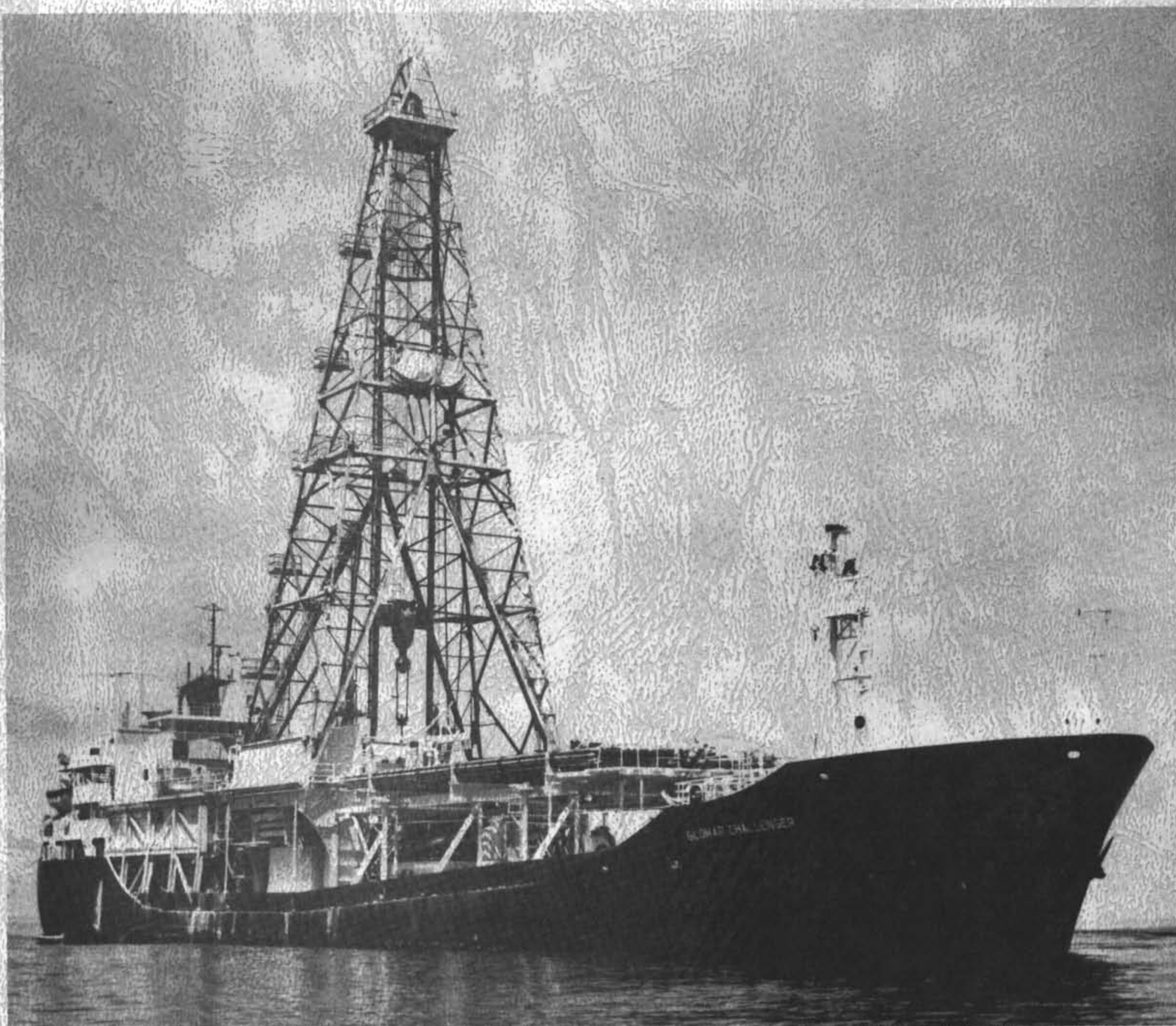
INTERNATIONAL PHASE OF OCEAN DRILLING (IPOD)
DEEP SEA DRILLING PROJECT
DEVELOPMENT ENGINEERING
TECHNICAL REPORT NO. 18

OPERATIONS RESUMES PART VII
LEG 71 THROUGH 84



SCRIPPS INSTITUTION OF OCEANOGRAPHY
UNIVERSITY OF CALIFORNIA AT SAN DIEGO
CONTRACT NSF C-482
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DISCLAIMER

TECHNICAL REPORT NO. 18

Operations Resumes
Leg 77 through Leg 84

Prepared for the
National Science Foundation
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Prime Contractor for the Project

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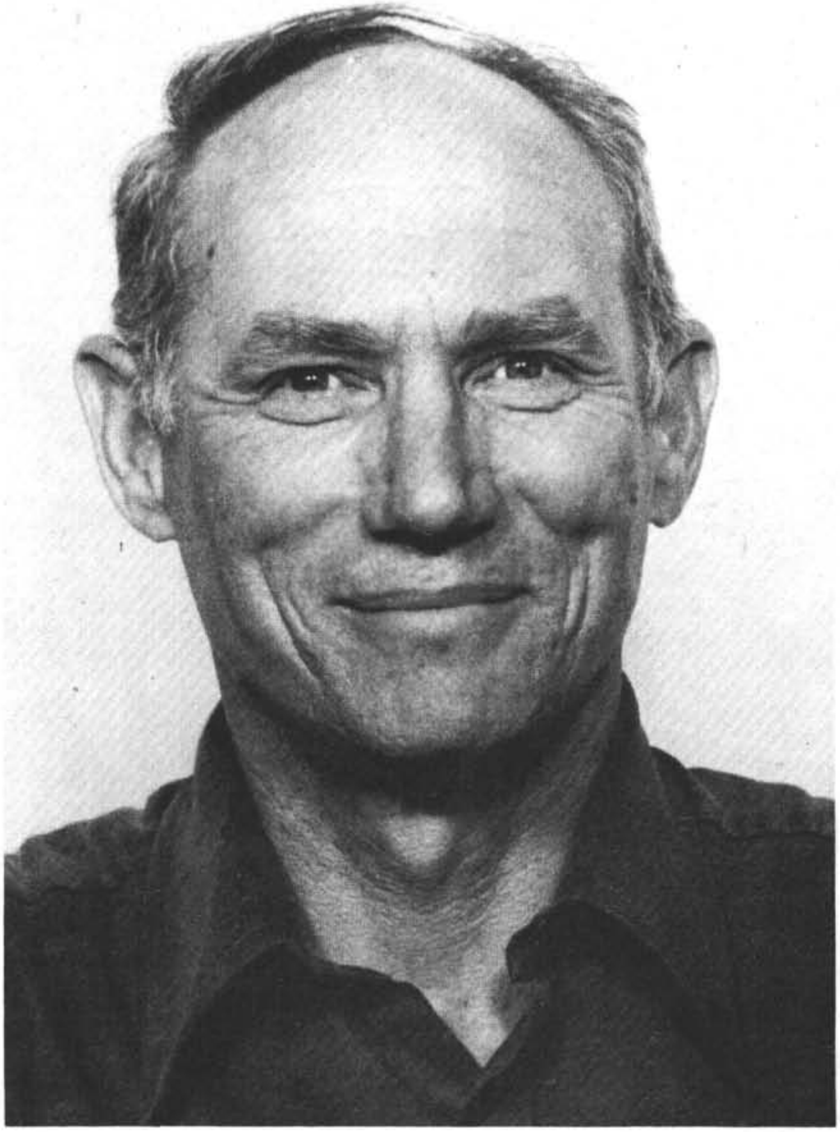
INTRODUCTION

IPOD/DSDP Technical Report No. 18 is the seventh edition published since the inception of Deep Sea Drilling Project operations in August 1968.

This volume relates operational and engineering procedures used aboard D/V GLOMAR CHALLENGER from Leg 71 through Leg 84.

Technical Report No. 18 follows the format of the previous six volumes citing Operations Resumes. This report documents technical achievements, drilling and coring results, drill bit performance, deployment of new coring systems, coring equipment modifications and procedural improvements. Problem areas are identified and remedial actions taken or proposed are presented. In addition, operational ramifications of weather, communications, personnel, port calls and under way periods are related.



VALDEMAR F. LARSON

1930-1981

V. F. "Swede" Larson was guiding influence in the operations and engineering aspects of the Deep Sea Drilling Project from his arrival in 1969 until his departure for reasons of health in May, 1981. His innovation and leadership were major factors in the record of operational success that has been compiled by the Project. We miss him.

ACKNOWLEDGMENTS

Achievements of the technical staff of the International Phase of Ocean Drilling of the Deep Sea Drilling Project have, to a great extent, been responsible for successful operations and for the resulting contributions to basic earth research credited to the Deep Sea Drilling Project.

To V. Robson, Head of Operations; to V. Larson and S. Serocki, who served as Head of Engineering and to their staffs: P. Porter, R. Knapp, G. Foss, P. Dempsey, P. Thompson, B. Adams, M. Storms, D. Bellows, D. Huey, D. Cameron, R. Keefe and P. Duley, the Project gratefully acknowledges your dedication, talents and expertise.

The DSDP Logistics Department, headed by R. Olivas, provided invaluable support for the efforts of the Operations, Engineering and Scientific groups involved with at-sea operations.

The professionalism and cooperation of the crew and management of the D/V GLOMAR CHALLENGER were the final and all-important factor in the Project's operational achievements. Ship's Managers B. Perkins and J. Duke; Captains J. Clarke, L. Dill and S. Shuman; Drilling Superintendents J. Guess, J. Ruddell and A. Wheeler and their dedicated staffs have earned the appreciation to all involved with the Project.

M. N. A. Peterson
Principal Investigator
Project Manager
IPOD/DSDP/SIO

OPERATIONS RESUMES

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Dr. William W. Hay, Joint Oceanographic Institutions, Inc.
Dr. Jean-Claude Sibuet, Centre Oceanologique de Bretagne
Cruise Operations Manager:
Mr. Robert R. Knapp, Deep Sea Drilling Project

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Special Tools Technician:
Mr. Perry Dempsey, Deep Sea Drilling Project

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Cruise Co-Chief Scientists:
Dr. Felix Gradstein, Geological Survey of Canada
Dr. Robert Sheridan, University of Delaware
Cruise Operations Manager:
Mr. Glen N. Foss, Deep Sea Drilling Project

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Dr. Felix Gradstein, Geological Survey of Canada
Dr. Robert Sheridan, University of Delaware
Cruise Operations Manager:
Mr. Robert R. Knapp, Deep Sea Drilling Project

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Dr. Richard T. Buffler, University of Texas
Dr. Wolfgang Schlager, University of Miami
Cruise Operations Manager:
Mr. Robert R. Knapp, Deep Sea Drilling Project

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Dr. Bernard Biju-Duval, Institut Francaise du Petrole
Dr. J. Casey Moore, University of California, Santa Cruz
Cruise Operations Manager:
Mr. Glen N. Foss, Deep Sea Drilling Project

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Dr. Roy D. Hyndman, Pacific Geoscience Centre (Canada)
Dr. Matthew H. Salisbury, Deep Sea Drilling Project
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Mr. Robert R. Knapp, Deep Sea Drilling Project

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Cruise Co-Chief Scientists:
Dr. Pierre C. De Graciansky, Ecole Nationale Superieure des Mines
Dr. C. Wylie Poag, U. S. Geological Survey
Cruise Operations Manager:
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Dr. David G. Roberts, Institute of Oceanographic Sciences (U.K.)
Dr. Detmar Schnitker, University of Maine
Cruise Operations Manager:
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Cruise Co-Chief Scientists:
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Cruise Operations Manager:
Mr. Michael A. Storms, Deep Sea Drilling Project

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Cruise Co-Chief Scientists:
Dr. Henri Bougault, Centre Oceanologique du Bretagne
Dr. Steven C. Cande, Lamont-Doherty Geological Observatory
Cruise Operations Manager:
Mr. Glen N. Foss, Deep Sea Drilling Project

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Cruise Operations Manager:
Mr. Glen N. Foss, Deep Sea Drilling Project

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Cruise Co-Chief Scientists:
Dr. Roger Anderson, Lamont-Doherty Geological Observatory
Dr. Jose Honnorez, University of Miami
Cruise Operations Manager:
Mr. H. Graham Norrie, Chevron U.S.A.

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Cruise Co-Chief Scientists:
Dr. Jean Aubouin, Universite Pierre et Marie Curie
Dr. Roland Von Huene, U. S. Geological Survey
Cruise Operations Manager:
Mr. Glen N. Foss, Deep Sea Drilling Project

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Cruise Operations Manager:
Mr. David P. Huey, Deep Sea Drilling Project

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
OPERATIONS RESUME
LEG 71

Leg 71 of the Deep Sea Drilling Project was the first voyage of the GLOMAR CHALLENGER into high-latitude waters in more than two years. Operating areas were on the Falkland Plateau and in the extreme southeast Argentine Basin. Latitudes of the drill sites ranged from 46 to 51 degrees south. Despite adverse operating conditions and resulting weather delays, significant contributions were made to the understanding of South Atlantic paleoenvironment during Cenozoic and Mesozoic time. Six holes were drilled at four sites with one reaching igneous basement. As usual many new questions were raised by the findings of the expedition.

The voyage commenced on December 28, 1979 at Valparaiso, Chile and terminated on February 21, 1980 at Santos, Brazil. Total length of the leg was 55.1 days; of which 21.9 days were spent on-site; 6.2 days in port and 27.0 days under way. 5.4 operating days were lost due to weather and 0.2 day to mechanical breakdowns.

