OCEAN DRILLING PROGRAM

LEG 131 PRELIMINARY REPORT

NANKAI TROUGH

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SCIENTIFIC REPORT

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ABSTRACT

The Nankai Trough accretionary prism is the product of subduction of the Philippine Sea Plate below the Honshu Arc. The focus of Ocean Drilling Program Leg 131 was to study (1) the influence of pore fluids and the hydrogeology of the accretionary prism, (2) the mechanical state and physical properties of deformed sediments, and (3) the fabrics and structural styles of accreted sediments. Site 808, the only site occupied during this cruise, is located at the toe of the actively accreted sediments. Due to operational difficulties and time constraints, a proposed reference site in the undeformed sediments seaward of the prism was not drilled.

The principal drilling results of Leg 131 established a middle Miocene (15.6 Ma) age for basement, mostly hemipelagic sedimentation from middle Miocene to Pleistocene time, and the onset of major turbidite deposition beginning less than 0.5 million years ago. The frontal thrust fault (intersected at 365 meters below seafloor) occurs within an overturned fold sequence and has 145 m of vertical throw, whereas the décollement occurs as a 20-m-thick zone between 945-965 mbsf, within a homogeneous hemipelagic sequence. The style and orientation of structural features changes with depth and with time, with small faults predominating in the deeper section and shear bands being more common at shallower depths. Porosity and bulk density curves show major discontinuities at the thrust (reflecting the recent offset of the sediments) and immediately below the décollement (perhaps indicating high pore pressures at this level). The first *in-situ* measurements of stress and pore pressure in an accretionary prism should help constrain deformation and compaction models. Interstitial pore water data show a lack of strong evidence for active, channeled fluid flow along the major (and minor) fault zones. This suggests that fluid expulsion in the Nankai prism may be primarily from diffusive flow. A major chloride minimum associated with the décollement may imply a past fluid flow event. Hydrocarbon-gas distributions suggest maturity levels higher than predicted from the present calculated geothermal gradient. Temperature measurements indicate a present heat-flow which agrees well with a conductive cooling model for oceanic lithosphere.

INTRODUCTION

Tectonic Setting of the Nankai Trough

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 (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 the 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 greater than 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 backarc 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 (25-12 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 area of Site 808 is smooth and flat, which aided the creation of rather laterally continuous structural features at the toe region.

The entire sedimentary sequence in the central Nankai Trough is 1.1 seconds of two-way traveltime (s twt) thick; the hemipelagic portion of this sequence is ~0.3 s thick. The structure of the accretionary prism is well imaged by seismic sections. 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 northwest) 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 the 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 toe region has been interpreted as resulting from high heat flux (Yamano et al., 1982).

Drilling Objectives

Drillsites in the Nankai Trough were occupied by D/V *Glomar Challenger* on DSDP Legs 31 (Karig, Ingle, et al., 1975) and 87 (Kagami, Karig, Coulbourn, et al., 1986). Leg 131 was a continuation of studies begun during Leg 87, but with a much stronger emphasis on physical properties, logging, and downhole experiments. The drilling location of Site 808 is positioned in the accreted and deformed sediments at the toe of the prism, where drilling planned to intersect both the frontal thrust and the décollement, and to recover basement.

The main objectives of Leg 131 scientific drilling included 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 accreted sediments.

These objectives are closely interrelated and were studied by a variety of methods on a range of spatial scales, including downhole experiments [e.g. water sampler with temperature pressure (WSTP), Lateral Stress Tool (LAST)], wireline logging, and laboratory analyses of sedimentology, physical properties, and structural fabrics. These different measurements were 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.

DRILLING RESULTS

Leg 131 drilled 7 holes at Site 808 (proposed site NKT-2) in the toe of the Nankai accretionary prism (Figs. 1-3). The site was located at shotpoint 1720 on *Fred Moore* Line NT62-8. During the 67 days of Leg 131 operations, 56.3 days were spent on site whereas 6.8 days were spent under way.

Hole 808A penetrated to 111.4 mbsf, with 79.6% recovery, but had to be abandoned prematurely when the unstable sand in the top 100 m collapsed, trapping the bottom hole assembly (BHA). This was severed with a back-off charge and the pipe recovered.

Hole 808B successfully penetrated to 358.8 mbsf using extended core barrel (XCB) drilling, but was stopped owing to slow rate of penetration. Core recovery was 24.1%. Attempts to log the hole using the sidewall-entry sub (SES) were terminated after only one log run when the lithoporosity tool was jammed in the bit/bit sub. Part of the tool was lost while pulling out of the hole. Fishing attempts having failed, the hole was cemented and abandoned.

Hole 808C started with the first successful ODP deployment of 86 m of drill-in casing to prevent collapse of the sands from 19 to 105 mbsf. The hole was washed to 298.5 mbsf and rotary core barrel (RCB) cored to 1327.0 mbsf with 55.7% recovery. Attempts at wireline logging were frustrated by poor hole conditions despite numerous wiper trips. Through-pipe logs of lithoporosity and geochemical tools were obtained for the interval from about 750 mbsf to the seafloor.

Hole 808D was designed to be a deep penetration hole with reentry cone and casing to 750 mbsf. After 6 days of operations, the 750 m of 11-3/4" casing buckled, during emplacement and the hole was abandoned.

Hole 808E was a second attempt at the same operation, except that the casing length was only 540 m, the total length of remaining casing. This time the casing was successfully set, and the hole drilled ahead to 1200 mbsf for downhole measurements. Again, despite numerous wiper trips and heavy-mud and KCl treatment the hole below the casing continued to show instability with swelling clays from 600 to 800 mbsf and collapse at the numerous fault zones. Attempts to obtain open-hole logs achieved only 100 m of log below the casing. A vertical seismic profiling (VSP) experiment was carried out from a depth of just over 600 mbsf to the top of the casing. The rotatable packer was deployed but failed to operate correctly on two attempts. The go-devil appeared to suffer damage in the pipe on deployment owing to the drill-string vibration. The ONDO tool deployment was attempted repeatedly, but the landing pads would not pass through the BHA.

Hole 808F was designated for relatively shallow instrumental measurements to 300 mbsf using the WSTP, LAST and Pressure Core Sampler (PCS). This hole had to be abandoned at a depth of 140 mbsf after only a few measurements when the cutting shoe of the XCB tool failed and left debris in the hole. Hole 808G was respudded in the same ship's position and was used for instrumental runs until the pipe had to be pulled for the end of the leg. The LAST and PCS were successfully deployed in this hole.

The major lithostratigraphic units recognized in the sedimentary sequence are as follows:

Unit I: Lower slope apron (0-20.55 mbsf), Pleistocene.
Interlayered clayey silt, fine-grained sand, bioturbated clayey silt, sandy clayey silt, and very thin ash layers. Gas expansion affected most of this unit. The fine-grained sands show typical Bouma T_{abde} sequences.

Unit II: Trench-fill deposits (20.55-556.8 mbsf), Pleistocene.
Subunit IIA: Upper axial trench sandy deposits (20.55-120.6 mbsf), Pleistocene. Silty to very coarse-grained sands with variable bed thickness and internal structures. Beds show typical Bouma T_{abe} and rare T_{cde} sequences. Disseminated plant material is common in some intervals. Slide deposits occur near the base of this subunit.
Subunit IIB: Lower axial-trench silty deposits (120.6-263.4 mbsf), Pleistocene. The interval from 219 to 263.4 mbsf is duplicated below the frontal thrust from 365 to 409.5 mbsf. Subunit IIB comprises very thin- to thin-bedded very fine-grained sandstones, siltstones, and mud, with minor ash; it has a finer mean grain size and thinner mean bed thickness than Subunit IIA. The sandstones and siltstones show partial Bouma T_{bcde} sequences. A mudstone pebble conglomerate at 263.4 mbsf provides an important correlative deposit that is duplicated across the frontal thrust.
Subunit IIC: Outer marginal trench deposits (409.54-556.8 mbsf), Pleistocene. The interval from 409.54 to 511 mbsf is stratigraphically equivalent to the interval 263.4-365 mbsf above the frontal thrust. The major lithology is bioturbated clayey siltstone/silty claystone with interbedded, usually graded, thin-bedded, very fine-grained sandstones and coarse siltstones showing Bouma T_{cde} sequences.

Unit III: Trench to basin transitional deposits (556.8-618.47 mbsf), Pleistocene.
Bioturbated clayey siltstone/silty claystone with thin ash/tuff layers. Unit III occurs from the first thick tuff bed to the last siltstone turbidite.

Unit IV: Shikoku Basin deposits (618.47-1243.0 mbsf), middle Miocene - Pleistocene.
Subunit IVA: Upper Shikoku Basin deposits (618.47-823.74 mbsf), Pliocene - Pleistocene. Interval from the last siltstone turbidite to the last occurrence of abundant ash/tuff layers. Characterized by abundant thin layers of tuff and volcanic sandstone intercalated within a thoroughly bioturbated mud succession rich in foraminifer tests.
Subunit IVB: Lower Shikoku Basin deposits (823.74-1243.0 mbsf), middle Miocene - Pliocene. A succession of thoroughly bioturbated clayey siltstones and silty claystones with traces of disseminated volcanic glass/tuff.

