITE LOCATIONS

Neogene Transect

Detailed site surveys were conducted on the Ontong Java Plateau to determine optimal locations for sites on the depth transect (Figure 2; Sites OJP-1, OJP-2, OJP-3, OJP-4 and OJP-6). Criteria used to select the proposed sites include the avoidance of those sites showing evidence of modern or past erosion (i.e., hyperbolae or channel structures), displacement or disruption in the sediment column, major faulting, and seismic anomalies. Also included as "hazards" are strongly reverberant layers that commonly occur mid-section in water depths greater than 3000 m. These features, which have the seismic appearance of the chert found near the bottom of Site 289, may be related to basement complexities, tectonic disruption, igneous intrusion, erosion and early chertification, or some combination of these. The sedimentary cover on the plateau thins from approximately 1200 m in thickness at 2200 m water depth to less than 450 m at 4300 m water depth (averaging about

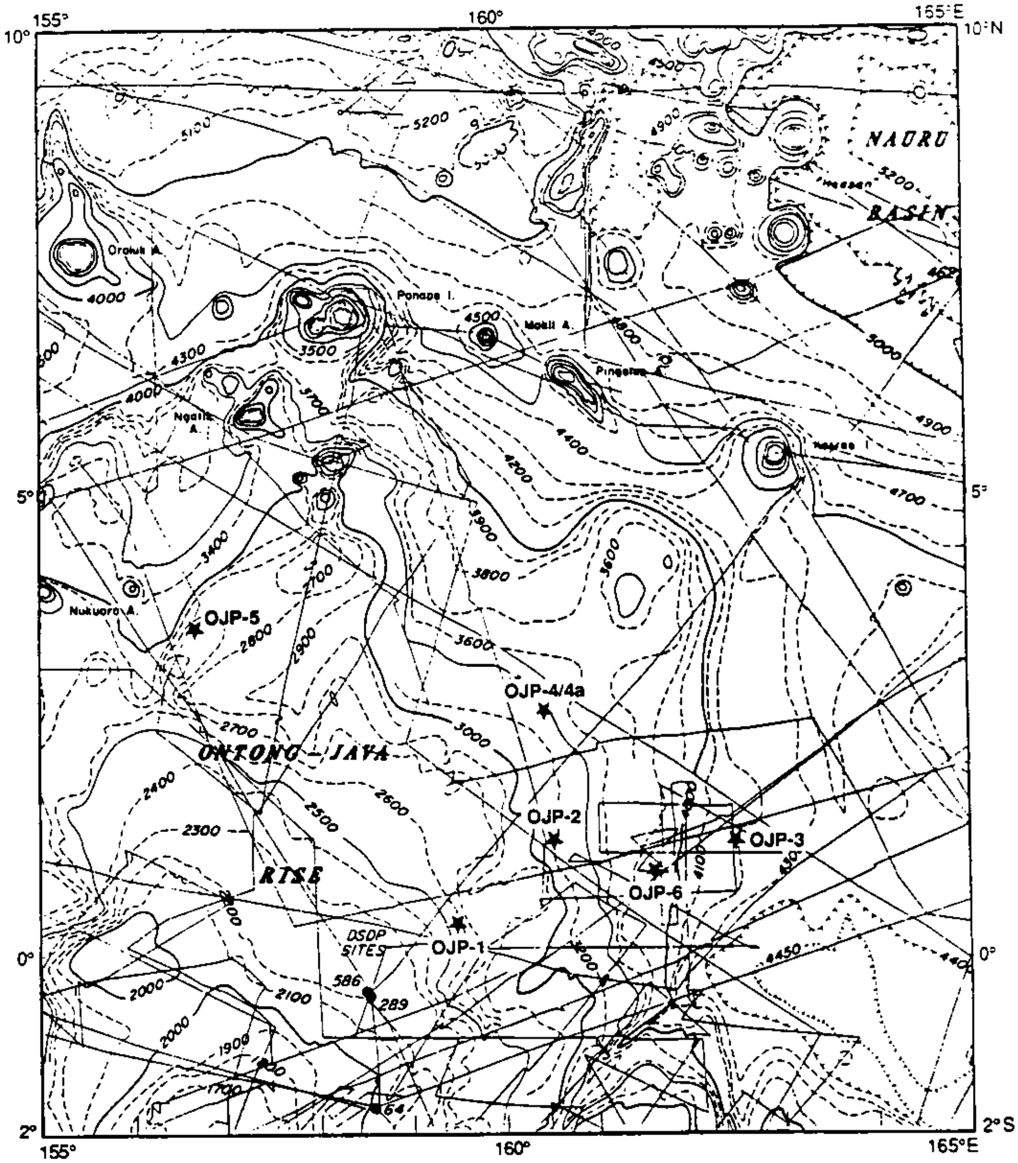


Figure 2. Bathymetric map showing the location of proposed Leg 130 sites. Bathymetry in meters.

100 m loss in thickness for every 200 m of water depth). Preference was given to those sites that showed relatively expanded sections and where the quality of the seismic images was high.

Pre-Neogene

The site of a deep basement hole (OJP-5) can be very flexible, subject to only the following provisos: It should be (1) located on the main high plateau; (2) distant from Sites 289 and 288, so as to avoid the local hiatuses in the sedimentary sections at those sites; and (3) in a region of relatively smooth basement and sedimentary topography, distant from complicating features such as plateau seamounts, structural complexities, and canyons, to maximize the chances of recovering minimally disturbed sediment and basement sections. Also, to best evaluate the proposed north-south age progression across the Ontong Java Plateau, the deep hole should be situated away from the postulated isochron passing through Site 289. Many locations on the high plateau meet these criteria, and the location chosen for OJP-5 is shown in Figure 2.

DRILLING STRATEGY

Leg 130 will drill the proposed sites in the order shown in Table 1, completing the Neogene objectives at proposed sites OJP-4, OJP-3 (or OJP-6), OJP-2, and OJP-1 before addressing the Paleogene and basement objectives at OJP-5.

Neogene

The objective of the Neogene portion of Leg 130 is to collect a series of sedimentary sequences in order to produce high-resolution records of isotopes, carbonate and biota to evaluate vertical oceanic chemical gradients and bottom-water processes, the nature and role of carbonate dissolution in the deep sea, basin-basin and basin-shelf fractionation, and the origin of seismic events on oceanic plateaus. To address these topics, Leg 130 will drill a transect of five sites (Figure 2) within a water depth range of 2600 to ~4000 m. The strategy is to drill until uppermost Oligocene sediments are reached at three of these sites (OJP-1, -2, and -3). These three sites will be triple APC'd: Two to refusal (250 mbsf?) and one to 50 mbsf. In addition, OJP-1 and -2 will be deepened with a single XCB hole to the depth (age) objective.

OJP-4 will also be triple APC'd: Two to refusal (250 mbsf?) and one to 50 mbsf. In addition, OJP-4 will be deepened with an XCB hole to refusal and then by RCB until 790 mbsf (or approximately 10 m into basement to reach its Paleogene and basement objectives). The fifth site (OJP-5) will be a reentry hole drilled to basement; this will be a single APC hole, owing to time constraints. Two standard Schlumberger logging runs will be conducted at OJP-1, -2 and -4.

Pre-Neogene Objectives

The Paleogene and Upper Cretaceous sedimentological objectives of Leg 130 are to fill critical gaps in Cretaceous biostratigraphy and paleo-biogeography, determine the extent of Cretaceous anoxic events, recover a well preserved Cretaceous/Tertiary boundary, and determine bathymetric changes on the Ontong Java Plateau.

The continental vs. oceanic origin of the Ontong Java Plateau also needs to be resolved. In order to determine the nature of the crust, basement age, and migrational history of the plateau, as well as the pre-Neogene sedimentological objectives discussed above, one single-bit RCB hole (OJP-4) coring into Mesozoic sediments and penetrating 10 m into basement, and one reentry hole (OJP-5) coring into Mesozoic sediments and penetrating 50 m into basement, are planned. OJP-4 will be deepened with an RCB to 790 mbsf (or about 10 m into basement) after the XCB refusal point has been reached; no more than 11.2 days will be spent at this site to ensure adequate time to complete all Neogene objectives at proposed sites OJP-1, -2, and -3. OJP-5 will consist of a single APC/XCB hole drilled until refusal (600 mbsf?). A reentry cone will then be set and drilling will continue with an RCB toward a target depth of 1400 mbsf (50 m into basement). Any time savings made up during the cruise from faster than expected transits, drilling rates, etc., will be applied to deepening OJP-5 to depths greater than 1400 mbsf. Two standard Schlumberger logging runs will be conducted at OJP-4 and -5. A formation microscanner/BHTV run also will be conducted at OJP-5.

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Table 1. Leg 130 Drill Sites

| Site | Latitude | Longitude | Water Depth (m) | Penetration (m) Sed. | Bsmt. | Drill Days | Log Days | Total Days |
|---|---|---|---|---|---|---|---|---|
| OJP-4 | 02°26.0'N | 160°32.7'E | 3400 | 780 | 10 | 9.7 | 1.5 | 11.2 |
| OJP-3 | 01°06.3'N | 162°35.7'E | 4200 | 250 | --- | 4.4 | --- | 4.4 |
| OJP-2 | 01°13.5'N | 160°31.8'E | 3200 | 500 | --- | 5.6 | 1.5 | 7.1 |
| OJP-1 | 00°19.2'N | 159°21.9'E | 2600 | 600 | --- | 5.6 | 1.4 | 7.0 |
| OJP-5 | 03°34.0'N | 156°36.0'E | 2820 | 1350 | 50 | 17.7 | 3.6 | 21.3 |
| Alternate Sites: | | | | | | | | |
| OJP-1a | 00°19.2'N | 159°21.9'E | 2600 | 600 | --- | 5.6 | 1.4 | 7.0 |
| OJP-3a | 01°06.3'N | 162°35.7'E | 4200 | 250 | --- | 4.4 | --- | 4.4 |
| OJP-4a | 02°26.0'N | 160°33.3'E | 3400 | 250 | 10 | 1.5 | --- | 1.5 |
| OJP-4b | 02°26.0'N | 160°32.7'E | 3400 | 780 | 10 | 9.7 | 1.5 | 11.2 |
| OJP-5a | 03°34.0'N | 156°36.0'E | 2820 | 1350 | 50 | 17.7 | 3.6 | 21.3 |
| OJP-6 | 00°59.0'N | 161°35.8'E | 3920 | 250 | --- | 4.2 | --- | 4.2 |

# LEG 131: NANKAI TROUGH PROSPECTUS

## INTRODUCTION AND OBJECTIVES

The accretion of sediments in oceanic trenches is an initial step in the process of mountain building and continental crustal growth. The study of these processes requires determining how deformation takes place in an accretionary prism, and how this deformation is influenced by variations in physical properties and the presence of fluids (Davis et al., 1983). This investigation also includes such important objectives as determining why at some zones there is primary accretion while at others there is erosion (Moore, Mascle et al., 1988), why forearc uplift or subsidence occurs, and the nature of earthquake processes. Geochemical models of prisms require a knowledge of the behavior of deforming sediments as they become chemically and physically consolidated with time, depth, and position, and whether deformation takes place plastically or through brittle fractures. Dewatering and fluid flow must also play a major role in consolidation and deformation (Moore, Mascle et al., 1988).

The investigation of accretionary prisms has been a major objective of modern land geology as well as an attractive ocean-drilling target. The Nankai Trough is considered to be one of the best places to achieve such objectives because (1) substantial site survey data exist, including excellent images of the thrust structures by seismic profiling (Aoki et al., 1982); (2) the décollement (detachment zone) is relatively shallow (~900 m) and can be penetrated with present drilling technology; (3) the trench sediments are sandy turbidites which represent a type example of most ancient accretionary prisms (e.g. Simanto belt, Taira et al., 1988; Southern Upland, Leggett et al., 1982); and (4) an almost direct ancient analogy is exposed on land (Shimanto accretionary prism), providing an opportunity for comparative study (Fig. 1).

Drill sites in the Nankai Trough were occupied by *Glomar Challenger* on DSDP Legs 31 (Ingle, Karig, et al., 1975) and 87 (Kagami, Karig, Coulbourn et al., 1986). Leg 131 is a continuation of studies began during Leg 87, but with a much stronger emphasis on physical properties, logging and downhole experiments. The proposed drill sites for Leg 131 are located in the central Nankai Trough, to the northeast of DSDP Sites 298, 582 and 583, where the trench wedge is relatively thin (~1300 m) and the décollement can be more easily reached by drilling (Fig. 2). One of the proposed primary sites (NKT-1) is located in the undeformed sediments at the trough; the other proposed primary site (NKT-1; alternate is NKT-10) is positioned in the accreted and deformed sediments at the toe of the prism (Fig. 3).

The main objectives of the scientific drilling during Leg 131 include elucidation of the following thematic issues:

- influence of pore fluids and the hydrogeology of the accretionary prism
- mechanical state and physical properties of deformed sediments
- fabrics and structural styles of sediments before and after accretion.

The objectives are closely interrelated, and will be studied by a variety of methods, on a range of spatial scales. Downhole experiments, wireline logging, and laboratory analyses of sedimentology, physical properties, and structural fabrics will be closely coordinated. Table 1 indicates how these different measurements will be combined to achieve a knowledge of seven primary aspects of accretionary prism development and evolution: (1) fluid flow; (2) porosity and density; (3) stress and strain; (4) elastic moduli; (5) sedimentology, structure and fabrics; (6) geochemistry; and (7) stratigraphy.

### 1. Fluid Flow

The extent and intensity of fluid flow are difficult to measure directly, but they strongly influence prism morphology and development (Westbrook and Smith, 1983; Brown and Westbrook, 1988). In

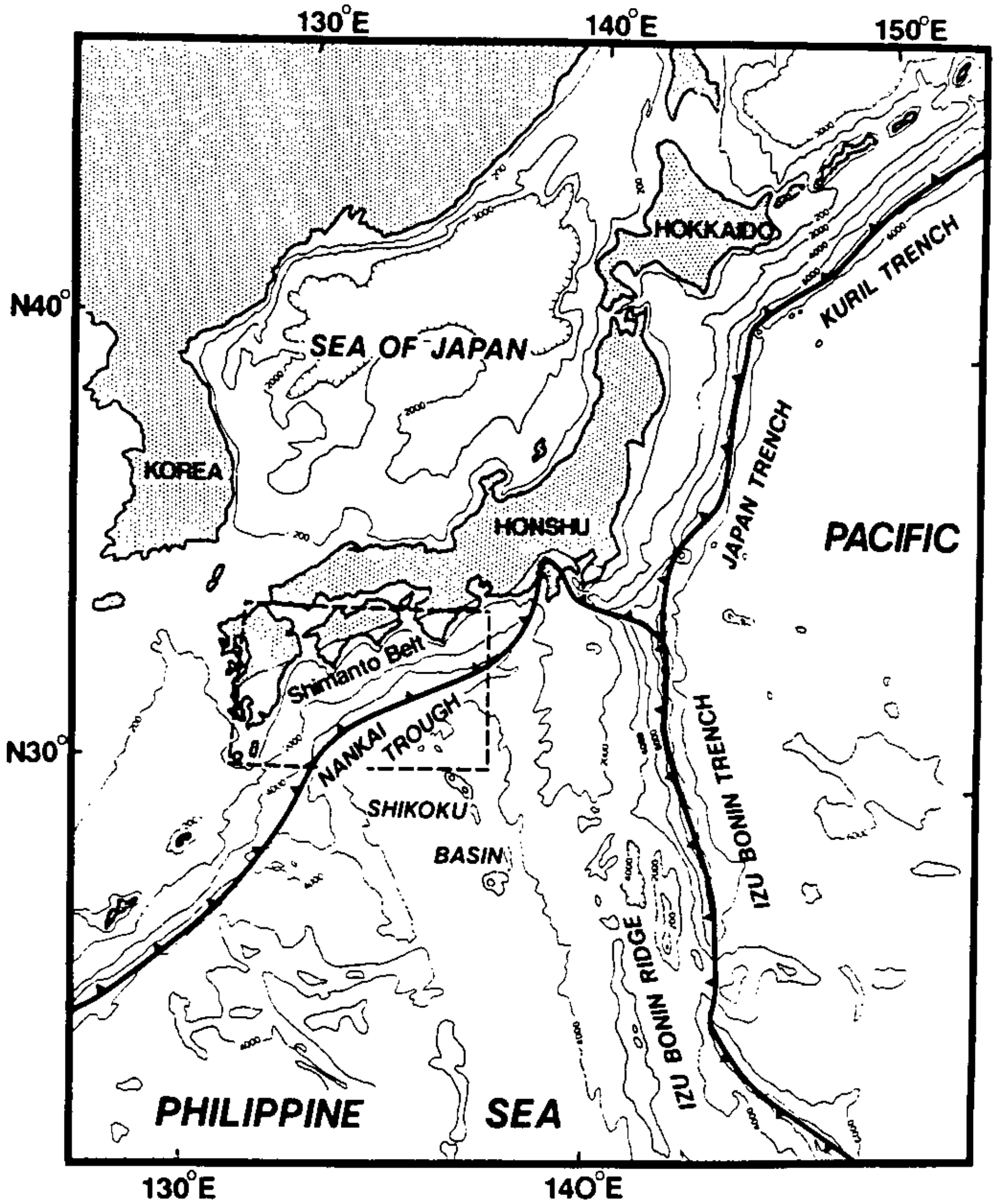


Figure 1. Tectonic setting of Nankai Trough. Dashed box shows location of Figure 2. The Shimanto Belt (shown by cross-hatched area) is a Cretaceous-Tertiary accretionary prism complex that grades into the present accretionary prism. Bathymetry in meters.

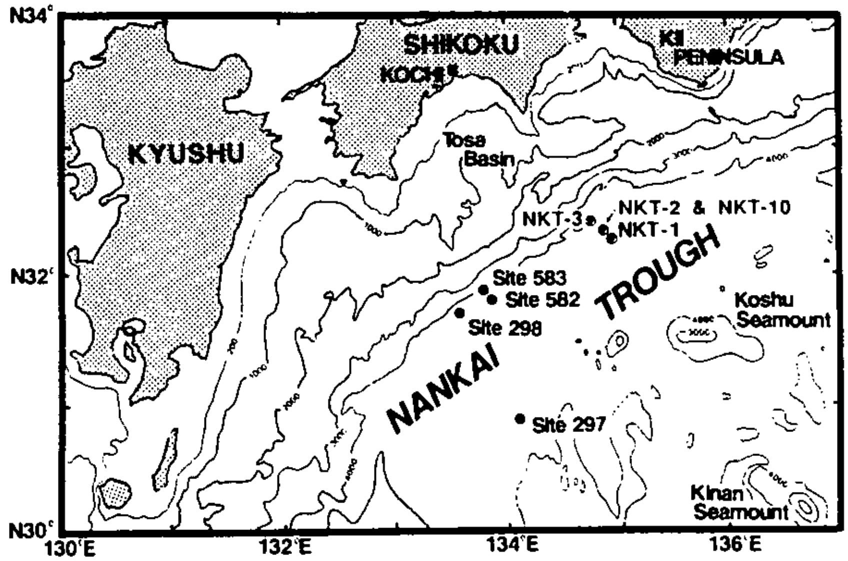


Figure 2. Location of proposed Leg 131 sites and previous DSDP sites in this area. Bathymetry is in meters.

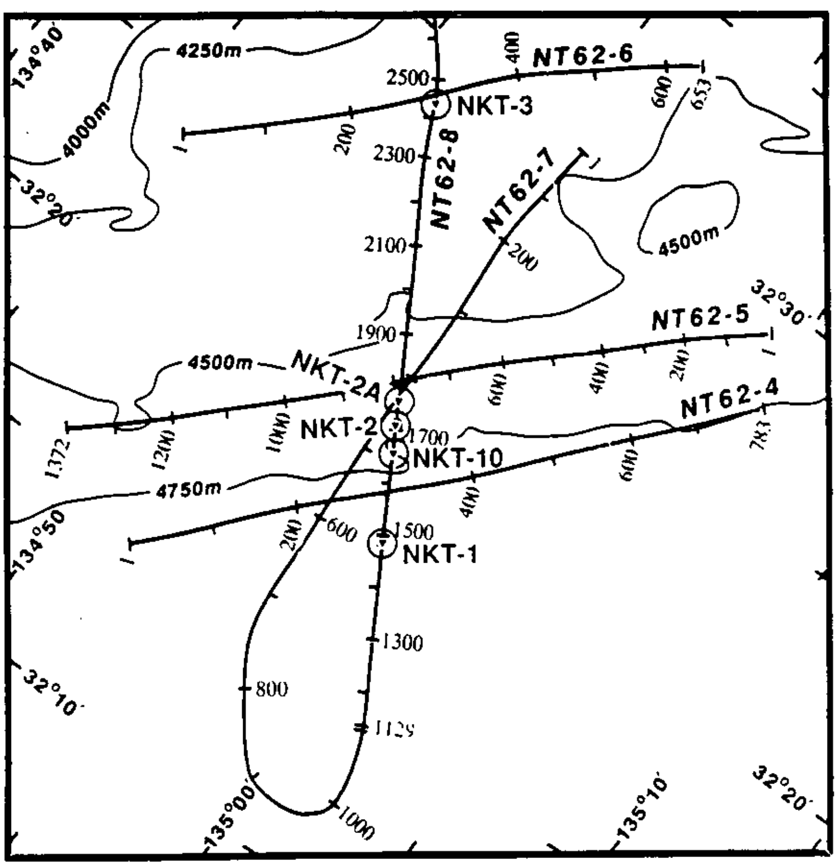


Figure 3. Trackline map of 48-fold seismic reflection lines showing shot-point locations and locations of proposed Leg 131 drill sites. The NT62-series seismic lines were obtained by *R/V Fred Moore* during U.S.-Japan two-ship seismic experiments in 1987.

particular, we intend to determine whether fluid flow is localized along particular zones, and the time-variable nature of that flow (e.g. Sample and Moore, 1987). Permeability and pore pressure will be measured *in situ* on a scale of centimeters with the LAST and WSTP tools, on a scale of meters with the wireline packer and Geoprops tools, and on a scale of tens of meters with a drill-string rotatable packer.

Flow regimes within the prism may be detected by the temperature or geochemical signature of each water mass. The fluid geochemistry will also contribute to the study of the source of the fluids and alteration processes within the prism. A string of temperature and pressure sensors (ONDO) will be emplaced down a deep penetration hole at proposed site NKT-2 to create a long-term observatory to augment the point sampling of this leg.

2. Porosity and Density

Porosity is directly related to the strength and the consolidation history of the sediments, as well as to other physical properties (Bray and Karig, 1985). Porosity and density will be measured on a range of scales, and a comparison of laboratory measurements with borehole logs and seismic experiments will be essential for quality control and stratigraphic correlation. Both intergranular and fracture porosity will be determined, with particular attention paid to shear zones, where this property may be either enhanced or reduced.

3. Stress and Strain

These are vital parameters for understanding the structures observed in both cores and drill holes. Stress orientation may be detected from borehole breakouts and fracture orientations with the formation microscanner (FMS). The state of stress in the borehole may then be directly related to strain indicators in the core. For these studies, core orientation will be critical; this parameter may be determined through examination of FMS records or paleomagnetic measurements. Laboratory measurements using anisotropic strain-relaxation techniques (which involve whole-round core samples) will be crucial. Of particular interest will be changes in the state of stress with depth and in proximity to faults. These measurements will provide invaluable constraints on the geometry and nature of deformation in the complex (Karig, 1986).