VALPARAISO PORT CALL

Leg 71 began officially at 0653 hours, December 28, 1979 when the GLOMAR CHALLENGER dropped anchor in the harbor of Valparaiso, Chile. Later that day the vessel was moved to a fuel anchorage where 263,800 gallons of diesel fuel were loaded. On December 29, another move was made to a general cargo berth. Port call activities consisted mainly of routine crew change, maintenance, inspection and resupply functions. DSDP cores and the CNEXO X-ray fluorescence van were offloaded for shipment. Unfortunately much of the oncoming freight consigned by both SIO and GMI was delayed by holiday shipping difficulties and was not received by the vessel.

VALPARAISO TO PUNTA ARENAS

The CHALLENGER departed Valparaiso at 0842 hours on January 3, 1980 with a partial scientific and technical staff for a "deadhead" transit to Punta Arenas. Maintenance jobs begun in Valparaiso were completed during this portion of the voyage. These included rewiring of the emergency power A-C switchboard and minor work on the dynamic positioning control system.

Rough weather slowed the vessel as she progressed southward off the coast of Chile. At Golfo Trinidad the CHALLENGER left the open sea and completed the transit to Punta Arenas through the canals of the Southern part of the Chilean "Inside Passage" and through the Straits of Magellan. An average speed of 8.84 knots was made good and the anchor was let go at Punta Arenas at 1242 hours, January 10.

PUNTA ARENAS PORT CALL

The stop at Punta Arenas was for the purpose of embarking eleven scientists and five Scripps personnel. Two SIO and two GMI employees departed the ship. In addition, fresh vegetables and seafood and a small amount of air freight were loaded. Unfortunately about half of an "emergency" air freight shipment sent to Punta Arenas failed to arrive. As the equipment was related to a new coring device that was not essential to the voyage, the vessel weighed anchor and departed for Site 511 at 1535 hours the same day.

PUNTA ARENAS TO SITE 511

The route to the first drill site took the CHALLENGER through the remainder of the Straits of Magellan, then eastward skirting the Falkland Islands to the south and on to the Falkland Plateau. Progress was slowed, first by headwinds, then by low visibility fog. The average speed of advance was held to 8.32 knots. The positioning beacon was launched at Site 511 at 0611 hours, January 15.

SITE 511 - FALKLAND PLATEAU

The first drill site was located about 410 miles east of the Falkland Islands (Islas Malvinas) and 390 miles northwest of South Georgia Island. Pipe operations progressed routinely and Hole 511 was spudded in 2602 meters of water at 1740 hours, January 15.

The hole was then continuously cored with fairly good core recovery through the first 80 meters, including about three meters of sand through cobble-sized ice-rafted material at the seafloor. Recovery in semiconsolidated oozes from 80 to 240 meters below seafloor (BSF) was a disappointing 30 per cent. The material was washed away with minimum rig pump circulation and was "dry" enough to jam the core barrel when the pump was stopped. This situation was aggravated by pebbles and manganiferous material that fell into the hole from the seafloor during the wireline trips to retrieve cores. Firmer oozes, clays and claystones were then penetrated with an excellent 75 per cent recovery rate to a total depth of 632 meters below seafloor (BSF). Successful temperature probe measurements were taken at 52.5 and 119 meters BSF.

Coring operations were terminated at the depth limit imposed by the JOIDES Safety Panel. Since a second hole was planned at the site and since time available for the voyage was short, the bit was not released for open-hole logging. The hole was flushed with mud and a gamma ray-neutron log was run through the drill pipe.

During the logging operation a heavy swell developed rapidly. As preparations were being made to plug the hole with cement, maximum operating limits for vessel roll were reached. It was necessary to abandon the plugging attempt and to pull pipe immediately. The safety of the drill string was in jeopardy.

Two hours later, when the bit had been pulled clear of the seafloor, weather conditions showed signs of stabilizing. The pipe trip was stopped and, after an additional hour of waiting, conditions had improved enough to spud a second hole.

The vessel was offset 300 meters to the south and an inner core barrel was pumped down in preparation for spudding. No pressure kick occurred after an ample interval of pumping. This was indication that the inner barrel had not seated properly at the bit and had probably been pumped out through open-ended pipe. It was a definite sign that successful coring could not be done and a pipe trip was started immediately.

When the drill string had been recovered, it was discovered that the hydraulic bit release had operated prematurely. The bit and associated components had been detached during or after the logging operation, leaving open-ended pipe.

SITE 511 to SITE 512

The CHALLENGER departed Site 511 to 0342 hours, January 21 in good weather. Site 512 was located 245 miles to the east-northeast and the transit was slowed by deteriorating weather. A strong gale was blowing as the vessel approached the drill site. Seas over the main deck and increasing vessel motion resulted in considerable difficulty in handling the positioning beacon as it was prepared for launch.

The beacon was dropped at 1105 hours on January 22, and the seismic gear was retrieved. On turning the vessel to return to the site, the beacon signal was not reacquired. As weather conditions had become too rough for pipe operations, the vessel hove to to ride out the gale. Although the depression was not particularly intense for the locality, the ship's barometer reading went off scale at 965 millibars. Wind velocity reached approximately 55 knots, but conditions moderated within about 12 hours. The vessel drifted about 40 miles off site and about 6 1/2 hours were spent in returning to the location and acquiring the beacon signal. An additional 14 hours were then spent positioning on the beacon while conditions improved to the point where vessel motion and stationkeeping remained within the limits required for pipe operations. The pipe trip began at 2330 hours, January 23.

HOLE 512 - MAURICE EWING BANK

At the beginning of the pipe trip, weather conditions were marginal but apparently improving. However it was necessary to interrupt the trip on two occasions to reposition the ship and to find the optimum heading to minimize roll. This was due primarily to a strong current aligned at a high angle to the wind and swell.

The corrected precision depth recorder (PDR) reading at Site 512 and 1846 meters. A 12 kHz beacon strapped to the drill pipe was employed to improve the accuracy of the depth determination and hopefully to avoid lost time spent on "water cores". The reading utilizing the beacon in conjunction with the PDR recorder was 1844 meters. Accordingly the first hydraulic piston core attempt covered an interval from 1842 to 1846.4 meters. A two and one half meter sediment core was recovered, establishing the water depth at 1845.9 meters.

The piston corer recovered 9.3 meters of ice-rafted sand, gravel and cobbles before encountering an interval of ooze and chalky ooze. This material was older than anticipated and consequently stiffer and dryer than expected. After a total penetration of 77.9 meters, the sediment was judged to be too well indurated to warrant further piston coring operations.

The hole was filled with drilling mud and the pipe was retrieved for the conversion to a conventional rotary coring BHA. During the round trip it was again necessary to shut down twice to position the vessel and minimize roll.

HOLE 512A

Hole 512A, offset 30 meters to the north of Hole 512, was spudded at 2206 hours, January 25. The previously-cored interval was drilled to 50.5 meters BSF where a temperature probe measurement was made. After further drilling to 72.5 meters, continuous coring began. The inner core barrel retrieved from the first 9.5 meter attempt contained only water. The previous inner barrel, which had been in place during the drilling, had contained several cobbles and pebbles in the core catcher. It was felt that some of the ice-rafter material from near the seafloor could have fallen to the bottom of the hole and subsequently jammed the throat of the core bit. A bit deplugger was therefore made up on an inner barrel and pumped down to punch out any obstruction. A normal seating pressure kick was noted, indicating that the obstruction had been cleared or had not existed.

During this time the strong crosscurrent and a freshening wind had renewed positioning problems. A satisfactory heading was found only after a 30-minute delay and core #2 was attempted. However the wind soon began kicking to 35 knots, taxing the positioning system to its limits. Coring was halted before the full 9.5 meters had been cut. The hole was quickly filled with mud and one joint of drill pipe was set back. At this point the wind had decreased somewhat and the core was retrieved. Full core recovery had been achieved, but the weather lull proved to be only temporary. The vessel was being pushed off station and it was necessary to pull the bit above the seafloor for the safety of the drilling assembly. Then six hours were spent waiting for a change in weather/current that would enable the vessel to maintain station and stay within roll limitations. There was finally no alternative but to recover the drill string while maintaining a minimum roll heading and being pushed slowly off site by the current.

Three hours after the pipe had been recovered, conditions had moderated and the pipe was run back for an attempt at a third hole. Before the trip to the seafloor was completed, however, the current had again strengthened. The interaction of the current with two sets of swells and a relatively light wind simply would not permit the vessel to maintain station on any heading without excessive roll. After a frustrating additional five hours of alternately repositioning the ship and resuming the trip, it became apparent that sustained drilling operations would be thwarted by the prevailing conditions at Site 512. The drill string was recovered and the vessel was under way for the next site at 1345 hours, January 27.

SITE 512 TO SITE 513

The route to the next proposed drill site took the vessel about 775 miles due east. Several icebergs were detected by radar only a few hours after departure from Site 512. It was necessary to detour about 50 miles to the north and take a parallel track to avoid these bergs and many more along the route. Nearly all ice encountered was noted to be south of 49 degrees south latitude.

A positioning beacon was launched at 0628 hours, January 31 at proposed Site AB-3 in the southeast Argentine Basin. PDR water depth was 3991 meters. The pipe trip proceeded in the normal manner, except that the BHA was given its bimonthly magnaflux inspection as it was madeup. The wind began increasing as the long string of pipe was assembled. The trip was halted as gusts reached 35 knots and seas became a factor from the standpoint of vessel motion. After 2 1/2 hours it was apparent that the weather was more than transitory and was continuing to deteriorate. With the bit only about 900 meters above the seafloor, it was necessary to reverse the trip and begin retrieving the drill string. During the reassignment of D.C. generators for proper power distribution for the trip, power to one of the main shafts was interrupted momentarily. This caused the vessel to lose heading and take a series of heavy rolls. One joint of drill pipe was bent and was removed from the string.

As the pipe trip proceeded in gale force winds, a group of icebergs of various sizes approached and literally surrounded the ship. The combined forces of wind and current were moving the bergs at speeds as high as three knots. This was the same ice that the vessel had passed while enroute to the site and more was known to be headed for the area. The hazard to the ship posed by the ice was considered too great for continued operations in the immediate area. Two hours were required to maneuver clear of the ice field before the vessel could be stopped and the positioning hydrophones housed for steaming.

At 0600 hours, February 1, the CHALLENGER got under way for an alternate drill site some 180 miles to the northwest. A beacon was dropped at the "new" Site 513 at 0548 hours, February 2.

HOLE 513 - SOUTHEAST ARGENTINE BASIN

The pipe trip and beginning of coring operations at the new site were routine. The PDR water depth was 4383 meters and 4381 meters was established by drill pipe measurement on the first core. Hole 513 was spudded at 1711 hours, February 2. By midnight the wind had begun to rise and at 0800 hours the following morning, vessel motion had reached operational limits due to growing seas. Coring operations were abandoned after 104 meters penetration and the drill string was pulled.

Strong gale conditions persisted through the pipe trip and vessel pitch reached twelve degrees. The bit was brought on deck at 1710 hours. A wait of 8 1/2 hours ensued while wind and swell conditions returned to levels suitable for handling pipe.

HOLE 513A

With weather conditions improving, the drill string was run back to the seafloor for a second attempt to core to basement. Hole 513A was spudded at 1315 hours, February 4. The hole was drilled ahead to a depth of 56.5 meters BSF. The interval corresponding to the lower 47.5 meters of Hole 513 was recored due to low core recovery on the earlier attempt. Much better results were achieved on the second try and coring proceeded smoothly to about 235 meters, where a difficult stratum of nannofossil ooze was encountered. The material was quite dry and firm, but seemed virtually to disintegrate on contact with water. Continuous circulation could not be used. After considerable experimentation, a technique of alternate "dry drilling" and breaking circulation was developed that produced satisfactory recovery. Nevertheless an interval of about 85 meters was cored with only 18.5 per cent recovery.

Chert and igneous rock were encountered at 380 meters BSF. Due to a rate of penetration of less than one meter per hour and to scheduling pressures, operations were terminated after only six meters of basalt basement had been penetrated. The pipe was recovered and the bit was brought on deck at 1810 hours, February 7.

SITE 513 to SITE 514

Departure from Site 513 was delayed for two hours while replacement of a bearing in propulsion motor Number One was completed.

The transit to Site 514 was completed in 20 1/2 hours. Two icebergs were passed at a safe distance and were the last to be seen on the voyage. A beacon was dropped at the new location, 130 miles to the northwest at 1709 hours, February 8, after a four-hour survey.

SITE 514 - SOUTHEAST ARGENTINE BASIN

The coring plan for Site 514 called for hydraulic piston coring of the Neogene sediment section, which was expected to be no more than 200 meters thick. After 43 hours, 150 meters had been cored and the base of Pliocene sediments had not been reached. It was then decided that, with limited operating time remaining, scientific objectives could best be met by coring the entire section to basement (about 430 meters). A round trip was begun for the conversion to a rotary coring bit and BHA.