Unit V: Acidic volcaniclastic deposits (1243.0-1289.9 mbsf), middle Miocene. Very thin (1-3 cm) to very thick (>100 cm) bedded varicolored tuffs, including (1) a thick quartz-rich acid tuff; (2) a gray to greenish-gray altered tuff, (3) a varicolored tuffaceous mudstone, and, (4) thin, dark-olive-gray mudstones.

Unit VI: Basaltic basement (1289.9-1327.0 mbsf), middle Miocene.
Basalt sills overlying pillow basalts, with some intercalated baked sediment containing age-diagnostic calcareous nannofossils.

The major surprise in this sequence is the appearance of beds of rhyodacitic tuffs (Unit V), reaching 4.5 m thick, over an interval of some 40 m just above the basalts. The source region for these is not clear.

Calcareous nannofossil stratigraphy proved useful for age assignments, and ties well with the paleomagnetic data. Of particular interest was a date of 13.6-16 Ma obtained from nannofossils in red mudstone recovered between basalts in the base of Hole 808C.

Most of the core proved to be satisfactorily stable for remanence determinations using the whole-core cryogenic system. With judicious use of the biostratigraphic ages as an initial guide, it was possible to provide considerable additional constraints on the age dating of the sediments. The agreement between the paleomagnetic and biostratigraphic data is very good, and the combined age dates complement each other very well. No unconformities were found in the entire sequence.

From the age dating above, accurate sedimentation rates can be calculated. The turbidite sedimentation occurred with a deposition rate well in excess of 1 km/m.y. since 0.46 Ma, preceded by a slower and smoothly varying rate, averaging a little over 40 m/m.y. Extrapolation of this rate to the basalt surface gives an approximate age of 15.6 Ma.

The frontal thrust of the accretionary prism was penetrated at a depth of 365 mbsf and the décollement at 945-965 mbsf. Steep bedding and mesoscopic structures above the thrust have been oriented using paleomagnetics and imply a consistent northwest-southeast shortening direction. The thrust has developed as a rupture through an overturned fold, as evidenced by overturned bedding observed below the thrust plane. Pervasive deformation in the zone between the thrust and the décollement changes in nature with depth, with shear bands occurring mainly above 500 m and fault structures below that. A complete absence of vein structures, except in the basaltic basement, indicates a lack of concentrated fluid flow even at the faulted zones.

Analysis of interstitial water shows distinct chemical trends, marking several prominent boundaries. There are clear offsets in concentration trends of Ca, Mg, and Li at the thrust, and changes in gradients of Ca, Cl, and silica at 560 mbsf correspond to the lithological boundary between the trench-fill turbidites (Unit IIC) and the transition zone (Unit III). At 820 mbsf changes in Ca, Mg, silica, and sulfate correspond to the lithologic boundary at the base of the abundant ash/tuff layers (Subunit IVA). A chloride minimum associated with the décollement may imply a past fluid flow event. There is no clear evidence for presently active fluid-flow.

Organic geochemistry reveals a pattern of anomalously high hydrocarbon maturity. Peaks in the abundance of thermogenic hydrocarbons, pentanes, butanes, and propanes in the depth range from 650 to 800 mbsf and from 1060 to 1280 mbsf suggest formation *in-situ* at temperatures above those inferred from the present geothermal gradient.

First-order discontinuities in physical properties are observed at the thrust and décollement. Compaction trends have normal gradients above the thrust and below the décollement, but discontinuities appear in the compaction trends at these two structures. Porosity increases downward across the thrust from about 40% to 47%, and density correspondingly decreases from about 2.1 to 2.0 g/cm^2. This is taken to indicate that the sediments have not re-equilibrated to the loading owing to the thrust displacement, confirming its young age. Across the décollement, porosity again increases downward from about 30% to 40%, and bulk density correspondingly decreases. This evidence of relatively lower compaction below the décollement is taken to indicate higher pore pressures in this zone. Lithologic boundaries are also detected as changes in gradients of physical-property trends. Additionally, in the zone between the thrust and the décollement, seismic-velocity anisotropy decreases with depth.

Six WSTP temperature measurements in the depth range 91-346 mbsf give a combined gradient of 111°C/km, and, when combined with the thermal-conductivity data, give a calculated heat flow of 126 mW/m^2. This value agrees well with the predictions of a purely conductive cooling model for oceanic lithosphere of the age observed at this site.

Owing to the poor hole stability, few open-hole logs were obtained. The limited data for the depth ranges from 80 to 160 mbsf and 550 to 650 mbsf show good correlation with the recovered core. In the upper interval, where core recovery was poor, this will allow determination of lithology for unrecovered intervals. Lithoporosity and geochemical logs were obtained through combinations of casing and drill pipe for most of the interval from 50 to 750 mbsf. Results of these through-pipe logs require detailed correction for attenuation by pipe/casing and have not yet been analyzed.

The PCS and LAST tools were both successfully deployed but the data await later analysis. While there was a high failure rate with these, as described in the Operations section of this report, this is always a risk especially with new tools.

SUMMARY AND CONCLUSIONS

Leg 131 investigated the hydrogeology, physical properties, and structural styles of deformed sediments in the toe of the Nankai accretionary prism. Initial results of Leg 131 show that:

1. The Shikoku Basin basaltic basement in the Nankai region is middle Miocene (approx. 15.6 Ma) in age, and is overlain by hemipelagic mudstones of middle Miocene to Pleistocene age. The onset of major turbidite deposition occurred less than 0.5 million years ago.

2. The first major thrust fault, intersected at 365 mbsf, occurs within an overturned fold and has a vertical stratigraphic throw of 145 m. The décollement zone, about 20 m thick, occurs from 945 to 965 mbsf within a lithologically homogeneous hemipelagic sequence.

3. Structural style and orientations change with depth and age in the prism, with shear bands common in the shallower part of the section and small faults predominating at depth. The absence of vein structures throughout the sedimentary section indicates a lack of concentrated fluid flow.

4. Physical-property data show major discontinuities at the thrust fault and décollement. A porosity increase below the décollement may indicate high pore pressures at this level. The first *in-situ* stress and pore-pressure measurements in ocean drilling history were made, and should constrain the models for deformation and compaction in the accretionary prism.

5. Interstitial pore-water geochemistry shows changes associated with lithologic boundaries but shows no evidence for active channeled fluid flow. A chloride minimum associated with the décollement may indicate a past fluid-flow event along this fault.

6. *In-situ* temperature measurements give a calculated heat flow of 126 mW/m^2, which agrees with conductive cooling models of the Philippine Sea lithosphere. However, hydrocarbon-gas distributions suggest higher maturity levels than those expected from the present geothermal gradient.

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TABLE CAPTIONS

Table 1. ODP Leg 131 Operational Site Summary

FIGURE CAPTIONS

Figure 1. Map of the Nankai Trough, the Shikoku Basin, and Japan, showing bathymetry, DSDP and ODP sites, and the Shimanto Belt (ancient accretionary prism).

Figure 2. Location of ODP Site 808 with respect to R/V *Fred Moore* line NT62-8.

Figure 3. Section of seismic line NT62-8 showing location of Site 808.

Figure 4. Summary figure for Site 808, showing Holes 808B and 808C relative to seismic section, lithostratigraphy, and age. Shear bands are most frequent from 300 to 600 mbsf; faults are more numerous from 600 to 1000 mbsf. Porosity shows distinct shift at the décollement, and Cl has a large minimum around the décollement.

Ocean Drilling Program
Site Summary Report
Leg 131

Hole	Latitude	Longitude	Sea Floor Depth (mbrf)	Sea Floor Depth (mbsl)	Number of Cores	Interval Cored (m)	Recovered Core (m)	Percent Recovered	Interval Drilled (m)	Total Penetration (m)	Time (hrs)
808A	32°21.12'N	134°56.67'E	4686.7	4676.0	13	111.4	88.7	79.6	0.0	111.4	60.00
808B	32°21.09'N	134°56.61'E	4685.0	4674.2	28	247.8	59.7	24.1	111.0	358.8	211.30
808C	32°21.17'N	134°56.66'E	4685.5	4674.6	108	1028.5	572.4	55.7	298.5	1327.0	394.80
808D	32°21.14'N	134°56.58'E	4684.0	4672.7	0	0.0	0.0	0.0	780.0	780.0	153.80
808E	32°21.11'N	134°56.61'E	4684.5	4672.9	0	0.0	0.0	0.0	1200.0	1200.0	461.50
808F	32°21.15'N	134°56.76'E	4696.0	4684.3	4	61.0	2.4	3.9	79.0	140.0	31.50
Not Including Wash Core:					3	11.0	0.0	0.0	129.0		
808G	32°21.15N	134°56.76'E	4696.0	4684.3	12	99.6	12.8	12.9	113.4	213.0	50.80
Not Including Wash Core:					11	64.6	11.3	17.5	148.4		
Site and Leg Totals:					165	1548.3	736.0	47.5	2581.9	4130.2	1363.70
Not Including Wash Core:					163	1463.3	732.1	50.0	2666.9	4130.2	