4. Elastic Moduli

These parameters can be estimated from seismic velocity measurements on cores, and correlated *via* wireline logging with seismic profiles and vertical seismic profile (VSP) results (Aoki et al., 1986). While core measurements show the properties relating to individual structures of the core, the VSP shows representative values from bulk volumes of the prism. These data will closely relate the study of stress and strain to porosity and density.

5. Sedimentology, Structure and Fabrics

Sedimentological studies will allow lithological correlation and provide constraints on conditions prior to deformation. Analyses of mineralogy (i.e. volume fractions, clay mineralogy, biogenic silica content), sedimentary facies, and sedimentary geochemistry will also provide important information for fluid and mass-balance considerations. The presence and composition of authigenic minerals and organic matter will reflect the burial and thermal history of the sediments. Grain size and fabric (as determined through structural and magnetic analyses) are important parameters for interpretations of mechanical and physical properties. Important structural considerations include the differentiation between brittle and ductile deformation patterns, estimation of displacement along faults, and identification of pervasive shear bands. These last features may suggest stress patterns during early stages of deformation at the toe of the complex.

6. Geochemistry

Like thermal anomalies, geochemical anomalies are excellent indicators of fluid flow, but with greater sensitivity by orders of magnitude. Geochemical analyses will assist in differentiating pervasive vertical fluid movement through the clastic complex and restricted dewatering confined to high-permeability conduits. In addition, the influences of sulfate reduction and methane production, and the presence and composition of dissolved gases, particularly in the vicinity of faults and the décollement zone, may constrain the origins of pore fluids and the formation of gas hydrates.

7. Stratigraphy

Age determination and correlation of sedimentary sections are important constraints to evaluation of large-scale structural styles. Biostratigraphy, paleomagnetism and tephrachronology will provide useful data for this purpose. Sedimentation rates have an important influence on sediment physical properties and on the change in these properties with time and deformation.

In all these areas the extrapolation of details of the recovered core to properties of the prism generally can be made only through interrelated measurements. Extensive laboratory physical-property analyses will be necessary, some of which will involve use of whole-round cores. The core sampling program will be planned very carefully in advance and may be considerably more exotic than that usual in ODP practice.

## BACKGROUND: SEDIMENTATION AND TECTONICS

The Nankai Trough is a topographic manifestation of the subduction boundary between the Shikoku Basin, a part of the Philippine Sea plate which is moving ~4 cm/yr to the northwest at the proposed drilling sites (Seno, 1977), and the Honshu Arc (a part of the Japanese Islands), which extends approximately east-northeast to west-southwest. To the east, the trough converges with a major arc-arc collision boundary between Honshu and Izu-Bonin arcs (Fig. 1).

The sediments that are being brought to the deformation zone are composed of two sequences: an upper turbidite layer and a lower hemipelagic layer (Kagami, Karig, Coulbourn et al., 1986). The turbidites have been transported laterally along the axis of the trough from the mountain ranges of the arc-arc collision zone (Taira and Niitsuma, 1986). The sedimentation rate in the trough is enormous, reaching 1 km/m.y. The thickness of the trench turbidite layer varies from place to place chiefly owing to the configuration of the oceanic basin (Le Pichon, Iiyama et al., 1987).

The Shikoku Basin is a back-arc basin formed behind the Izu-Bonin Arc by mostly east-west directed spreading, accompanied by a late-phase northeast-southwest spreading episode during the late Oligocene to middle Miocene (25 to 12 Ma) (Kobayashi and Nakada, 1978; Chamot-Rooke et al., 1987). The fossil spreading axis lies in the central part of the Shikoku Basin and has been subducted at the middle part of the Nankai Trough. Ridge-transform topographies produce a local ponding of turbidites in the trough by acting as "dams" for turbidity currents. Owing to the general shallowness of the Shikoku Basin, especially over the fossil spreading axis, the trench turbidite layer is thinnest in this area. The oceanic-basement configuration in the vicinity of the proposed sites is smooth and flat, which aided the creation of laterally continuous structural features at the toe region.

Individual turbidites are composed of a graded unit of mostly medium- to very fine-grained sand at the base, which grades to silt at the top. The mean thickness of each turbidite is ~ 30 cm, intercalated with hemipelagic background mud with a mean thickness of ~5 cm (Taira and Niitsuma, 1986). Some individual turbidite sand layers reach 2 m in thickness.

The hemipelagic sediments underneath the turbidites are composed mostly of bioturbated mud intercalated with volcanic ash. The lithology encountered at DSDP Site 297 showed that within these hemipelagic sediments there is a zone of relatively coarse-grained sediments--mud intercalated with silt and sand--350-550 meters below the sea floor (mbsf), which is considered to be mostly of early Pliocene age (Ingle, Karig et al., 1975). The lower part of the hemipelagic unit was recovered during DSDP Leg 58 at Site 443, where the Miocene sequence was composed of mud, tuff, and basaltic sills (Curtis and Echols, 1980).

The sites proposed for drilling on Leg 131 are located in the central Nankai Trough, where the entire sedimentary sequence is 1.1 seconds two-way travel time (s twt) thick; the hemipelagic section of this sequence is ~0.3 s thick. The structure of the accretionary prism is well imaged by seismic sections (Figs. 4 and 5). The deformation front is defined as the location of initiation of the incipient thrust with several meters of displacement, as identified on 3.5-kHz profiles. This is the proto-thrust zone; it is followed by a series of imbricated thrusts that show a structure typical of thrust-fold belts. The décollement can be identified within the hemipelagic layer. The zone of imbricate thrusts extends landward (to the west) about 30 km with a master detachment surface, while the prism thickens to 1.9 s and is covered by lower-slope, hemipelagic sediments. This zone then abruptly changes to a steep slope of vaguely defined internal structure.

A bottom-simulating reflector (BSR) is ubiquitous in this region. It first appears at the front of the imbricate thrust zone, ~0.15 s (one-way time) below the seafloor, and steadily increases in depth below seafloor landward, reaching a maximum depth of 0.3 s twt under the slope at ~3000 m water depth. The BSR becomes shallower toward the upper part of the slope. The anomalously shallow BSR at the tow region has been interpreted as resulting from high heat flux (Yamano et al., 1982).

## PREVIOUS DRILLING

DSDP legs in the Nankai Trough region drilled three sites in the trough and on the slope, all of which are west of the Leg 131 proposed sites. Site 298 penetrated 611 m at the toe of the prism in a water depth of 4659 m. The total length of spot-cored section was 145.5 m with 46% core recovery (Ingle, Karig et al., 1975).

Site 582 was drilled into the undeformed trench fill, with a maximum penetration of 700 m. The turbidite sequence at this site is 550 m thick and is underlain by Pliocene-upper Pleistocene hemipelagic sediment. Core recovery was 41%. Site 583 was drilled at the toe of the prism and eight holes achieved maximum penetration of 450 m and overall core recovery of 77%. The upper parts of three holes (at Site 583) were hydraulically piston cored to ~60 mbsf. These sediments are typically finely graded hemipelagic mud, divided into beds about 10 cm thick, with individual beds commonly separated by layers of sand and vitric ash. The oldest sediments recovered at Site 583 are Quaternary. Hole 583F was also logged continuously for ~200 m. The temperature gradient in the upper 200 m of sediment at Site 583 was ~5°C/100 m (Kinoshita and Yamano, 1986). Neither solid gas hydrate nor high gas pressure was encountered at either site (Kagami, Karig, Coulbourn et al., 1986).

## OPERATIONS PLAN

Leg 131 will depart from Guam on 1 April 1990 and after 5 days transit will arrive at the Nankai Trough. It should be noted that all sites proposed for drilling during this cruise are within an area only a few kilometers across. Leg 131 is scheduled to end in Pusan, South Korea, on 2 June 1990, after 62 days at sea.

Proposed site NKT-2 (Table 1; or alternatively, NKT-10) will be drilled first; NKT-2 is the preferred location for maximizing scientific return. In order to achieve the detailed suite of complementary measurements required to satisfy the objectives listed in the site descriptions, the operational plan envisaged at the time of this writing includes drilling four separate holes at this site (Fig. 6). While this appears a complex plan, it contains contingency planning and some redundancy to maximize the chance of success. Hole instability is very likely, and may require casing the upper parts of *all* holes to ensure safe deployment of downhole tools. Because the wireline packer is important for achieving the major hydrogeographic objectives of this cruise, it may be run within casing as an operational and scientific test prior to running it in open hole.

The first hole will be drilled through the first major thrust unit with emphasis on retrieving logs and undisturbed core from the upper section and allowing use of the WSTP, LAST, and Geoprops tools. The second hole will complete the logging and core record down to and through the décollement zone. The third hole is dedicated to packer and VSP experiments; again, because of the likelihood of hole instability, a rapidly drilled third hole should provide the best conditions for these experiments. This hole will be spot cored and logged briefly to assist in identification of packer seats. The fourth hole will be drilled through the décollement and then cored to bit destruction, possibly into basement. This hole will be cased through the décollement to provide stable conditions for the long-term deployment of the ONDO temperature experiment and to ensure completion of coring and logging objectives in the portion of the hole below the décollement. Several of these holes may end up being combined, if drilling conditions during the cruise allow this possibility.

The drilling plan at proposed site NKT-1 is considerably simpler, since the single hole planned will not be complicated either by the major structural discontinuities of NKT-2 or by the need for long-term hole stability. The program of coring and measurements will, however, provide a similar data set to allow a direct reference comparison with NKT-2.

Proposed site NKT-3 is a reserve site in the event of insuperable difficulties causing abandonment of NKT-2 or its alternates. The scientific objectives would be similar to NKT-2, but with concentration on collection of core from the deformed sediment section with little drilling disturbance.

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Table 1. Summary Site Information, Leg 131

| Site | Latitude Longitude | Water Depth (m) | Penetration Sed. (m) | Penetration Bsmt. (m) | Drilling | Logging (days) | Total |
|---|---|---|---|---|---|---|---|
| NKT-1 | 32°18'N 134°59'E | 4800 | 900 | 0 | 10.1 | 4.0 | 14.1 |
| NKT-2 | 32°21'N 134°57'E | 4660 | 1300 | 50 | 29.1 | 12.8 | 41.9 |
| Alternate Sites: | | | | | | | |
| NKT-2A (Alternate for NKT-2) | 32°22'N 134°56'E | 4500 | 1500 | 50 | 35.8 | 13.8 | 49.6 |
| NKT-3 | 32°25'N 134°54'E | 4350 | 1600 | 0 | 9.7 | 3.9 | 13.6 |
| NKT-10 (Alternate for NKT-2) | 32°20'N 134°57'E | 4750 | 1150 | 50 | 29.1 | 12.8 | 41.9 |

# WIRELINE SERVICES CONTRACTOR REPORT

## LEG 126

### Objectives and Logging Operations

The main objectives of Leg 126 were to document the origin and evolution of the Bonin Arc and forearc, to study the process of arc rifting, and to analyze the products of dewatering of the lithosphere. A standard suite of geophysical and geochemical measurements was planned for each of the four holes initially scheduled. In addition, the recording of borehole well images was planned for each drillhole. finally a vertical seismic experiment was scheduled at each of the two backarc sites. Due to a difficult drilling environment in which the drillpipe often became stuck, downhole measurements were recorded at three sites only. In Hole 791B, the drillstring became stuck near the sediment-basement contact; the geochemical combination was therefore used to record data through pipe. These were the only data recorded in the backarc region. In the forearc, a full set of downhole measurements was run in Hole 792E and 793B. A successful vertical seismic profile (VSP) was made in Hole 792E, whereas poor borehole conditions in Hole 793B allowed recording of only a few shots. A series of temperature logs was recorded in Hole 792E and Hole 793B.

### The Formation Microscanner

Over a kilometer of high-resolution FMS images were recorded during ODPLeg 126. The FMS sensor consists of four orthogonal pads that are pressed against the borehole wall during recording. Each pad carries a series of closely spaces electrodes which provide continuous electrical conductivity traces, later coded into an "electrical image." With a sampling rate of 2.5 mm, and a resolution of the order of microns for conductive features, the FMS clearly delineates sedimentary features such as ash layers, fractures and foliation planes, and brecciated regions. As the FMS is oriented in space with 3-axis accelerometers and flux-gate magnetometers located inside the tool, it records the strike and dip of the detected features. Features such as ash layers less than a centimeter thick (Hole 792E) and turbidite sequences (Hole 793B) were imaged (Figure 1).

### Hole 792E: Frontal Arc High

Site 792 is located in the western half of the Izu-Bonin forearc sedimentary basin, 170 km west of the axis of the Izu-Bonin Trench, where the forearc sediments lap onto the edge of a basement high. The principal objectives of this site were to determine: (1) the stratigraphy of the forearc basin; (2) the uplift and subsidence history across the forearc; (3) the nature of the igneous basement and the formation of the 200-km-wide arc-type forearc crust; and (4) the micro-structural deformation and the large-scale rotation and translation of the forearc terrane since Eocene time. Hole 792E cored to 885.9 mbsf, with 52% recovery in the sediments above 804.0 mbsf, and 16% recovery in the basement below.

The downhole measurements in general are in agreement with laboratory data. They outline each of the lithostratigraphic boundaries derived from core analysis, and they confirm the presence of two fault zones encountered (1) at the base of Unit III, and (2) at the upper and lower boundaries of Unit V. The temperature records show Units II and III are permeable, except for a calcium-rich section from 386.0 to 404.5 mbsf observed in cores and revealed by the geochemical log data. Within Unit IV, and abrupt drop in electrical resistivity at 587.0 mbsf is correlated to (1) a seismic reflector on the VSP, (2) an increase in smectite content observed in XRD, (3) an increase in magnetic susceptibility measured on cores, and (4) a variation in pore-water $Ca2+$ and $Mg2+$ concentrations. It is therefore the site of a past and present boundary to fluid circulation. Unit V is characterized by low average values of physical properties and is bounded by two narrow fault zones located at 780.0 mbsf and 804.0 mbsf (the sediment-basement interface). All the physical properties increase abruptly at this interface. Fresh and altered sections can be distinguished in the basement on the basis of velocity, bulk density, and electrical resistivity.

LEG 127

The primary objectives of Leg 127 were to determine the age of the opening of the Japan Sea along with its rifting and bathymetric history. Four out of the ten holes drilled during Leg 127 were logged. However, rapidly degrading hole conditions throughout the whole leg and problems with the drill string at Sites 794 and 797 precluded the initially planned packer/hydrofracture experiments for *in situ* stress measurements, resulting in no *in situ* stress data for this leg. The Borehole Televiewer (BHTV) records for Holes 796 and 797 did not display any prominent breakouts. The Temperature Logging Tool (TLT ) was run successfully only at two Sites (794 and 797) due to software problems at Sites 795 and 796.

Yamato Basin Sites (794 and 797):

Three successful logging runs were completed in Hole 794 B, located in the northern Yamato Basin. An interval down to 549 mbsf was logged with the geophysical toolstring (combination of sonic/litho-density/resistivity), the geochemical toolstring and the FMS. The boundary between Units I and II, characterized by the opal-A/opal-CT transition, is clearly displayed in almost all logs. The opal-CT/quartz transition, at about 400 mbsf and a tuff and claystone interval between 490 and 520 mbsf, displaying low densities, velocities and resistivities, are further characteristic features of the logs obtained at this site. The sediment/basement contact could not be logged due insufficient basement penetration (5 m).

Six logging runs (including three partial FMS runs) were successfully made in C-Hole at Site 797, located at the west-central Yamato Basin. Rapidly swelling clays caused unstable conditions in the lower sections and logging operations below 516 mbsf were restricted to use of the FMS, reaching a logging depth of 610 mbsf. The geochemical toolstring was logged through pipe for safety reasons. The BHTV, logged from 549 to 603 mbsf using the sidewall-entry sub, indicated small fractures but no borehole breakouts. The geochemical logs along with the FMS data and images provide valuable information about structural and compositional characteristics of the uppermost interbedded basalts and sediments.

The logs also provide continuous data over an interval of extremely poor core recovery from 350 to 430 mbsf in the sedimentary section, permitting a characterization of this interval as a chert and porcellanite layer.

A comparison of the logging data from both Yamato Basin sites shows remarkable correlations, strongly suggesting similar basin-wide processes controlling the sedimentation and diagenesis.

Japan Basin Site (795):

The logging operations in Hole 795 B, located at the northern end of the Japan Basin, were affected by extremely unstable hole conditions. Only one toolstring (the geophysical combination) was deployed and logged over a 108 m interval from 117 to 225 mbsf before rapidly degrading hole conditions lead to abandonment of this site.

The logging data obtained over this short interval in the uppermost part of a relatively uniform sedimentary unit revealed no characteristic features.

The Okushiri Ridge Site (796):

Four successful logging runs were completed between 100 and 340 mbsf in Hole 796 B, located on the Okushiri Ridge. The logging data obtained by the geophysical tool combination, the geochemical toolstring, the FMS and the Borehole Televiewer represent a complete record of the lithologic column in a hole generally dominated by poor core recovery.

The logs, especially the resistivity, velocity and bulk density profiles characterize the sedimentary section well. The opal-A/opal-CT transition is clearly detectable at 215 mbsf. The

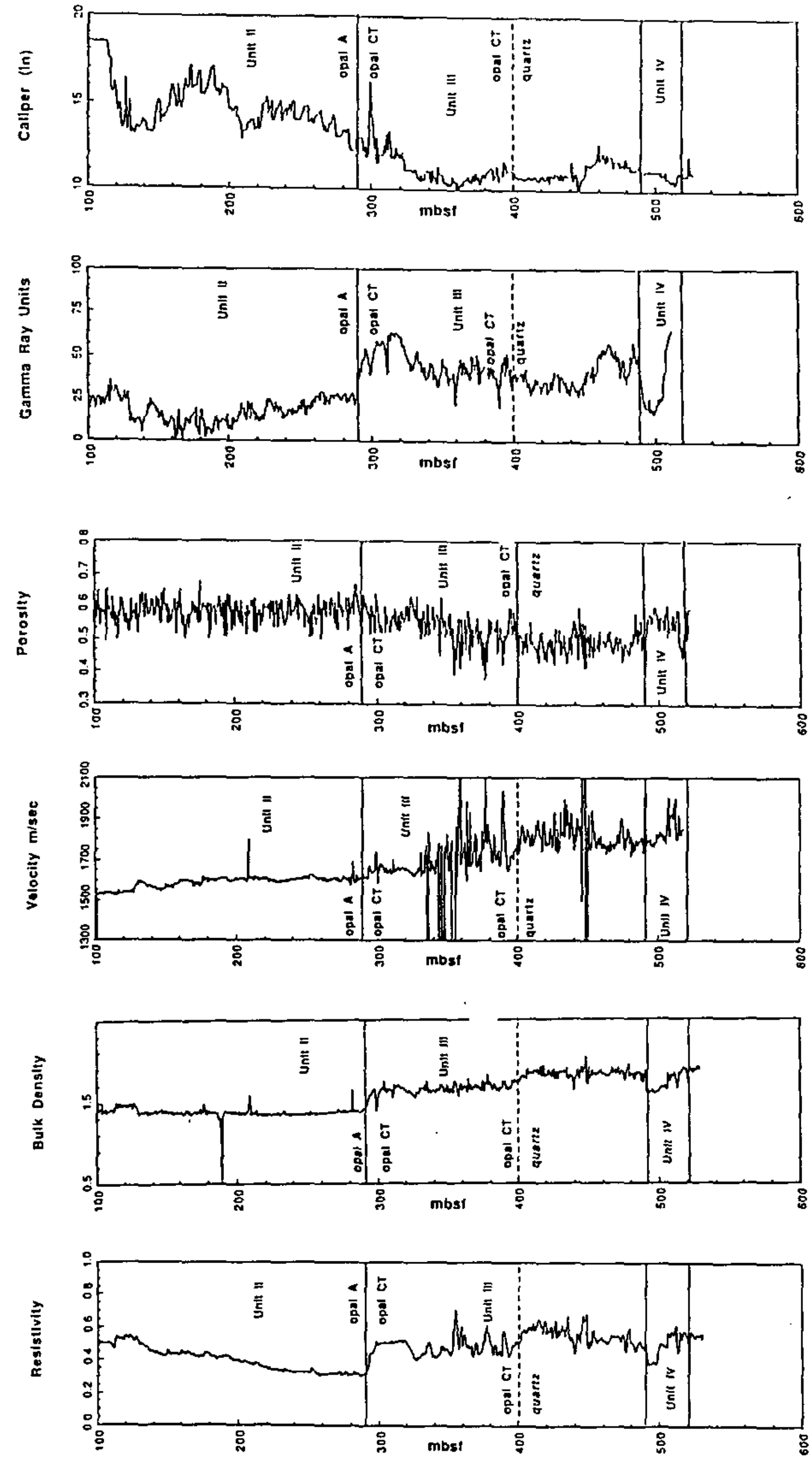


Figure 1. Selected logging results for Hole 796B, Leg 127.

FMS images display a large number of mostly horizontal layers with thicknesses varying from 1 to 30 cm. The Borehole Televiewer images again show small scale fractures but no prominent breakouts.

This hole demonstrates the importance of logging operations as the logging data represent indispensable data needed to complete the description of the lithologic column due to extremely poor core recovery rates.

LEG 128

Leg 128 represented the second of two ODP legs devoted to probing the history of the Japan Sea. Leg 128 drilled two structural highs (Sites 798 and 799) and one basin (Site 794), first occupied during Leg 127. Overall logging operations were very successful with a full complement of logs run at Holes 798B, 799A and 799B. Only at Hole 794D was the logging program not completed due to poor hole conditions.

Site 798, Oki Ridge

A complete suite of four combination logging runs logging runs was obtained from 518 to 70 mbsf at Hole 798B. The tools run included: SDT (Digital Sonic Tool), DITE (Phaser Induction Tool), FMS, LDT (Lithodensity Tool), CNL (Compensated Neutron Log), ACT (Aluminum Clay Tool), GST (Geochemical Spectroscopy Tool) and the NGT (Natural Gamma Spectroscopy Tool) which is run on all four logging strings. In addition the Lamont Temperature Logging Tool (TLT) was deployed on the base of three of the tool strings.

The most significant result of the downhole measurements program at Hole798B was the detection of climate cycles in the logs. The Oki Ridge is a strategically positioned location for regional paleoclimate studies and its very high sediment accumulation rate make this an ideal site to test the sensitivity of downhole logs as a paleoclimatic tool. The geochemical and physical property logs exhibit remarkable cyclicity to a depth of ~300 mbsf. Most of the variance in the logs can be explained in terms of variations in terrigenous sediment and biogenic opal content thought to be reflecting periodic variations in eolian dust supply from asian source areas. Because of the environmental setting and the excellent data quality, the Hole 798B logging results should present the best opportunity in the history of ODP logging to recover detailed climatic information from downhole logs.

The recently introduced FMS produced a detailed record of the numerous volcanic ash layers in the sequence indentifying layers as thin as 0.5 cm as well as revealing the thickness of dolomitic layers which were poorly recovered in the cores. A synthetic seismogram was computed from the sonic and density logs and comparison with the seismic line previously shot over the site showed good correlation of the seismic reflectors.

Site 799, Yamato Trough

A complete suite of four combination logging runs was completed at Hole 799A (from 469 to 104 mbsf) and Hole 799B (from 1049 to 443 mbsf). These consisted of all the tools listed above for Hole 798B, with the addition of a vertical seismic profile (VSP) experiment conducted in Hole 799B. The Lamont temperature tool was deployed 3 times in Hole 799A and twice in Hole 799B. Hole conditions were again good, resulting in the recording of high quality logs in both holes.