By the time the bit had reached spud-in position, however, weather conditions had deteriorated to a marginal level as wind gusts exceeded 35 knots. Operations were halted in anticipation of better conditions following the passage of the weather front. After 5 1/2 hours, the wind had not abated and growing seas were causing vessel motion to approach operational limits. The drill string was retrieved while it was hoped that conditions would improve and the trip could be reversed. No real signs of improvement were noted until the drill pipe had been recovered and only the BHA remained below the vessel. After another 2 1/2 hour wait, wind, vessel motion and stationkeeping conditions had improved sufficiently to resume operations. The wind and seas continued to decrease for an additional three hours while the drill pipe was run. Then, within a short time, the wind changed direction nearly 180 degrees and regained its former strength. This caused a confused sea and swell condition which resulted in unavoidable rolling of the ship and disrupted positioning. With the BHA and 104 stands of pipe suspended, a stand of extra high-strength pipe was picked up and another wait began. When over four hours had elapsed and conditions had not improved enough for spudding, it was finally conceded that too much time had been lost to weather delays for further scientific objectives to be attained.

The drill string was recovered for the final time and the rig was secured for getting under way. Ironically, when the vessel departed Site 514 at 2328 hours, February 12, operating weather conditions were quite good.

SITE 514 TO SANTOS

The weather delay and consequent early termination of operations at Site 514 resulted in departure for Santos 24 hours sooner than had been anticipated. The distance to be traveled was over 1600 nautical miles and it was calculated that 8 1/2 days would be required for the transit at eight knots. This is somewhat slower than the CHALLENGER's normal speed, but headwinds and adverse currents were anticipated, based on pilot charts and previous experience on Leg 36. The tract was laid out to cross DSDP Site 358 and proposed drill Site AB-10. This provided a valuable reference seismic profile and added only 17 miles to the voyage.

Relatively good weather conditions prevailed during the transit and an average speed of advance of 8.8 knots was made. Leg 71 came to its official end when the first mooring line was put over at Berth 37, Santos, Brazil at 0812 hours, February 21, 1980.

DRILLING AND CORING EQUIPMENT

The standard DSDP bottomhole assembly was used on Holes 511, 512A, 513 and 513A. This consists of a bit, hydraulic bit release, one 8 1/4" drill collar, coring top and head subs, three 8 1/4" drill collars, one five-foot stroke bumper sub, three 8 1/4" drill collars, two bumper subs, two 8 1/4" drill collars, crossover sub, and one 7 1/4" drill collar. The hydraulic piston coring BHA used on Holes 512 and 514 consisted of bit, bit sub, one 8 1/4 drill collar, top sub, special HPC head sub, three 8 1/4 drill collars, two five-foot stroke bumper subs, two 8 1/4 drill collars, crossover sub and one 7 1/4 drill collar. The second bumper sub was added between the drill collar stands due to the abnormal swell and heave conditions encountered.

The only problem of consequence involving drilling equipment was the spontaneous actuation of a hydraulic bit release following completion of operations in Hole 511. This occurrence appeared to be the result of a highly unusual combination of vessel heave, hole conditions and operating procedures. There is little prospect of future occurrences and design modifications do not appear warranted.

The heave compensator was deployed on Holes 511 and 512A. The mechanism functioned well, limiting bit weight fluctuations to 2000 to 3000 pounds with vessel heave reaching about 1.5 meters total amplitude. The compensator was not utilized for the remainder of the voyage, however, due to unstable weather conditions and the delay and hazard inherent in handling the machinery in rough weather. Core recovery problems in soft nannofossil ooze were solved by substituting flapper-type core catchers (normally used with the piston corer) for the standard soft-formation finger type catcher. The material was apparently being washed out through the core catcher during retrieval of the inner barrel. At greater depths, the ooze became dryer and semi-indurated and presented a more challenging recovery problem. The sediment was too firm to permit penetration of the drill without circulation of drilling fluid. It apparently disintegrated on contact with water, however, and no core was recovered when even minimum continuous pumping was maintained. It was necessary to develop a technique of "dry drilling" with frequent pauses to break circulation. Considerable bit weight was required and it was often necessary to raise the bit off bottom to establish circulation. This slowed the coring operation considerably, but fair recovery was achieved. Core recovery was also affected adversely by ice-rafted cobbles and pebbles falling into the hole from near the seafloor during subsequent coring operations.

CORE BITS

Holes 511 and 513 were cored with 9 7/8" Smith F93CK core bits. Drilling was easy and was not much of a test for the bits. The long chisel inserts gave a very good penetration rate through the hard clays encountered at depth in Hole 511.

A modified 11 1/2 inch "wide-throat" piston coring bit was used for the HPC operations at Holes 512 and 514. There were no problems and the bit remains in excellent condition.

Hole 513 was cored with a bit assembled in the SIO shop from new Hughes Tool cutting components and a used Smith body. 380.5 meters of ooze and chalky ooze and 6.5 meters of basalt were penetrated. Core recovery problems encountered in the ooze were similar to those of Hole 511 with a standard bit and it is difficult to judge whether the longer core throat of the new bit was a factor in the low recovery. The average penetration rate in the basalt was a disappointing 0.8 meters per hour. Core recovery in the basalt was 75 per cent, however, and fairly long, unbroken sections of core were obtained. This is attributed to the fact that the hughes/MSDS bit cuts a core about 25 millimeters smaller in diameter than a standard bit. Unfortunately the same feature prevented passage of a temperature probe past the bit cones on an unsuccessful heat flow measurement.

SPECIAL TOOLS

The hydraulic piston coring system was utilized at Holes 512 and 514. No problems of consequence were experienced with the basic coring mechanism. Buytrate core liner failures caused considerable difficulty in removing cores from inner barrels and disturbance of the cores at Hole 512 where sediments were quite stiff. Some liner failures occurred at Hole 514, but they were not a major problem. Sequential relative orientation of cores was attempted, but met with only limited success due to multiple and ambiguous marks on the aluminum landing rings. Drill pipe rust flakes were again a detrimental factor in paleomagnetic investigations.

Three temperature probe measurements were attempted. Two runs in Hole 511 were successful. The attempt in Hole 512A was unsatisfactory due to the failure of the probe to pass through the throat of the core bit. The motion compensator was used for all three runs and was effective in decoupling vessel heave in fairly soft sediments with much less bit weight than would be necessary if the bumper subs were utilized.

Excellent Eastman deviation survey results were achieved in Hole 511 with the motion compensator in use. Several surveys were attempted in subsequent holes without the compensator, but no satisfactory readings were obtained due to the effects of vessel motion.

LOGGING

No open-hole logs were requested or attempted on Leg 71. As a second hole was planned at Site 511, the bit was not released for logging and a through-pipe gamma ray-neutron log was run. A fairly good quality log was recorded, but attenuation of the signal by the drill pipe and the monotonous character of the sediment diminished its usefulness. A few noise spikes were noted on the gamma ray curve. They increased in number on subsequent repeat runs. It is felt that the gamma ray curve was somehow affected by its confinement with the neutron source inside the steel drill pipe. On earlier legs the gamma ray curve of the open-hole neutron log has been seriously disturbed at times when the tool was inside pipe or in open basalt hole, but never in open sediment hole.

DYNAMIC POSITIONING AND BEACONS

Operations were affected by only one malfunction of the dynamic positioning system. While repositioning over the beacon at Site 512 between weather breaks, intermittent operation of the main screws while backing down was noted in the semi-automatic positioning mode. The problem was traced to a dirty or loose electrical contact on a relay driver curcuit card in the positioning computer.

During the coring the Hole 511, it was necessary to offset the vessel about 100 meters to alleviate stress of the drill pipe against the guide horn. This phenomenon did not recur on subsequent sites and may have been caused by a deep-running local current.

All other stationing problems experienced were simply the result of the vessel's thrusters and/or main screws being "outmuscled" by the elements.

Five ORE positioning beacons were deployed during the course of the voyage. No positioning difficulties were attributed to beacons. They all maintained a strong and satisfactory signal for the duration of site occupancy, although the longest such period was less than six days.

A positioning beacon with its frequency modified to 12 kilohertz was attached to the drill pipe with a special bracket and used as an aid in determining water depth for Holes 512 and 514. The depth as determined by the beacon was within one meter of the drill pipe depth in both cases. One "water core" wireline trip was saved by this measure as the PDR depth was found to be 4.2 meters shallow at Site 514.

ENGINEERING

A rash of bearing failures plagued the ship's power generating and propulsion equipment. Two D.C. generator bearings and two D.C. propulsion motor bearings were replaced during the voyage. Fortunately it was not necessary to make any of the repairs during coring operations when the use of all engines and generators was required. Departure from Site 513 was delayed by two hours while the port shaft was immobilized for the replacement of the bearing in propulsion motor number one.

A major project undertaken by the Engineering Department during the cruise was the installation of an additional auxiliary cooling water system. The system will circulate chromate-treated fresh water from ship's tanks to cool reefer and chiller units, reduction gears and air compressor aftercoolers. This will leave the presently installed (and overloaded) auxiliary seawater cooling system for the ship's air conditioning system, the three SIO high pressure air compressors and other scientific equipment. The system is about 60 per cent complete pending the arrival of additional parts.

WEATHER AND CURRENTS

Weather conditions (including icebergs and currents) kept operational strategy on the defensive for the entire voyage. At every drill site, either a delay of operations or an early hole abandonment was involved. Actual weather downtime accounted for just under 25 per cent of site time. In addition, drilling, coring and tripping operations and ship's transit speed were slowed appreciably by inclement weather conditions.

Weather observations recorded during the 33 day period from departure from Punta Arenas to departure from Site 514 measured an average wind velocity of over 16 knots. Winds exceeded 35 knots on seven days. The weather pattern was about normal for the area and season and no real storms occurred, although weather maps indicated that one was approaching as the vessel departed the final site.

Currents were expected to be light and not a significant operational factor. There was evidence of considerable current, however, at both Falkland Plateau sites. A surface current from the south to southwest at Site 512 was estimated to approach a velocity of two knots at times and was the determining factor in abandoning the site. Satisfactory positioning was impossible when the current and wind vectors were divergent.

Although the operating localities were known to be within the area of Antarctic iceberg occurrence, considerably more ice was encountered than had been anticipated. Contact was maintained with Palmer Station, Antarctica for ice information. They could only provide the locations of bergs more than ten miles across, however, as their only source of information for the area was satellite imaging. The concentrations of smaller bergs encountered by the CHALLENGER were in the general areas of such "megabergs" reported earlier by Palmer and were probably the result of their breakup. Icebergs were the determining factor in abandoning the originally planned location (AB-3) for Site 513. Wind and current driven bergs were tracked at up to three knots as they approached and passed the vessel's position.

In general, weather forecasting was of little operational value. The operating area was situated on the fringes of facsimile map coverage from Chile, Argentina and South Africa. Surface analysis and prognosis maps were received infrequently due to poor radio reception and the maps that were received bore little semblance to reality. The rapidly changing weather patterns permitted only reaction, not anticipation.

COMMUNICATIONS

Radio communications conditions were somewhat better than had been anticipated due to the remoteness of the operating area. Routine traffic for DSDP and GMI headquarters was handled on a daily basis through Scripps radio station WWD. The optimum "window" for communications was fairly late in the evening (ship's time), resulting in daily operational summaries being about 20 hours old before they reached San Diego. In addition to occasional radio-telephone contact with Palmer Station for ice information, the normal amount of weather, AMVER and required vessel-location traffic was sent.

It was also possible to make good quality amateur radio phone patches to the U. S. on a regular basis. This was a significant morale factor for those wishing to make personal phone calls. Commercial calls were placed to the U. S., Germany and Argentina for members of the scientific staff.

PERSONNEL

Morale remained fairly high for the duration of the voyage among virtually the entire complement. Particular credit is due the GMI drilling crew, who were required to work long hours in cold, miserable weather and often hazardous conditions of vessel motion. Several of these pipe trips were futile due to changing weather conditions. The rig crew maintained a positive attitude despite the fact that half the men were inexperienced in their jobs due to recent high personnel turnover.

The SIO technical staff turned in its usual professional effort. Handling of the towed profiling gear in heavy weather was a particular challenge. The scientific staff, for the most part was philosophical and understanding in the face of frustrations due to weather delays, aborted sites, etc. No serious illnesses or injuries occurred during the voyage.