Table 1

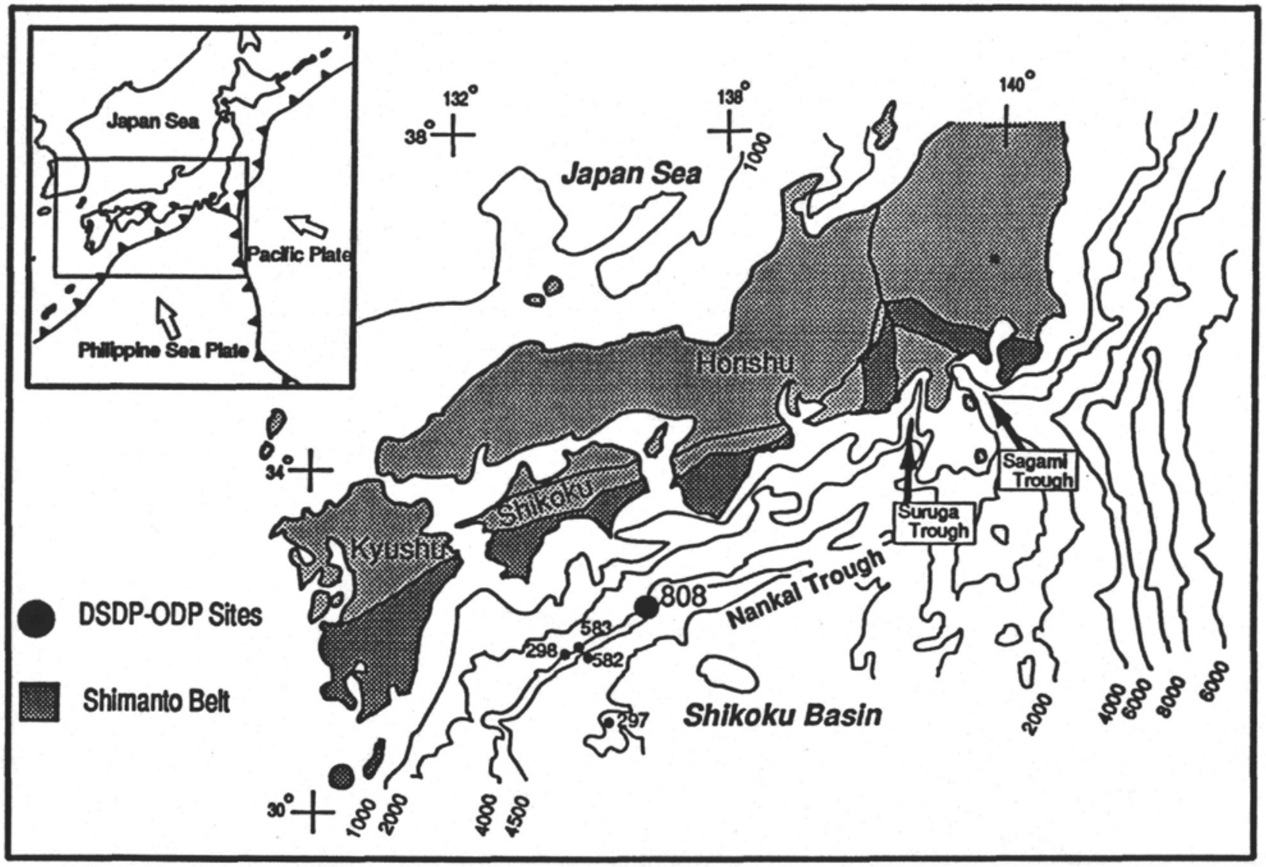
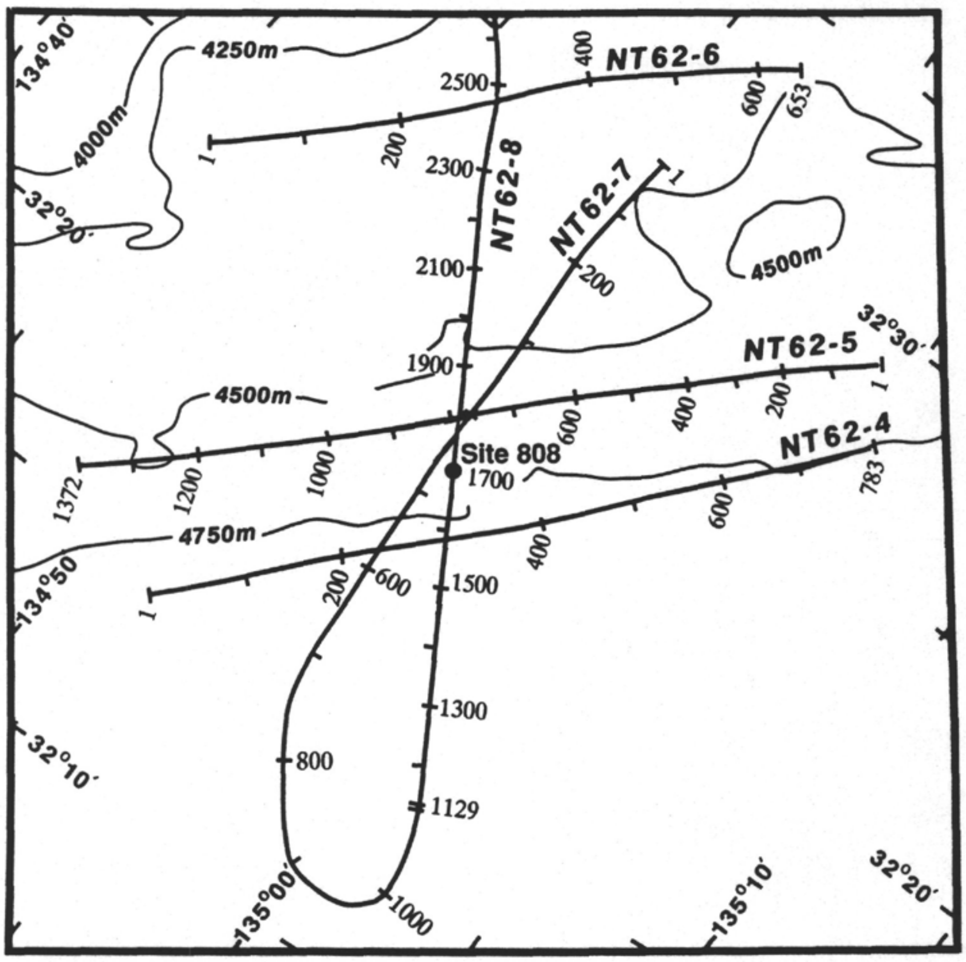

Japan Sea
Pacific Plate
Philippine Sea Plate
132°
138°
140°
38°
34°
30°
Japan Sea
1000
Honshu
Shikoku
Kyushu
Sagami Trough
Suruga Trough
Nankai Trough
808
583
298
582
297
Shikoku Basin
DSDP-ODP Sites
Shimanto Belt
1000
2000
4000
4500
2000
4000
6000
8000
6000

Figure 1



4250m
4000m
4500m
4500m
4750m
NT62-6
NT62-8
NT62-7
NT62-5
NT62-4
Site 808
134°40'
32°20'
134°50
32°10'
135°00'
135°10'
32°20'
32°30'
2500
2300
2100
1900
1700
1500
1300
1129
1000
800
600
400
200
653
1372
1200
783