Below about 400 mbsf in Holes 799A and B, the logging data show marked increases in sediment rigidity and bulk density with a decrease in porosity which is consistent with the increase in diagenetic opal-CT. The logs show a further shift to increased sediment rigidity at about 600 mbsf, which mineralogical analyses indicate is the depth of authigenic quartz formation. The logs are very useful in indentifying the numerous dolomite layers present below 400 mbsf which were poorly represented in the core material. The FMS identified numerous volcanic ash layers and also enabled the dips of beds to be calculated. The NGT allowed

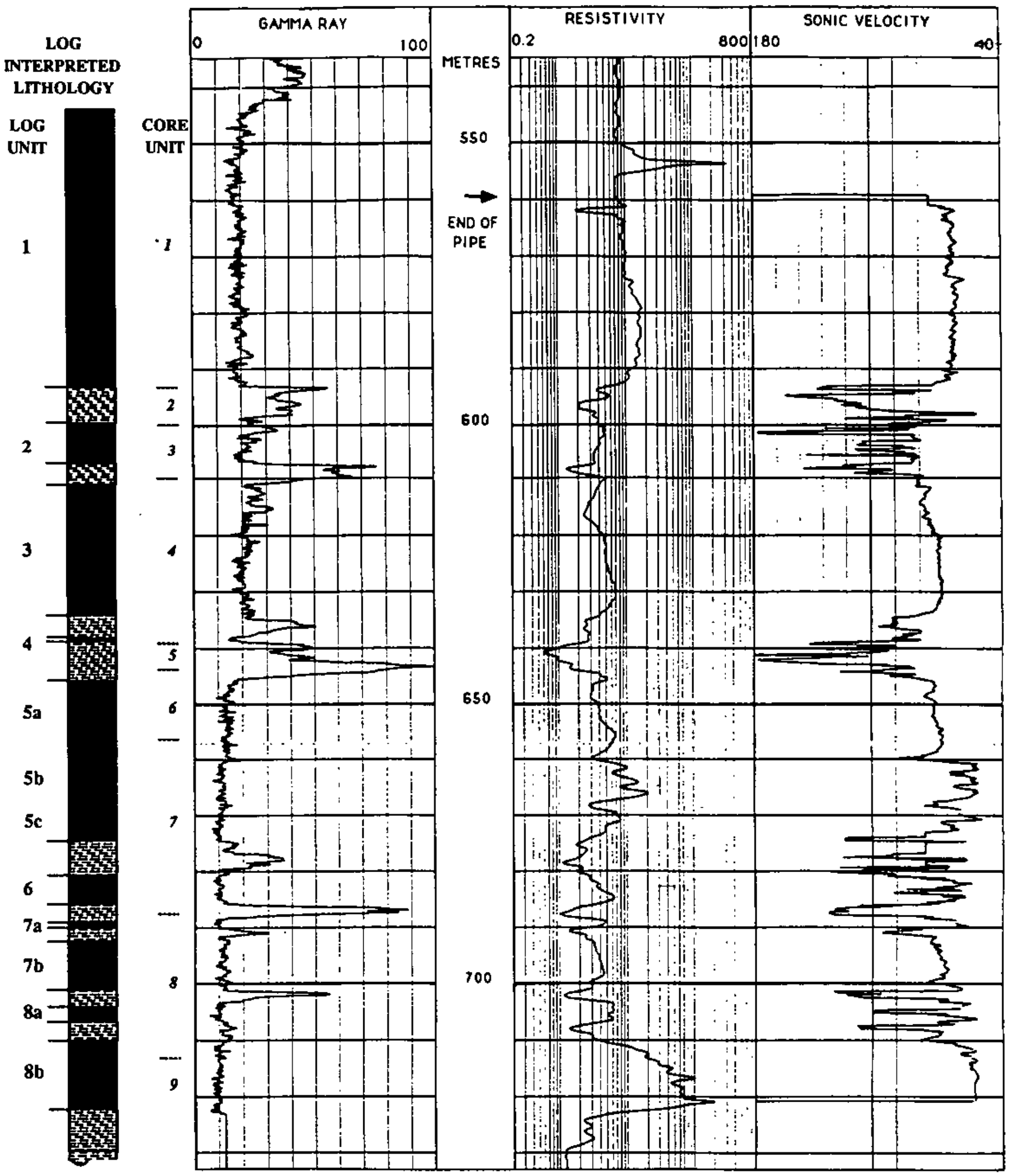


Figure 2. Selected log traces for Hole 794D. Column 1, interpreted lithology from the logs; eight igneous units (dark shading) separated by sediment/altered volcanic material (light shading). Column 2, lithologic units based on core observations extrapolated with logging data, are included for comparison. Total gamma ray (0-100, API Units). Resistivity (Phasor induction medium; 0.2-800 Ohm/m). Sonic travel time (180-40 microseconds/ft).

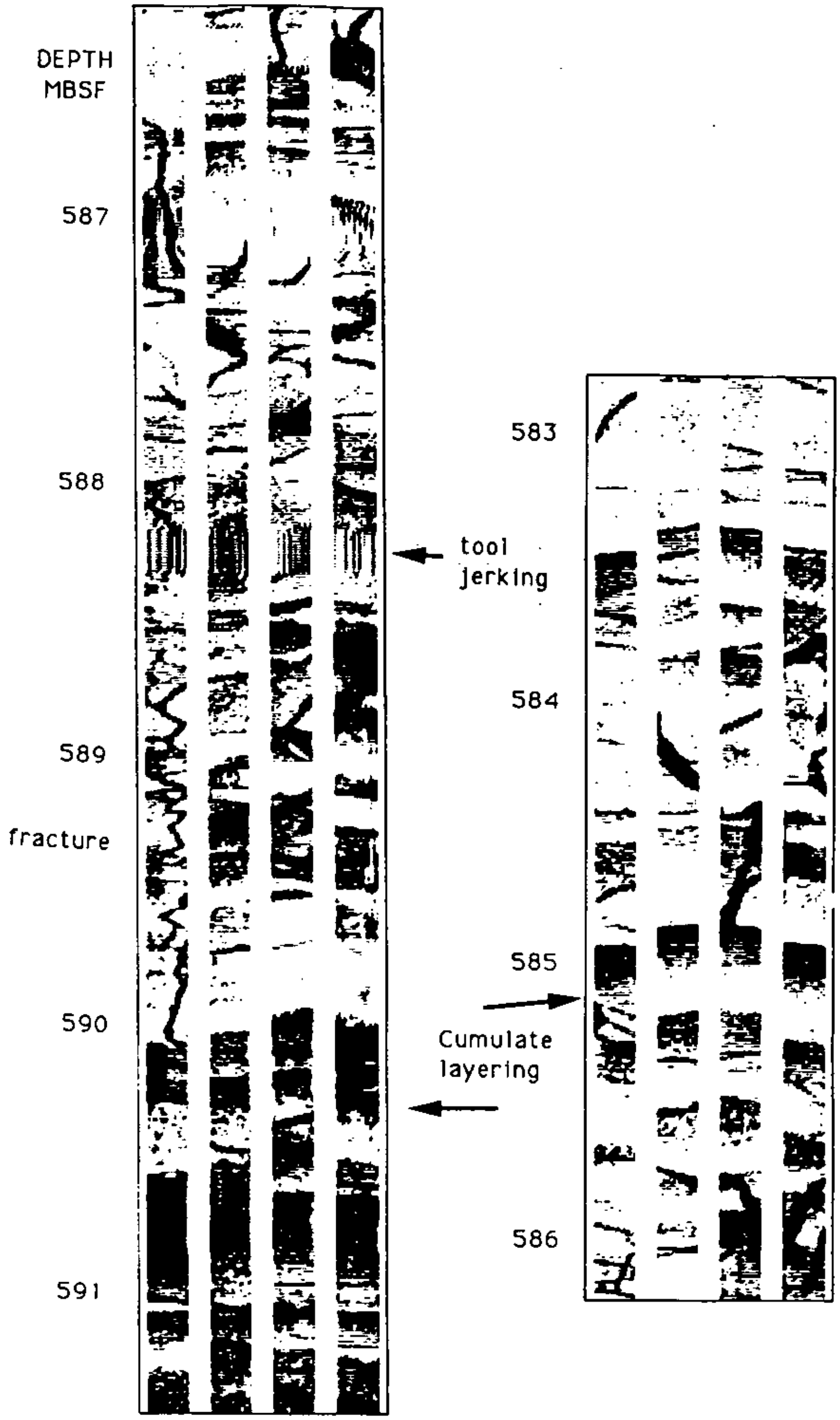


Figure 3. Preliminary Microresistivity images from the Formation Microscanner (FMS) of an 8-m section of Hole 794D. The four tracks represent the resistivity profile of the borehole wall measured by each of the four orthogonal pads of the FMS. Depths are shown in meters below sea floor.

delineation of the thicker ash layers *via* their increased Th/U ratio over the surrounding sediments. This defined a 24-m-thick rhyolitic ash layer particularly well near the base of Hole 799B. Data from the VSP experiment will be used to define the certical seismic character at Hole 799B, and to determine the depth and character of deep structure below the hole.

Site 794, Yamato Basin

Despite the reduced logging program at Hole 794D, the data obtained were of high quality and invaluable for accurately constraining the number, position and thickness of the igneous sills and flows in the sequence (See Figure 2). This had not been possible from the cores alone, as core recovery was poor (22%). Although sediment was only recovered from one interval between sills, the logs suggest that sediment is present between most of the igneous units; this is due

Due to poor hole conditions encountered in Hole 794D, only one of the four logging runs scheduled at this site was fully completed. The seismic stratigraphy combination (SDT-DITE-NGT, and TLT) was run in the 173.5 m of open hole from total depth of 733.5 mbsf to the base of the casing. The FMS obtained data from 592 to 562 mbsf, the upper portion of the open hole.

mainly to the high gamma counts in these zones. At the very base of the hole the low resistivity suggests another sediment zone indicating that the true igneous basement was not reached at this site.

The FMS that was run in the uppermost sill shows in remarkable detail the orientation and scale of faults and fractures, as well as possible cumulate layering within the thick sill (Figure 3).

## ODP SITE SURVEY DATA BANK REPORT

The JOIDES/ODP Data Bank received the following data between June 1, 1989 and July 31, 1989. For additional information on the ODP Data Bank, please contact Dr. Carl Brenner at Lamont-Doherty Geological Observatory, Columbia University, Palisades, NY 10964.

- From K. Suyehiro (ORI, Japan): Multichannel seismic lines KT-88-9-102, 103, 104 and 106, in the area of proposed Japan Sea sites J1d-1, J1d-2 and J3b-2.
- From L. Abrams (URI): Magnetic tape of digital underway geophysics merged with navigation, from *R/V Fred Moore* 35-12 site survey of the Old Pacific area.
- From J. Diebold (LDGO) and R. Larson (URI): Reprocessed multichannel seismic lines 39, 46, 47 and 49, from *R/V Conrad* 20 cruises in the area of the proposed Geochemical Reference sites.
- From T. Shipley (UT): Multichannel seismic lines collected during *R/V Fred Moore* 35-12 site survey of the Old Pacific area; microfilm of processed seismic lines collected during *R/V Thomas Washington* (ROUNDABOUT 11) survey of the Ontong Java Plateau; and microfilm of *R/V Fred Moore* 35-06 multichannel seismic profiles in the Nankai Trough area, along with watch log and MCS acquisition log.
- From T. Shipley (UT): Processed single channel reflection profiles collected by *R/V Thomas Washington* during ROUNDABOUT 11 site survey of the Ontong Java Plateau; magnetic tape of *R/V Fred Moore* and *Tansei Maru* navigation in the Nankai Trough area.

# PROPOSALS RECEIVED BY THE JOIDES OFFICE

September, 1989 through December, 1989

| Ref. No. | Theme/Area | Author(s) | Country | Date Rcvd |
|---|---|---|---|---|
| 350/E | Gorda deformation zone off N. Calif. | M. Lyle & al. | US | 9/89 |
| 351/C | Bransfield Strait | D.C. Storey & al. | UK/US/G | 9/89 |
| 352/E | Drilling into Layer 3, Mathemat. Ridge | D.S. Stakes & al. | US | 9/89 |
| 353/C Rev. | Antarctic Peninsula, Pac. Margin | P.F. Barker & al. | UK | 9/89 |
| 354/A | Angola/Namibia upwelling system | G. Wefer & al. | G/US | 9/89 |
| 355/E | Formation of a gas hydrate | R. von Huene & al. | G/US | 9/89 |
| 271/E Rev/2 | APC coring seamounts off Calif. | J. Barron | US | 9/89 |
| 233/E Rev/2 | Oregon accretionary complex | L.D. Kulm & al. | US/G | 9/89 |
| 356/A | Denmark Str., Greenl. Scotl. & Jan Mayen ridges | P.P. Smolka & al. | G | 9/89 |
| 357/E Rev. | East Pacific Rise near 12°50' | R. Hékinian & al. | FR/US | 10/89 |
| 286/E Add. | Layer 2/3 transition at hole 504B | K. Becker | US | 10/89 |
| 221/E Add. | Eastern Equatorial Pacific Neogene | N.G. Pisias & al. | US | 11/89 |
| 317/E Add. | Northern Cascadia subduction zone | R.D. Hyndman & al. | CAN | 11/89 |
| 358/A | To drill a transect at the Vøring margin | O. Eldholm & al. | NOR | 11/89 |
| 359/A | North Atlantic conjugate passive margin | B. Tucholke & al. | US/CAN/FR | 11/89 |
| 360/D | Valu Fa Ridge (S. Lau Basin) | U. von Stackelberg & al. | CONSOR. | 12/89 |
| 361/A | Active Hydrotherm. Mid-Atlantic Ridge | G. Thompson & al. | US/UK | 1/90 |

# EXECUTIVE COMMITTEE REPORT

The JOIDES Executive Committee met at the Royal Academy of Arts and Sciences in Amsterdam, The Netherlands, October 3-4, 1989. Foremost on the agenda were long-term and near-term planning and scientific objectives for ODP.

## LONG-TERM SCIENTIFIC OBJECTIVES

The time frame for the long-term program remains the same as that presented during the 31 May-1 June 1989 meeting. The current phase of the Ocean Drilling Program comes to a close in 1993 as the Memoranda of Understanding (MOU) with ODP partner countries expire. While the National Science Foundation is responsible for orchestration of contractual actions such as renewal of the MOUs, as manager of ODP, JOI is charged with presentation of the scientific and engineering benefits of ocean drilling.

Dissemination of the Long-Range Plan (LRP) is just one of several actions being taken toward renewal of the ODP through the year 2002. Revisions and additions to the Long-Range Plan include a brochure about the ODP and an Executive Summary; these will accompany the LRP document. The LRP will be available in final form from the JOI office in early 1990.

PCOM's mandate calls for sponsoring and convening COSOD-type conferences at appropriate intervals. One plan had called for COSOD III in mid-1992. After discussion, EXCOM leaned toward both (a) a small series of international science-focused meetings in the summer or fall of 1991, partly retrospective ("distinguished past") and partly forward-looking ("exciting future"), with timing, venues, and organization largely decided by the country or countries for which these will be partly "marketing exercises" for MOU renewal; and (b) COSOD III in perhaps 1993, with a focus on means of implementation of plans in the renewed program.

## NEAR-TERM PLANNING

EXCOM accepted, and the JOI Board of Governors ratified, the changes proposed by PCOM to the panel membership statements and regarding reinstitution of working groups. EXCOM will assist JOI in setting up and charging the third Performance Evaluation Committee (PEC). The review is to include the broader structural aspects of the program as well as the performance of the subcontractors. Nominations for the next PEC review should be submitted during the June 1990 EXCOM meeting. Progress towards ODP membership for the U.S.S.R. and for the Korea-People's Republic of China-Taiwan Consortium has been proceeding more slowly than anticipated. EXCOM will advise JOI regarding procedures to select the post-1992 subcontractors.

EXCOM approved the JOI proposal for formal initiatives with international advisory bodies of large global geoscience programs. There were, however, considerable reservations about the direct contact once a year between the liaison groups and PCOM, because of the possibility of short-circuiting the JOIDES advisory panel structures. That reservation led to the proviso that PCOM and EXCOM members shall not be members of the liaison groups.

H. Dürbaum and J. Austin were appointed to the Budget Committee. J. Briden and B. Lewis will remain on BCOM until summer of 1990. The date for the next BCOM meeting is 6-8 March, 1990.

The PCOM resolution about non-JOI membership on PCOM was passed from EXCOM to the JOI Board of Governors.

## DATA DISSEMINATION

PCOM is to recommend to JOI any action about dissemination of ODP data, including action concerning the group that prepared the CD-ROM of DSDP data. PCOM should take action after hearing the IHP report.

# INFORMATION HANDLING PANEL MEETING SUMMARY

The Information Handling Panel met in Seattle, Washington during 18-20 September, 1989. IHP spent much of that time discussing the means of attaining the 12-month Initial Results volume and 30-month Scientific Results volume schedules. To achieve these schedules, the panel felt that the following additions to the budget need to be made:

•In order to have barrel sheets ready at 4 months post cruise for the initial post-cruise meeting, additional drafting assistance is needed. Cost would be about $24,000.

•In order for post-cruise samples to be made available in a timely fashion, cores should be shipped back to the repository after each leg instead of after every other leg. This represents an additional cost of $60,000 per year.

•To speed manuscript processing, prime control of the manuscript review and revision process needs to be returned to ODP at TAMU. Editorial Boards for each volume still can serve in an advisory capacity on matters of acceptance and rejection of manuscripts. Additional personnel for taking the Scientific Results (SR) volume papers from submission through production would cost about $180,000 (with overhead).

PUBLICATION POLICY

The panel reviewed publication policy and made additional recommendations:

•The co-chief scientists and leg paricipants should mutually and formally agree on what paper(s) for the SR volume will fulfill their obligation to the leg.

•It should be the responsibility of the participants who wish to publish outside the SR volume to inform editors of the outside journal that the manuscript is being submitted to ODP as well, or to obtain waivers of copyrights and/or permissions required to reprint articles in the SR volume which have appeared in non-ODP publications.

The panel strongly recommends that JOIDES move forward with plans to put the ODP data base on CD-ROMs.

# LITHOSPHERE PANEL MEETING SUMMARY

The JOIDES Lithosphere Panel Meeting occurred in Windischeschenbach, Federal Republic of Germany, during 8-12 September, 1989.

NEAR-TERM PLANNING

LITHP endorsed the Leg 129 Prospectus with at least 100 m of basement penetration at PIG-1, or PIG-2 and PIG-3. The nature of Jurassic ocean crust is extremely important, such that, if drilling conditions are favorable, up to 300 m of basement penetration at one site would be highly desirable. LITHP objected most strongly to the suggestion of not drilling a deep basement reentry site on Leg 129.

The Leg 130 program received strong support from LITHP as a multi-objective drilling program. Even so, there was no LITHP thematic input into the draft prospectus for the Ontong Java Plateau. LITHP strongly urged that the deep reentry site be targeted to recover at least 150 m of basement and be drilled as the first site on the leg.

Lack of communication for Leg 130 raised the general issue of the detailed planning of drilling legs. To avoid future problems, LITHP strongly endorsed the notion of thematic input/participation in putting together prospectii. A related issue concerned effective communication between all thematic panels. In order to ensure effective communications for multi-objective legs, LITHP requested a permanent liaison to OHP.

A new LITHP ranking placed Geochemical Reference Sites as a very high priority. Fundamental questions raised by Legs 125 and 126 require constraints on the nature of material being subducted. LITHP strongly urged that Geochemical Reference Sites be drilled in 1992 or 1993.

LITHP strongly endorsed the two-leg drilling plan for sedimented ridges formulated by the SRDPG. The recommendations presented by this report should be implemented and drilling should be scheduled for 1991.

LONG-RANGE PLANNING

LITHP outlined four long-term goals that have been incorporated into the Long-Range Planning document: (1) a deep drill hole traversing normal ocean crust to mantle; (2) establishment of global-seismic arrays and ridge-crest observatories; (3) investigation of the magmatic and hydrothermal processes of crustal accretion at a variety of spreading rates; (4) improved understanding of off-axis volcanism.

Priorities for 1991 CEPAC drilling were as follows: (1) 504B (1 Leg); (2) Sedimented Ridges (1 Leg); EPR bare rock (1 Leg); (4) Chile triple junction; (5) Cascadia Margin; and (6) East Equatorial Pacific Neogene.

LITHP met jointly with DMP to consider imminent logging needs. Recommendations were that the logging group at LDGO be given the responsibility and resources necessary to construct a high-temperature, slimline toolstring to measure as many as possible of the following: Temperature, borehole fluid resistivity, formation resistivity, natural gamma, sonic, caliper, flow meter, and borehole fluid pressure. LITHP also recommended that TAMU develop or continue development of: (1) high-temperature bits and coreliners; (2) a modified Barnes-Uyeda tool; (3) the DCS and pogo guidebase; and, (4) post-drilling seals for ODP holes.

The next meeting will be scheduled to overlap with TECP's next meeting for the first week of March, 1990 in New Orleans.

# OCEAN HISTORY PANEL MEETING SUMMARY

OHP met in Giessen, Federal Republic of Germany 26-28 October, 1989.

COMMUNICATIONS

OHP recommended that if JOI is forging formal links with major global geoscience initiatives, the International Geosphere-Biosphere Program (IGBP) would be an appropriate liaison group. This issue could be raised at the upcoming IGBP Working Group on Past Global Change, chaired by Hans Oeschger.

In order for the DPGs to report to PCOM through the thematic panels it is essential that thematic panel members receive copies of their reports (e.g. the CEPACDPG prospectus). OHP suggested that the JOIDES Office take responsibility for copying and distribution these reports. This would ensure that, although the thematic panel may not meet between DPG and PCOM meetings, at least panel chairmen will be able to transmit panel reactions to PCOM.

NEAR-TERM PLANNING

TAMU should be aware that for Leg 130 (Ontong Java Plateau), it is essential that the core orientation device be operational and in place for all APC holes, and that all precautions be taken to avoid impediments to its successful use (such as the barrel magnetization problem identified on Leg 115). This technology will also be needed if the Eastern Equatorial Pacific Neogene Transect program is drilled.

In view of the importance of high resolution physical properties data to the objectives of Leg 130 and other future legs, and in view of the mistrust that is generated by the presence of a systematic offset between careful discrete sample bulk density measurements and high-caliber continuous GRAPE data, OHP requested that the SMP chairman provide clear guidelines as to the most appropriate way of using these two independent estimates in the context of detailed Mass Accumulation Rate reconstructions.

OHP recommended that the sampling strategy required to achieve the scientific objectives of a leg such as 130 should be properly planned and that a statement of sampling requirements and strategy within the cruise prospectus was the appropriate place for this. The statement would ensure that a conflict between routine sampling directives and the needs of the shipboard scientific party does not compromise the achievements of the leg, or give rise to the drilling of needless extra holes or to petty subterfuge designed to circumvent the TAMU directives.