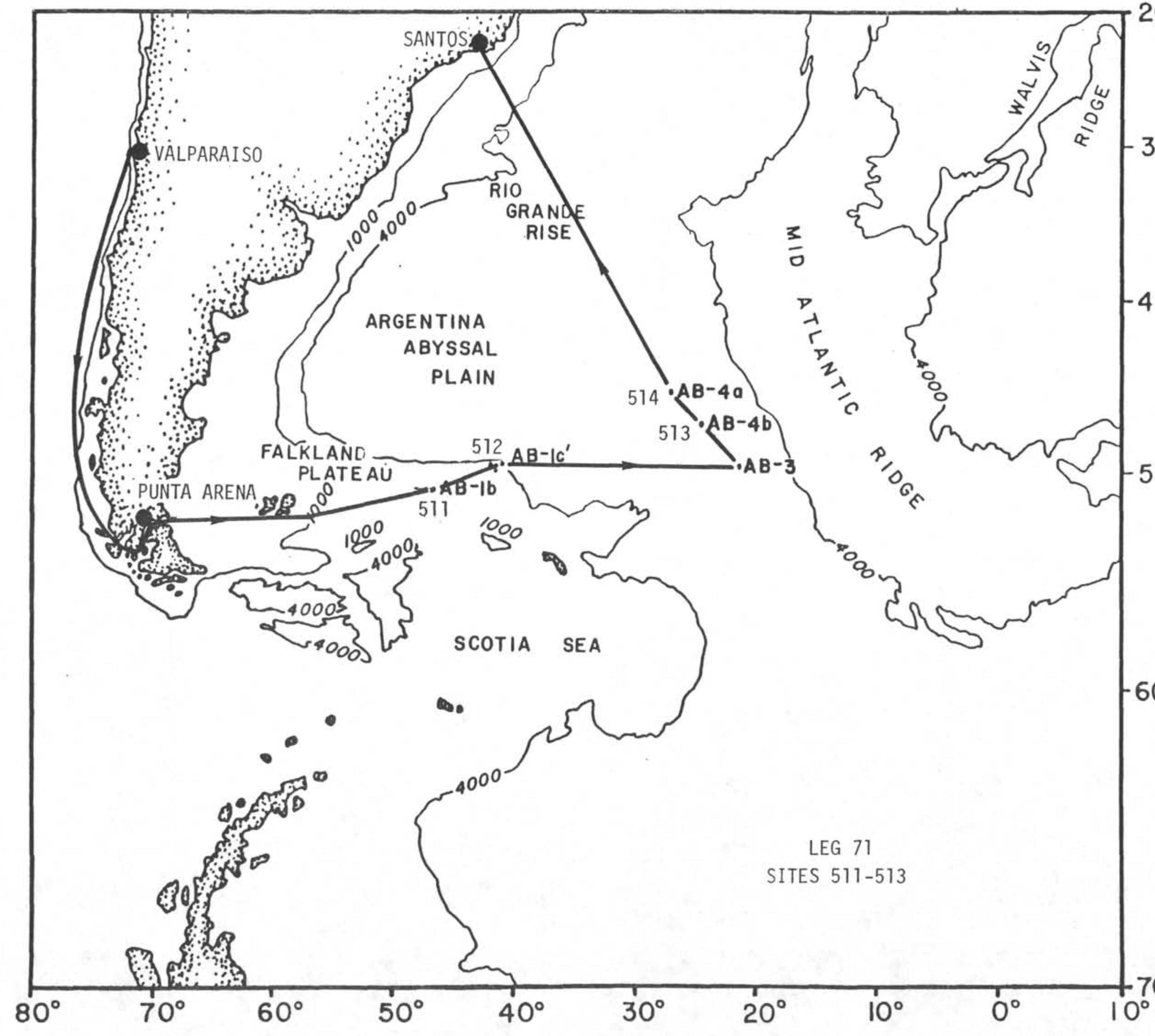
Glen N. Foss
Cruise Operations Manager
Deep Sea Drilling Project

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
OPERATIONS RESUME
LEG 71

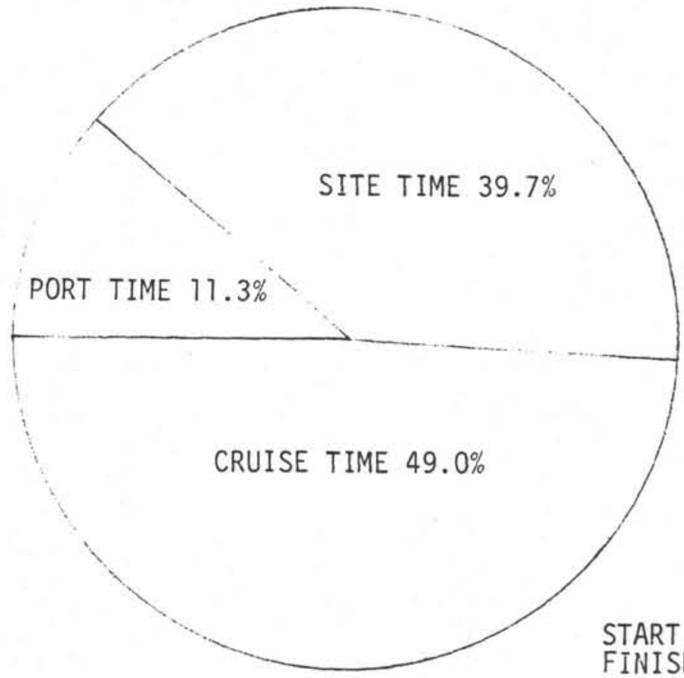
Total Days (December 28, 1979 - February 21, 1980)	55.05
Total Days in Port	6.20
Total Days Under Way	26.99
Total Days On Site	21.86

Trip Time	4.2
Drilling Time	0.1
Coring Time	10.6
Downhole Measurements	0.6
Mechanical Downtime	0.2
Weather Downtime	5.4
Other	0.8

Total Distance Traveled (Nautical Miles)	5466.1
Average Speed (Knots)	8.3
Sites Investigated	4
Holes Drilled	6
Number of Cores Attempted	173
Total Meters Cored	1303.0
Total Meters Recovered	822.4
Per Cent Recovery	63.1
Total Meters Drilled	138.5
Per Cent Penetration Cored	90.4
Maximum Penetration (Meters)	632.0
Minimum Penetration (Meters)	77.9
Maximum Water Depth (Meters)	4381.0
Minimum Water Depth (Meters)	1843.9
Total Penetration (Meters)	1441.5

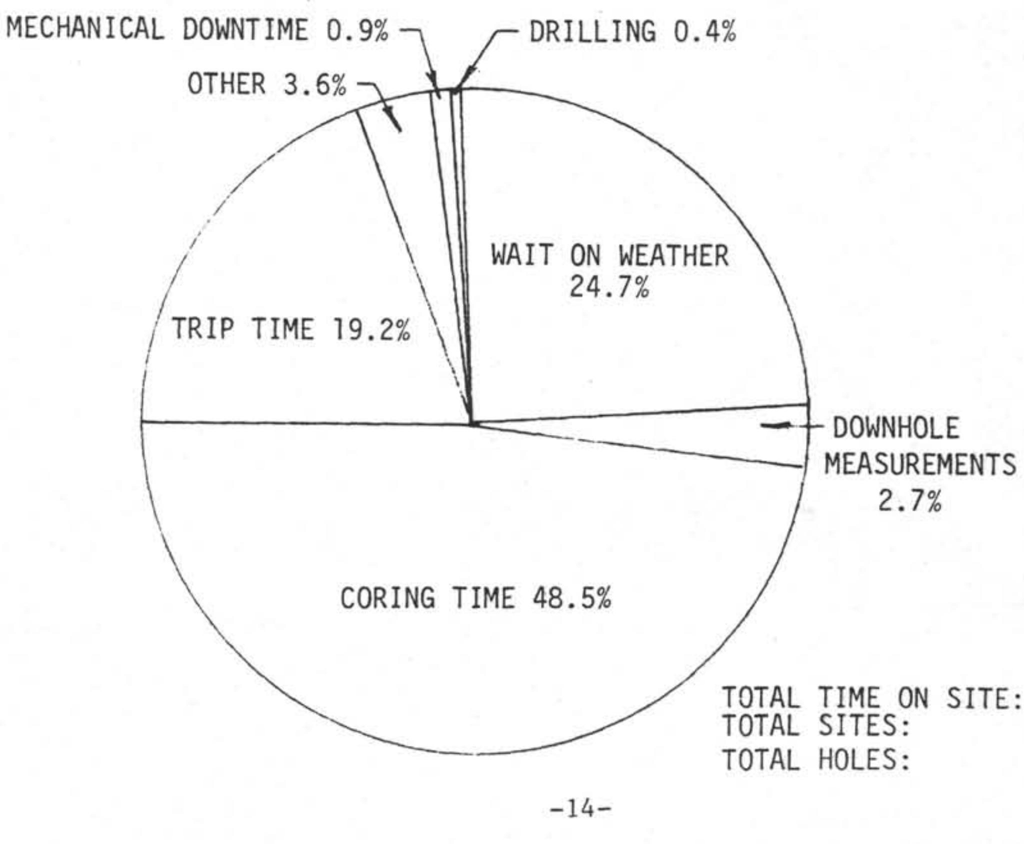

SANTOS
VALPARAISO
RIO
GRANDE
RISE
WALVIS
RIDGE
1000
4000
ARGENTINA
ABYSSAL
PLAIN
MID
ATLANTIC
RIDGE
514
AB-4a
513
AB-4b
512
AB-Ic'
AB-3
FALKLAND
PLATEAU
AB-Ib
511
PUNTA ARENA
SCOTIA SEA
LEG 71
SITES 511-513
20°
30°
40°
50°
60°
70°
80°
70°
60°
50°
40°
30°
20°
10°
0°
10°

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
TOTAL TIME DISTRIBUTION
LEG 71



START LEG: December 28, 1979
FINISH LEG: February 21, 1980
TOTAL TIME: 55.05 Days

ON-SITE TIME DISTRIBUTION
LEG 71



TOTAL TIME ON SITE: 21.86 Days
TOTAL SITES: 4
TOTAL HOLES: 6

DEEP SEA DRILLING PROJECT
TIME DISTRIBUTION
LEG - 71

Date	Site No.	Cruise	Trips	Drill	Core	Stuck Pipe	W.O.W.	Position Ship	Mech. Repair	Port Time	Re-Entry	Other	Total Time	Remarks
12/28/79 01/10/80		170.8								145.8		1.2	317.8	Valparaiso to Punta Arenas
01/10/80 01/15/80		110.6								2.9			113.5	Punta Arenas to Site 511
01/15/80 01/21/80	511		16.4		105.4	0.4	1.0	12.7	1.0			4.6	141.5	Site 511
01/21/80 01/21/80		31.4											31.4	511 to 512
01/22/80 01/25/80	512		14.6		19.8		38.4					2.5	75.3	Hole 512
01/25/80 01/28/80	512A		13.0	2.1	3.1		23.1	1.9	1.3			2.8	47.3	Hole 512A
01/27/80 02/02/80		112.5											112.5	512 to 513
02/02/80 02/03/80	513		19.0		14.9		20.0					5.0	58.9	Hole 513
02/03/80 02/07/80	513A		18.7	1.2	67.6		8.6	0.7	2.0			0.5	99.3	Hole 513A
02/07/80 02/08/80		20.7											20.7	513 to 514
02/08/80 02/12/80	514		18.2		42.7		38.5					2.9	102.3	Site 514
02/12/80 02/21/80		200.7											200.7	Site 514 to Santos
		646.7	99.9	3.3	253.5	0.4	129.6	15.3	4.3	148.7	0	19.5	1321.2	Totals.

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
SITE SUMMARY
LEG 71

HOLE	LATITUDE	LONGITUDE	WATER DEPTH METERS	NUMBER OF CORES	CORES WITH RECOVERY	PERCENT OF CORES WITH RECOVERY	METERS CORED	METERS RECOVERED	PERCENT RECOVERED	METERS DRILLED	TOTAL PENET METERS	AVG RATE PENET	TIME ON HOLE	TIME ON SITE
511	51° 00.28'S	46° 58.30'W	2602.0	70	68	97.1	632.0	385.5	61.0	0	632.0	26.5	141.5	141.5
512	49° 52.194'S	40° 50.713'W	1843.9	19	19	100.0	79.9	66.8	85.8	0	79.9	- -	75.3	
512A	49° 52.17'S	40° 50.71'W	1844.0	2	1	50.0	17.3	7.8	44.9	72.5	89.8	78.1	47.3	122.6
513	47° 34.99'S	24° 38.40'W	4381.0	11	6	54.5	104.0	53.8	51.7	0	104.0	189.1	35.4	
513A	47° 34.99'S	24° 38.40'W	4381.0	36	35	97.2	321.0	169.1	52.7	66.0	387.0	21.7	99.3	134.7
514	46° 02.77'S	26° 51.30'W	4322.2	35	34	97.1	150.8	139.4	92.4	0	150.8	- -	63.3	102.3
			TOTALS	173	163	94.2	1303.0	822.4	63.1	138.5	1441.5	- -	- -	501.1

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
BIT SUMMARY
LEG 71

HOLE	MFG	SIZE	TYPE	SERIAL NUMBER	METERS CORED	METERS DRILLED	METERS TOTAL PENET.	HOURS ON BIT	CONDITION	REMARKS
511	Smith	9 7/8	F93CK	651KR	632.0	-----	632.0	23.8	Unknown	Released accidentally
512	MSDS	11 1/2	HPC	Maude	77.9	-----	77.9		Excellent	
512A	MSDS Hughes	9 7/8	Hybrid	H1	17.3	72.5	89.8	1.2	New	Throat too small for h.f. probe.
513	Smith	9 7/8	F93CK	646KR	104.0	0	104.0	0.6	New	Soft ooze only.
513A	MSDS Hughes	9 7/8	Hybrid	H1	321.0	66.0	387.0	17.8	TO-B2SQ-I	Cored 6.5 m basalt in 8 hrs-5 broken teeth all cones handy-19.0 total hours.
514	MSDS	11 1/2	HPC	Maude	150.8	0	150.8		Excellent	

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
BEACON SUMMARY
LEG 70

SITE NO.	MAKE	FREQ kHz	SERIAL NUMBER	SITE TIME HOURS	
511	ORE	16.0	496	141.5	Single life; strong throughout.
512	ORE	13.5	507	75.3	Single life; strong throughout.
512A	ORE	13.5	507	47.3	
			Total Hours	122.6	Good beacon.
513	ORE	16.0	501	23.5	Double life; site aborted, did not spud; beacon OK
513	ORE	16.0	497	99.3	Single life; strong for duration.
514	ORE	13.5	512	102.3	Double life; strong for duration.