Figure 2

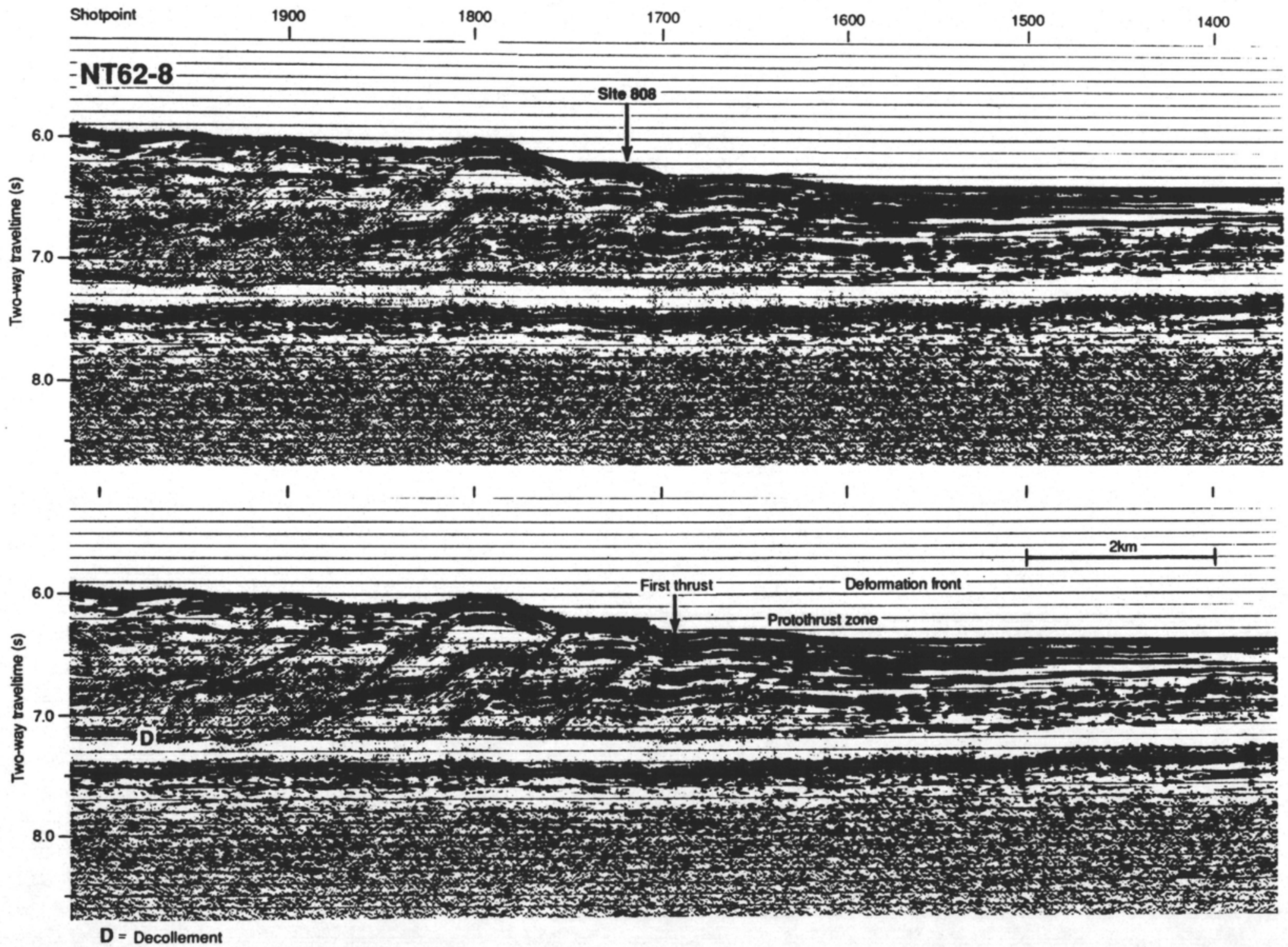

Shotpoint
1900
1800
1700
1600
1500
1400
NT62-8
Site 808
6.0
7.0
8.0
Two-way traveltime (s)
2km
First thrust
Deformation front
Protothrust zone
D
D = Decollement

Figure 3

ODP Leg 131 - Site 808

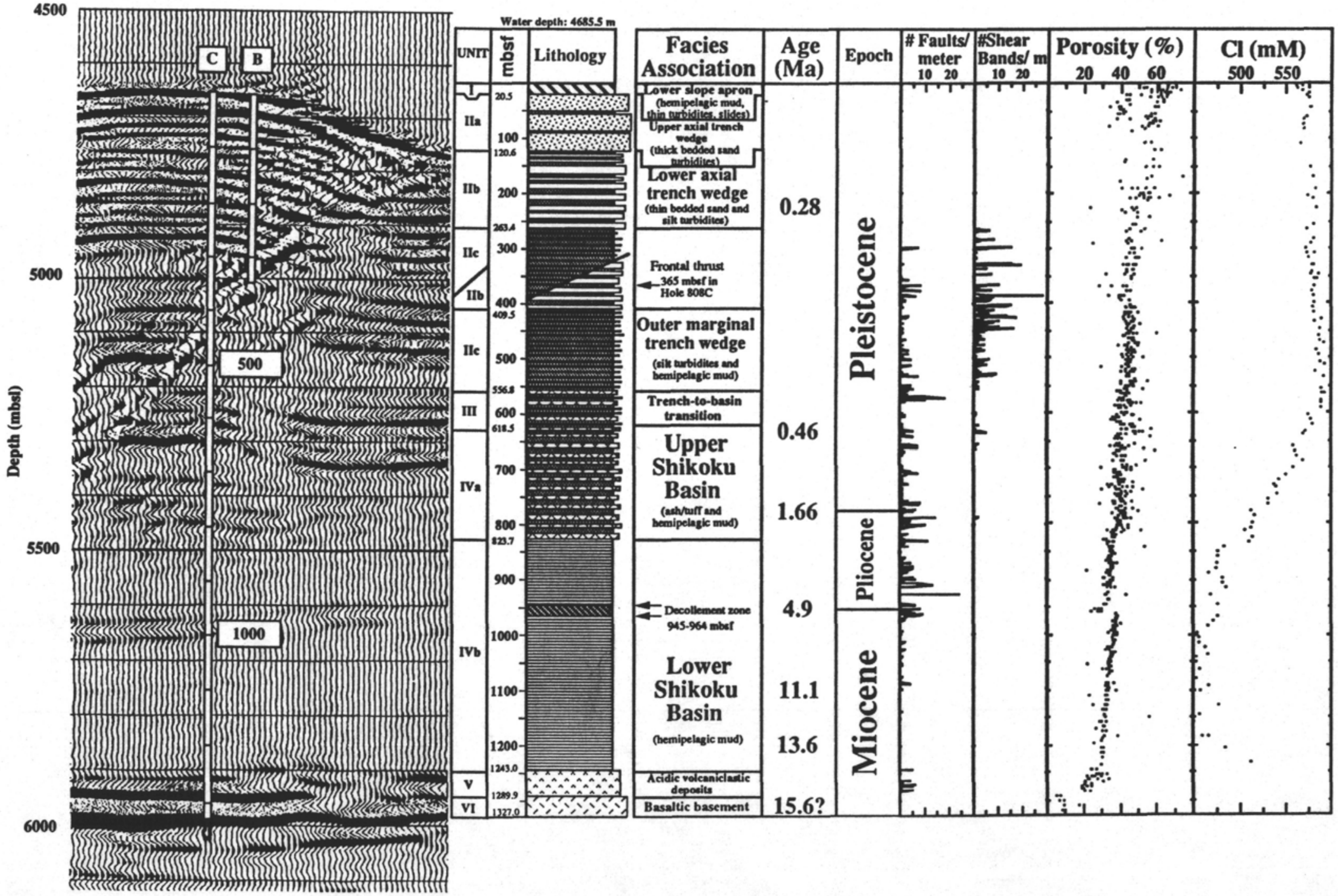


Figure 4

OPERATIONS SYNOPSIS

The ODP/LDGO Operations and Engineering personnel aboard *JOIDES Resolution* for Leg 131 were:

Operations Superintendent	Glen Foss
Operations Superintendent/ Development Engineer	Tom Pettigrew
Development Engineer	Hiroshi Matsuoka
Schlumberger Engineer	Scott Shannon
LDGO Wireline Packer Specialist	Erich Scholz

OPERATIONS

Guam to Site 808

The *JOIDES Resolution* departed Guam at 1930 hr (UTC) on 30 March 1990 (0430 hr, 31 March, local). The transit to Site 808 (proposed site NKT-2) covered 1230 nmi in just over 4 days at an average speed of 12.4 kt. Relatively calm seas and excellent weather prevailed through most of the transit. About 16 nmi southeast of the proposed drillsite, speed was reduced and the pre-site survey began. Ship speed was kept at about 7 kt to compensate for up to 30-kt winds and a strong Kuroshio current coming from different directions. The seismic survey used two 3.28-L (200-in.^{3}) water guns and the standard eel, with 3.5-kHz and 12-kHz echosounders operating. Owing to the sea conditions and the need for the ship to travel 7 kt to maintain steerage way, the seismic data were very noisy. The survey proceeded northwest to about 5 nmi past the site, at which point the ship then turned to a reciprocal course and recrossed the site, at times allowing 50° set for the effect of current and sea.

Site 808

The site location was identified from comparison of the 3.5-kHz profile record with the reference seismic reflection profile, and an acoustic positioning beacon was dropped on the second crossing at 0240 hr, 4 April 1990, at 32°21.111' N and 134°56.671' E. GPS satellite positioning was available during the site survey. D/V *JOIDES Resolution* continued about 2 nmi southeast before retrieving the seismic gear and returning to the beacon to take station.

Hole 808A

The ship was positioned about 14 m northwest of the beacon, and Hole 808A was spudded in at 2145 hr, 4 April 1990, at 32°21.116' N and 134°56.666' E in 4687 m (precision depth recorder, PDR) of water. Core 131-808A-1H recovered 6.27 m of sediment and the mud line was estimated by drill pipe measurement (DPM) to be 4686.7 meters below the rig floor (mbrf). Cores 131-808A-1H through -13H were taken from 0 to 111.4 mbsf, with 111.4 m of sediment cored and 88.68 m recovered (79.6% recovery). Core-orientation surveys were taken on Cores 131-808A-2H through -6H. The cored sediments throughout this hole were highly expanded owing to a considerable amount of gas. Following Core 131-808A-11H, at 96.9 mbsf, the WSTP tool was run for temperature and water sampling but encountered 1.5 m of fill in the bottom of the hole. The tool-retrieval mechanism failed during the sampling cycle, making it necessary to retrieve the WSTP with an additional wireline run. Core 131-808A-12H was attempted at the same depth as the WSTP run, but had no recovery. The hole collapsed following Core 131-808A-13H. The coring line and APC were removed, but attempts to free the drill-string were unsuccessful. The bottom hole assembly (BHA) was severed with a back-off charge at the bottom of the top (7-1/4-in.) drill collar at 0545 hr, 6 April 1990. The drill-string cleared the rig floor at 1445 hr, 6 April 1990, ending Hole 808A.