OHP discussed the relative merits of proposed sites OJP-3 and OJP-6 for Leg 130, and favored drilling the deeper OJP-3. In addition, OHP recommended that the chief scientists be permitted to reverse this choice if the material recovered at site OJP-4 suggests that this would be preferable. In the event that unforseen circumstances permitted, OHP would welcome drilling of both OJP-3 and -6. OHP emphasized that the upper part of shallow site OJP-1 essentially duplicates DSDP Site 586, and that the primary purpose of this site is to improve recovery of the very important middle-late Miocene and early Miocene records revealed in a fragmentary and distorted form at Site 586. Time should be devoted to double-XCB recovery of this part of the section rather than to needlessly replicating the latest Neogene.

LONG-TERM PLANNING

OHP gave highest priority to the Eastern Equatorial Pacific Neogene Transect for drilling in FY 1991. OHP did not wish to rank the remaining programs on the list because none of them addresses themes within the OHP mandate.

# SEDIMENTARY AND GEOCHEMICAL PROCESSES PANEL MEETING SUMMARY

SGPP met at GEOMAR-Kiel, in the Federal Republic of Germany, 19-20 September 1989. The meeting was devoted to: (1) review of drilling proposals; (2) revision of the SGPP white paper; (3) preparation for CEPACDPG and (4) discussion of technology issues. Ranking of proposals will be completed during the Spring, 1990 meeting.

## SGPP WHITE PAPER

The discrepancy between the panel mandate as handed down by PCOM and the few themes to which SGPP has devoted its energies was evident. A new introduction was included to explain this as well as the chapter sequence and linkage between themes. SGPP made plans to incorporate: (1) a more explicit statement about instrumented holes; (2)a section on ice margin processes; (3) a greatly expanded section on sediment fluxes (including carbon budget as it pertains to paleocean chemistry); and (4) to divide the evaporite discussion between metallogenesis and paleocean chemistry. No outside comments were received.

## PREPARATION FOR CEPACDPG

Hydrothermal processes at sedimented ridges and the Cascadia accretionary margin received SGPP highest ranking. SGPP recommended that drilling of sedimented ridge crests should occur only at an hydrothermally active segment and that SGPP's conception of the Cascadia drilling means the Oregon margin, because fluids, sediments and hydrology are a documented and integral part of the drilling proposals.

## TECHNOLOGY ISSUES

Sand drilling was discussed, based on the TAMU document (88-0300). SGPP's concerns were for improved recovery in the thematic areas of: (1) shallow-water sands to secure one end-member for determining magnitude of sea-level changes; (2) volcaniclastics within accretionary margins; (3) contourites for deep water history; (4) carbonate sands in atoll drilling; (5) sulfide sand and gravel in ridge valleys and sedimented ridge crests; and (6) unconsolidated mounds at mid-ocean ridges. SGPP will prepare a short summary document to highlight this issue and send a one-time liaison to the annual TEDCOM meeting.

# DRAFT, SEDIMENTED RIDGES DRILLING PROSPECTUS

## INTRODUCTION

The Sedimented Ridge Detailed Planning Group (SRDPG) was established by PCOM in December 1988 and charged with developing a detailed prospectus for drilling at sedimented ridges in the eastern Pacific. The members of the DPG were drawn from the combined membership of LITHP's EPR and Sedimented Ridge Working Groups. The SRDPG met 13-15 June 1989 in Ottawa and developed the drilling program presented in this document. The panel relied heavily on the 1988 LITHP White Paper, *"A Drilling Strategy for Sedimented Ridge Crests,"* in its discussions and the reader is referred to that document for a more thorough presentation of the thematic goals and scientific objectives of sedimented ridge drilling. This prospectus focuses on the drilling strategy required to address these scientific goals, the geological setting and location of the proposed drilling sites, and associated coring, logging and sampling requirements. The format of the prospectus follows that used in the current CEPAC Prospectus.

## THEMATIC GOALS

Sediment-covered spreading centers, although relatively rare, provide the Ocean Drilling Program with a unique opportunity to investigate a number of fundamental geologic processes including hydrothermal circulation, sulfide metallogenesis, and crustal formation. These objectives have been identified as a high priority for drilling in both the COSOD I (Working Group I) and COSOD II (Working Groups II and III) reports and in the LITHP White Paper. Sedimented ridge drilling has been rated a top CEPAC priority by LITHP and should also be of considerable interest to the newly formed Sedimentary and Geochemical Processes Panel (SGPP).

## SCIENTIFIC OBJECTIVES

Sedimented ridges provide an unparalleled opportunity for quantitative studies of the fundamental physical and chemical processes associated with submarine hydrothermal systems. A regionally continuous, relatively impermeable sediment cover over zero-age crust limits the recharge and discharge of hydrothermal fluids, and conductively insulates the underlying crust. Where discharge of fluids does occur, very large hydrothermal sulfide deposits can be produced. The sediments may also preserve a relatively continuous stratigraphic record of magmatic, tectonic and thermal events, providing clues to the spatial and temporal variability of these processes. Although a sedimented ridge drilling program will provide information on all of these processes, LITHP and the Sedimented Ridge Working Group have recommended that the primary focus of drilling at sedimented ridges should be on hydrothermal problems. Specifically, the two highest priority objectives are:

- A three-dimensional characterization of the fluid flow and geochemical fluxes within a sediment-dominated hydrothermal system.
- A systematic investigation of the processes involved in the formation of sediment-hosted massive sulfide deposits.

## GEOLOGIC SETTING OF PROPOSED DRILLING SITES

Three sedimented rift valley settings were considered for this drilling program: Guaymas Basin in the Gulf of California, Escanaba Trough along the Southern Gorda Ridge, and Middle Valley on the Northern Juan de Fuca Ridge. Detailed descriptions of the sites and site survey data are given in drilling proposals 232/E, 275/E and 284/E. Summaries for Middle Valley and Escanaba Trough are given below. These rifts have much in common, including their general dimensions, the extensiveness of sediment fill, the occurrence of syn-sedimentary volcanism, and the presence of demagnetized or non-magnetic crust. Distinct differences exist in sediment type, the level of current hydrothermal activity, and the size and type of massive sulfide deposits at each of the rift valley sites. These differences are important with respect to the nature of the sulfide deposits, and this is reflected in the selection of several sites at both Middle Valley and Escanaba Trough for a sulfide drilling program. The differences are believed to be less important as they relate to fundamental hydrothermal processes at sedimented ridges. For this reason, a single site was selected for the hydrologic study. On the basis of simplicity, level of current hydrothermal activity, and completeness of site survey information, Middle Valley was favored for this phase of the program.

Middle Valley

For most of the length of the Juan de fuca Ridge, magma is supplied in abundance, and although the spreading rate is only 58 mm/yr, the morphology of this ridge is similar to that of faster spreading ridges. At the north end of the ridge, at its intersection with the Sovanco Fracture Zone (Figure 1), the supply of magma is diminished significantly and a deep extensional rift is present, known as Middle Valley (Figure 2). The proximity of this rift valley to the continental margin has caused it to be filled with Pleistocene turbidite sediments. Basement shoals to the south away from the fracture zone intersection, but continuous sediment cover over the full 10-15-km width of the valley between the primary bounding normal faults persists over a distance of 60 km along the axis.

Early heat-flow measurements in the valley indicated that temperatures in the oceanic crust beneath the sediments were buffered by ubiquitous hydrothermal circulation. In spite of large variation in sediment thickness, temperatures fell within a range of about 150 to 320°C. Subsequent detailed measurements have substantiated this conclusion and have provided a more complete picture of the heat flow and basement temperature variations in the southern part of the valley. A compilation of heat-flow measurement is shown in Figure 3. This information is combined with estimates of sediment thickness from seismic reflection data (Figure 4) to give estimates of temperatures at the sediment-basement interface (Figure 5). There is a general tendency for basement temperatures to increase toward the center of the valley and away from the normal faults that bound the valley on the eastern side. This may be due to the influence of hydrothermal recharge supplied through the thinner sediments that fill the eastern part of the valley, and through basement exposures along the normal faults themselves. Estimated temperatures also decrease in the northern part of the survey area where high sedimentation rates cause the simple estimates of basement temperatures to be erroneously low, and in the southern part of the area where the sediments are probably too thin to prevent advective heat loss. Elsewhere, temperatures range from about 150 to 350°C. In a few cases, estimated temperatures exceed 350-400°C. These estimates are probably erroneously high. Fluid discharge through the sedimentary section is known to occur at two of these locations, and thus the assumption of conductive heat transfer used to calculate temperature profiles from the surface heat-flow measurements breaks down.

Within the Middle Valley area, discharge currently is focused at two locations. The most vigorous occurs above a small buried basement edifice (the location of site MV-1 in Figs. 2-5). This area, referred to below as the High Heat Flow Area (HHFA), is associated with conductive heat-flow values ranging from 2 to over 20 $Wm^{-2}$. A small number of isolated chimneys vent black "smoke" and areas with active vent fauna communities have been observed. These and other small sulfide outcrops occur in a rift-parallel zone roughly 1200 m long and 300 m across within a minor (10-m relief) local topographic depression (Figure 6). Detailed piston coring shows that the amount of sulfide deposited in this area is very minor, with large lateral gradients in the degree of alteration of the upper 4 m of sediment. Cores recovered from the center of this zone are highly altered and have been dewatered by heating to the point that sediments from depths of less than 3 m are semi-indurated. Sediments just tens of meters away are relatively unaltered.

Vol. XVI, No. 1

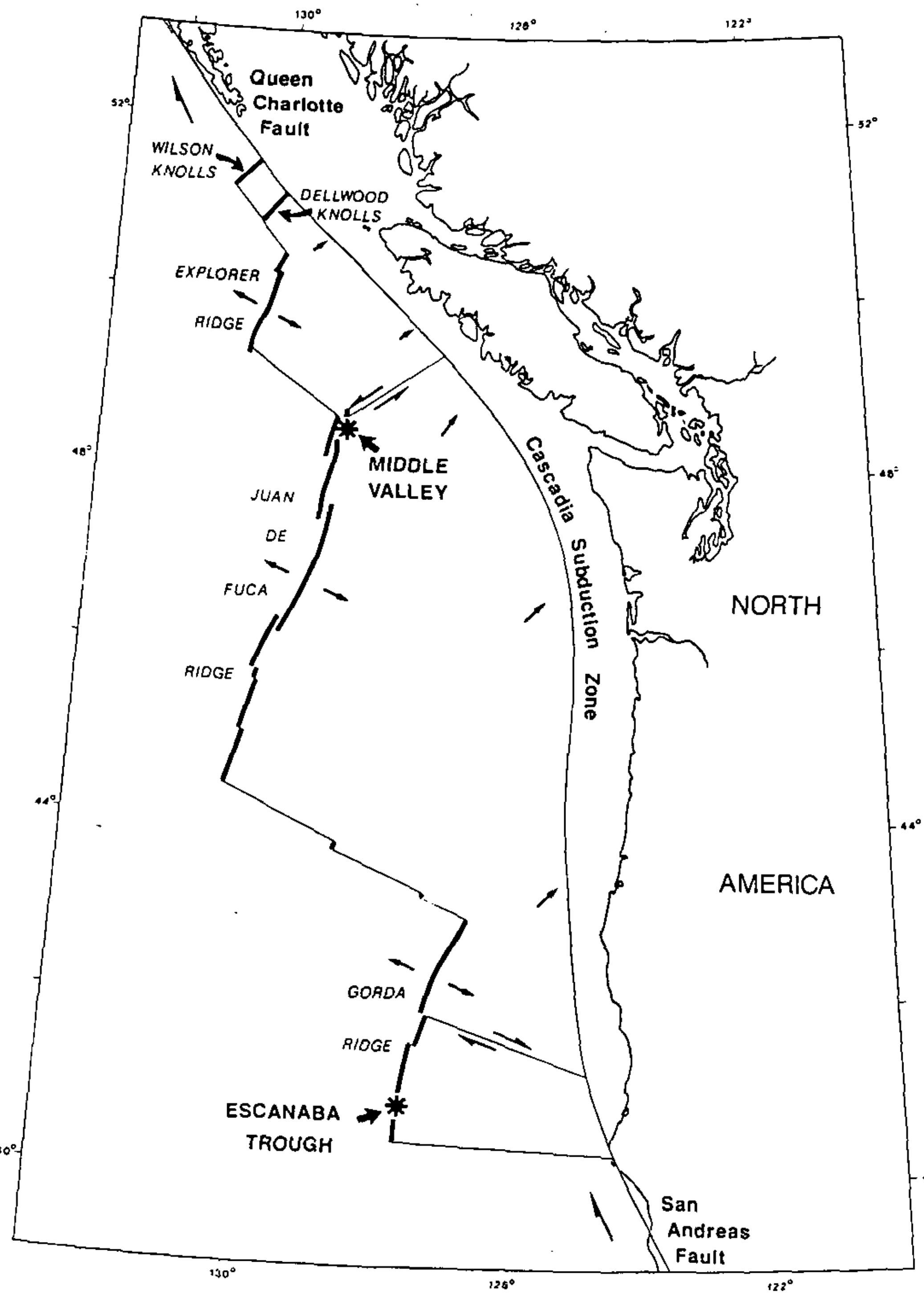


Figure 1. Location map for Middle Valley and Escanaba Trough.

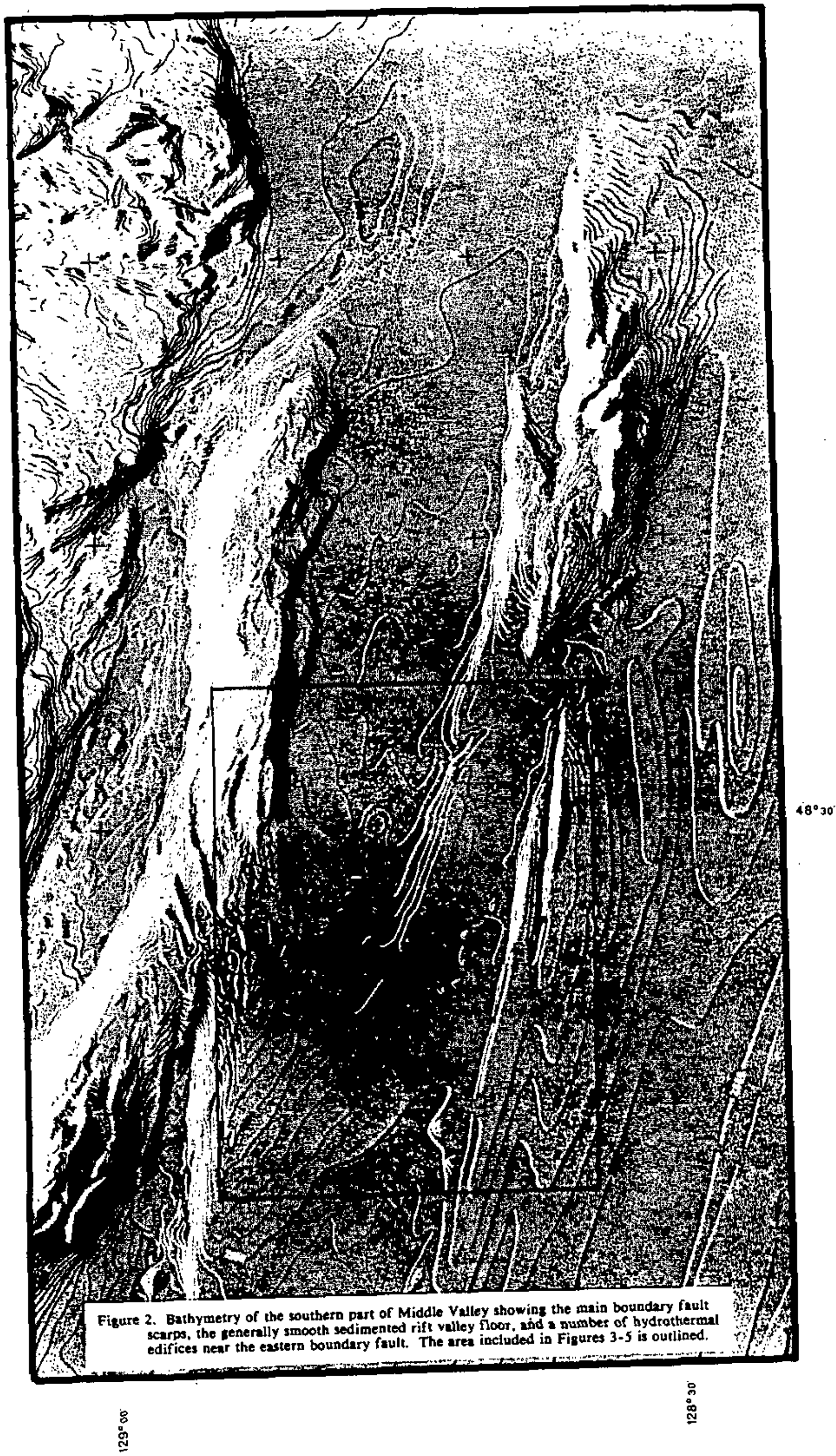


Figure 2. Bathymetry of the southern part of Middle Valley showing the main boundary fault scarps, the generally smooth sedimented rift valley floor, and a number of hydrothermal edifices near the eastern boundary fault. The area included in Figures 3-5 is outlined.

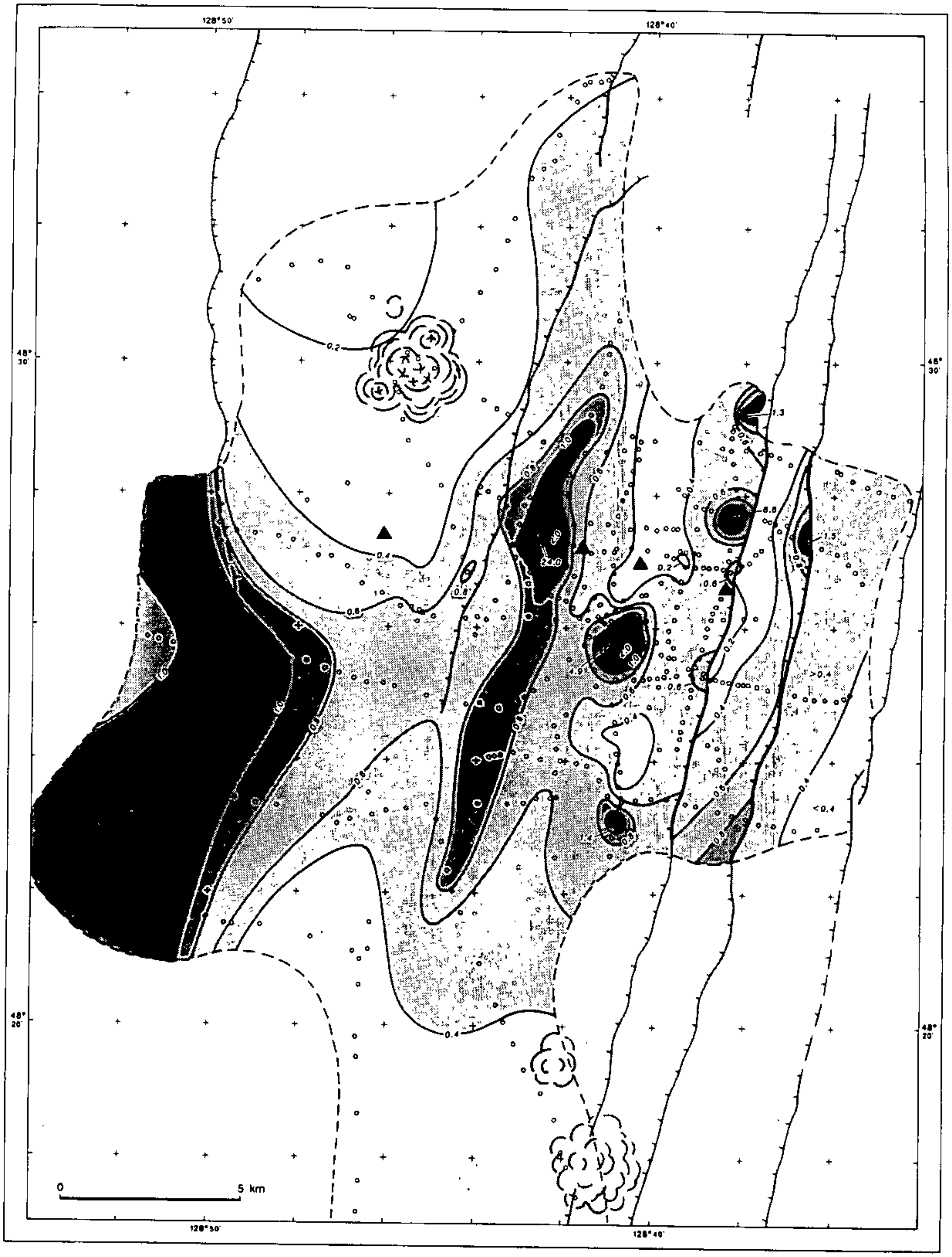

Figure 3. Heat flow measurements in Middle Valley contoured at 0.2 W/m intervals. Locations of proposed drilling sites are shown for reference.

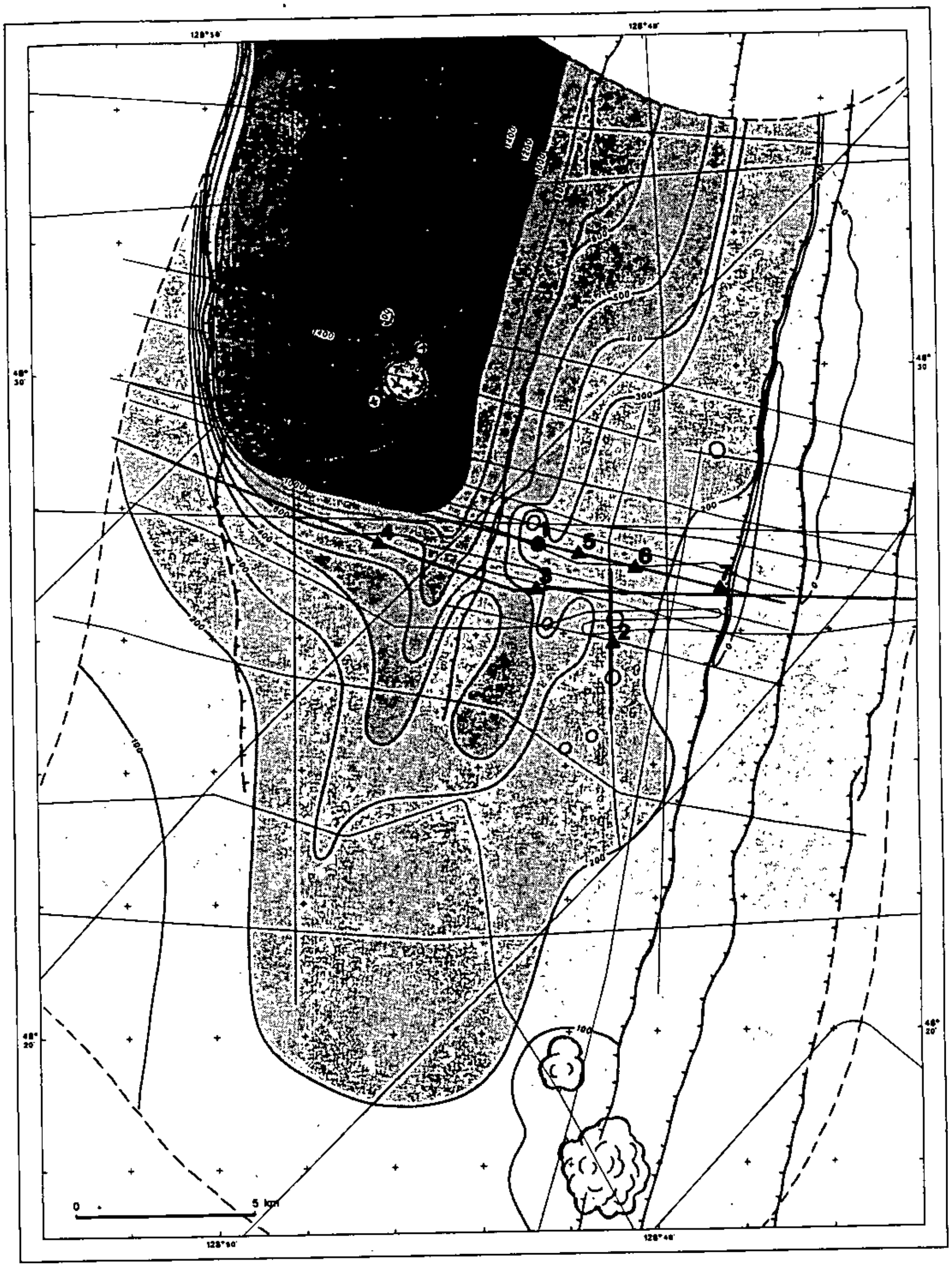


Figure 4. Sediment thickness in Middle Valley contoured at 100 m intervals. Thicknesses are minimum estimates, since in many parts of the valley full acoustic penetration of the valley fill may be prevented by thick interbedded flows or sills. Location of proposed drilling sites and of seismic profiles are included for reference.