DEEP SEA DRILLING PROJECT
LOGGING SUMMARY
LEG 71

HOLE	TOTAL DEPTH (M)	WATER DEPTH (M)	OPEN ENDED PIPE AT (M)	FLUID IN HOLE	BIT SIZE	TOTAL TIME FOR LOGGING (HOURS)	RUN NO.	LOGS RECORDED	FROM (M)	TO (M)	OBSERVATIONS
511	3234	2606		Sea Water	9 7/8	4.8	1	GR-N-CEL	3230	2600	Thru-Pipe log; fair log; 1.5m heave;
						4.0					CEL noisy; a few noise spikes on GR
						8.8	TOTAL				flush hole; rig sheaves, etc.
512	1921.8	1843.9									No logs requested - HPC
512A	1933.8	1844.0									No logs requested.
513	4485	4381									No logs requested.
513A	4768	4381									No logs requested.
514	4473	4322.2									No logs requested - HPC

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
OPERATIONAL RESUME
LEG 72

Leg 72, of the Deep Sea Drilling Project, was the second of five legs that will be studying the Late Mesozoic and Cenozoic paleoenvironments in the South Atlantic Ocean. The five sites were located in the northern exit of the Vema Channel, The Rio Grande Rise, the rise of the plateau on the east flank of the Vema Channel and on the plateau of the east flank. Twelve holes were drilled at these sites and one reached igneous basement. The others contributed significant information to understanding the geologic history in these areas.

The leg commenced on February 21, 1980 at 0812 hours when the first line came ashore at Santos, Brazil and ended 46.92 days later at 0623 hours, April 8, 1980 when the anchor was dropped in the harbor in Santos, Brazil. Total length of the leg was 46.92 days of which 31.85 days were spent on site, 5.54 days in port, and 9.53 days spent underway.

The on-site time breakdown consists of 6.1 days tripping, 0.26 days drilling, 20.88 days coring, 0.45 day making downhole measurements, and 2.08 days waiting on weather, and 2.08 days of miscellaneous items, such as heat flow and pipe motion measurements.

SANTOS PORT CALL

Leg 72 offically began at 0812 hours, February 21, 1980 with the first line ashore at Pier #37 in Santos, Brazil. Port call activities consisted mainly of routine inspection, maintenance, crew change and resupply functions. In addition to these items, the drill pipe was inspected, an X-ray defraction van was placed aboard in the core van area, and 182.805 gallons of fuel was loaded. When all of the necessary items had been completed, the CHALLENGER left the dock to anchor in the harbor and a short wait for the arrival of the last member of the scientific party. With his arrival, the anchor was retrieved and at 2112 hours, February 26, 1980, the CHALLENGER departed for Site 515.

SITE 515 - SOUTHWESTERN BRAZIL BASIN

The first drill site for Leg 72 was located about 553 miles east southeast of Santos, Brazil. At 1520 hours, February 29, a 16.0 kHz ORE beacon was dropped, and when the ship was positioning in the automatic mode, make up of the drill string began. When the drill string make up was completed, the hole was spudded at 0446 hours, March 1. After the mud line core was recovered, establishing ocean bottom at 4265.0 meters, the hole was washed to 39.5 meters subbottom and the second core was cut and recovered. Following the recovery of this core, the new pressure core barrel was dropped and a 6.5 meter core was cut. However, when the sandline was lowered, the core barrel could not be recovered. The tool could be moved up the hole about 30 feet and then would come no more, even with pulls of 12,000-13,000 pounds with the sandline. After a number of attempts, the shear pin in the overshot parted and it was recovered without the pressure core barrel. The drill string was then pulled to find out why the core barrel could not be recovered.

When recovered, the maximum outside diameter of the PCB was found to be 3.875 inches, the same dimension as the inside diameter of the new head sub which was located in the bottomhole assembly. It was to be used with the hydraulic piston core barrel later. It was felt that the PCB had been able to fall through this restrictive area because of its weight and speed of falling, but could not be pulled back with the sandline. Hole 515 was therefore abandoned at 1900 hours, March 1, when the bit reached the derrick floor.

HOLE 515A

Hole 515A, offset 110 feet north and 110 feet east of Hole 515, was spudded at 0836 hours, March 2. The BHA was a shortened (76.03 meters) version of the standard one used for conventional coring, because this hole was to be cored using only the hydraulic piston corer.

After spudding, the hole was continuously cored to a subbottom depth of 107.9 meters. The decision to stop coring at this point was made because the shear strength of the cored material was over 1000 and the amount of material recovered per core was decreasing to less than 3 meters per core. The hole was abandoned at 0900 hours, March 4, when the bit reached the derrick floor.

HOLE 515B

After removing the HPC setup from the drill string, a new bottomhole assembly was made up. Without changing offsets, the drill string was lowered and Hole 515B was spudded at 0900 hours, March 4. The previously cored interval was washed to 94.0 meters below the seafloor where continuous coring began again. The first 20 cores, which were taken in soft sediments, was cored with the heave compensator locked out. As the sediments began to become firmer, the heave compensator was then used until the total depth was reached. Core recovery was excellent, averaging 79.2% which in turn made an excellent geological interpretation of the cored section possible. The primary geologic goal was reached in Core 56 and then one more core was taken to verify this objective. The drill string was recovered and the hole was officially abandoned when the bit reached the derrick floor at 0745 hours, March 9.

SITE 516

The CHALLENGER departed Site 515 at 0829 hours, March 9 and traveled approximately 250 miles south southeasterly and at 1548 hours on March 10, a 16.0 kHz beacon was dropped for positioning purposes at Site 516.

The BHA was made up for use with the hydraulic piston corer. In addition to the BHA, a 12.0 kHz beacon was attached 273.4 meters above the bit to assist in determination of the water depth and thus avoid taking a water core at the mud line. Using the information from this beacon a good mud line core was obtained and established the water depth at 1327.9 meters.

The hole was continuously cored to a subbottom depth of 183.3 meters, when the sediment was considered to be too stiff to justify continued piston coring. Core recovery averaged 80.8%. Four cores were retrieved without recovery, which was attributed to the type of material being cored and not a failure of the piston corer. The hole was officially abandoned when the bit cleared the mud line at 1345 hours, March 12.

HOLE 516A

Without making any offset changes, and continuing to use the hydraulic piston corer, Hole 516A was spudded at 1416 hours, March 12, and again established that the water depth was 1327.0 meters. This hole was cored basically to recover additional material for sampling and would have overlapping cores with those in Hole 516.

One additional change was made to the equipment used in obtaining these cores and that was in the overshot assembly. In an attempt to prevent multiple orientation marks on the orientation ring, a swivel assembly had been added to the overshot, which is used for lowering the hydraulic piston corer in Hole 516. However, this did not eliminate this problem, and a rotary shifting tool was added to the overshot assembly before this hole was spudded. When the second core was recovered, it was discovered that the pin on one of the dogs on this tool had sheared and had to be replaced. Then when the core barrel was being lowered to cut Core #4, it could not be lowered deeper than eight wraps of the sandline from bottom. The tools were recovered and the shifting tool was removed. After this had been done, the tool was lowered to bottom without trouble. While in use on the first three cores only single orientation marks were made and it appeared the problem had been solved. However, after the removal of the shifting tool, the next seven orientation rings had only a single mark, so there is still a question as to whether the tool is the answer to obtaining good orientation data.

After coring to a subbottom depth of 69.5 meters, the drill string was pulled and the hole was abandoned when the bit reached the derrick floor at 0645 hours, March 13.

HOLE 516B

Following the recovery of the drill string, a new bottomhole assembly was made up with a special pressure core barrel bit, and run in the hole. When the bit had reached 1313.5 meters, a special core barrel was assembled. This core barrel was to be used in the instrumented drill string motion experiment. After the timing instrument was set this core barrel was dropped and another instrumented joint of pipe was added to the drill string. Following the installation of this joint, motion readings were recorded with the recording section of the joint 10 feet above the derrick floor, then 10 feet below and, finally, 30 feet below. After these measurements were made, the drill string was lowered and the hole was spudded at 1513 hours, March 13. The hole was washed to 15.6 meters and then a 7.6 meter core was cut. While the core was being cut, the instrument package in the core barrel was recording additional motion data. After the core was cut, the bit was pulled above the mud line at 1530 hours, March 13 and this hole was then officially abandoned.

HOLE 516C

With the drill string hanging at 1313.5 meters, the special instrumented core barrel was recovered and the special joint of pipe was removed from the drill string. The special pressure core barrel was picked up and dropped to the bit. After this barrel landed, the pipe was lowered and Hole 516C was spudded at 1647 hours, March 13. The hole was washed to 14.1 meters and then a 6.5 meter PCB core was cut. This core barrel was then recovered, but failed to recover any cored material due to damage to the tool during the free fall to the bottom of the pipe. Further attempts for a pressure core at this time had to be deferred due to rapidly deteriorating weather conditions, and it was necessary to pull the drill string. Hole 516C was abandoned at 2130 hours, March 13 when the bit reached the derrick floor.

HOLE 516D

While waiting for the weather to improve, the pressure core bit was exchanged for a regular F94CK bit attached to a hydraulic bit release. After nine hours of waiting, conditions improved enough to run the drill string. Plans were made to take three heat flow measurements as the bit was washed through the interval previously cored with the HPC.

The hole was spudded at 1232 hours, March 14 and was washed to 90.1 meters sub-bottom. The overshot was lowered to retrieve the inner barrel but could not engage it and bring it to the derrick floor. The overshot was recovered and the shear pin replaced and then lowered. Again it would not pick up the core barrel. After the overshot was recovered, a second core barrel was rigged with short hard core catcher dogs and dropped in the pipe. When the overshot was lowered and retrieved only the second core barrel was recovered. It was dropped again and a pull of over 8500 pounds was exerted before it could be brought to the derrick floor. This time the core barrel contained about 1 1/2 meters of sediment. It was therefore assumed that the bit had been released in some unexplainable manner. The drill string was pulled and when the bottom of the BHA reached the derrick floor at 1942 hours, March 14 the HBR and bit were indeed found to be missing. How the sleeve could have shifted is still a mystery.

HOLE 516E

When a new bit had been assembled with a new hydraulic bit release, the drill string was made up and run in to 1304 meters. Hole 516E was then spudded at 0118 hours, March 15 and then washed and drilled to 90.1 meters. A heat flow measurement was taken at this depth and when this tool had been recovered, the hole was deepened to 128.1 meters and a second heat flow measure was taken. After this tool had been recovered and another core barrel was being pumped down, Weather conditions began deteriorating due to a sudden change in wind direction. The heave compensator and power sub were set back and then pipe was pulled and laid down as weather conditions did not improve. The hole was finally abandoned when the weather laid down enough to allow the balance of the string to be pulled. The bit reached the derrick floor at 1800 hours, March 15 and Hole 516E was offically finished.

HOLE 516F

With weather conditions improving, after 19 hours, the drill string was made up and run back for another attempt to reach basement rock. Hole 516F was spudded at 0014 hours, March 17. After spudding, the hole was washed to 169.1 meters below seafloor, and a heat flow measurement was recorded. The hole was then continuously cored to 416.1 meters below seafloor where another heat flow measurement was taken. Coring continued, following this measurement, to a depth of 691.6 meters, at which time the rocks being cored had become firm enough to have the heave compensator picked up and placed in the drill string. A few cores after installing the heave compensator, the drill rate had decreased to the point that knobby drilling joints were also placed in the drill string. Coring continued routinely until 1190.1 meters below seafloor where the scientific staff decided to discontinue coring operations because the seismic reflector which had been interpreted to be basement rock had been penetrated over 100 meters and recovered cores were still very hard limestones. After recovering this core the hole was circulated clean with 50 barrels of mud and the blowout prevented used with the hydraulic piston corer was installed. This was necessary because a new hydraulic bit release shifting tool was to be used and required a higher pressure than could be controlled with the regular line wiper. After these operations had been completed, plans were again changed and coring continued. While cutting Core #125 (1248.6-1252.6 BSF) drill string motion measurements were taken for the Engineering Department. This core also recovered some of the first basaltic rock in the hole. After Core #126 was recovered, the heave compensator was removed from the drill string in anticipation of worsening weather conditions as predicted by the weatherman. Following this, two more cores were cut and recovered to a subbottom depth of 1270.6 meters. The bit used set a new record for rotating hours of 157 hours 23 minutes.

After the last core was recovered, the hole was then circulated clean and the new bit release tool was lowered on the sandline. It was pressured up but no indication was seen on the pressure gauge that it had released the bit. The pipe was pressured again and the bit set down on the bottom, then picked up and rotated, but the bit would not release. The tool was recovered and was found to have no seals left and the shear pin had sheared. A regular go-devil was then dropped and after it reached bottom, the pipe was pressured, the bit set on bottom then picked up and rotated. The pressure then indicated that the bit had been released.

The drill string was then pulled to logging depth and preparations were made for this operation. The first tool, gamma/density/temperature, was lowered and a temperature measurement was made at the mud line. It was then lowered out of the pipe and the temperature was recorded as it went down. When the tool had reached 1740 meters, it was noted that the weight was not increasing and the recorded temperature was not changing. The tool was pulled and while it was coming up it would pull tight then loosen and repeat this until the tool was in the drill pipe. When about 1800 feet of cable remained in the pipe, a snarled ball of wire came to the rig floor. It was cut off and the balance of the cable and the tool were recovered. The logging cable was then reheaded, the tool re-attached, and it was again lowered into the hole.

After the tool left the bottom of the drill pipe it was lowered slowly and lost weight at a depth of 1515 meters. It was raised and lowered a number of times but would go no deeper. It was then assumed that the hole was bridged with sediments and the tool was pulled to the derrick floor.