Hole 808B

The ship was offset about 100 m southwest of the beacon, where the PDR-estimated depth was 4685.0 m. Because of a planned reentry cone at this site, a jet-in test was conducted to determine the conductor casing point. The bit could be jetted only to 24 mbsf without rotation. After the jet-in test, the bit was pulled clear of the seafloor and offset 10 m farther southwest. Hole 808B was spudded at 0400 hr, 7 April 1990, at 32°21.085' N and 134°56.613' E, at a depth of 4685 mbrf (DPM) and was drilled without coring to the total depth of Hole 808A at 111 mbsf. Continuous XCB coring began while weather conditions deteriorated. After Core 131-808B-7X was taken (178.5 mbsf), the combination of strong winds and strong current from different directions caused the ship to take positioning excursions up to 185 m. The current was too strong to permit turning the ship into the wind. It was decided to plug the hole with mud, pull clear of the hole, and respud after the weather improved. After the hole had been filled and before the drill-string had been tripped out, the weather improved, and it was decided to recommence coring. Coring continued to 358.8 mbsf (Core 131-808B-28X), with WSTP measurements taken following Cores 131-808B-9X, -11X, -13X, -15X, -17X, -20X, -26X, and -28X. Five successful temperature measurements were made, down to depths of 345.6 mbsf. Coring operations were terminated because the rate of penetration (ROP) slowed to less than 5 m/hr, and because of consistently low core recovery (24.1% recovery overall). The operating plan was changed to include an RCB penetration as deep as possible after the logging of Hole 808B.

In preparation for logging, the hole was flushed with 30 bbl of high viscosity mud. A final WSTP measurement was attempted at the total depth (TD) of the hole, but was unsuccessful owing to excessive hole fill. A wiper trip to 65 mbsf and back to TD was made to condition the hole, with high drag (up to 35,000 lb) noted at several levels within the hole. A second mud sweep was followed by displacement water and enough lime-enhanced viscous mud to fill the hole. The bit was pulled to 102 mbsf for logging.

The first run for the seismic-stratigraphy string was cut short when the threaded bullnose of the LDGO temperature logging tool unscrewed and an electrical problem occurred. The second run could not pass an obstruction in the hole at 181 mbsf; therefore, the hole was logged from 181 to 80 mbsf. A second wiper trip was successfully made without rotation to test the feasibility of using the side-entry sub (SES) to aid the logging. The SES was installed with the bit at 102 mbsf. Two attempts at running the lithoporosity string were short-circuited because current-induced vibrations of the drill string caused loosening of a tool connection. On the third attempt, after the tool was lowered out of the pipe at the bottom of the hole, the drill string was accidentally lowered down over the tool owing to a combination of ship heave (during high winds and strong current) and to clear rigging problems with a circulating hose and support cable for the SES logging sheave. The lithoporosity tool was jammed into the bit and broken, causing a loss of power to the tool and slackening of the logging cable. The cable and drill string were raised together until the SES reentered the moonpool. The logging cable was crimped and cut downhole to free the cable and hold the tool in the pipe. Before raising the pipe out of the hole, a free-fall funnel (FFF) was dropped to the seafloor in case the tool became free and remained in the hole. The BHA was brought up, and the tool was not in the bit. A fishing attempt for the tool in the hole was unsuccessful, and was further hampered by rough weather conditions and problems with a stripped outer strand of the VIT-camera cable. The hole was filled with barite-weighted mud and cemented in the upper part. The drill string reached the rig floor at 1000 hr, 15 April 1990, ending Hole 808B.

Hole 808C

Hole 808C was spudded at 1530 hr, 16 April 1990, about 90 m northwest of Hole 808A, at 32°21.170' N and 134°56.657' E, and at a depth of 4685.5 mbrf (DPM). An 86 m string of 11 3/4-in. casing was drilled into place from 1 to 105 mbsf using the drill-in casing system (DIC), the first successful deployment of this system. Drilling then proceeded with the RCB bit and an inner core barrel in place to 298.5 mbsf. Continuous RCB coring then began. A fault zone was penetrated on the very first core and initiated a sequence of hole-cleaning problems. Several faults, including a major thrust zone, were cored in the next 100 m as indicated by fractured and sheared core and reduced core recovery. Hole fill of 4-9 m on connections persisted, despite repeated mud pills and extra circulation, to about 480 mbsf. Good recovery and relative hole stability then were experienced through a siltstone/claystone section to the décollement at about 960 mbsf.

The associated fracture zones of the décollement extended over a 30-40-m interval. The fractured and sheared sediments caused reduced recovery and some hole instability. Below the décollement, hole conditions again stabilized. Core recovery was reduced somewhat by vertical fractures in the claystone that caused the core to jam in the liner and/or catcher. The success in reaching and penetrating the décollement prompted the decision to extend the hole through the lower pelagic sediment section and into basement. Coring continued non stop to a TD of 1327 mbsf in basement at 1205 hr, 28 April. Overall recovery in Hole 808C was 55.7%. The pipe became stuck several times, requiring greater than 100,000 lb overpull to free it. Most of the problems occurred at the fault zones, including the décollement, that were identified in the coring. Excessive torque while coring indicated possible swelling in the lowermost portion of the hole.

The hole was then prepared for logging operations with mud sweeps and two wiper trips. The bit was released, and the hole was displaced with logging mud. The pipe was then pulled to 747 mbsf for logging. The seismic stratigraphy string was run in the hole until it encountered a bridge at 756 mbsf. In an attempt to spud the bridge with the logging tools, communication was lost to the tools and they had to be retrieved. With the logging tools out of the hole, the pipe was lowered back to 1312 mbsf in an attempt to clear the bridges. The pipe was then raised to 891 mbsf (just above the décollement) for the next logging attempt. The lithoporosity string could not be gotten out of the pipe, so the hole was logged through the pipe from 891 mbsf to the mud line. The geochemical string could be gotten only 3 m out of the pipe, so the hole was once again logged up to the mud line through the drill pipe. Owing to the instability of the entire borehole, it was not prudent to deploy the SES. The logging equipment was rigged down and the hole was filled with heavy mud from 891 mbsf to the mud line. The drill string was pulled from the hole with the BHA reaching the rig floor at 2045 hr, 1 May 1990.

Hole 808D

Hole 808D was planned as a reentry hole for the ONDO tool. The hole was spudded at 1530 hr, 2 May 1990, (32°21.143'N, 134°56.578'E; 4684 mbrf), when jetting-in of the 16-in. casing and reentry cone assembly began. The jet-in procedure went smoothly, and the reentry-cone mud skirt was landed on the seafloor in 1 1/2 hr. The drill string was released from the running tool and the hole was drilled ahead to 780 mbsf.

Hole-conditioning procedures required 36 hr owing to swelling clays and a troublesome fracture zone at approximately 400 mbsf. Drilling operations had to be suspended for 12 hr during the hole-cleaning process because of the weather. Strong north winds gusting to 58 kt coupled with the ever-present Kuroshio current from the west, caused the ship to roll a maximum of 12°. Although hole conditions were not ideal for running casing, further hole conditioning would not have improved them. Therefore, the hole was displaced with casing mud, and a round trip was made for the 11 3/4-in. casing string.

The ship was moved up current 25 nmi and allowed to drift back while deploying the 11 3/4-in. casing string to avoid excessive stress on the casing from the current. The drift of the ship over the 25 nmi was calculated at 1.9 kt. While lowering the 741-m casing string into the hole, it became apparent that weight of the casing string had been lost. The drill-string was lowered to just below the point at which the 11 3/4-in. casing hanger should have landed in the reentry cone without setting down. The drill pipe was then pulled from the hole for inspection.

Once on deck, only the hex-kelly running tool with VIT guide sleeve, cementing swivel, and cross-over sub with 2.45 m of 5-in. drill pipe attached remained of the casing/cementing assembly. There was no clear evidence of what had caused the failure. Hole 808D officially ended at 0630 hr, 8 May 1990, when the 11 3/4-in. casing running tool was pulled through the drill floor.

Hole 808E

Hole 808E was a retry of Hole 808D. Hole 808E (32°21.108' N and 134°56.610' E, 4684.5 mbrf) was spudded at 1740 hr, 9 May 1990, with jetting-in of a reentry cone. After jetting-in, the hole was drilled ahead to 554 mbsf. The hole was conditioned to receive the 11 3/4-in. casing string and then the drill pipe was retrieved.

During rigging up of the casing-running equipment, the ship was moved 18 nmi up current and allowed to drift back to location as 521 m of 11 3/4-in. casing and cementing stringer were made up and deployed. Hole 808E was reentered at 1930 hr, 11 May. The casing was lowered into the hole, latched into the reentry cone, cemented in place, and then the drill pipe was retrieved.