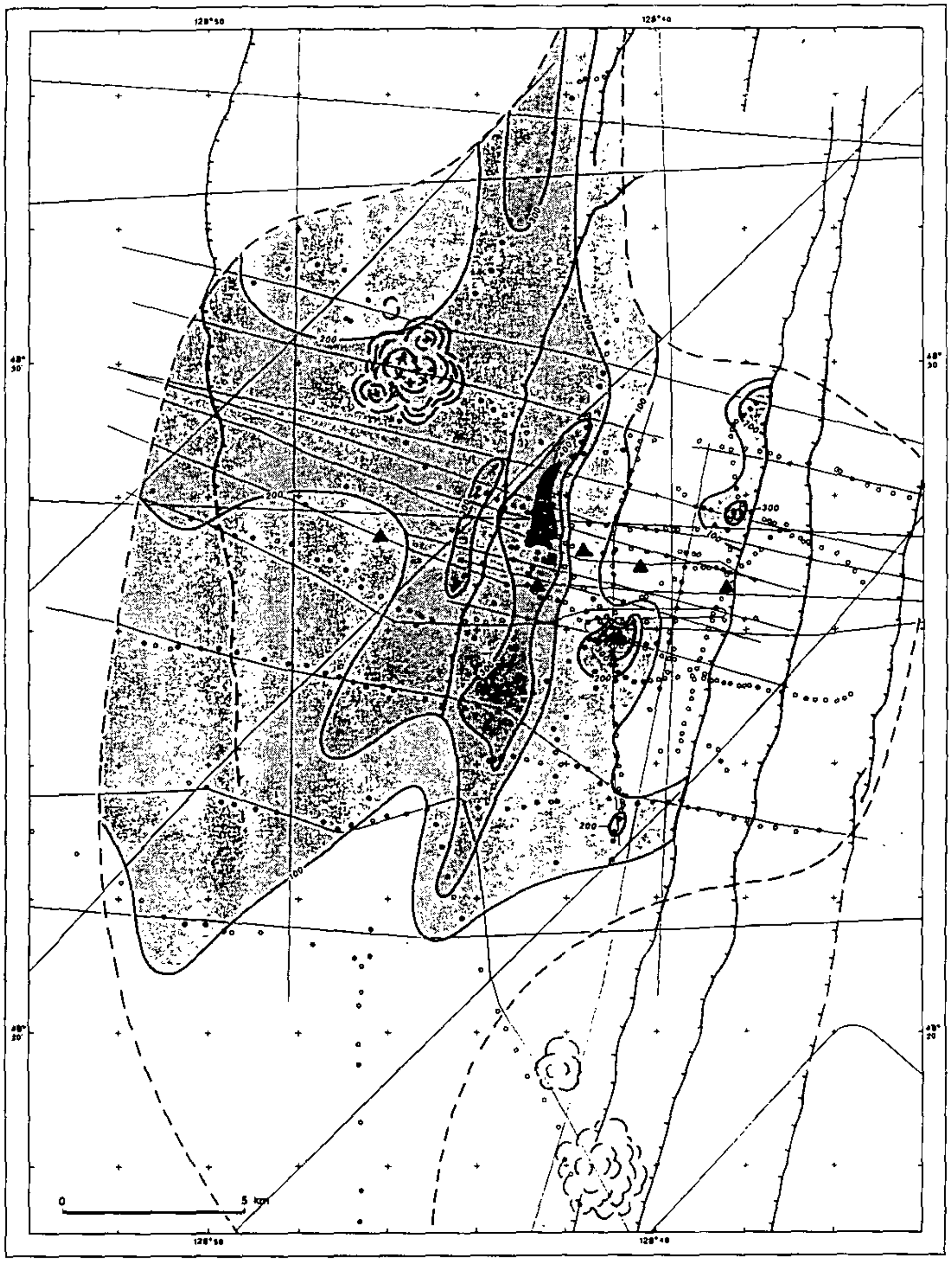

Figure 5. Estimated temperatures for the sediment-basement interface as estimated in Figure 4, assuming an equilibrium conductive temperature profile through the sediment section. Contours are shown at 100°C intervals. Location of proposed drilling sites are shown for reference.

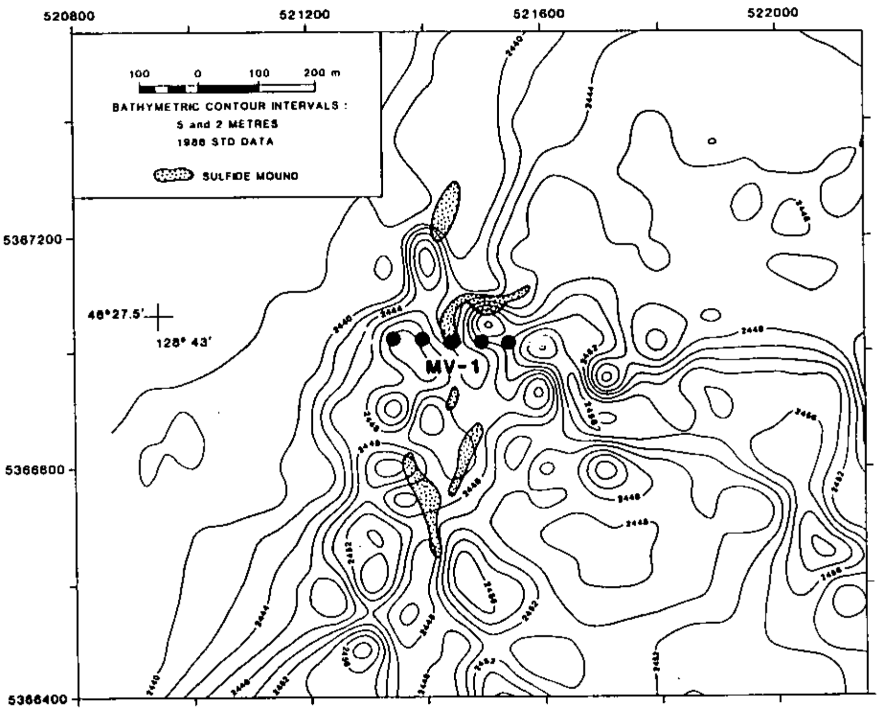


Figure 6. Detailed bathymetry and sulfide outcrops in the High Heat Flow area at site MV-1. Black dots show locations of "S" holes at this site.

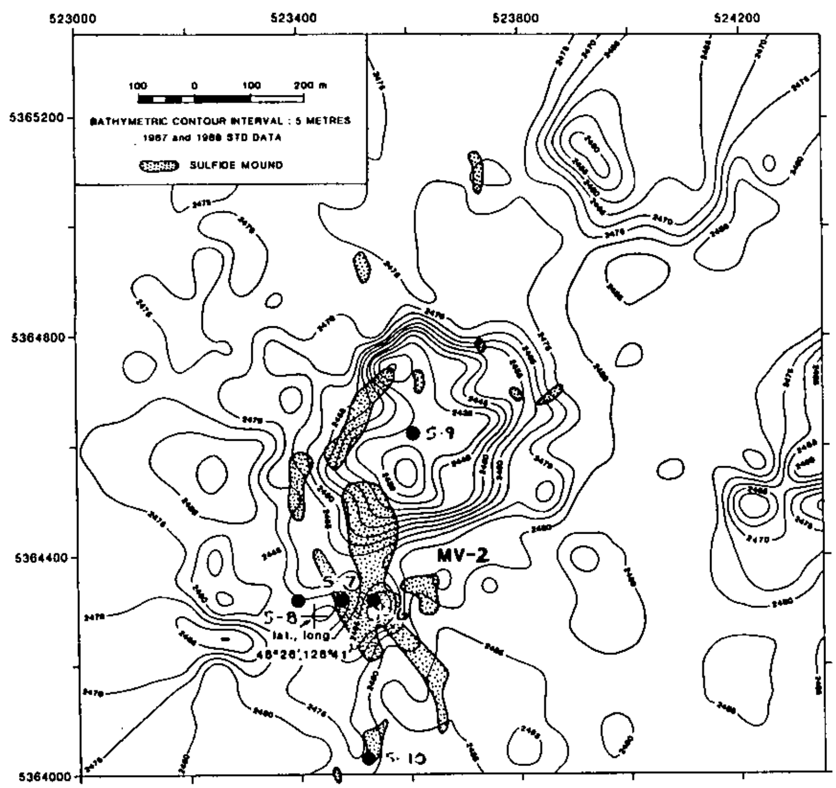


Figure 7. Detailed bathymetry and sulfide outcrops on North Sulfide Mound at site MV-2. Black dots show locations of "S" holes at this site.

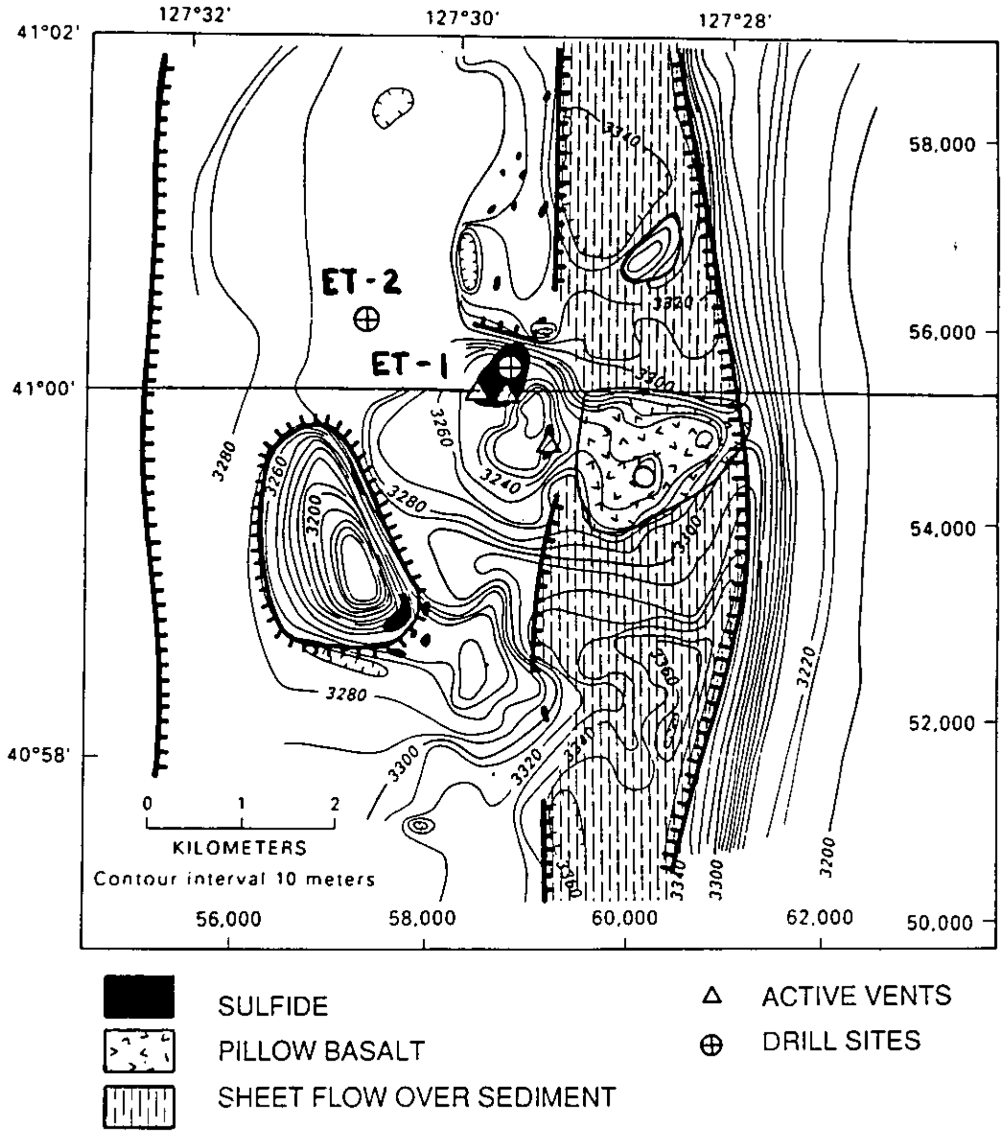


Figure 8. Geological and bathymetric map of Escanaba Trough showing the location of proposed drilling sites ET-1 and ET-2.

The hydrothermally altered sediments are weakly mineralized with disseminated pyrite and contain secondary carbonate concretions. No temperature measurements or fluid samples have been collected from these vents, but judging from the regional basement temperature estimates, vent fluid temperatures are probably of the order of 350°C. The lack of surficial topography suggests that the basement edifice predates and is simple buried by the overlying sediment section. The amount of burial is ill constrained by the seismic data; the best, but maximum, estimate is 120 m. All available evidence suggests that this area represents a hydrothermal discharge zone in the initial stages of formation. Although high temperature fluids are discharging at the seafloor, the system has not been active long enough to form a large sulfide deposit.

A second area of current hydrothermal discharge occurs just south of a large sediment/sulfide dome, referred to below as the North Sulfide Mound (NSM; location of site MV-2). NSM is a circular feature approximately 400 m in diameter that rises 40-50 m above the relatively flat floor of Middle Valley, with a less prominent elongate feature about 10 m high that extends about 400 m to the south (Figure 7). Several domes having similar morphology and dimensions occur in this part of the valley. All appear to be the result of lacolithic intrusions within the sediment section. Photography and sampling show the domes to be ringed by massive sulfides. An extensive area of pyrite massive sulfide with fragmental textures occurs on the west flank of NSM (Figure 7). The southern flank of the mound is covered by an area of outcropping pyrrhotitic massive sulfide. These outcrops extend southward along the less prominent elongate mound, and terminate in an area of localized high heat flow (Figure 3). Although the sulfides overlie an area with high projected temperatures at the sediment-basalt interface, the major element composition of the sulfides (Pb-poor), the Pb-isotope ratios of sulfide, and the Sr-isotope ratios of barite are consistent with formation from a fluid which equilibrated with predominantly basaltic source rocks. The north-to-south changes in the morphology of the sulfide outcrops, the change from pyritic to pyrrhotitic sulfide, and the southward increase in heat flow are all consistent with a southward migration of the area of active venting with time. While there is no present evidence for active hydrothermal vents on NSM, the southern portions of this mature sulfide deposite have clearly formed very recently.

Escanaba Trough

The southern Gorda Ridge spreads at a rate of about 25 mm/yr, and has a morphology characteristic of other slowly spreading ridges. A deep axial rift flanked by high rift mountains runs fairly continuously along the length of the ridge between the Blanco and Mendocino fracture zones (Figure 1). Sediments from the continental margin (locally from northern California and from Astoria Fan) flood the deepest part of the axial valley near the Gorda Ridge-Mendocino Fracture Zone intersection. In the proposed drilling area (40°50'N to 41°02'N) the thickness of sediment within the southern rift valley floor ranges between 350 and 600 m. Localized normal faulting disrupts the entire sediment section in the center of the valley. At several locations along this 2-3-km-wide inner rift zone, volcanics have intruded the sediment section, and in some cases extensive flows are observed on the sediment surface. Volumetrically, the intrusions appear to be small, for only minor topographic relief is produced (typically a few tens and up to 100 meters). As in the case of the domes or plugs above the lacoliths in Middle Valley, many of the "mature" domes in Escanaba Trough are ringed by massive sulfides (Figure 8).

Detailed mapping and sampling of sulfides in this part of the Escanaba Trough (known as the NESCA area) was carried out on two submersible cruises in 1988. Single-channel seismic reflection profiling, multipenetration heat flow, and piston coring were conducted in this area in 1989. Large surface exposures of massive sulfide occur in the NESCA area; massive sulfides have also been encountered below the surface in piston cores. The large central deposit is the only mature sediment-hosted massive sulfide deposit that is known to be hydrothermally active. Hydrothermal fluids, with a maximum temperature of 220°C, issue from vents composed of anhydrite-barite-saponite which sit atop pyrrhotitic massive sulfide mounds. The exiting vent fluids are depleted in metals and rich in alkalies. Fluid chemistry is strongly influenced by hydrothermal interaction with sediment as exemplified by $^{87}Sr/^{86}Sr$ ratios that are more radiogenic than seawater. The composition of the sulfide deposits also reflects the importance of sedimentary source rocks in this hydrothermal system. Relative to basalt-hosted deposits, the Escanaba Trough sulfides are strongly enriched in Pb, As, Sb, Bi and Sn. Pb isotopes are radiogenic and require a dominantly sedimentary source. Some sulfide samples contain hydrothermal petroleum. Altered sediment recovered in cores near the active sulfide deposit confirm that magnesium metasomatism is occurring in the hydrothermal upflow zone. Sediment cores near the active deposit also contained high concentrations of $H_2S$.

Volcanic intrusions in Escanaba Trough are numerous and large, as are the associated sulfide deposits, but in general, the level of current hydrothermal activity appears to be low. Three multipenetration heat flow and seismic lines across the valley a few km south of the profile shown in Figure 6 indicate that heat flow is relatively low, about $0.2 Wm^{-2}$, and remarkable constant. Despite the extensive evidence for hydrothermal interaction with the sediment, the present heat-flow values indicate basement temperatures of only 75 to 90°C, much lower than in Middle Valley.

## DRILLING STRATEGY AND LOGISTICS

To address the scientific goals of the sedimented ridge drilling program outlined above, three types of holes are proposed (Table 1):

*Type A holes* - A-holes are non-reentry holes that will be drilled down as close to the sediment-basement interface as possible (up to 500 mbsf). The unconsolidated and semiconsolidated sediment in the upper part of the section will be cored by APC/XCB; the highly indurated sediments expected in the lower part of the sedimentary section will require the RCB or DCS systems.

*Type B holes* - B-holes are reentry holes that will penetrate into basement, and be cased to basement. All B-holes will be drilled at least a short distance (~50 m) into basement; at least one will be deepened substantially into basement (>500 m). The DCS would be desirable for basement drilling.

*Type C holes* - C-holes consist of shallow (<100 m), closely spaced holes across sulfide bodies to sample and define their structure in three dimensions. High sample recovery is extremely important in these holes; the DCS and "pogo" guidebase would be very desirable for this part of the program.

### <u>Hydrogeology Experiment ("H" holes)</u>

In order to characterize the fluid flow and geochemical fluxes in the Middle Valley hydrothermal system, an array of seven holes is recommended, designated "H" holes in Table 1. The highest priority is single basement reentry hole which has the objective of drilling into the high-temperature reaction zone of this active system. This reentry hole is targeted to drill at least 500 m into basement and should be located in a well defined high heat-flow zone near, but not directly on, an active vent. Complementing this hole is an array of six shallower holes to define the three-dimensional pattern of fluid flow over a 100-200 $km^2$ area. The main objective of these holes is to penetrate into, but not substantially below, basement. They are located in areas of high and low heat flow within both active discharge and potential recharge zones. At least three of these holes will be outfitted with reentry cones for potential subsequent deepening into basement to address both magmatic and hydrothermal problems. At all seven holes an extensive program of logging, fluid sampling and borehole experiments is recommended, and plans should be made to seal the four reentry holes for possible later hydrogeological and geochemical experiments.

Tentative sites for these holes are shown on the maps in Figure 2-5. Multichannel seismic data will be collected in this area in September 1989, and the final position of the proposed holes may be adjusted on the basis of these and other new data.

Holes H1 and H2 are located in currently active hydrothermal discharge areas at sites MV-1 and MV-2. Both of these sites will also be part of the sulfide drilling program; one may be the location of a basement reentry hole. Site MV-1 is in the HHFA described above where numerous black smoker chimneys occur (vent fluid temperatures and chemistry to be determined during a proposed *Alvin* program in June 1990) and the cunductive heat flux ranges from 2 to nearly 30 $Wm^{-2}$. Local basement temperatures are estimated to be in excess of 300°C. In the vicinity, depths to basement are of the order of 400 m. Directly beneath the peak of the heat flow anomaly and the hydrothermal field, a local basement edifice rises to within about 120 m of the seafloor; above that level, sediment reflectors are disturbed but it is not clear whether this is due to hydrothermal induration (the surficial sediments are highly indurated in this area) or to the presence of volcanic rock.

Site MV-2 is located in an area where massive sulfide deposits occur in the near-surface sediments just south of North Sulfide Mound. The mound is cored by a small basement edifice roughly 120 m below the surface. The drill site is located where the conductive heat flow peaks at about 5 $Wm^{-2}$ and where inactive chimneys have been photographed. The underlying sediment section is relatively undisrupted to a depth of about 120 m at which point a small sill or volcanic edifice is visible. Basement depths in the vicinity are roughly 250 m.

Site MV-3 is located within the same thermal anomaly as site MV-1 (heat flow = 2 $Wm^{-2}$; estimated basement temperature >300°C) but where no local basement edifice is visible (sediment thickness = 400 m). It is anticipated that the hole at this site will penetrate a section of sediment where temperatures are high, but where conductive heat transport dominates, and intercept a "reservoir" zone of high-temperature fluid in basement. This site also is a candidate for multiple reentry, basement penetration.

Site MV-4 is located where basement temperatures are also expected to be high and fluid flux through the sediments low. This site lies near the center of the rift valley where the heat flow is about 0.4 $Wm^{-2}$, the sediment thickness is 520 m, and the basement temperature is estimated to be over 200°C. Site MV-4 is about 4 km away from sites MV-1 and MV-3.

Sites MV-5, MV-6 and MV-7 are located between the high temperature discharge site where site MV-1 is located and the normal faults which bound the valley. Basement temperatures decrease systematically toward the faults (roughly 150°C at site MV-5, 80°C at site MV-6, and 60°C at site MV-7). This pattern is believed to be due to the influence of hydrothermal recharge of seawater through the crustal outcrops at the normal fault scarps that bound the valley, and perhaps through the thinner sediments that fill this part of the valley.