The drill pipe was then picked up and lowered and found resistance at 1515 meters. The pipe was able to push through this spot, however, it was stopped again at 1540 meters and would not go through. A circulating head was attached to the pipe to wash away the bridging material. When the pipe reached 1540 meters, it became plugged and also stuck. It was pulled free with an overpull of about 35,000 pounds. It was then decided to abandon any further efforts to penetrate the bridging material, because of possible danger to the drill string. The drill string was then pulled and after magnafluxing the BHA, the hole was abandoned at 1730 hours, March 29, when the top connector reached the derrick floor.

SITE 517

Following the completion of Hole 516F, the CHALLENGER traveled 147 miles west southwesterly and Site 517 began when a 16.0 Khz beacon was dropped at 1354 hours, March 30.

The hydraulic piston corer bottom assembly was made up and run and this site was spudded at 2340 hours, March 30. Twelve cores were cut and recovered before it became necessary to abandon the hole due to unsatisfactory wind and sea conditions. Unsafe ship's roll developed if the ship was headed into the winds, and it could not be held on position if headed into the swells. Therefore, the hole was abandoned at 1636 hours, March 31, when the bit reached the derrick floor.

SITE 518

Site 518 was located 65 miles north by west of Site 517 but it was not occupied for slightly over 40 hours after departing Site 517. This was due to the unfavorable weather conditions which caused the abandonment of Site 517. The ship traveled to the area selected for Site 518 and a beacon was dropped. This beacon was used as a reference point because the weather had not improved and additional profiling was done in the area while waiting for improved drilling and positioning conditions.

Site 518 officially began when finally positioning on the beacon started at 0954 hours, April 2. The ship was on the final location at 1230 hours and make up of the drill string began. The drill string was run in to 3917.0 meters and an instrumented drill string strain measurement was made with the recording device located in the drill string, 30 feet below the derrick floor. On completion of this measurement, the balance of the drill string was made up and the hole was spudded at 2300 hours, April 2. The hole was then continuously cored to a subbottom depth of 76.7 meters using the hydraulic piston coring system. Due to time constraints, drilling stopped at this depth, and the hole was offically abandoned at 0845 hours, April 4.

SITE 519

Site 519 was located 66 miles north northwest of Site 518 and after cruising for about 8 hours, a 13.5 kHz double life beacon was dropped at 1900 hours. April 4.

The bottomhole assembly was made up and run followed by the drill string. After 122 stands had been run, the weather had changed and it was felt that it was unsafe to continue running in the hole. After waiting on weather for over nine hours, and pulling one stand every 20 minutes, the prognosis of the weather had not improved and because of time constraints the decision was made to abandon any attempt to drill at this site. The pipe was then pulled and the site was officially abandoned at 1948 hours, April 5. The vessel then proceeded to Santos, Brazil for crew change and resupply.

DRILLING AND CORING EQUIPMENT

Two different bottomhole assemblies were used on this leg depending on the type of coring that was to be done. The first of these was that used with the hydraulic piston coring equipment and consisted of the HPC bit, bit sub, outer core barrel, top sub, (HPC) head sub, three 8 1/4" drill collars, two 5' bumper subs, three 8 1/4" drill collars and a crossover sub. This assembly was used in Holes 515A, 516, 516A, 517 and 518. The other assembly consisted of the bit, hydraulic bit release, profile sub, outer core barrel, three 8 1/4" drill collars, one 5' bumper sub, three 8 1/4" drill collars, two 5' bumper subs, two 8 1/4" drill collars, a crossover sub and one 7 1/4" drill collar. This was used in holes 515, 515B, 516D, 516E, and 516 F. The hydraulic bit release was changed in this assembly to a regular bit sub in Holes 516B, 516C, and 519. The only problem that developed with these assemblies was at Hole 516D when the hydraulic bit release released prematurely after only 90 meters of hole had been drilled. The reason this happened has not been determined.

The heave compensator was used on Holes 515B and 516F after the sediments had become firm enough for it to assist in the coring operation. At Hole 515B it was necessary to lock it out of the operating mode for about 12 hours while an electrical problem in the Olmsted valve was corrected. This did not interfere with the coring operation and core recovery was not affected.

BITS

Four different bits were used on this leg, F93CK, F94CK, PCB and HPC. One of the F93CK cored almost 700 meters and was in excellent condition when it was recovered. The other bit, of this type, drilled only 90 meters of soft sediment when it was unexpectedly released after the hydraulic bit release was activated unintentionally. The HPC bit was used routinely with this type of coring operation and had no trouble. One of the high points of the leg was when the F94CK bit drilled 1398.7 meters of hole with a record setting rotating time of 157.85 hours. Unfortunately, the final condition of this bit could not be observed because it was released to allow the hole to be surveyed with downhole logging tools. The PCB bit was used to make some downhole drill string motion measurements, and attempted to cut one core using the new pressure core barrel. The bit was not used again on this leg.

LOGGING

Downhole logging had been planned for this leg, however it was attempted at only one hole, 516F. After this hole had reached total depth, it was circulated clean, the bit was released, and the pipe was pulled until only the bottomhole assembly was below the mud line. The gamma/density/temperature tool was made up and run in the hole. After this tool had been lowered about 300 meters below the bottom of the pipe, the weight indicator showed that the tool had apparently stopped. The tool was then pulled and a snarl in the cable came to the rig floor about 1800 feet above the tool. The damaged cable was cut off and then reheaded and the tool was carefully lowered again. This time weight loss was detected after the tool was only about 60 meters below the pipe. It was worked up and down awhile but then was pulled because the hole had apparently bridged. This fact was hard to believe because the hole had been cored to total depth with no indications of hole stability problems. An attempt was made to wash through the bridging material but this could not be accomplished and the hole was abandoned. There were no more attempts to log any of the holes because they were too shallow to make logging possible.

SPECIAL TOOLS

The new pressure core barrel (PCB) was to be tested on this leg for later use while coring clathrates on Leg 76. However, it was only run twice and then not to successfully. The first time was at Site 515. After the mud line was established the hole was washed to 39.1 meters and a second core was cut and recovered. The PCB was then dropped and a 6.5 meter core was cut. However, when the sandline was lowered the core barrel could not be recovered. After shearing the pin in the overshot, the sandline was recovered and then the drill string was pulled. When the tool was recovered it was found that the outside dimensions of the core barrel and the inside diameter of the newly made landing sub for the hydraulic piston corer were the same. The PCB had enough weight and momentum to be pulled back. The tool was next dropped and a core cut at Site 516C after the bit had been washed to 14.1 meters. When the core barrel was recovered it was found to be damaged apparently as the result of a hard landing. Unfortunately it was not run again due to the type of BHA in use and the time constraints for achieving the scientific objectives. One more attempt was planned for the last site but this could not be accomplished because the hole was not spudded due to poor weather conditions. A complete report on the PCB follows this section.

In addition to the PCB testing, some drill string measurements of motion tension bending and torsion were made using special joints of pipe and instruments. These measurements were made in 516B and 518, and apparently satisfactory results were obtained.

LEG 72 - PCB REPORT

ABSTRACT

The Pressure Core Barrel was unsuccessfully tested twice downhole and once on deck. During the first test it was discovered that the PCB was incompatible with both the modified HPC head sub and the hydraulic bit release--both assemblies having inner diameter restrictions of 3 7/8" which is the same as the outer diameter of the PCB. Therefore use of the PCB was limited to the one remaining rotary-cored site. On the second and last downhole test, the PCB failed due to premature shearing of the aluminum pins which held it together. This diagnosis is supported by the results of the one deck test in which the first stage, second stage, and vent sub pins sheared after dropping the tool about 12 inches through air.

The shear strength of brads pins vs aluminum was measured using a hydraulic press. The brass pins appear to be stronger by about 200 lbs/in. Three of the four PCB units have been rebuilt using brass shear pins. The fourth has not been rebuilt due to lack of spare pivot pins which were sheared on the last test.

Test #1 - Site 515 - Water Depth 4265 m - Core Depth 49 m

BVA Used: "A"

Included in drill string: Standard bit, hydraulic bit release sub, modified HPC head sub.

Results: No pressure, no recovery. PCB stuck in pipe. Drill string had to be tripped.

Immediately prior to the first test it was discovered that the inner bore through the core guide of each of the five PCB bits aboard was too narrow. These were later machined out to the proper bore, but for the first test a standard bit had to be used.

The overall plan for the site was to spot core through the first 150-200 meters --during which time two PCB tests were to be run--then continuously core to bit destruction, then drop the bit, pull up to the mudline, set the HPC collet in the modified head sub, and finally piston core the upper section of the hole. After a mudline core and a second standard core, the PCB was dropped down the pipe. It was pumped down at 35 SPM for 20 minutes. After 35 minutes, when the PCB appeared to reach bottom, all circulation through the drill string was lost.

A 6.5 m core was cut. During retrieval attempts the PCB was repeatedly able to travel only about 10 meters up from the bit before it jammed in the pipe. After several attempts of pulling up to 13,000 lbs (1,500 lbs. overpull) with no success, the drill string was stripped.

On deck it was discovered that the 3 7/8" O.D. Ball Valve Assembly could not pass up through the modified HPC head sub though it had passed through on the way down. Specification drawings were checked to find that both the modified HPC head sub and the hydraulic bit release have 3 7/8" inner diameters which make them incompatible with the PCB. The post-run inspection of the PCB revealed the following:

1. The Ball was closed and undamaged.

2. The face of the Seat was marred by several shallow depressions, but the Teflon O-Ring was intact.

3. The Vent Sub was closed, and the Latch Assembly Shear Pins had sheared.

4. The Catcher sleeve was destroyed--smashed against the Ball.

5. The two halves of the Outer Body were bowed slightly apart. One of the halves suffered a shallow gouge (3/8" long x 3/16" wide) at the point of maximum deformation along its outer circumference. The Outer Body regained its shape when the Catcher Sleeve obstruction was removed.

6. One Puller Pin was deformed and had to be replaced.

7. The burst disk in the Pressure Relief Valve had burst. There were no spares aboard for this part, but one was fabricated out of .003" stainless steel shim stock. It was tested on deck to 4700 psi.

All of the damage can be attributed to the rough treatment the tool received during the retrieval attempts, where it was repeatedly subjected to compression loads after it had scoped out. The damages were not serious and the tool is still operational.

Test #2 - Site 516 - Drop Test - 12" through air

BVA Used: "D"

Results: First stage, second stage, and Vent Sub pins sheared, apparently from impact.

This was not originally meant to be a test. In order to check the PCB spacing a fully assembled PCB including swivel and latch (but minus the four shear pins in the BVA Latch) was picked up and dropped about 12" into the lower bottomhole assembly which was hung off below the rig floor prior to running in the hole. When the PCB was stabbed into the pipe, the Catcher Sub was knocked against the pipe, causing the first stage pin to shear. But the fingers on the Catcher Sleeve held it in place and prevented the first stage from scoping out, so it was decided to continue lowering the tool. The PCB was lowered as far as possible, then dropped. When it was picked up and layed on deck it was discovered that the second stage and Vent

Sub pins had sheared. The post-test inspection revealed:

1. The Ball was partially closed, crimping the Catcher sleeve had not drawn clear. The Ball was also dented on its leading edge. (It was filed smooth again).

2. The Outer Body was bowed apart slightly by the mangled Catcher Sleeve inside. It regained its shape when the Catcher Sleeve was removed.

3. The Vent Sub Shear Pin had sheared and the Vent Sub was closed.

Test #3 - Site 516C - Water: 1251 m - Core Depth 14 m

BVA Used: "B"

Included in the Drill String: PCB bit, standard bit sub, standard head sub.

Results: No pressure; no recovery.

The PCB was carefully stabbed in the pipe to ensure that the first stage pin remained intact. It was pumped down at 35 SPM. The pump turned off before it reached the bottom 11 minutes later, with the bit still above the mudline. There was no loss of circulation when it latched.

The weather was deteriorating rapidly and it was necessary to wait 20 minutes before spudding in due to an excursion from the beacon. The bit was washed down 14.1 meters before the 6.5 meter core. No trouble was encountered in retrieving the PCB but once on deck it was evident that it had again been damaged. Sea conditions required pulling the pipe without running the second scheduled PCB test. The post-run inspection revealed:

1. The Ball was closed and undamaged, but the two Pivot Pins through the Ball Cage were sheared off.

2. The Catcher Sleeve was destroyed, having smashed against the closed Ball.

3. The Vent Sub was closed, and the BVA Latch appeared to have functioned properly.

4. On one of the halves of the Outer Body, the notched lip which engages the Snap Ring was deformed. It was filed back into shape.

5. The Outer Body was again bowed apart by the crumpled Catcher Sleeve inside. Again the deformity was not permanent.

6. A small section was missing from the Teflon O-Ring in the Seat.

7. No traces of mud were found either above or below the Ball. However, sand was found packed in the Double Box Sub and between the Extension Sleeve and the Outer Extension Body (where it had reclosed).

It appears that all of the damage was caused by the tool slamming closed after prematurely scoping open before it landed. Shear loads of aluminum vs brass shear pins were later measured using a hydraulic press. The loads to shear 4 pins were 1800 lbs. and 2600 lbs. respectively. Three pins sheared at 1500 lbs. and 2000 lbs. respectively. Using the stronger brass might prevent future premature failure of the shear pins.