Hole 808E was reentered at 1230 hr, 13 May, with an RCB BHA. The cementing shoe was drilled out and the hole was drilled to a TD of 1200 mbsf. After several wiper trips, the bit was released, the hole was displaced with weighted KCl mud, and the BHA was pulled to 35.7 mbsf for logging operations. The first logging suite consisted of the seismic stratigraphy string. The hole was logged from the mud-line down to 576 mbsf, where an impenetrable bridge was encountered. The hole was then logged back to the mud-line, and the logging tools retrieved. The drill pipe was lowered to 850 mbsf to clear any existing bridges. The seismic stratigraphy string was redeployed, encountering a bridge at 621 mbsf. The open hole was logged, and then the logging tools were retrieved. The drill pipe was lowered to 850 mbsf and then retrieved.

Hole 808E was reentered at 1047 hr, 19 May, for vertical seismic profile (VSP) and TAM drillstring packer experiments. The well seismic tool (WST) was deployed and VSP data gathered from 600 mbsf to the mud line. The WST was retrieved, and the packer was positioned at 511 mbsf. The first attempt to inflate the packer resulted in a partial set. The packer was deflated and the go-devil retrieved. The go-devil and Kuster recorders were redressed and redeployed on the wireline. Again, a partial set of the packer was indicated. With allotted packer experiment time expiring, flow tests were carried out in the hope that the downhole recorders would gather some useful information. The packer was deflated, and, with the go-devil left in place for inspection, the drill pipe was retrieved. The Kuster recorders were lost in the hole.

Hole 808E was reentered at 0930 hr, 22 May, for deployment of the ONDO thermistor array. The array was deployed twice, both times stopping at 3830 mbrf. The array was recovered and a core barrel deployed without encountering any obstructions in the drill pipe. The array was redeployed two more times, stopping inside the BHA at 4660 mbrf. The array was retrieved, and a modified set of landing pads installed. The array was redeployed again, stopping inside the BHA at 4660 mbrf. With expiration of deployment time, the array was pulled from the hole. The drill pipe was retrieved, and Hole 808E officially ended at 0055 hr, 26 May, with the bit back on deck.

Hole 808F

A standard APC/XCB BHA was made up for the next hole, which was to be dedicated to special tool measurements. Hole 808F (32°21.146' N and 134°56.762' E; 4696.0 mbrf DPM) was spudded at 1320 hr, 27 May 1990, and then washed to 50 mbsf. The LAST tool was deployed at 50 and 85 mbsf with incomplete data gathered owing to power and software problems. The WSTP temperature probe was deployed at 55.0 and 90 mbsf, with a good temperature reading only from the second run. The PCS was unsuccessfully deployed at 55 mbsf owing to being sanded up. A broken XCB cutting shoe lost in the bottom of the hole stopped the drilling. The BHA was pulled from the hole and the bit cleared the seafloor at 0825 hr, 28 May 1990, officially ending Hole 808F.

Hole 808G

Hole 808G was spudded immediately after pulling out of Hole 808F at 0825 hr, 28 May, and was washed to 120 mbsf. The XCB was deployed at 120.0, 129.6, 139.2, 148.9, 193.0, and 208.0 mbsf. Core 131-808G-8X at 193.0-203.0 mbsf recovered 9.97 m of sandy and silty clay. The other cores did not recover any sediment. The WSTP temperature probe was deployed at 148.9 and 192.0 mbsf, and the WSTP pressure probe was deployed at 192.0 mbsf. In all cases, the tools flooded with water. The PCS was deployed at 185.0 mbsf, recovering 0.49 m of pressurized core. While placed in cold storage, the PCS pressure chamber lost most of its trapped pressure. Once the pressure chamber had reached *in situ* temperature, the core was removed and immediately immersed in liquid nitrogen. The LAST was deployed at 186.0, 203.0, 212.0, and 213.0 mbsf, with only the first run recovering 0.84 m of core, and *in situ* stress and pore-pressure data collected from the first, third and fourth runs. The 'GS' overshot prematurely sheared twice, causing minor delays in the downhole measurements.

With the allotted leg time expiring, the hole had to be abandoned. While the drill pipe was being retrieved, another beacon was dropped for easier location of Hole 808E by the Leg 132 crew should they have time to attempt deployment of the ONDO tool. The bit was back on deck at 1110 hr, 30 May, officially ending Hole 808G and Site 808.

Owing to the long duration of Site 808, five beacons were dropped, at 0240 hr, 4 April; 2230 hr, 11 April; 2230 hr, 1 May; 0000 hr, 9 May; and 1000 hr, 30 May 1990.

<u>Site 808 to Pusan</u>

The voyage to Pusan covered 520 nmi in 57 hr at an average speed of 9.1 kt. The *JOIDES Resolution* arrived outside Pusan at 2030 hr, 1 June. The leg officially ended with the dropping of the anchor at 2100 hr, 1 June (0600, 2 June, local).