A great deal of information about the hydrologic systems active in Middle Valley should be gained with this array of sites. The influence of sediment thickness on regional recharge can be determined by sampling and logging sediment sections that are away from discharge sites and that have a wide range of thicknesses (120 m at MV-7, 200 m at MV-6, 250 m at MV-5, and 520 m at MV-4). The importance of local recharge at fault scarps can be investigated by determining fluid chemical gradients and physical conditions in basement along the profile from site MV-7 to MV-3. Temperatures, permeabilities, fluid chemistry, and pressures at all of the diverse sites will provide important new constraints for models of hydrothermal flow in basin settings. Observations in high-temperature fluid reservoir zones at sites MV-3 and MV-4 and directly beneath the discharge sites (sites MV-1 and MV-2) will provide important information about the source region for fluids that produce massive sediment-hosted sulfides. The role that intrusive and extrusive volcanics within the sediment section play in enhancing permeability can potentially be examined if site MV-7 can be located to intersect the eastern boundary normal fault.

Sulfide Mineralization Drilling Sites ("S" holes)

Processes involved in the formation of submarine base-metal sulfide deposits operate in two distinct regimes. The upper regime is the area of focused hydrothermal upflow, sulfide deposition, and "footwall" alteration. The lower regime is the area of high temperature seawater-rock interactions that control metal transport and metamorphism of the metal source rocks. The proposed drilling sites ("S" holes in Table 1) address fundamental processes operative in both regimes.

*Upper Regime* - The upper part of the hydrothermal system will be investigated in three areas of current or recent sulfide deposition: the HHFA in Middle Valley, the NSM in Middle Valley and the NESCA sulfide deposits in Escanaba Trough. In the HHFA (site MV-1) a minimum of five shallow (<100 m), closely spaced (~10s of m) holes will be drilled across the sulfide deposit (Figure 6). This transect of shallow holes will be located in the same area as Hole H1, one of the basement holes drilled for the hydrogeology experiment. A similar suite of closely spaced, shallow holes are proposed at site ET-1 in the NESCA sulfide deposit (Figure 8). Finally, four holes will be drilled at site MV-2 in the NSM deposit near hole H2 (Figure 7).

Two aspects of the upper part of the hydrothermal system will be investigated with these holes: Temporal and spatial variations in depositional mechanisms within the sulfide mounds and in the subsurface, and the alteration associated with subsurface flow of hydrothermal fluid and seawater entrained in the upper part of hydrothermal discharge zones. Comparative investigations of the three areas will establish whether temporal changes occur in fluid composition, determine the role of post-depositional interactions within sulfide mounds on their composition, and explore the effects of differing hydrothermal fluids and source rocks on deposit composition. The HHFA at Middle Valley represents the earliest, progenitive stage of sulfide formation, where high-temperature venting is prominent, but sulfide deposition is minimal. The NSM in Middle Valley represents an intermediate stage of formation; focused venting is not present, but the southernmost heat flow anomaly probably indicates discharge of lower temperature fluids, and may indicate active growth and metal redistribution within the mound. Escanaba Trough contains the most mature deposits of the sediment-associated type known on the seafloor. Some of these are actively venting while others are cold and degraded by seafloor weathering. This area may represent the terminal stage of massive sulfide formation.

Variations within individual deposits may be as important as variations between deposits. Closely spaced drilling of at least two relatively mature deposits (like NSM and NESCA) is necessary in order to investigate lateral and vertical zoning within individual deposits. Ancient ore deposits can have large compositional gradients that strongly affect the economics of mining. The controls on compositional zoning are poorly understood. Studies of the surface exposures of ridge-crest deposits indicate that economically important commodities, such as gold and tin, may be deposited only in those parts of the sulfide deposits where a narrow set of chemical and structural conditions exist. Studies of the vertical distribution of elements in a sulfide mound are needed to test these hypotheses.

Closely spaced drilling across active and inactive sites will also delineate the extent of alteration, and determine the geochemical reactions which control alteration. Specifically, these holes will establish the relative effects of high-temperature metalliferous fluid, versus locally advecting seawater and heated pore water, on the mineral assemblages in sediments adjacent to vent sites. Hydrothermal alteration and transferral of heat into sediments in the upflow zone changes the physical properties of the sediment, inducing dewatering and fracturing. These changes influence the relative importance of movement of hydrothermal fluids along beds with high permeability (i.e. turbidites) versus the movement of fluids along thermally induced fractures. The local subsurface plumbing affects the cooling and mixing rates of subsurface hydrothermal fluids and therefore the mechanism and extent of sulfide deposition and alteration within the sediments.

*Lower-Regime* - The lower part of the hydrothermal system, including the high-temperature reaction zone where evolved seawater interacts with hot sediment and basalt, will be investigated in the "A" and "B" holes drilled in Middle Valley as part of the hydrogeology experiment (especially sites MV-1 and MV-2) and in two additional "A" holes drilled in Escanaba Trough at sites ET-1 and ET-2 (Table 1). Site ET-1 is located in a large sulfide deposit on the western side of a large lacolith; ET-2 is about 5 km to the northwest (Figure 8). Drilling at the latter site will obtain a reference section of unaltered sediment in the upper part of the hole and determine the degree of alteration and pore fluid chemistry in the lower part of the section away from a major hydrothermal upflow zone.

Drilling at these sites in both Middle Valley and Escanaba Trough will provide important controls on fluid-rock ratios, fluid residence times and reaction rates. The high-temperature alteration mineralogy in the deeper source region is distinct from the shallow alteration zones that form below sulfide deposits in hydrotherm upflow zones. The deeper alteration is an aspect of seafloor metamorphism and records the chemical exchange between seawater and the upper oceanic crust. This drilling will address the differing responses of sediment and basalt to high-temperature hydrothermal interaction. The deposits in Escanaba Trough reflect extensive alteration of sedimentary source rocks; those in Middle Valley suggest the hydrothermal system is dominated by reaction with basalt. The drilling will investigate the origin of these differences in what appear to be similar sediment-buried rifts.

Factors which control the distribution and localization of hydrothermal systems will also be investigated with these holes. The basaltic signature of the Middle Valley deposit could indicate that fluids primarily reside in and react with the permeable, fractures portions of the upper oceanic crust. Fluid discharge controlled by faulting could provide rapid transport of this fluid to the seafloor with minimal opportunity for interaction with sediment. The sedimentary signature of the Escanaba Trough deposits might result from extensive hydrothermal interaction within permeable capped aquifers such as the turbidite sands which fill the median valley. Areally extensive reservoirs of hydrothermal fluid could contain the huge volumes of fluid required to form the large sulfide deposits observed in Escanaba Trough. Volcanic edifices which locally penetrate the sediment cover of the ridge could provide both topographic and thermal foci for harvesting hydrothermal fluid from a large reservoir and localizing hydrothermal discharge. The deeper drilling proposed for Middle Valley and Escanaba Trough will test these hypotheses.

Local controls on the distribution of hydrothermal discharge sites includes faulting, igneous intrusion and the permeability structure of the sediments. Most of the larger deposits are associated with the flanks of uplifted sediment hills. Drilling will test the proposed mechanisms of formation of these hills, including uplift over bysmalithic intrusion and displacive growth through hydrothermal precipitation within the sediment. Drilling near these structures (*e.g.* ET-1) will penetrate the transition from the deeper reaction zones to the focused discharge zones and investigate the controls on the transition from interstitial porosity-controlled fluid flow to fracture-dominated fluid discharge. Local topography, sedimentary facies, unconformities, faulting, intrusion, hydrothermal alteration, thermal dewatering, and lithification will all affect development of cross-stratal permeability and the localization of discharge zones.

Downhole Measurements and Sampling Strategy

Four types of measurements are considered essential to the success of the sedimented ridge drilling program: Temperature, pore pressure, permeability, and fluid sampling.
In the "A" holes, temperature, pore pressure and fluid sampling should be carried out every 20 m with a high-temperature version of the Barnes-Uyeda tool in unconsolidated and semi-consolidated sediments. In more indurated sediments, bottom hole temperature measurements should be made every 100 m using a tool like the USGS/Sandia slimline high-temperature probe, the Japanese P-T tool, or the high-temperature tool under development by von Herzen and Cann.

Standard physical property measurements and fluid sampling should also be routinely undertaken on core material aboard the ship. Permeability can be measured by setting a near-surface (low temperature) packer and determining the integrated permeability in a step-wise fashion as the hole is drilled. A similar suite of measurements should be carried out in the basement reentry holes. If these are drilled with the DCS, reaming these holes with the RCB could allow some standard logging to be done through the side-entry sub while maintaining circulation.

If the DCS is available, borehole hydrogeological experiments would be feasible in the "B" holes by developing seals between the standard drill pipe and casing, and between the standard drill pipe and the DCS drill pipe. This would allow measurements of permeability and pressure to be made on the rig floor of the drillship and allow drawdown and slug tests. Also, it will be necessary to develop some type of post-drilling seal (ideally wire-line re-enterable) for the "B" holes. Borehole seismic experiments, including an oblique seismic experiment, should be carried out in the deep basement reentry hole.

Drilling Logistics and Scheduling

Drilling time estimates for the program outlined above ar given in Table 1. The total is ~115 days for drilling, logging and sampling, exclusive of transits (transits are potentially minimal due to the proximity of the proposed sites to several major North American ports). Thus nominally, two legs would be required to carry out the program proposed here. It would not be feasible to adequately address *both* the hydrogeological and sulfide mineralization objectives in a single leg of drilling.

In recommending a tentative drilling schedule, the SRDPG considered several factors. First, all of the "A" holes in the hydrogeology experiment should be completed before final selection of the "B" sites is made (for planning purposes in Table 1 four sites have been designated as "B" sites). Second, the deepest holes, and those drilled in the hottest parts of the hydrothermal system, should be drilled on the second leg to allow additional time to develop the tools needed to drill and log under high-temperature conditions. Third, the best weather window for drilling at these sites is a six-month period from April to September. Based on these considerations, the following breakdown of drilling on the two legs is recommended:

| | |
|---|---|
| LEG I (Spring/Summer, 1991) | |
| 7 "A" holes (sites MV-1 to -7) | 33 days |
| 3 "B" holes in Middle Valley | 14 |
| Sulfide drilling (site MV-1) | 10 |
| | 57 days |

| | |
|---|---|
| LEG II (Spring/Summer, 1992) | |
| 2 "A" holes (sites ET-1, ET-2) | 12 days |
| Sulfide drilling (site ET-1) | 10 |
| Sulfide drilling (site MV-2) | 16 |
| Deepening one "B" hole in Middle Valley ~500 m into basement | 20 |
| | 58 days |

ENGINEERING REQUIREMENTS

Based on the drilling and borehole measurement strategies summarized above, the SRDPG prioritized the technical development required for a successful sedimented ridge program as follows:

*Essential development*:

•High temperature drill bits and core liners

•Barnes-Uyeda tool modified for higher temperatures (up to 200°C) and to make it stronger (shorten its length?)

•Slimline, self-contained probe to measure temperatures up to 350°C (borrow/lease USGS/Sandia or Japanese P-T tool?)

•Post-drilling seal for reentry holes (drillable okay, but highly desirable that it be wire-line re-enterable)

*Desirable development:*

•DCS

•"Pogo" guidebase

•Openable annulus seal for DCS

•Standard logging through side-entry sub while maintaining circulation

•Pressure core barrel

- Capability to measure $H_2S$ and related gases on drillship
- Slimline high-temperature logging tools (of various types) and high temperature logging cable
- High-temperature packers

SUPPORTING INFORMATION

Both Middle Valley and Escanaba Trough are extremely well surveyed and no additional site survey information is *required* prior to drilling. Some of the available data are shown in Figures 2-5. Additional, more detailed descriptions of the geological setting, hydrothermal systems and sulfides in Middle Valley and Escanaba Trough are available in the publications listed below. E. Davis (Pacific Geoscience Center) is the principal contact for site survey data from Middle Valley; J. Franklin (Geological Survey of Canada) and R. Zierenberg (U.S. Geological Survey) are the principal contacts for site survey data on the sulfides in Middle Valley and Escanaba Trough, respectively.

Although not required for site selection, additional data from both areas would be *desirable* prior to drilling. These data include additional high-resolution side-scan imagery in both areas; multichannel seismics to better constrain the physical properties of the sedimentary section and identify shallow crustal drilling targets including possible crustal magma chambers; and sampling of the vent waters in Middle Valley. Multichannel seismic data will be collected in September, 1989 and the hydrothermal vents in Middle Valley will be sampled during a proposed *Alvin* program in June 1990. Numerical modeling of the hydrogeology of the Middle Valley area before drilling, and after Leg I, also would be extremely useful.

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## REPORT OF THE ANNUAL MEETING OF THE PANEL CHAIRMEN

The Annual Meeting of JOIDES Panel Chairmen was held on 26 November 1989 at Woods Hole Oceanographic Institution and chaired by Ted Moore. The following is a summary of those items which were of major concern to the panel chairmen and were brought up either during the presentation of the individual reports or during the general discussion.

There is a need for groups to do both long-range planning and detailed planning for drilling programs in addition to the thematic panels. The role of **Working Groups** is seen as providing long-range, broader scale planning, addressing specific thematic problems for which the thematic panels do not have the time or the necessary expertise to accomplish. This planning includes determining both the objectives of drilling a particular high-ranked theme and the criteria that must be met to successfully address this theme by drilling. Working groups can also be constituted to evaluate a theme that cross-cuts the interests of multiple thematic panels (*e.g.* sealevel change) as well as problems that concern both the thematic panels and service panels. It was deemed appropriate that drilling proponents serve on these working groups since they are often experts on the themes being examined and the main job of the group is to set the criteria for successfully addressing the theme. These groups may also need to evaluate which area best meets the criteria established. This does result in a conflict with having proponents on working groups, however, such conflicts were not perceived to be a great problem as long as a significant number of non-proponents are included and the selection criteria are objectively established. Conflicts of interest must be weighed against the loss of the proponent's expertise if they are excluded. An alternative, and probably unsatisfactory solution, would be to have the thematic panels and/or PCOM select the best area for addressing the theme.

**Detailed Planning Groups** do the more focussed planning concerned with selection of sites for a particular drilling program. These groups may be constituted from the working group with addition of proponents, if not already included, and others whose expertise is desired. The Sedimented Ridges Detailed Planning Group was suggested as a model for such groups, since it was originally constituted (more or less) as a working group to establish the criteria and then evolved into a detailed planning group to plan the drilling.

The question of the necessity of **liaisons** between disparate thematic panels such as LITHP and OHP was discussed. It was felt by Rodey Batiza that these liaisons provide an important path for insuring that a thematic panel's interest in a particular multiple-objective leg, of common interest to both panels, is effectively conveyed to the other panel. This is not always accomplished via panel minutes. In the past the interests of the various thematic panels were integrated by the regional panels, such as CEPAC, but in the future this may not occur if there is not a DPG. Additionally, the panel chairmen endorsed the continued joint or overlapping meeting of thematic and service panels to help foster improved communications.

Erwin Suess was concerned that **sealevel change** gets fragmented attention because of the splitting of SOHP into OHP and SGPP. The panel chairmen suggested that there needs to be a working group with members from all four thematic panels to address this theme, since there are aspects of this problem that involve all thematic panels.

Dave Rea, Rob Kidd, and Mahlon Ball all expressed specific concerns about the **lack of a 4-year plan** for the general track of the vessel. The weather window at high northern latitudes cannot be effectively used without having this plan. Planning of site surveys and the orderly advance towards maturity of a proposal is impeded. Without adequate site survey packages, the safety aspects of programs cannot be properly evaluated. There was a general concern by all panel chairmen that ODP lacked adequate long-range planning for the track of the vessel.

Ted Moore discussed problems of the **new publications policy** caused by the tightening of time requirements for the submission of manuscripts in order to get publication of the "Scientific Results" volume 30 months after a cruise. One problem is that important data and syntheses are not getting published. Nick Shackleton suggested that these papers be published in later ODP volumes. Dave Rea suggested that some of these papers could be included as data papers in an appendix. Erwin Suess suggested that synthesis papers could be published in the open literature. The consensus of the panel chairmen was that if a manuscript falls beyond the volume deadline but contains critical data, it should be published in future volumes as an appendix. If the paper has been submitted in time but is not of sufficient quality for inclusion, it should be published as a data paper in the volume. Synthesis papers should go into the open literature if they are not included in the volume.

The current ODP policies on **sampling of cores** were discussed. The panel chairmen feel that the sampling requirements of a drilling leg, necessary for accomplishing the scientific objectives of that leg, need to be specifically stated in the prospectus. In that way IHP and SMP can determine if an exemption from the standard sampling policy is required to accomplish the scientific goals of that leg.

The panel chairmen feel that the current methods for **reviewing proposals and developing rankings of programs** is sufficient. Proponents should be informed about the reviews of their proposals and furnished with an abstract of the review. It was suggested that drilling proposals should be supplied to anyone who requests them.

There was a concern about who keeps track of how the **technical requirements**, necessary for accomplishing long-range goals of thematic panels, are being addressed by ODP. It was established that it is the responsibility of TEDCOM, via PCOM, to inform TAMU about and track the development of the technical requirements. Eventually a Working Group may be required to help develop a specific capability.

Finally the panel chairmen discussed items from the PCOM Agenda Book listed under Item I - **Issues Related to Community Concerns**. Many of these items were covered in the discussions above. The panel chairmen did not feel that outside reviews of drilling proposals are necessary, however, JOIDES drilling proposals should be available to anyone who wishes to examine them. The panel chairmen do not see any reason to place persons from non-JOIDES institutions on PCOM. They felt that a disciplinary balance should be required of PCOM, just as it is of thematic panels.

# PLANNING COMMITTEE REPORT

The Annual Meeting of the Planning Committee was held 27-30 November, 1989 at the Woods Hole Oceanographic Institution. The focus of discussion for this meeting centered around the FY91 drilling schedule. Highlights of the Woods Hole meeting appear below. At PCOM's next meeting (24-26 April 1990 in Paris) the agenda will focus on establishing the general track of the *JOIDES Resolution* over the next four years.

## ODP Engineering Developments

Mike Storms reported on the plans for the next joint engineering development and science leg (Leg 132) scheduled for 7 June to 5 August. The Diamond Coring System Phase II (DCS) will be the main engineering development undergoing tests. The focus of this leg will be to test the ability of the DCS to drill and return core in three lithplogies that are presently difficult to core: young, fractured basalts in the Bonin backarc basin; interbedded chalk and chert sequences on Shatsky Rise; and shallow-water carbonate formations on MIT Guyot. At the bare-rock site a new "mini" Hardrock Guidebase and bare-rock spudding and hole-stabilization techniques will be tested. The prospectus for this leg can be obtained from ODP/TAMU (see page 65).

## Drilling Plans for FY91

At its Oslo meeting last spring, PCOM announced that drilling legs for calendar year 1991 would be scheduled from among the following list of programs given high priority by the thematic panels: Cascadia Accretionary Prism; Chile Triple Junction; Eastern Equatorial Pacific Neogene Transect; East Pacific Rise Bare Rock Drilling; Hydrothermal Processes at Sedimented Ridge Crests; Lower Crust at Site 504B. At the Woods Hole meeting PCOM voted to schedule the following legs for drilling in calendar year 1991: Hydrothermal Processes at Sedimented Ridges I, Eastern Equatorial Pacific Neogene Transect, Lower Crust at 504B. In the event that Lower Crust at 504B cannot be drilled, East Pacific Rise Bare Rock Drilling will be substituted. The approximate drilling schedule for FY91 is given below.

PCOM acknowledged the earlier commitment to global planning after 1991, but the immediate need for technical developments (i.e. high-temperature, slimhole tools) made it prudent to plan tentative additional legs through the spring of 1992. PCOM will evaluate these tentative legs at the April 1990 meeting based on the global drilling priorities from the thematic panels. The tentative legs scheduled for drilling following Lower Crust at 504B are: 2 legs of drilling at Chile Triple Junction, East Pacific Rise Bare Rock Drilling I, Cascadia Accretionary Prism I, and Hydrothermal Processes at Sedimented Ridges II.

## Publications Policy

The effects of the new ODP publications policy were discussed. The new policy is having an overall positive effect on helping to speed up publication of both the "Initial Reports" and "Scientific Results" volumes. PCOM was concerned that some of the recent Scientific Results volumes will not contain synthesis chapters from the Co-Chief Scientists. Without these summary chapters a very important part of the most visible results of ODP will be lost to the general detriment of the program. This concern was also expressed by the Panel Chairmen at their annual meeting (see the report of this meeting on page 56).

## Thematic Synthesis Publications of Indian Ocean Drilling Results

At the Annual Meeting last year, PCOM and JOIDES committed itself to a final meeting of the Indian Ocean Panel and Indian Ocean Drilling Leg Co-Chief Scientists. At the Woods Hole meeting a 5-person *ad hoc* Indian Ocean sub-committee recommended and PCOM adopted the suggestion that a meeting be convened to: discuss and synthesize the results of the nine-leg Indian Ocean

Drilling Program in light of COSOD I objectives; assess both the successes and short-falls of this drilling; emphasize unexpected achievements; and highlight the direction for future studies. A further purpose is to assemble synthesis and review papers for publication as a volume outside of ODP. Attendance at the meeting will include former IOP members, Indian Ocean Co-Chiefs and selected shipboard participants. The location and time of the meeting will probably be at the University of Cardiff (Wales) in June 1991, in conjunction with a planned meeting of UK Indian Ocean Participants.

### Formation of Detailed Planning Groups for Cascadia Accretionary Prism and East Pacific Rise

Since PCOM tentatively scheduled both East Pacific Rise Bare Rock and Cascadia Accretionary Prism for drilling after Lower Crust at 504B, there was a need to establish two Detailed Planning Groups to choose among the competing drilling proposals and to provide detailed drilling plans as well as suggest possible future legs for these programs. These two DPGs are presently being staffed and it is anticipated that they will meet during spring or summer to provide guidance for scheduling FY92 drilling at the next Annual Meeting.

### Resolution Concerning USSR Participation in ODP

The following resolution was adopted by PCOM and transmitted by the Chairman of EXCOM to Dr. Eric Bloch, Director of NSF, and to Dr. Allan Bromley, Assistant to the President for Science and Technology: *The JOIDES Planning Committee recommends scientific and technological goals for the Ocean Drilling Program and includes representatives from each of the international partners and the ten JOI Institutions. The Committee has recently learned that failure to permit the Soviet Union to participate in the Ocean Drilling Program has begun to cause difficulties for scientific cooperation in other non-ODP programs. Marine Science is inherently international and relies on the cooperation of many nations and access to territorial seas of great scientific interest. The unilateral US decision to deny ODP membership to the Soviet Union who participated effectively in the Deep Sea Drilling Program, the ODP predecessor, has involved the international ODP members without consultation and without their concurrence. In recent months the Soviet Union has indicated that their rejection by the program inhibits their desire to cooperate fully in other international programs. The ODP Planning Committee urgently recommends that an invitation to join the Ocean Drilling Program be extended to the Soviet Union early in 1990.*

A positive response has been received from Dr. Bromley. In his letter Bromley states that he agrees that it would be in the best interest of all concerned to have the USSR once again participate fully in the drilling program and has communicated that conclusion to President Bush.