Don Cameron
Development Technician
Deep Sea Drilling Project

HYDRAULIC BIT RELEASE

The hydraulic bit release was in the bottomhole assembly on Holes 515, 515B, 516D, 516E, 516F and was released for logging purposes at 516F. The first attempt at releasing the bit at 516F was made using a new go-devil which was lowered on the sandline. After the prescribed pressures had been applied the bit had not released. The bit was then set on bottom and picked up but still had not released. It was then rotated and still did not released. The tool was pulled to the derrick floor and appeared to have actuated as it should. A standard go-devil was then dropped and after pressuring up, setting down on bottom and then rotating the bit released. The other release occurred at Hole 516D. After washing the hole to 90.1 meters the sandline overshot was lowered to recover the core barrel used in washing down. The overshot landed but could not pick up the inner barrel. A second core barrel with short hard dogs in the core catcher sub, was then lowered on the sandline. When recovered the first time it had not picked up the core barrel and it was lowered again. This time when it was recovered the barrel had mud in the core catcher so the core catcher sub was removed and it was discovered that the liner had about 3 meters of mud in it. It was then assumed that the bit had been released and the drill string was pulled. When all the pipe was recovered the bit release sleeve had been shifted and the bit dropped. When and how his occurred cannot be explained at this time.

BEACONS AND POSITIONING

Five beacons were dropped on this leg and all worked well. Sixteen kHz beacons were used on four sites and at 13.5 khZ on the last site. The sixteen were used to avoid creating a positioning problem when the 12.0 kHz beacon was attached to the drill pipe for the HPC cored holes. The only positioning problem was when the ship took excursions of 100 $\pm$ feet due to the loss of acoustics as result of rough sea conditions.

COMMUNICATIONS

Communications, although not significantly delayed during the leg, were not completely satisfactory due to interference problems from Radio Rome on 17105 kHz, which is the single frequency Radio WWD was able to employ during this leg. Only by supplementing this frequency by 17408.6 SSB could communications be effected at times.

In addition the "radio window" for 17105 at 1 KW power seemed to be limited to a few hours late in the day. Radio WWD's high power SSB transmitter could generally be heard throughout the day but this transmitter was usually committed to other work.

Volume of traffic was normal and generally message length was shorter than on some previous legs. The usual heavy amateur traffic in "phone patches" for ship's personnel was effected satisfactorily with the assistance of the ship's doctor and the third mate.

There were not major equipment problems.

Commercial traffic was via Brazilian stations, as were most weather reports.

R. R. Knapp
Cruise Operations Manager
Deep Sea Drilling Project

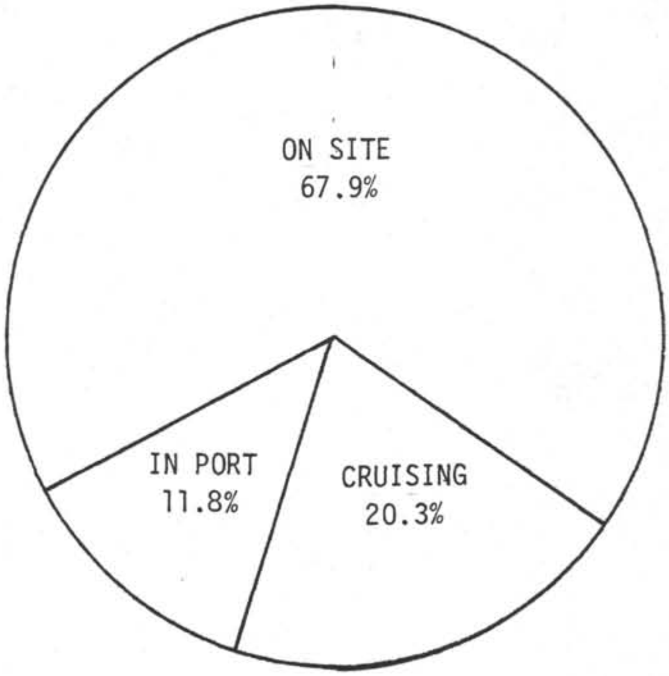
INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
OPERATIONAL RESUME
LEG 72

Total Days (February 21, 1980 - April 8, 1980)		46.92
Total Days in Port		5.54
Total Days Cruising Including Site Survey		9.53
Total Days On Site		31.85
Trip Time	6.1	
Drilling Time	.26	
Coring Time	20.88	
Waiting on Weather	2.08	
Downhole Measurements	.45	
Other	2.08	

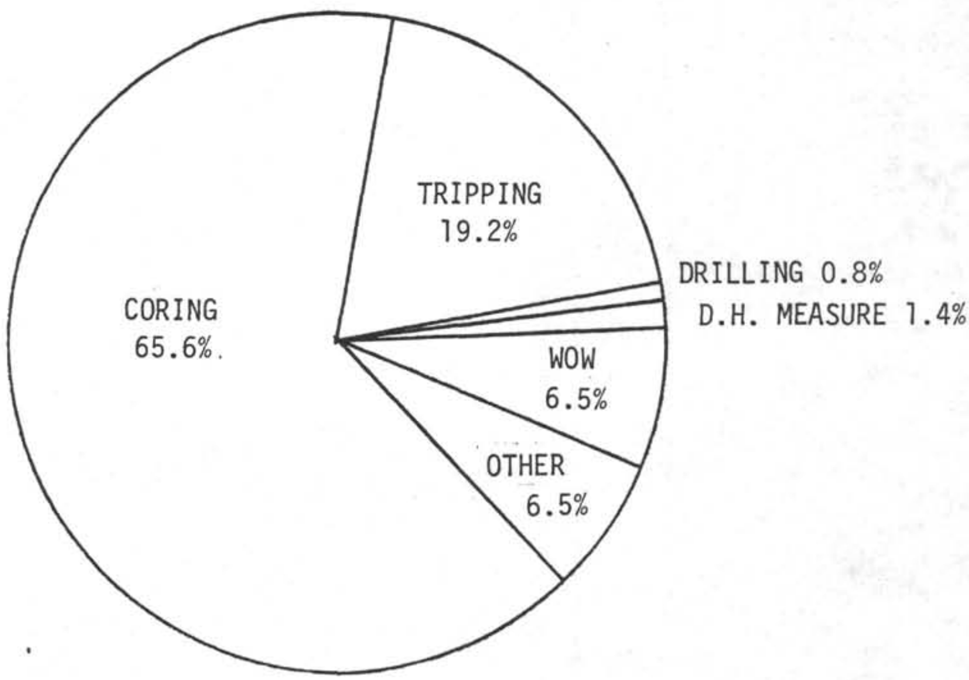
Total Distance Traveled Including Survey (Nautical Miles)	1846.4
Average Speed (Knots)	8.7
Number of Sites	5
Number of Holes Drilled	12
Number of Cores Attempted	308
Number of Cores With Recovery	297
Total Meters Cored	2162.9
Total Meters Recovered	1543.9
Percentage Recovery	71.4%
Total Meters Drilled	549.9
Total Meters of Penetration	2712.8
Percentage of Penetration Cored	79.7%
Maximum Penetration (Meters)	1270.6
Minimum Penetration (Meters)	20.6
Maximum Water Depth (Meters)	4840.0
Minimum Water Depth (Meters)	1327.9

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT

TOTAL TIME DISTRIBUTION
LEG 72



ON SITE TIME BREAKDOWN
LEG 72



INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
BEACON SUMMARY
LEG 72

SITE NO.	MAKE	FREQ. kHz	SERIAL NUMBER		SITE TIME HOURS	
515	ORE	16.0 D.L.	502		27.7	
515A	ORE	16.0 D.L.	502		62.0	
515B	ORE	16.0 D.L.	502		118.7	
				TOTAL	208.4	Hydrophones could not be lowered and there was no problem positioning.
516	ORE	16.0 D.L.	503		45.9	
516A	ORE	16.0 D.L.	503		17.0	
516B	ORE	16.0 D.L.	503		8.8	
516C	ORE	16.0 D.L.	503		6.0	
516D	ORE	16.0 D.L.	503		22.2	
516E	ORE	16.0 D.L.	503		24.3	
516F	ORE	16.0 D.L.	503		333.5	
				TOTAL	457.7	Total hours with no problems.
517	ORE	16.0 D.L.	514		26.7	
518	ORE	16.0 D.L.	515		46.8	
519	ORE	13.5 D.L.	516		24.8	

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
SITE SUMMARY
LEG 72

HOLE	LATITUDE		WATER DEPTH METERS	NUMBER OF CORES	CORES WITH RECOVERY	PERCENT OF CORES WITH RECOVERY	METERS CORED	METERS RECOVERED	PERCENT RECOVERED	METERS DRILLED	TOTAL PENET METERS	AVG RATE PENET	TIME ON HOLE	TIME ON SITE
515	26° 14.33'S	36° 30.17'W	4265.5	3	2	66.6	17.5	5.45	31.1	38.0	55.5	158.5	27.7	
515A	26° 14.31'S	36° 30.17'W	4266.6	27	25	92.6	107.9	95.69	88.8	- -	107.9	HPC	62.0	
515B	26° 14.32'S	36° 30.19'W	4266.6	57	57	100.0	541.5	429.1	79.2	94.9	636.4	32.5	118.7	208.4
516	30° 16.59'S	35° 17.11'W	1327.9	44	40	90.9	183.3	148.07	80.8	- -	183.3	HPC	45.9	
516A	30° 16.59'S	35° 17.11'W	1327.9	16	15	93.7	69.5	61.10	87.9	- -	69.5	HPC	17.0	
516B	30° 16.59'S	35° 17.11'W	1327.9	1	1	100.0	7.6	4.52	59.5	15.6	23.2	257.7	8.8	
516C	30° 16.59'S	35° 17.11'W	1327.9	1	0	0.0	6.5	0.0	0.0	14.1	20.6	294.2	6.0	
516D	30° 16.59'S	35° 17.11'W	1327.9	0	0	0.0	0.0	0.0	0.0	90.1	90.1	300.3	22.2	
516E	30° 16.59'S	35° 17.11'W	1327.9	0	0	0.0	0.0	0.0	0.0	128.1	128.1	284.6	24.3	
516F	30° 16.59'S	35° 17.11'W	1327.9	128	127	99.2	1101.5	691.72	62.8	169.1	1270.6	8.1	333.5	457.7
517	30° 56.81'S	38° 02.47'W	2970.4	12	12	100.0	50.9	48.49	95.3	- -	50.9	HPC	26.7	26.7
518	29° 58.42'S	38° 08.12'W	3946.0	19	18	94.7	76.7	59.57	77.7	- -	76.7	HPC	46.8	46.8
519	29° 03.20'S	38° 43.68'W	4840.0	Site not drilled due to weather.			- -	- -		- -	- -	- -	- -	- -
		TOTAL		308	297	96.4	2162.9	1543.71	71.4	549.9	2712.8		764.4	764.4

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
BIT SUMMARY
LEG 72

HOLE	MFG	SIZE	TYPE	SERIAL NUMBER	METERS CORED	METERS DRILLED	METERS TOTAL PENET.	HOURS ON BIT	CONDITION	REMARKS
515	Smith	9 7/8"	F93CK	646KR	17.5	38.0	55.5	0.35	T1-B1-SEI	Rerun with only .5 hours rotating time.
515A	Smith	11"	HPC		107.9		107.9			
515B	Smith	9 7/8"	F93CK	646KR	541.5	94.9	636.4	19.6	T1-B1-SEI	
516	Smith	11"	HPC	- -	183.3	- -	183.3	- -	No Change	
516A	Smith	11"	HPC	- -	69.5	- -	69.5	- -	No Change	
516B	Smith	9 5/8"	PCB	PCB #5	7.6	15.6	23.2	0.1		
516C	Smith	9 5/8	PCB	PCN #5	6.5	14.1	20.6	0.1		
516D	Smith	9 7/8	F93CK	649KR	- -	90.1	90.1	0.3	Unknown	Bit lost when HBR released w/o go-devil.
516E	Smith	9 7/8	F94CK	AE3467	- -	128.1	128.1	0.45		
516F	Smith	9 7/8	F94CK	AE3467	1101.5	169.1	1270.6	157.4	Bit Released	New record for total hours on a bit
								157.85		
517	Smith	11"	HPC	- -	50.9	- -	50.9	- -		
518	Smith	11"	HPC	- -	76.7	- -	76.7	- -		
519	Smith	9 7/8"	F93CK	646KR	- -	- -	None	- -		Bit not used. Site not drilled due to weather.

DEEP SEA DRILLING PROJECT
TIME DISTRIBUTION
LEG -

Date	Site No.	Cruise	Trips	Drill	Core	Stuck Pipe	W.O.W.	DOWNHOLE MEAS.	Mech. Repair	Port Time	Re-Entry	Other	Total Time	Remarks
2/21/80 2/26/80										133.0			133.0	
2/26/80 2/29/80		66.1											66.1	
2/29/80 3/01/80			18.9	2.4	4.2							2.2	27.7	
3/01/80 3/04/80			21.4		40.1							.5	62.0	
3/04/80 3/09/80			16.2		100.5							2.0	118.7	
3/09/80 3/10/80		31.3										.8	32.1	
3/10/80 3/12/80			7.0		37.1							1.8	45.9	
3/12/80 3/13/80			4.5		12.3							.2	17.0	
3/13/80			3.6	.2	.1							4.9	8.8	
3/13/80 3/14/80			8.8	.8			8.9					3.7	22.2	
3/14/80 3/15/80			7.4	1.7			8.1					7.1	24.3	
3/15/80 3/29/80			13.1	1.0	269.9		23.0	8.7				17.8	333.5	
3/29/80 3/30/80		20.4											20.4	
3/30/80 3/31/80			12.3		11.8							2.6	26.7	
3/31/80 4/02/80		41.3											41.3	
4/02/80 4/04/80			15.9		25.0			2.0				3.9	46.8	
4/04/80		8.2										2.1	10.3	
4/04/80 4/05/80			13.2				10.1					1.6	24.8	
4/05/80 4/08/80		58.3											58.6	

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
OPERATIONAL RESUME
LEG 73

Leg 73 of the Deep Sea Drilling Project will be remembered as a landmark voyage for its scientific success in the analysis of South Atlantic paleoenvironment. A series of holes extending southeastward from the Mid-Atlantic Ridge was drilled to assemble a nearly complete composite section of the Tertiary paleontologic and paleomagnetic record. In addition cores were recovered containing a well-preserved record of the terminal Cretaceous crisis and its aftermath.