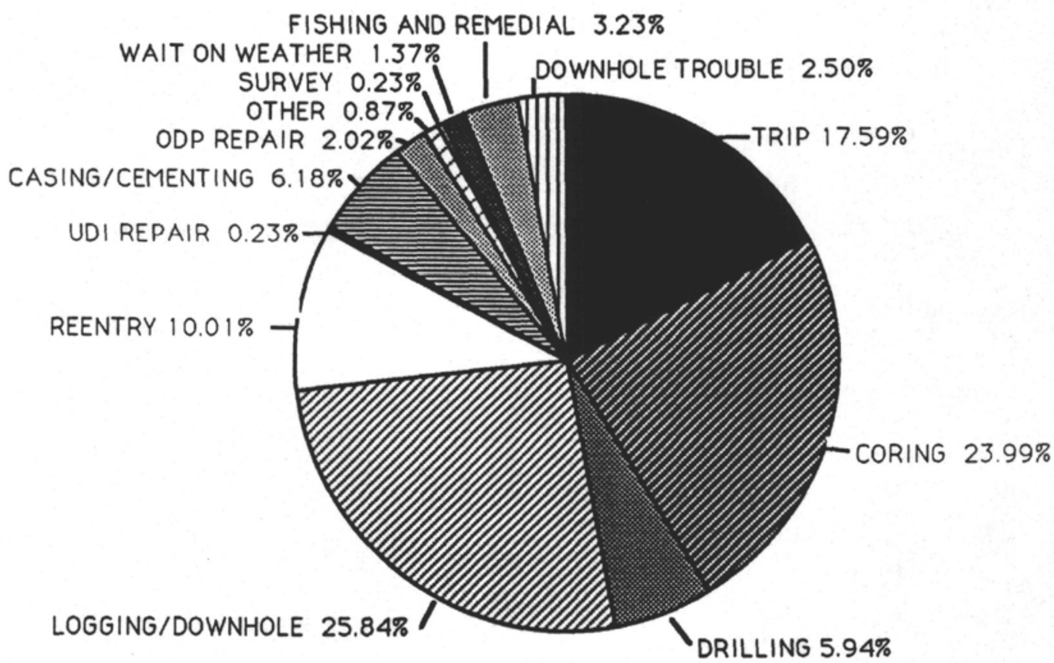
OCEAN DRILLING PROGRAM
OPERATIONS RESUME
LEG 131

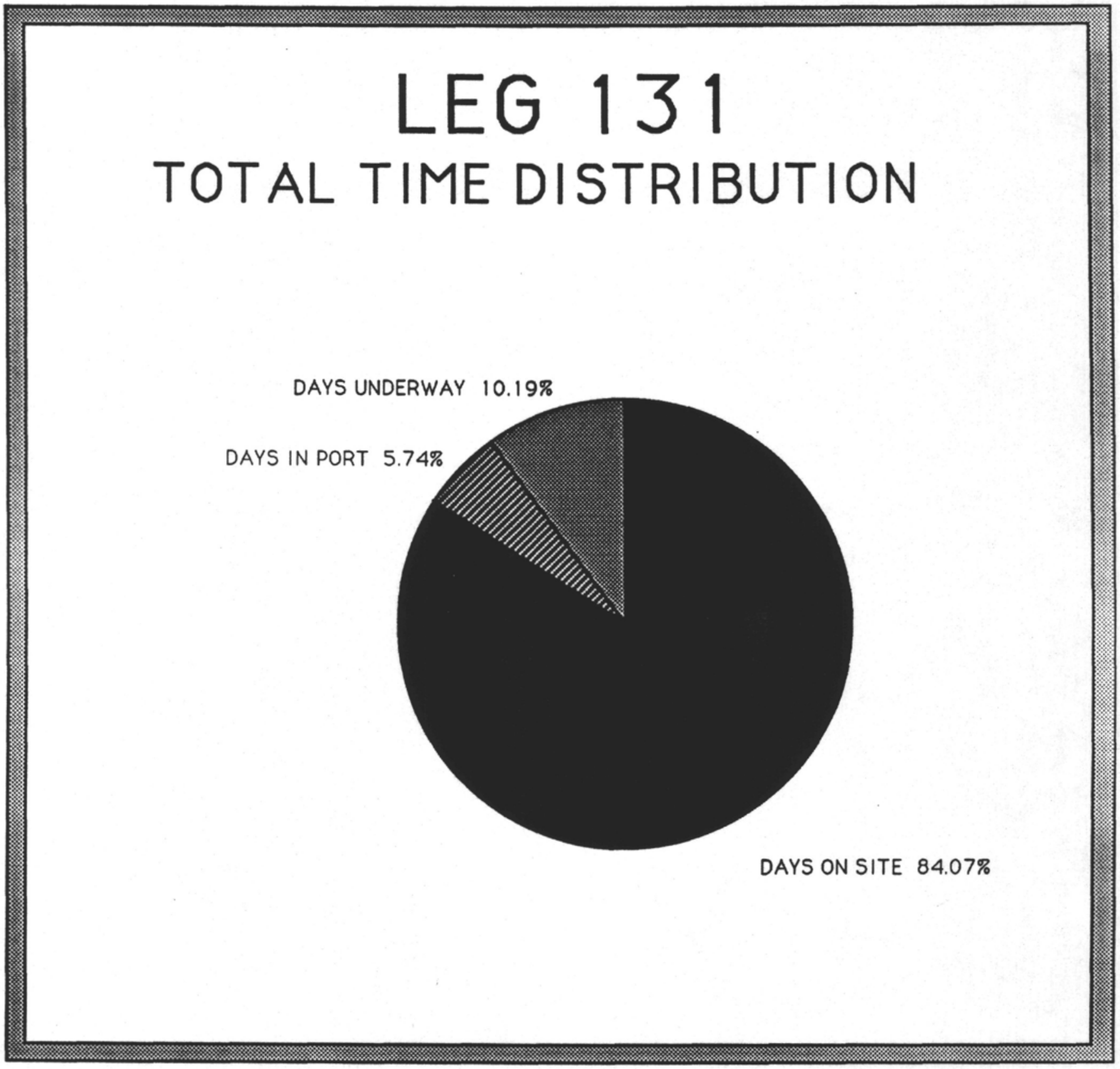
Total Days (3/27/90 - 6/2/90)	67.03
Total Days in Port	3.85
Total Days Under Way	6.83
Total Days on Site	56.35

Trip Time	9.91
Coring Time	13.52
Drilling Time	3.35
Logging/Downhole Science Time	14.56
Reentry Time	5.64
Repair Time (Contractor)	.13
Repair Time (ODP)	1.14
Casing and Cementing Time	3.48
Downhole Trouble Time	1.41
Survey Time	.13
Wait on Weather	.77
Fishing & Remedial Time	1.82
Other	.49

Total Distance Traveled (nautical miles)	1750
Average Speed (knots)	11.2
Number of Sites	1
Number of Holes	7
Number of Reentries	6
Total Interval Cored (m)	1463.3
Total Core Recovery (m)	734.6
Percent Core Recovered	50.2
Total Interval Drilled (m)	2666.9
Total Penetration (m)	4130.2
Maximum Penetration (m)	1327.0
Maximum Water Depth (m from drilling datum)	4696
Minimum Water Depth (m from drilling datum)	4684

LEG 131
ON SITE TIME DISTRIBUTION




LEG 131
TOTAL TIME DISTRIBUTION
DAYS UNDERWAY 10.19%
DAYS IN PORT 5.74%
DAYS ON SITE 84.07%

TECHNICAL REPORT

The ODP Technical and Logistics personnel aboard *JOIDES Resolution* for Leg 131 were:

Laboratory Officer:	Bill Mills
Assistant Laboratory Officer:	Joe Powers
Computer Systems Manager:	Edwin Garrett
Curatorial Representative:	Gretchen Hampt
Yeoperson:	Jo Claesgens
Electronics Technician:	Randy Current
Electronics Technician:	David Erickson
Electronics Technician:	Roger Ball
Photographer:	John Tenison
Chemistry Technician:	Scott Chaffey
Chemistry Technician:	Valerie Clark
Marine Technician:	Dan Bontempo
Marine Technician:	Woon-Hyun Cho
Marine Technician:	Joe DeMorett
Marine Technician:	Howard Gordon
Marine Technician:	Kazushi Kuroki
Marine Technician:	Michael Moore
Marine Technician:	Joan Perry

INTRODUCTION

The D/V *JOIDES Resolution* set out from Agana, Guam on 30 March 1990, with a crew of 113 (52 scientists and technical staff). After drilling 1 site and 7 holes, Leg 131 ended in Pusan, South Korea, on 2 June.

Port call: Agana, Guam

On 27 March, at 0630 (local), the D/V *JOIDES Resolution* docked at Victor Berth in Agana, Guam. Leg 131 technicians moved on board the same day at noon. Crossover with the offgoing techs was hectic as usual. Initially, we had only 2 days to move freight on and off ship before moving to the fueling pier. Supply containers were spotted on the dock, and two forklifts were provided for our use. We were able to accomplish loading and off-loading within two long and hard days of work.

By the end of the second day we were informed that our fueling would be delayed by 1 day. This gave the technical crew a chance to unpack and prepare the labs. At this point we were still waiting to offload the Leg 130 frozen shipment and onload the last-minute air freight for a scientist. Also, we were awaiting the delivery of our liquid nitrogen dewars.

At 0900 (local) on the fourth day, we moved to the fueling dock. The liquid nitrogen dewars arrived and the frozen shipment was offloaded late that afternoon. Late arrival air freight was located and delivered just before our departure.

In addition to our routine port call work, the following events also took place: (1) The ONDO (Japan ODP's long-term downhole temperature experiment) equipment was loaded and assembled; (2) A new high voltage transformer was installed in the XRF lab and other repairs were made; (3) An inspection by the American Bureau of Shipping was made of the ship's hazardous zone. Deficiencies were noted in the downhole measurements lab that were corrected during Leg 131.

On the second day of the Guam port call, the lab stack's regulated and ship's power experienced several cycles of brownouts (and possible surges) in a 30-40-s period. Details of the event are documented in a report from SEDCO's electrical supervisor. Several pieces of lab equipment were damaged as a direct result. The most serious damage was to the Liebert power conditioner. Damage was repaired, and the Liebert was operational, before we left port.

Underway Lab: Transit, Site Survey, and VSP

During our 7 days of transit to and from Site 808 we collected standard bathymetric, magnetic and navigational data (approximately 1700 nmi). On our fourth day out, the starboard maggie developed high noise. The spare maggie was deployed and the starboard retrieved for re-heading.

An extensive pre-site survey was originally planned for proposed sites NKT-1 and NKT-2 but was shortened when the R/V *Tansei Maru* agreed to survey our sites during the ONDO experiment. On 4 April 0653 (local), both 200-in. water guns were deployed. During the survey we experienced difficulties with the port pressure regulator and could only maintain 1500 psi, which may have contributed to intermittent firing problems of the port gun. The survey was concluded with usable results.

On-Site Lab Operations

Downhole Measurement Lab and Reentry Systems

One of the major objectives of this leg was to obtain *in-situ* geophysical measurements. Extensive logging and downhole programs were conducted to meet these goals. Laboratory bench space was scarce and clearly pointed out the need for additional lab space for servicing and operating downhole tools.

Downhole operations were complicated by unstable hole conditions and the strong Kuroshio current. The Kuroshio ran between 2 and 5 kt, inducing strong drill-string vibrations that could be felt throughout the ship. Reentry and downhole tools were shaken, necessitating frequent maintenance and repairs. Often, when the TV reentry system (VIT) was retrieved, one or more strands of cable armor would break and ball up. It would take as much as 12 hr to cut away about 4 km of damaged armor wire. On one particular reentry, the guide sleeve was ripped apart, allowing the VIT to swing free of the pipe. We were very fortunate to recover the VIT. To deploy casing, it became necessary to position the ship 25 nmi up-current and then drift back to prevent the current from damaging the casing.

The VSP hose bundle and electrical line were found damaged by careless arc welding. It is not known if this happened before or during our leg. The hose was replaced because of the extensive damage. In addition to a new hose bundle, a second buoy spindle (similar to the one used to tow the 400-in. water gun but without the exhaust port) was fabricated to replace the chains. A new exhaust hose was made to connect the 400-in. water gun exhaust to the other buoy spindle (with the exhaust port). Gun and hydrophone depths were the same as on past legs.

The VSP experiment was conducted on 20 May (local). Schlumberger's first tool was damaged by pipe vibration, but repairs were made and the tool was set in the hole on the second try. Pipe vibration greatly degraded the gun signal, but scientists were confident that post-cruise processing will provide meaningful data. The 400-in. water gun made 700 shots without incident in spite of a 3 kt current, which kept the rigging and crane's whip line taut. Fortunately, seas were calm or the gun would have been lifted out of the water by the swell and current.

The WSTP tools were used extensively on this leg. Both tools were set up: one was configured for temperature and water sampling and the other for pressure measurements and water sampling. On the pressure configured tool, the electrical bulkhead connector was removed to provide an additional port for measuring hydrostatic pressure. Although *in-situ* water sampling and pressure measurements were not successful, we did obtain six good heat flow measurements in very hard formations.