### Approximate Cruise Schedule for FY91

| | | | |
|---|---|---|---|
| 134 | 16 Oct.- 11 Dec. | 1990 | Vanuatu |
| 135 | 16 Dec.- 16 Feb. | 1991 | Lau-Tonga |
| 136 | 21 Feb..- 30 Mar. | 1991 | Engineering 3A (At Site 504B) |
| | 4 Apr. - 16 May | 1991 | Engineering 3B (At EPR) |
| 137 | 21 May - 7 July | 1991 | Sedimented Ridges 1 |
| 138 | 27 July - 25 Sep. | 1991 | E. Equatorial Pacific Neogene |
| 139 | 30 Sep. - 29 Nov. | 1991 | 504B or EPR-1 |

## JOIDES/ODP BULLETIN BOARD

### JOIDES MEETING SCHEDULE (01/01/90)

| Date | Place | Committee/Panel |
|---|---|---|
| 14-16 January, 1990 | Santa Cruz, CA | SGPP |
| 23-24 January, 1990 | College Station, TX | DMP |
| 24-25 January, 1990 | Hilo, Hawaii | USSAC |
| 13-14 February, 1990 | Salt Lake City, UT | TEDCOM |
| 27-28 February, 1990 | Menlo Park, CA | PPSP |
| 5-7 March, 1990* | New Orleans, LA | LITHP |
| 5-7 March, 1990* | New Orleans, LA | TECP |
| 6-8 March, 1990 | Washington, DC | BCOM |
| 6-7 March, 1990* | College Station, TX | SMP |
| 7-9 March, 1990* | College Station, TX | IHP |
| 16 March, 1990 | College Station, TX | Annual Co-Chiefs |
| 29-31 March, 1990* | Honolulu, HI | OHP |
| 24-26 April, 1990 | Paris, France | PCOM |
| May or June, 1990* | Menlo Park, CA | SSP |
| 30-31 May, 1990 | Palisades, NY | USSAC |
| 20-22 June, 1990 | Washington, DC | EXCOM & ODPC |
| 8-9 August, 1990 | LaJolla, CA | USSAC |
| 14-16 August, 1990* | LaJolla, CA | PCOM |
| 2-4 October, 1990 | France | EXCOM |
| 27 November, 1990* | Kona, Hawaii | Panel Chairmen |
| 28 Nov.-1 Dec., 1990* | Kona, Hawaii | PCOM |
| 23-25 April, 1991* | Austin, TX | PCOM |
| 20-22 August, 1991* | Hannover, FRG | PCOM |
| 3 December, 1991* | Univ. Rhode Island | Panel Chairmen |
| 4-7 December, 1991* | Univ. Rhode Island | PCOM |
| ex-IOP & Co-Chiefs** | | |

* Tentative meeting; not yet formally requested and/or approved.

** This important meeting to be approved if and when requested.

### ODP/TAMU PANEL LIAISONS:

Downhole Measurements Panel - ANDREW FISCHER; Information Handling Panel - RUSS MERRILL; Pollution Prevention & Safety Panel - LOUIS GARRISON; Site Survey Panel - AUDREY MEYER; Technology & Engineering Development Committee - BARRY HARDING; Executive Committee - PHILIP RABINOWITZ; Planning Committee - LOUIS GARRISON; Shipboard Measurements Panel - JACK BALDAUF & DENNIS GRAHAM

# CONTINUED CALL FOR ODP DRILLING PROPOSALS

Although PCOM will be establishing a 4-year general direction for the *JOIDES Resolution* at the 24-26 April 1990 meeting in Paris, the continued submission of drilling proposals is important since ODP remains a proposal-driven program. Through proposals, individual scientists and groups have the opportunity to respond to the major thematic drilling priorities for ODP and contribute their expertise. The two major sources for defining the direction of ODP science are the COSOD II report and priorities developed by the thematic panels and published in the JOIDES Journal. Opportunities exist for getting proposals accepted into the general drilling schedule, since some established themes lack site-specific proposals or lack proposals that are deemed technologically feasible at this time. New areas of thematic interest come to the forefront as our knowledge of the oceans increases. Periodically, workshops are convened to help identify new areas for drilling efforts. Continued submission of new proposals is extremely important for the continued sucess of ODP.

Guidelines for the submission of proposals can be found in the JOIDES Journal, Special Issue No. 6 published December 1988, or an updated document "Guidelines for the Submission of Proposals and Ideas" can be obtained from the JOIDES Planning Office, Hawaii Institute of Geophysics, 2525 Correa Road, Honolulu, HI 96822. Under the new submission guidelines, proponents must forward ten copies of the proposal to the JOIDES Office. Proponents are asked to attach a one page abstract to the proposal, supply as complete a data base as possible, note anticipated safety problems, and note upcoming surveys. [Note: Keep foldouts to a minimum as they slow down copying and mailing of proposals.]

## LOGGING SCHOOL

TO BE HELD IN CONJUNCTION WITH THE
3-6 JUNE 1990 JOINT MEETING OF AAPG and SEPM
SAN FRANCISCO, CALIFORNIA

The next Logging School will be held in early June 1990 in conjunction with the Joint Meeting of the American Association of Petroleum Geologists (AAPG) and the Society of Economic Paleontologists and Mineralogists (SEPM) in San Francisco.

The ODP Logging School has been designed to introduce the scientific applications of downhole logging used in the Ocean Drilling Program to scientists of varying disciplines. ODP logging specialists from Borehole Research Group at Lamont-Doherty Geological Observatory will demonstrate how logging data are being used to solve scientific problems of paleoenvironment, stratigraphy, geochemistry, basement structure, hydrogeology, geomechanics, and tectonics.

The exact date and location of the logging school has not yet been announced. To receive more updated information about the course, please contact: Robin Smith at JOI, Inc., 1755 Massachusetts Ave., NW, Suite 800, Washington, D.C. 20036-2102, Tel: (202) 232-3900, telemail: R.Smith.JOI (omnet).

## WORKSHOP REPORTS AVAILABLE

The following reports are available. For copies please write to JOI/USSAC Workshop Report, 1755 Massachusetts Ave. NW, Suite 800, Washington, D.C. 20036-2102.

Scientific Seamount Drilling, Tony Watts and Rodey Batiza, conveners.

Vertical Seismic Profiling (VSP) and the Ocean Drilling Program (ODP), John Mutter and Al Balch, conveners.

Dating Young MORB?, Rodey Batiza, Robert Duncan and David Janecky, conveners.

Downhole Seismometers in the Deep Ocean, Mike Purdy and Adam Dziewonski, conveners.

Ocean Drilling and Tectonic Frames of Reference, Richard Carlson, William Sager and Donna Jurdy, conveners.

Science Opportunities Created By Wireline Reentry of Deep-Sea Boreholes, Marcus G. Langseth and Fred N. Speiss, conveners.

Wellbore Sampling, Richard K Traeger and Barry W. Harding, conveners

South Atlantic and Adjacent Southern Ocean Drilling, James A. Austin, convener.

Measurements of Physical Properties and Mechanical State in the Ocean Drilling Program, Daniel K. Karig and Matthew H. Salisbury, conveners.

Paleomagnetic Objectives for the Ocean Drilling Program, Kenneth L. Verosub, Maureen Steiner and Neil Opdyke, conveners.

Cretaceous Black Shales, Michael A. Arthur and Philip A. Meyers, conveners.

Caribbean Geological Evolution, Robert C. Speed, convener.

Drilling the Oceanic Lower Crust and Mantle, Henry J.B. Dick, convener.

## COLOR CORE PHOTOS AVAILABLE ON SLIDES OR VIDEO DISK

The entire collection of color core photographs from the Deep Sea Drilling Project (DSDP) and the Ocean Drilling Project (ODP) is now available to the scientific community. The photos show cores recovered from holes drilled at more than 750 sites in the world's oceans. The collection includes over 23,000 photographs and comes in two formats: 35-mm slides or 12-inch video disk. The 35-mm slides are boxed and consecutively numbered. Both the slides and video disk come with an Introduction booklet giving details on their use and an index. To view the video disk, the user must have access to a NTSC standard disk player with random access capabilities and a video monitor. (An example of such a player is the Sony video disk player #20002-2.)

This collection will be particularly useful to those scientists working on samples from either DSDP or ODP. Those considering placing requests for DSDP or ODP samples will find the photographs make it easier to select the particular interval from which they want their samples taken.

The cost of the slide collection is US$4,500. The video disk costs US$50. These prices are in effect until July 1, 1989. Please call thereafter for a new quote.

To place an order, or for additional information, call or write to: Publications Distribution, Ocean Drilling Program, Texas A&M University, 1000 Discovery Drive, College Station, Texas 77840, U.S.A., Tel: (409) 845-2016.

## NEW OPPORTUNITIES FOR ODP THEMATIC PUBLICATIONS

The Ocean Drilling Program is now seeking scientists worldwide who are interested in serving as conveners or leading editors for ODP thematic volumes. The Joint Oceanographic Institutions has seed money available to defray out-of-pocket costs such as postage, telephone, copying, travel to consult with colleagues or potential publishers, etc. These thematic volumes would be published by outside firms or societies, rather than ODP. For more information, write or call Ellen Kappel at the JOI Office.

## 1991 NSF/ODP FIELD PROGRAMS

The Ocean Drilling Program of the National Science Foundation, in its continuing effort to encourage the development of mature drilling proposals, is accepting proposals for regional geological and geophysical studies well in advance of drilling from US scientists and institutions. In keeping with the thematic emphasis of the international Ocean Drilling Program, the Foundation will accept proposals for work in any ocean. However, as the international planning effort focuses drilling plans on a particular region of the world, proposals for work in that region will receive special attention. It is expected that in the spring of 1990 the Planning Committee will establish a general plan for drilling in 1993 and 1994.

Proposals are evaluated primarily on their intrinsic scientific merit in the general context of marine geology and geophysics. ODP proposals, however, are also judged on their value to the drilling program. Thus these proposals should also contain a separate section (two or three pages) that specifically addresses the potential of the proposed research to enhance the effectiveness of and scientific return to the drilling program. This section should discuss both long-term ODP goals as outlined in the report of the Conference on Scientific Drilling (COSOD) as well as the specific scientific problems to be addressed. The COSOD report is available from the JOI office.

The target dates for submission of proposals for marine field work in 1991 are February 1 and June 1, 1990. Field programs that were funded for 1989 included a video and acoustic side-scan survey of the East Pacific Rise using ARGO, a multichannel seismic and SeaMARC survey of the Oregon margin, and a seismic and coring program in the East Pacific.

## SITE SURVEY AUGMENTATION

The JOI/U.S. Science Support Program has a limited amount of funds available for supplementing ODP site survey data sets. Proposals generally fall into the following categories:

- Support to participate in non-U.S. site surveys
- Support to assemble site data
- Support for "site science" on ships of opportunity

By making Site Survey Augmentation funds available, the JOI/U.S. Science Support Program allows U.S. scientists to take advantage of a wide range of drilling-related opportunities. Proposals for SSA support may be submitted at any time. Please contact Ellen Kappel at the JOI office for further information and proposal guidelines.

## ESCO-SOCIETA' GEOLOGICA ITALIANA INTERNATIONAL CONFERENCE

## GEOLOGY OF THE OCEANS

Citta del Mare, Palermo, Italia

14-16 May, 1990

After three years of activity as a member of the Ocean Drilling Program, the European Consortium for ODP (ECOD) is organizing an International Conference in order to present and discuss some of the relevant scientific results obtained. The conference is co-sponsored by the Geological Society of Italy. Scientific contributions presented at the conference include invited papers (30 minute presentations), oral communications (15 minutes), and posters. Abstracts will be distributed prior to the meeting. For more information write or call: Dr. Maria Bianca Cita, ESCO Chairman, Department of Earth Sciences, University of Milan, Via Mangiagalli, 34 I, 20133 Milano, Italy; Tel: 2-236981; Fax: 2-2364393.

## THE GEOLOGICAL SOCIETY, UNITED KINGDOM

## EVOLUTION OF UPWELLING SYSTEMS SINCE THE EARLY MIOCENE

Burlington House, London, U.K.

3-4 September, 1990

Results of DSDP and ODP legs will be the focus of this conference. The central aim is to consolidate the growing body of knowledge on the evolution of upwelling systems and to examine the consequences emerging from a wealth of studies on upwelling sedimentation performed within the framework of scientific ocean drilling. The following general themes are set for the conference:

(1) Establish and explain simultaneous events in Cenozoic upwelling sedimentation.

(2) Establish and standardize criteria for upwelling intensity and productivity.

(3) Examine diagenetic conditions in upwelling sediments.

There will be a number of keynote speakers. If you wish to contribute a paper, please inform one of the three co-convenors and send an abstract of not more than 100 words by February 1, 1990. The proceedings will be published in a Special Publication of the Geological Society. A registration fee of 20 pounds will be required (free to students), and the convenors are seeking funds to help overseas contributors attend the meeting. Attendance is limited to 200; advance registration is advisable.

Co-convenors:

Dr. C.P. Summerhayes
IOS Deacon Laboratory
Wormley, Godalming
Surrey, GU8 5UB
U. K.

Dr. W.L. Prell
Brown University
Geology Department
324 Brook St.
Providence, RI 02912 (USA)

Dr. K-C. Emeis
Geological Institute
University of Kiel
Olhausenstrasse 40
2300 Kiel, F.R.G.

## BIBLIOGRAPHY OF THE OCEAN DRILLING PROGRAM

The publications below are available from ODP Subcontractors. Items from ODP/TAMU are available at 1000 Discovery Drive, College Station, TX 77840. Items from LDGO can be obtained from the Borehole Research Group, LGDO, Palisades, NY 10964.

ODP/TAMU, Texas A & M University

1. Proceedings of the Ocean Drilling Program, Initial Reports

| | |
|---|---|
| Volumes 101/102 (combined) Dec 86 | Volume 113 published Sept 88 |
| Volume 103 published Apr 87 | Volume 114 published Nov 88 |
| Volume 104 published July 87 | Volume 115 published Nov 88 |
| Volume 105 published Aug 87 | Volume 116 published Jan 89 |
| Volume 107 published Oct 87 | Volume 117 published June 89 |
| Volume 108 published Jan 88 | Volume 118 published May 89 |
| Volumes 106/109/111 (combined) Feb 88 | Volume 119 published Sept 89 |
| Volume 110 published Apr 88 | Volume 120 published Nov 89 |
| Volume 112 published Aug 88 | Volume 121 published Nov 89 |

2. Proceedings of the Ocean Drilling Program, Scientific Results

| | |
|---|---|
| Volumes 101/102 (combined) Dec 88 | Volume 105 published Oct 89 |
| Volume 103 published Dec 88 | Volume 108 published Dec 89 |
| Volume 104 published Oct 89 | Volume 111 published Dec 89 |

3. Technical Notes

#1 Preliminary time estimates for coring operations (Revised Dec 86)
#3 Shipboard Scientist's Handbook (Revised 1990)
#5 Water Chemistry Procedures aboard the *JOIDES RESOLUTION* (Sept 86)
#6 Organic Geochemistry aboard *JOIDES RESOLUTION* - An Assay (Sept 86)
#7 Shipboard Organic Geochemistry on *JOIDES RESOLUTION* (Sept 86)
#8 Handbook for Shipboard Sedimentologists (Aug 88)
#9 Deep Sea Drilling Project data file documents (Jan 88)
#10 A Guide to ODP Tools for Downhole Measurement (June 88)
#11 Introduction to the Ocean Drilling Program (Dec 88)
#12 Handbook for Shipboard Paleontologists (June 89)

4. Scientific Prospectuses

| | | |
|---|---|---|
| #20 | (Oct 87) | Leg 120 |
| #21 | (Mar 88) | Leg 121 |
| #22/23 | (June 88) | Legs 122 & 123 |
| #24 | (Aug 88) | Leg 124 |
| #25/26 | (Dec 88) | Legs 125 & 126 |
| #27/28 | (April 89) | Legs 127 & 128 |
| #29 | (Aug 89) | Leg 129 |
| #30 | (Oct 89) | Leg 130 |
| #31 | (Oct 89) | Leg 131 |

5. Preliminary Reports

| | | |
|---|---|---|
| #20 | (June 88) | Leg 120 |
| #21 | (Aug 88) | Leg 121 |
| #22 | (Oct 88) | Leg 122 |
| #23 | (Dec 88) | Leg 123 |
| #24 | (Feb 89) | Leg 124 |
| #25 | (June 89) | Leg 125 |
| #26 | (Aug 89) | Leg 126 |
| #27 | (Sept 89) | Leg 127 |
| #28 | (Oct 89) | Leg 128 |
| #29 | (Feb 90) | Leg 129 |

6. Engineering Prospectuses

| | | |
|---|---|---|
| #1 | (Aug 88) | Leg 124E |
| #2 | (Nov 89) | Leg 132 |

7. Engineering Preliminary Reports

| | | |
|---|---|---|
| #1 | (Mar 89) | Leg 124E |

8. Brochure: The Data Collection of the ODP: Database Information

Bibliography of the Ocean Drilling Program, continued

9. Other Items Available
   - Ocean Drilling Program brochure (English, French, Spanish, German or Japanese)
   - Onboard *JOIDES RESOLUTION* (new edition, 24 pp.)
   - ODP Sample Distribution Policy
   - Micro Paleontology Reference Center brochure
   - Instructions for Contributors to ODP Proceedings (Revised Apr 88)
   - ODP Engineering and Drilling Operations
   - Multilingual brochure with a synopsis of ODP (English, French, Spanish, German and Japanese)
   - ODP Poster
   - ODP Scientific Highlights: Legs 101-123, January, 1985-December, 1988 (12 pp.)
   - Western Pacific Cruises (Objectives of Legs 129-135)
   - Four years of Scientific Ocean Drilling (Reprinted from *Sea Technology*, June, 1989)

LAMONT-DOHERTY GEOLOGICAL OBSERVATORY

- Wireline Logging Manual (3rd Edition, 1988)

## DATA AVAILABLE FROM THE NATIONAL GEOPHYSICAL DATA CENTER

Computerized data from the DSDP are now available through NGDC in compact-disc read-only-memory (CD-ROM) format. The DSDP CD-ROM data set consists of two CD-ROMs and custom, menu-driven, access software developed by NGDC with support from JOI/USSSP. 500 complimentary copies of the DSDP CD-ROMs are being offered to U.S. researchers in academia and government, courtesy of JOI/USSSP. An additional 200 copies of the set are available on a cost recovery basis.

Volume I of the 2-disc set contains all computerized sediment/hardrock files, the Cumulative Index (Paleontology, Subject, and Site), bibliographic information, age and fossil codes dictionaries, an index of DSDP microfilm, sediment chemistry reference tables, and copies of DSDP documentation for each data and reference file.

Volume II contains all digital downhole logging data from the DSDP, including some data digitized for the CD-ROM set by the Woods Hole Oceanographic Institution under contract to JOI/USSSP. All of the data are in the Schlumberger Log Information Standard (LIS) format, some ASCII and Gearhart-Owen data have been translated to LIS by WHOI for the CD-ROM. All DSDP underway and geophysical data are on disc 2, including bathymetry, magnetics, and navigation in the MGD77 format (no data for Legs 1-3; navigation only for Legs 4, 5, 10, 11; SEG-Y single channel seismic data not included). Volume II also contains the DSDP Core Sample Inventory and color/monochrome shaded relief images from several ocean views.

Data are also available on magnetic tape, floppy diskette, or as computer listings. Costs for services are: $90/2-disc CD-ROM data set, $90/magnetic tape, $30/floppy diskette, $25/microfilm reel. Costs for computer listings and custom graphics vary. Prepayment is requires by check or money order (drawn on a U.S. bank), or by charge to VISA, Mastercard, or American Express. A $10 handling fee is added to all shipments ($20 for non-U.S. shipments), rush orders are extra. Data Announcements describing DSDP data sets are available at no charge, as are inventory searches of correlative (non-DSDP) geological and geophysical data available from NGDC. For details, call (303)497-6339 or write to: Marine Geology and Geophysics Division, NOAA/NGDC E/GC3, Dept. 334, 325 Broadway, Boulder CO 80303 (Fax 303-497-6513). Internet address cjm@ngdc1.colorado.edu.

## DSDP AND ODP DATA AVAILABLE

ODP Data Available

ODP databases currently available include all DSDP data files (Legs 1-96), geological and geophysical data from ODP Legs 101-124E, and all DSDP/ODP core photos (Legs 1-124E). More data are available as paper and microfilm copies of original data collected aboard the *JOIDES Resolution*. Underway geophysical data are on 35 mm microfilm; all other data are on 16 mm microfilm.

All DSDP data and most ODP data are contained in a computerized database (contact the ODP Librarian to find out what data are available electronically). Data can be searched on almost any specified criteria. Files can be cross-referenced so a data request can include information from multiple files.

Computerized data are currently available on hard-copy printouts, magnetic tape, or through BITNET.

Photos of ODP/DSDP cores and seismic lines are available. Seismic lines, whole core and close-up core photos are available in black and white 8x10 prints. Whole core color 35-mm slides are available.

The following are also available: (1) ODP Data Announcements containing information on the database; (2) Data File Documents containing information on specific ODP data files; (3) ODP Technical Note #9, "Deep Sea Drilling Project Data File Documents," which includes all DSDP data file documents.

To obtain data or information contact: Kathe Lighty, Data Librarian, ODP/TAMU, 1000 Discovery Dr., College Station, TX 77840, Tel: (409) 845-8495, Tx: 792779/ODP TAMU, BITNET: %DATABASE@TAMODP, Omnet: Ocean.Drilling.TAMU Small requests can be answered quickly, free of charge. If a charge is made, an invoice will be sent and must be paid before the request is processed.

Data Available from National Geophysical Data Center (NGDC)

DSDP data files can be provided on magnetic tape according to user specifications (see table below). NGDC can also provide correlative marine geological and geophysical data from other sources. NGDC will provide a complimentary inventory of data available on request. Inventory searches are tailored to users' needs.

Information from DSDP Site Summary files is fully searchable and distributable on floppy diskette, as computer listings and graphics, and on magnetic tape. NGDC is working to make all DSDP data files fully searchable and available in PC-compatible form. Digital DSDP geophysical data are fully searchable and available on magnetic tape. In addition, NGDC can provide analog geological and geophysical information from DSDP on microfilm. Two summary publications are available: (1) "Sedimentology, Physical Properties, and Geochemistry in the Initial Reports of Deep Sea Drilling Project Vols. 1-44: An Overview," Rept. MGG-1; (2) "Lithologic Data from Pacific Ocean Deep Sea Drilling Project Cores," Rept. MGG-4.

Costs for services are: $90/magnetic tape, $30/floppy diskette, $20/microfilm reel, $12.80/copy of Rept. MGG-1, $10/copy of Rept. MGG-4. Costs for computer listings and custom graphics vary. Prepayment is required by check or money order (drawn of a U.S. bank), or by charge to VISA, Mastercard, or American Express. A $10 surcharge is added to all shipments ($20 for foreign shipments), and a $15 fee is added to all rush orders. Data Announcements describing DSDP data sets are available at no charge. For details, call (303) 497-6339 or write to: Marine Geology and Geophysics Div., Natl. Geophys. Data Center, NOAA E/GC3 Dept. 334, 325 Broadway, Boulder, CO 80303.

## AVAILABLE DATA

| Data Available | Data Source | Description | Comments |
|---|---|---|---|
| **1. LITHOLOGIC and STRATIGRAPHIC DATA** | | | |
| Visual Core Descriptions | | | |
| -Sediment/sedimentary rock | Shipboard data | Information about core solor, sedimentary structures, disturbance, large minerals and fossils, etc. | |
| -Igneous/metamorphic rock | Shipboard data | Information about lithology, texture, structure, mineralogy, alteration, etc. | |
| Smear slide descriptions | Shipboard data | Nature and abundance of sedimentary components. | |
| Thin section descriptions | Shipboard data | Petrographic descriptions of igneous and metamorphic rock. Includes information on mineralogy, texture, alteration, vesicles, etc. | |
| Paleontology | *Initial Reports, Proceedings* | Abundance, preservation and location for 26 fossil groups The "dictionary" consists of more than 12,000 fossil names. | |
| Screen | Processed data | Computer-generated lithologic classifications. Basic composition data, average density, and age of layer. | |
| **2. PHYSICAL PROPERTIES** | | | |
| G.R.A.P.E. (gamma ray attentuation porosity evaluator) | Shipboard data | Continuous whole-core density measurements. | |
| Grain Size | Shore laboratory | Sand-silt-clay content of a sample. | Legs 1-79 only |
| Index properties: bulk and grain density, water content, and porosity | Shipboard data | Gravimetric and volumetric measurements from a known volume of sediment | |
| Liquid and plastic limits | Shipboard data | Atterberg limits of sediment samples. | |
| Shear-strength measurements | Shipboard data | Sediment shear-strength measurements using motorized and Torvane instruments. | |
| Thermal conductivity | Shipboard data | Thermal conductivity measurements of sediments using a thermal probe. | |
| Velocity measurements | Shipboard data | Compressional and shear-wave velocity measurements. | |
| Downhole measurements | | | |
| -Heatflow | Shipboard data | *In-situ* formation temperature measurements. | |
| -Pressure | Shipboard data | *In-situ* formation and hydrostatic pressure. | |
| **3. SEDIMENT CHEMICAL ANALYSES** | | | |
| Carbon-carbonate | Shipboard data, shore laboratory | Percent by weight of the total carbon, organic carbon, and carbonate content of a sample. | Hydrogen percents for Legs 101,103, 104, 106-108; nitrogen percents for Legs 101, 103, 104, 107, 108. |
| Interstitial water chemistry | Shipboard data, shore laboratory | Quantitative ion, pH, salinity, and alkalinity analyses of interstitial water. | |
| Gas chromatography | Shipboard data | Hydrocarbon levels in core gases. | |
| Rock evaluation | Shipboard data | Hydrocarbon content of a sample. | |
| **4. IGNEOUS AND METAMORPHIC CHEMICAL ANALYSES** | | | |
| Major element analyses | Shipboard data, shore laboratory | Major element chemical analyses of igneous, metamorphic, and some sedimentary rocks composed of volcanic material. | |
| Minor element analyses | Shipboard data, | Minor element chemical analyses of igneous, metamorphic, and | |

## AVAILABLE DATA (Continued)

| Data Available | Data Source | Description | Comments |
|---|---|---|---|
| **4. IGNEOUS AND METAMORPHIC CHEMICAL ANALYSES, CONT'D.** | | | |
| | shore laboratory | some sedimentary rocks composed of volcanic material. | |
| **5. X-RAY MINERALOGY** | | | |
| X-ray mineralogy | Shore laboratory | X-ray diffraction | Legs 1-37 only |
| **6. PALEOMAGNETICS** | | | |
| Paleomagnetics | Shipboard data, shore laboratory | Declination, inclination, and intensity of magnetization for discrete samples and continuous whole core. Includes NRM and alternating field demagnetization. | |
| *Susceptibility* | *Shipboard data* | *Discrete sample and continuous whole-core measurements.* | |
| **7. UNDERWAY GEOPHYSICS** | | | |
| Bathymetry | Shipboard data | Analog records of water-depth profile | Available on 35-mm continuous microfilm |
| *Magnetics* | *Shipboard data* | *Analog records and digital data.* | Available on 35-mm continuous microfilm |
| Navigation | Shipboard data | Satellite fixes and course and speed changes that have been run through a navigation smoothing program, edited on the basis of reasonable ship and drift velocities, and later merged with the depth and magnetic data. | Available in MGD77 exchange format |
| Seismics | Shipboard data | Analog records of sub-bottom profiles and unprocessed signal on magnetic tape | Available on 35-mm continuous microfilm |
| **8. SPECIAL REFERENCE FILES** | | | |
| *Leg, site, hole summaries* | Shipboard data initial core descriptions | Information on general leg, site, and hole characteristics (i.e. cruise objectives, location, water depth, sediment nature, drilling statistics). | |
| *DSDP Guide to Core Material* | *Initial Reports,* prime data files | Summary data for each core: depth of core, general paleontology, sediment type and structures, carbonate, grain size, x-ray, etc. | Legs 1-85 only |
| AGEPROFILE | *Initial Reports,* hole summaries | Definition of age layers downhole. | |
| COREDEPTH | Shipboard summaries | Depth of each core. Allows determination of precise depth (in m) of a particular sample. | |
| **9. AIDS TO RESEARCH** | | | |
| ODASI | A file of ODP-affiliated scientists and institutions. Can be *cross-referenced and is searchable.* | | |
| *Keyword Index* | A computer-searchable bibliography of DSDP- and ODP-related papers and studies in progress. | | |
| *Sample Records* | Inventory of all shipboard samples taken. | | |
| *Site Location Map* | DSDP and ODP site positions on a world map of ocean topography. | | |
| *Thin Section Inventory* | Inventory of all shipboard thin sections taken. | | |

## New ODP Offprint Policy

Current ODP policy calls for 50 offprints of every paper published in the "Scientific Results" volumes of the Proceedings of the Ocean Drilling Program to be made available without charge to the authors of these papers. If a paper has more than one author, the 50 offprints will be sent to the first author unless an alternative distribution is requested.

The practice of charging for offprints was begun almost 2 years ago as the result of a JOIDES policy in response to budget reductions in ODP publications. The financial burden this placed on authors whose institutions could not fund the purchase of offprints has been a major factor in the decision to discontinue charging for them.

It is possible, however, for an author who wants more than 50 offprints of a paper to order these additional copies through the Chief Production Editor at ODP headquarters. Authors must initiate such requests well before the volume is printed and be prepared to pay for the extra offprints ordered, which are provided at cost.

Anyone having questions about this policy should contact Russell B. Merrill, Manager of Science Services, or William D. Rose, Supervisor of Publications.

## ODP EDITORIAL REVIEW BOARDS (ERB)

For each ODP cruise, an editorial board is established to handle review of the manuscripts intended for publication in the "Scientific Results" volume of the Proceedings of the Ocean Drilling Program. These boards consist of the Co-Chief Scientists and the ODP Staff Scientist for that cruise, one other scientist selected by the Manager of ODP Science Operations in consultation with the cruise Co-Chief Scientists, and an ODP Editor. These boards are responsible for obtaining adequate reviews and for making decisions concerning the acceptance or rejection of papers. The names of scientists serving on ERBs for Legs 106 through 123 are listed below. Please note that: *indicates Co-Chief Scientist; **indicates Staff Scientist; ***indicates Outside Scientist.

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Dr. Will Sager** (TAMU)
Dr. Joseph R. Curray*** (SIO)

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* indicates Co-Chief Scientist
** indicates Staff Scientist
*** indicates Outside Scientist.

A chairman for each ERB, usually a Co-Chief Scientist, has been elected since Leg 120.

**New Publications** available on request from the Office of Public Information at ODP-TAMU:

- "ODP Scientific Highlights: Legs 101-123, January 1985-December 1988." The 12-page booklet thematically summarizes the findings of the first four years of drilling.
- "Western Pacific Cruises" summarizes Legs 129-135.

A third publication is available on a limited basis. Reprints of "Four Years of Scientific Deep Ocean Drilling," *Sea Technology*, June 1989, also discusses ODP's achievements in scientific ocean drilling. Authors of the 3-page article are Drs. Rabinowitz, Garrison and Meyer.

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| Larsen, H-C. | TECP | (45)1-118866 | 19066/GGUTEL DK |
| Larson, R.* | PCOM | (401)792-6165 | 7400188/LARS UC |
| Laughton, A.* | EXCOM | (44)42-879-4141 | 858833/OCEANS G |
| Lee, C-S. | IHP | (61)062-499240 | AA 62109 |
| Leinen, M.* | PCOM | (401)792-6268 | 257580/KNAU UR |
| Levi, S. | PCOM | (503)737-2296 | 5105960682/OSU COVS |
| Lewis, B. | BCOM,EXCOM | (206)543-7419 | 9104740096/UW UI |
| Lewis, S. | SSP | (415)856-7096 | 171449/PCS USGS MNPK |
| Louden, K.* | SSP | (902)424-3557 | 01921863/DALUNIVLIB HFX |
| Loughridge, M.* | IHP | (303)497-6487 | 258169/WDCA UR |
| Loutit, T.* | OHP | (713)966-6114 | not available |
| Lovell, M.* | DMP | (44)5533-522522 | 347250/LEICUN G |
| Lysne, P.* | DMP | (505)846-6328 | 169012/SANDIA LABS |
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| Macko, S.* | SGPP | (514)987-4080 | not available |
| Magnusson, M. | ODPC | not available | not available |
| Malfait, B.* | NSF | (202)357-9849 | 7401424/NSFO UC |
| Malpas, J.* | PCOM | (709)737-4708 | 0164101/MEMORIAL SNF |
| Manchester, K.* | TEDCOM | (902)426-3411 | 01931552/BIO DRT |
| Maronde, D.* | ODPC | (49)228-885-2328 | 17228312/DFG |
| Marx, C. | TEDCOM | (49)5323-722239 | 953813/TU ITE D |
| Maxwell, A.* | EXCOM | (512)471-4860 | 9108741380/UTIG AUS |
| Mayer, L.* | OHP | (902)424-2503 | not available |
| McClain, J.* | LITHP | (916)752-7093,0350 | 9105310785/UCDAVIS |
| McGrath, K. | JOI | (202)232-3900 | 7401433/BAKE UC |
| McKenzie, J.* | SGPP | (41)1-256-38-28 | 817379/EHHG CH |
| Merrell, W.* | EXCOM | (409)740-4403 | not available |
| Merrill, R. | ODP/TAMU | (409)845-9324 | 62760290/ESL UD |
| Mevel, C.* | LITHP | (33)1-43-36-25-25 | 200145/UPMC SIX F |
| Meyer, A. | ODP/TAMU | (409)845-9299 | 62760290/ESL UD |
| Meyer, H. | SSP | (511)643-3128 | 0923730/BGR HA D |

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|---|---|---|---|
| Michot, J. | ODPC | (32)2-642-22-36 | 23069/BODPC |
| Mienert, J.* | SGPP | (49)431-720-0249 | not available |
| Millheim, K. | TEDCOM | (918)660-3381 | 284255/CDFTU UR |
| Mix, A.* | OHP | (503)737-2296 | 5105960682/OSU COVS |
| Moberly, R.* | PCOM,EXCOM | (808)948-8765 | 7238861/HIGCY HR |
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| Moore, T.C.* | IHP | (313)747-2742 | not available |
| Moores, E.* | TECP | (916)752-0352 | 9105310765/UCDAVIS |
| Moran, K.* | SMP | (902)426-8159 | 1931552/BIO DRT |
| Morin, R.* | DMP | (303)236-5913 | not available |
| Moss, M.* | EXCOM | (619)534-2836 | not available |
| Mottl, M.* | SMP | (808)948-7006 | 7238861/HIGCY HR |
| Mutter, J.* | LITHP | (914)359-2900X525 | 258294/MCSP UR |
| Natland, J.* | PCOM | (619)534-5977 | 9103371271/UCWWD SIO SDG |
| Nemoto, T.* | EXCOM, ODPC | (81)3-376-1251 | 25607/ORIUT J |
| NSF (ODP) | | (202)357-9849 | 7401424/NSFO UC |
| ODP/TAMU | | (409)845-2673 | 62760290/ESL UD |
| ODP Databank | LDGO | (914)359-2900X542 | 7105762653/LAMONTGEO |
| Ogawa, Y.* | TECP,SGPP | (81)92641-1101X4320 | 25607/ORIUT J |
| Okada, Hakuyu* | CEPDPG | (81)92641-1101X4301 | 25607/ORIUT J |
| Okada, Hisakate* | OHP | (81)23631-1421X2585 | 25607/ORIUT J |
| Ottosson, M-O. | ODPC | (46)8-15-15-80 | 13599/RESCOUN S |
| Pascal, G.* | DMP | (33)98-46-25-21 | 940627/OCEAN F |
| Pautot, G.* | SSP | (33)98-22-40-40 | 940627/OCEAN F |
| Pearce, J.* | LITHP | (44)91-374-2528 | 537351/DURLIBG |
| Pedersen, T.* | OHP | (604)228-5984 | not available |
| Perfit, M.* | LITHP | (904)392-2128 | not available |
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| Phipps-Morgan, J.* | LITHP | (617)253-5951 | not available |
| Powell, T.* | PPSP | (61) 62-499397 | not available |
| Prahl, F.* | SGPP | (503)737-4172 | 5105960682/OSU COVS |
| Premoli-Silva, I. | OHP | (39)2-23698248 | 320484/UNIMI I |
| Puchelt, H. | LITHP | not available | not available |
| Purdy, G.M.* | TECP | (508)548-1400X2826 | 951679/OCEANINST.WOOH |
| Pyle, T.* | JOI | (202)232-3900 | 7401433/BAKE UC |
| Rabinowitz, P.* | ODP/TAMU | (409)845-8480 | 62760290/ESL UD |
| Rea, D.* | CEPDPG | (313)936-0521 | not available |
| Renard, V. | SSP | (33)98-22-42-26 | 940627/OCEAN F |
| Reynolds, R. | LDGO | (914)359-2900X671 | 7105762653/LAMONTGEO |
| Rhodes, J.M.* | SMP | (213)545-2841 | not available |
| Richards, A. | SMP | (31) 2977-40012 | 20000/MCC NL |
| Riddihough, R.* | CEPDPG,EXCOM,TECP | (613)995-4482 | 0533117/EMAR OTT |
| Riedel, K. | ODP/TAMU | (409)845-9322 | 62760290/ESL UD |
| Riedel, W.* | IHP | (619)534-4386 | not available |
| Rischmüller, H.* | TEDCOM | (49)511-654-2669 | 923730/BGR HA D |
| Roberts, D.* | PPSP | (44)1-920-8474 | 888811/BPLDNA G G |
| Robertson, A.* | TECP | (44)31-667-1081 | 727442/UNIVED G |
| Rosendahl, B.* | EXCOM | (305)361-4000 | 317454/VOFM RSMAS MIA |
| Rutland, R.* | ODPC | (61) 062 499111 | not available |
| Sager, W.* | IHP | (409)845-9828 | 258781/GRITUR |
| Saito, T.* | OHP | (81)236-311421X2585 | 25607/ORIUT J |
| Sancetta, C.* | CEPDPG | (914)359-2900X412 | 7105762653/LAMONTGEO |
| Sartori, R. | SSP | (39)51-22-54-44 | 511350/ I |
| Sawyer, D.* | TECP | (713) 285-5106 | 62013673 |
| Saunders, J. | IHP | (41) 61-295564 | not available |
| Schaaf, A.* | IHP | (33)78-898124X3810 | UCB 330 208 |
| Schilling, J-G. | EXCOM | (401)792-6628 | 257580/KNAU UR |
| Schlanger, S. | CEPDPG | (312)491-5097 | not available |
| Schrader, H. | CEPDPG | (47)5-21-35-00 | 42877/UBBRB N |
| Schuh, F. | TEDCOM | (214)380-0203 | 794784/ARCO PLNO |
| Searle, R.* | CEPDPG | (44)385-64971 | 537351/DURLIBG |
| Sengör, A. | CEPDPG, ODPC | (90)1-1433-100 | 23706/UTU TR |

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|---|---|---|---|
| Shackleton, N.* | OHP | (44)223-334871 | 81240/CAMSPL G |
| Shanks, E.* | TEDCOM | (214)951-3271 | 730531/MOBINT |
| Shatto, H.* | TEDCOM | (713)467-8616 | not available |
| Sinha, M.* | SSP | (44)223-333400 | 817297/ASTRON G |
| Skinner, A.* | TEDCOM | (44)31-667-1000 | 727343/SEISED G |
| Sliter, W. | CEPDPG | (415)329-4988 | 171449/PCS USGS MNPK |
| Small, L. | EXCOM | (503)737-4763 | 5105960682/OSU COVS |
| Smith, G.* | LITHP | (314)658-3128 | 550132/STL UNIV STL |
| Smith, R. | JOI | (202)232-3900 | 7401433/BAKE UC |
| Solheim, A. | SMP | (47)-2-123650 | 74745/POLAR N |
| Sondergeld, C.* | DMP | (918)660-3917 | 200654/AMOCO UR |
| Spall, H.* | IHP | (703)648-6078 | 160443/USGS UT |
| Sparks, C.* | TEDCOM | (33)1-47-52-63-95 | 203050/IFP A F |
| Spencer, D. | EXCOM | (508) 548-1400 | 951679/OCEANIST WOOH |
| Spiess, V. | IHP | (42)1-218-3387 | not available |
| Stanton, P. | TEDCOM | (713)940-3793 | 9108815579/USEPRTX HOU |
| Stein, R. | OHP | (49)641-702-8365 | 482956/GRIWOTY UNIGI D |
| Stel, J.* | ODPC | (31)370-440780 | not available |
| Stephansson, O. | DMP | (920)91359 | not available |
| Storms, M. | ODP/TAMU | (409)845-2101 | 62760290/ESL UD |
| Strand, H. | TEDCOM | (47)-4-678066 | not available |
| Stow, D.* | SGPP | (619)265-5498 | not available |
| Suess, E.* | SGPP | (49)431-720-020 | not available |
| Summerhayes, C.* | EXCOM | (44)42-879-4141 | 858833/OCEANS G |
| Suyehiro, K.* | SSP | (81)3-376-1251 | 25607/ORIUT J |
| Svendsen, W. | TEDCOM | (612)331-1331 | 210685/LYHO UR |
| Symonds, P.* | SSP | (61) 62-499490 | not available |
| Taira, A.* | PCOM | (81)3-376-1251X256 | 25607/ORIUT J |
| Tamaki, K.* | IHP,CEPDPG LITHP,TECP | (81)3-376-1251 | 25607/ORIUT J |
| Thomas, E.* | SMP | (203)347-9411 | not available |
| Tokuyama, H.* | SMP | (81) 3-376-1251 | 25607/ORIUT J |
| Tucholke, B.* | PCOM | (508)548-1400X2494 | 951679/OCEANIST WOOH |
| Valet, J-P.* | SMP | (33) 1-43-362525x3566 | 202810/VOLSISM F |
| Van Lieshout, R. | ODPC | (31)2159-457-39 | not available |
| Veis, G. | ODPC | (30)1-777-36-13 | 215032/GEO GR |
| Villinger, H.* | DMP | (49)471-483-1215 | 238695/POLAR D |
| Vincent, E. | OHP | (33)1-43-36-25-25X5162 | 200145/UPMC SIX F |
| von der Borch, C.* | SGPP | (61) 8-2752212 | not available |
| Von Herzen, R.* | SSP | (508) 548-1400 | 951679 |
| von Rad, U.* | PCOM | (49)511-643-2785 | 923730/BGR HA D |
| Vorren, T. | SGPP | (47)83-44000 | 64251/N |
| Vrellis, G. | TEDCOM | (30)1-80-69-314 | 219415/DEP GR |
| Waggoner, G. | JOIDES | (808)948-7939 | 7407498/JOID UC |
| Watkins, J.* | PCOM | (409)845-8478 | not available |
| Weaver, P. * | OHP | (44) 42879-4141 | not available |
| Wefer, G. | OHP | (49)421-218-3389 | 245811/UNI D |
| Weigel, W. | SSP | (49)40-4123-2981 | 214732/UNI HH D |
| Westbrook, G.* | TECP | (44)21-414-6153 | 333762/UOBHAM G |
| Westgaard, L. | EXCOM,ODPC | (47)2-15-70-12 | 79913/NAVF N |
| Whitmarsh, R.* | SMP | (44) 42-879-4141 | 858833/OCEANS G |
| Wilkens, R.* | DMP | (808)944-0404 | 7238861/HIGCY HR |
| Wortel, R. | TECP | (31)30-53-50-86 | 40704/VMLRU NL |
| Worthington, P.* | DMP | (44)9327-63263 | 296041/BPSUNA G |

# Notice

## NEW TELEPHONE AND FAX NUMBERS FOR THE JOIDES OFFICE

The University of Hawaii will be switching to a new telephone system and the JOIDES Office will have new numbers. The the switch-over is presently scheduled to occur sometime in May 1990, but this date has been moved back many times over the past year. For the present continue using the numbers shown in this directory, but if you can't get through to us after May, the following numbers may be in effect. JOIDES Office - (808) 956-7939 Fax: (808) 956-2538

**A REMINDER** - In order to help speed up communications, FAX numbers have been included in the Directory section of the JOIDES Journal. If we do not have your Fax number and you would like it included, please let us know. As always the editorial staff of the JOIDES Journal appreciates your help in keeping the Directory listings up-to-date. Please send any revisions or corrections to: JOIDES Planning Office, Hawaii Institute of Geophysics, University of Hawaii, 2525 Correa Road, Honolulu, HI 96822, USA Telemail: JOIDES.HIG; FAX: 808-949-0243.

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Any opinions, findings, conclusions or recommendations expressed in this publication are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.

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In addition, there are occasional special issues of the JOIDES Journal which are listed below:

Special Issue No. 1: Manual on Pollution Prevention and Safety, 1976 (Vol. II)

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

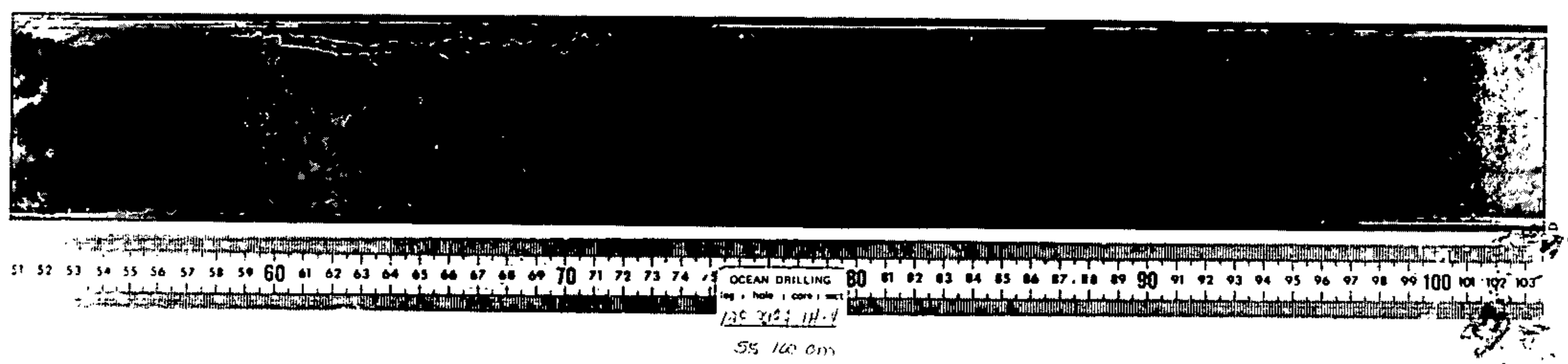
Special Issue No. 3: Initial Site Prospectus, Supplement Two, June 1980 (Vol. VI)

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

Special Issue No. 4: Guide to the Ocean Drilling Program, Supplement One, June 1986 (Vol. XII)

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

Special Issue No. 6: Guide to the Ocean Drilling Program, December 1988 (Vol. XIV)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