The Double C system one- and two-channel recording packages for the WSTP was tested successfully on this leg. Two electronic packages were configured for both temperature and pressure measurements. The Double C system still needs refinement of the deck interface box and software control before it can be considered fully operational. The system will be returned to shore for upgrade and should be operational by Leg 133.

The LAST was tested on our last hole. Initially, sandy hole conditions and programming problems resulted in failed runs, but later measurements were successful.

A grueling 4-day attempt to deploy the ONDO tool was unsuccessful. The causes for deployment failure have been identified and a request was made to deploy the ONDO on the next leg.

There were two pressure core sampler (PCS) runs. On the first run, sand prevented the tool from actuating the ball valve. On the second run, core was brought up under pressure, but during the cool down period pressure slowly leaked past a damaged seal. When the tool was opened, less than 300 lbs of pressure remained. The core material was immediately placed in liquid nitrogen for storage and shipment.

Core, Magnetics and Physical-Properties Labs

During the first half of this leg, these labs were kept busy conducting a careful and detailed structural and geophysical analysis (see measurements table). During the second half, those technicians and scientists not engaged in downhole measurements stayed busy upgrading manuals, developing new techniques/software, and improving lab operations.

At the beginning of the leg there was concern about a magnetic "hot spot" in the core splitting room. A careful survey was made in the core-splitting room and other areas of the core lab. The magnetic field was found to be twice Earth's normal at the top of the splitting room's core rack, but just a few feet below the field drops to zero. Other areas in the core lab showed similar variation. Our shipboard paleomagnetists felt that these field variations were insignificant. What was more troubling to them was the magnetic "imprinting" from the core barrels. It was suggested that a simple degaussing ring (as used by TV servicemen) would clean up the lab environment and that a similar device should be routinely used on core barrels.

There is concern about a secondary harmonic in the Schonstedt GSD-1 degausser. This problem will be investigated further with the vendor, but for now the problem can be avoided. Difficulties exist using the 2G RF pre-amp box and squid electronics (on loan to us). These problems did not greatly affect lab operations and will be discussed with the 2G representative in Pusan.

Chemistry Lab

A detailed interstitial-water and carbonate program was conducted in the Chemistry lab. While downhole measurements were being made, Dr. Gieskes revised the "Wet Chemical Analysis of Sediments for Major Element Composition" and the

"Chemical Methods for Interstitial Water Analysis" cookbooks. The scientists also trained our chemistry technicians in these methods and employed them in various studies.

X-ray Lab

The XRD equipment processed 531 samples. Owing to heavy usage during recent legs the XRD equipment should be scheduled for an overhaul prior to Leg 133.

In Guam, a XRF service technician installed a new high voltage power transformer. In addition, the service tech modified a circuit board to make the unit functional. After completing a full major element calibration, the modified circuit board failed disabling the XRF for sample analysis. The shipboard technicians requested another factory service call for the Pusan port call.

Thin-Section and Paleo Labs

The thin-section lab had a moderate work load, although clayey samples did provide a challenge. There were few paleontologists staffed for this leg, so part of the paleontology lab was used for an anelastic-strain recovery experiment.

Computers

Programs on "DATA:" were moved to "SOFTWARE:" for more efficient use of disk space. This also involved changing many logicals so that programs would execute correctly. Past problems with the network were mostly resolved.

The addition of the network to the shipboard computing system has been a real boon, providing faster access and data sharing among the users. This leg also saw a greater use of data collection and processing by local micro-computers with spread sheets and graphic packages.

Miscellaneous

The slow coring and downhole measurements allowed time for the technical staff to complete dry-dock projects. New bench tops were installed for the physical properties lab and core-entry area. Trim pieces were added to the new lab furniture.

Extensive work was done in the downhole measurement lab (DML) to remedy ABS deficiencies. This included:

1. Replacing plastic tie wraps with stainless steel.
2. Securing loose cables in the overhead.
3. Rerouting metal flex ducting through the overhead.
4. Replacing broken and missing ceiling tiles.
5. Removing a hinged table top that blocked the escape exit.
6. Repairing holes in wall panels with steel plates.

While the ceiling panels were down in the DML, the SEDCO electricians serviced the power supply and "purge-air" regulator for the rig-floor camera. The purge-air regulator and power supply were then remounted on the wall, below the ceiling, for easier maintenance. The electricians also ran power cables for the diamond coring system (DCS) and wired the power strips in the wet room for regulated power.

New recessed lighting was installed in the underway lab, replacing the old hanging fluorescent lights. Installation of the remaining ceiling tiles was completed. A wood tool cabinet was built to replace the old red metal tool cabinet on the fantail.

New shelving was installed in the Paleo lab, over the computer stations, to hold the equipment and printers.

ONDO technicians joined us via the R/V *Tansei Maru* on 18 May and were picked up by the *Tomi Maru* on 24 May. Fresh vegetables and fruit were supplied by these vessels to everyone's delight.

LEG 131 LAB OPERATIONS

General:

Sites:		1
Holes:		7
Meters cored:	1463.3	
Meters of cores recovered:	732.1	
Total number of samples:	4976	

Number of Lab Analyses:

Physical properties:	
Density:	942
Velocity:	1417
Chemistry:	
Carbonate:	932
Gas:	170
IW:	382
XRD	531
Thin section:	46

Underway Geophysics: (approximate)

Total transit (nautical miles):	1750
Bathymetry (nautical miles):	1700
Magnetics (nautical miles):	1400
Seismic (nautical miles):	32

Number of Downhole Tool Measurements:

WSTP tool:	
WST:	10
WSP	2
T	1
LAST:	6
PCB:	2

OCEAN DRILLING PROGRAM
OPERATIONS RESUME
LEG 131

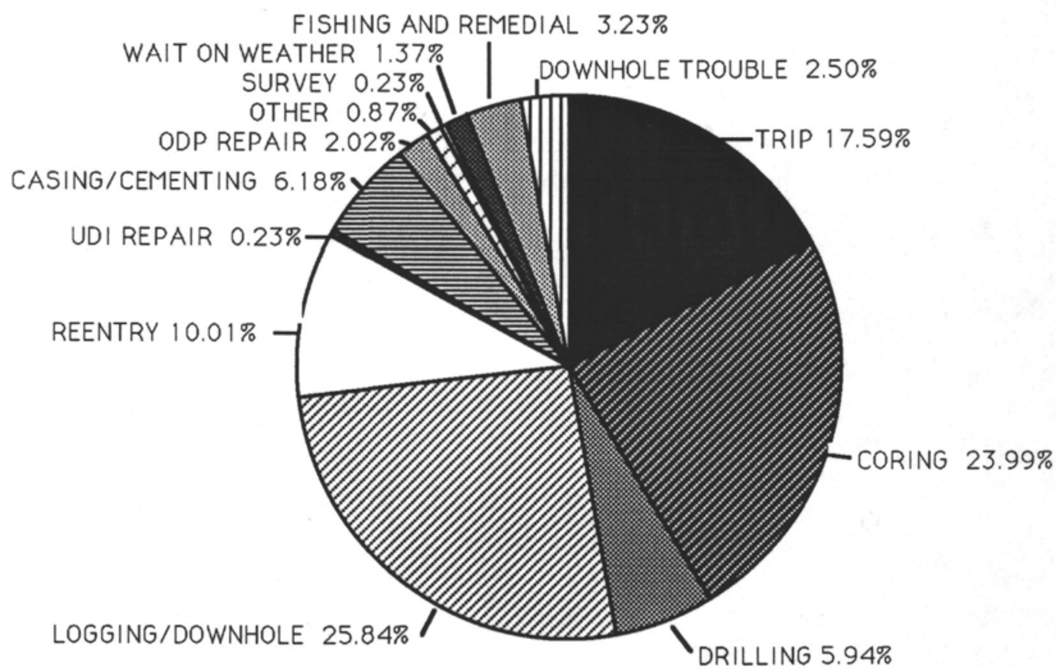
Total Days (3/27/90 - 6/2/90)	67.03
Total Days in Port	3.85
Total Days Under Way	6.83
Total Days on Site	56.35

Trip Time	9.91
Coring Time	13.52
Drilling Time	3.35
Logging/Downhole Science Time	14.56
Reentry Time	5.64
Repair Time (Contractor)	.13
Repair Time (ODP)	1.14
Casing and Cementing Time	3.48
Downhole Trouble Time	1.41
Survey Time	.13
Wait on Weather	.77
Fishing & Remedial Time	1.82
Other	.49

Total Distance Traveled (nautical miles)	1750
Average Speed (knots)	11.2
Number of Sites	1
Number of Holes	7
Number of Reentries	6
Total Interval Cored (m)	1463.3
Total Core Recovery (m)	734.6
Percent Core Recovered	50.2
Total Interval Drilled (m)	2666.9
Total Penetration (m)	4130.2
Maximum Penetration (m)	1327.0
Maximum Water Depth (m from drilling datum)	4696
Minimum Water Depth (m from drilling datum)	4684

LEG 131

ON SITE TIME DISTRIBUTION



LEG 131
TOTAL TIME DISTRIBUTION