It was also an extremely successful and trouble-free cruise from the operational standpoint. Thirteen holes were drilled at six sites and over a kilometer of core was recovered. The entire sediment section was penetrated at four of the sites and drilling ended in an igneous complex at another.

The voyage commenced on April 8, 1980 at Santos, Brazil and terminated on June 1, 1980 at Capetown, Republic of South Africa. Total length of the leg was 54.2 days, of which 31.4 days were spent on site, 5.4 days in port and 17.4 days under way. Weather downtime accounted for 0.5 day and mechanical breakdowns only 0.1 day.

SANTOS PORT CALL

Leg 73 began with the arrival of the GLOMAR CHALLENGER at Santos, Brazil. The vessel's arrival was one day ahead of schedule and she was forced to remain at an anchorage outside the harbor until a dockside berth became available. The anchor was let go at the roadstead at 0623 hours, April 8. After a 12 hour wait at anchor, clearance was received to move to Berth 35 in Santos Harbor. Mooring was completed at 2000 hours.

The port call was a major resupply effort for both Scripps and GMI. In addition to freight and consumables, 142,000 gallons of diesel fuel were loaded. Principal work items included a major overhaul of the Bowen hydraulic system, completion of refurbishment of the propulsion electrical switchboard and removal and cleaning of the four retractable positioning hydrophone arms.

SANTOS TO SITE 519

With port call activities completed, the CHALLENGER departed Santos at 1615 hours, April 13 (14 hours ahead of schedule). Following routine thruster tests outside the harbor, course was set directly for Site 519, some 1880 miles distant.

Fairly good speed was achieved until the fourth day, when brisk headwinds slowed the vessel to a little over eight knots for three consecutive days. Conditions improved for the final two days and the voyage to the operating area was completed in eight days and sixteen hours.

HOLE 519

Site 519 was located on the east flank of the Mid-Atlantic Ridge about 1450 miles due west of Luderitz Bay, South West Africa. The drill site was located on the first pass by navigation and seismic profiling and a positioning beacon was dropped at 1139 hours, April 22.

The drill string was run and measured and the hydraulic piston core (HPC) assembly was lowered on the wireline to its seat in the outer core barrel. Hole 519 was spudded at 0148 hours, April 23. The piston core barrel stroked to a depth of 3781.4 meters and 2.9 meters of core was recovered, establishing the water depth at 3778.5 meters. This agreed within one meter of readings obtained with the precision depth recorder (PDR) and a 12 kHz pinger attached to the drill pipe.

Piston coring operations proceeded fairly smoothly through a sedimentary section comprised of calcareous ooze with occasional clay-rich strata. The cores were generally undisturbed and the overall recovery rate was 91 percent. Butyrate core liner failures were common, however, and were the cause of most of the lost section and disturbed core.

Drill pipe pressure failed to bleed off after Core No. 37 was punched from 151.5 meters below seafloor. This indicated that the corer had not extended to its full 4.5 meter stroke. On recovery the core barrel was found to contain only ten centimeters of sediment mixed with numerous chips of basalt and volcanic glass. The cutting edge of the core catcher shoe was damaged and it was concluded that basement has been reached.

The drill string was then recovered and the bit was brought on deck at 1300 hours, April 25.

HOLE 519A

A standard core bit was attached to the core barrel assembly and the bottomhole assembly (BHA) was converted for rotary coring. The drill string was then run to just above the seafloor and the power sub was picked up for drilling.

Most of the sediment section was drilled, with spot cores taken to complement intervals of disturbance or low recovery in the HPC section of Hole 519. Igneous rock was encountered within one meter of the basement depth recorded in Hole 519. Thirty meters of basalt and diabasic flows were penetrated. Except for a two to three meter rubble zone at the basement contact, drilling and hole conditions were good and 44 percent core recovery was achieved in the basalt section.

Operations were terminated due to scheduling considerations and the drill string was recovered. The vessel was underway at 1400 hours, April 27. A final pass was made over the positioning beacon following a 2 1/2 hour post-site survey and course was set for Site 520.

HOLE 520

The next drill site lay only about 45 miles to the northeast of Site 519 and the move was made in 5 3/4 hours. A positioning beacon was launched at 2146 hours, April 27 and an additional 1 1/4 hours of profiling was done to confirm the suitability of the location.

A rotary coring BHA was made up, complete with a hydraulic bit release and special core barrel head sub (to permit conversion to HPC operations). The pipe trip to the sea floor was routine with the exception of two interruptions totaling one hour for intense rain squals. Hole 520 was spudded at 1045 hours, April 28.

As piston coring of the upper sediment section was planned, the hole was drilled to a depth of 218 meters BSF with only four "spot" cores taken. The section was then cored continuously to 379.5 meters. Alternate coring and drilling of 9.5 meter intervals then proceeded to about 449 meters, where basalt rubble was encountered. Scientific objectives were considered accomplished and coring operations were terminated at a total depth of 4675.5 meters, 458.5 meters BSF.

A hydraulic bit release go-devil was then pumped into place in the bit release assembly and the bit, with its associated components, was detached and left at the bottom of the hole. The drill string was pulled clear of the seafloor at 1942 hours, May 1.

HOLE 520A

A wireline run was made to emplace the HPC seal sub conversion collet in the special head sub of the outer core barrel. This was accomplished without incident and the releasing pin sheared at about 3000 pounds overpull to permit recovery of the running tool.

The bit was washed down through the upper sixteen meters of soft sediment for an attempt to piston core a firm stratum encountered but not recovered, in Hole 520. The HPC assembly was then run into place in the outer core barrel with the sandline and the pipe was pressured up to actuate the piston corer. Pressure buildup in the pipe was anomalously low for the shear pin combination used in the HPC and it was feared a proper seal had not been effected at the collet. When the HPC assembly was retrieved, however, it was found to have extended properly. The core barrel contained 2.4 meters of soft sediment and the butyrate liner was badly split. Scheduling considerations precluded further coring at Site 520, but an attempt was made to drill a few additional meters to test the efficiency of washing ahead with open-ended pipe. The hard layer, still unidentified, could not be penetrated and operations were discontinued.

The drill string was recovered and the CHALLENGER departed for Site 521 at 2100 hours, May 1.

HOLE 521

Site 520 was located about 60 miles southeast of Site 520 and 75 miles east of

Site 519. The transit was made in 7 3/4 hours and an additional hour's pre-site survey was made following the beacon drop.

The drill string, equipped with the hydraulic piston coring BHA, was run to the seafloor and Hole 521 was spudded at 1814 hours, May 2, in 4141 meters of water.

HPC operations progressed smoothly to a depth of 84 meters BSF. On Core No. 21, drill pipe pressure failed to bleed off, indicating incomplete stroke, and the HPC barrel was pulled up through the bit with some difficulty. On recovery the barrel was found to be bent. The barrel and lower subs bore deep longitudinal gouges, apparently from the cutting structure of the bit. The core catcher shoe cutting edge was damaged and it was concluded that the barrel had been deflected by an irregular basement surface. The core barrel contained 25 cm of soft sediment. The presence of hard rock was verified by washing down about 1/2 meter with the drill bit and encountering hard drilling. The bit was then pulled clear of the seafloor.

HOLE 521A

Due to the excellent recovery and quality of the section from Hole 521, the sediment column was to be recored to provide sufficient material for sampling. The vessel was offset about 440 meters to the southeast and Hole 521A operations began at 2123 hours, May 3.

The first core attempt was unsuccessful due to inaccuracy in water depth measurement. The second attempt recovered 2.8 meters of sediment and established water depth at 4140.6 meters. Piston coring was successful with good recovery to 71.1 meters, where the cutter of the core catcher shoe was again damaged by contact with hard rock.

The drill string was then pulled and the CHALLENGER departed for Site 522 at 0638 hours, May 5, following a 1 1/2 hour post-site survey.

HOLE 522

Site 522, further down the flank of the Mid-Atlantic Ridge, was located 278 miles east of Site 521 and 1100 miles west of Luderitz Bay. The beacon was dropped after a 35 1/4 hour move and, after a one hour presite survey, the geophysical profiling gear was retrieved and the vessel was positioned over the beacon.

A routine pipe trip was made with the 12 kHz pinger attached to the drill pipe. The PDR had registered a water depth of 4451 meters. The pinger/PDR record was read during preparations for spudding in and a depth of 4446 meters was calculated. Two consecutive 4.5 meter piston cores were attempted, bottoming at 4448.5 and 4453 meters. No sediment was recovered in either core barrel. The bit was then lowered until weight loss registered on the weight indicator. A third attempt, covering the interval from 4455 to 4459.5 meters, recovered 2.9 meters of core and established a water depth of 4456.6 meters. (The depth discrepancy was later found to have been caused by mislocation of the pinger by one 9.5 meter joint of pipe).

HPC operations progressed smoothly to a depth of 148.7 meters BSF with excellent recovery of undisturbed core. At this point basement was judged to be within a few meters and operations were terminated to avoid possible equipment damage from striking hard rock.

HOLE 522A

The drill string was pulled clear of the seafloor and the second hole of the site was spudded at 1615 hours, May 9. The hole was drilled to 47 meters BSF and continuous recoring of the section of greatest scientific interest began.

Weather conditions deteriorated during the coring of Hole 522A and core quality and recovery were consequently not so good as on Hole 522. Operating limits of the CHALLENGER with respect to positioning power and vessel motion were approached, but not exceeded. The coring program was effective in filling gaps and in duplicating the section of Hole 522. The corer struck basement at 156 meters BSF.

HOLE 522B

A round trip was made to convert the BHA for rotary coring and the vessel was offset about 35 meters to the northeast. The power sub was then picked up in preparation for drilling operations. At this point, a test of vessel and drill string motion instrumentation was made with the string hanging free above the seafloor.

Hole 522B was spudded at 1127 hours, May 12, and was drilled to 39 meters BSF where the instrumented inner core barrel was pulled in preparation for a combination temperature probe/in situ water sampler run. The hole was "spot" cored to 139.5 meters BSF where continuous coring began. Additional temperature probe measurements were made at 55 and 149 meters BSF. The basalt contact was found at 154 meters and a second drill string motion/stress test was made while the second basalt core was being cut. Coring continued in dense basalt at the slow rate of less than one meter per hour to a depth of 170.5 meters BSF. Operations were terminated at this point due to scheduling considerations and the drill string was recovered.

SITE 523

The last site of the East Mid-Atlantic Ridge flank transect was about 210 miles southeast of Site 522 and 1000 miles west of the Orange River Delta. The positioning beacon was launched after a 22 1/2 hour transit and an additional 1 1/2 hours were spent on present surveying before the gear was retrieved and stationkeeping began.

The site approach had been made in deteriorating weather and, when automatic positioning had been achieved, it was determined that wind and swell conditions would not permit pipe operations within established vessel motion limits. Slowly decreasing winds allowed increasingly favorable headings with respect to the swell and the pipe trip began after a 6 1/2 hour weather delay.

Due to adverse conditions, the pipe trip was slowed by about four hours. After "feeling" for bottom and observing the weight indicator, Hole 523 was spudded at 0615 hours, May 16. The first piston core punched to 4576 meters and recovered 4.0 meters of sediment. This indicated a water depth of 4572 meters, compared with a PDR reading of 4573. The drill string pinger was not used.

A twelve-foot swell from the southwest persisted for the first day of coring operations and then began to die slowly. The resultant vessel heave degraded depth control and core quality significantly. Concurrent with the vessel motion problem, mechanical difficulties arose in the HPC apparatus wherein the corer would operate prematurely while being lowered through the drill pipe or would fire at a low pipe pressure, achieving incomplete penetration. The malfunction was traced to the brass shear pins of the HPC, which were too loosely threaded into their seats and were backing out of position. The use of thread sealing tape alleviated the problem.

Thin strata of highly indurated material (probably hard chalk) were contacted at 56 meters BSF. It was necessary to set out the HPC assembly and sandline and to drill three meters before piston coring could be resumed successfully. Coring then continued in good weather with good results.

Below about 120 meters BSF, considerable "suction" was noted when the bit was pulled clear of the bottom of the hole following the firing of the piston corer. A 25 minute delay followed the firing of core barrel No. 48 and the drilling assembly remained at total depth while a malfunction in the sandline winch control servo pump was corrected. On raising the pipe, an overpull of about 80,000 pounds was noted. This was slightly higher than on the previous core. When the HPC assembly arrived on deck, the sub connecting the core barrel to the remainder of the assembly was found to have parted, leaving the core barrel in the hole.

The bit was carefully washed ahead five meters and an attempt was made to fish the inner barrel with a wireline spear. Results of these measures indicated that the barrel had been pushed into the side of the hole and bypassed by the bit. Three additional piston cores were then taken for a total of ten meters. The cores were normal except for suction overpull approaching 100,000 lb on the final two runs. On core attempt No. 51, the HPC could not be seated in the outer core barrel to enable pressuring the pipe. After several attempts to seat the HPC, it was recovered, redressed and inspected. The aluminum landing ring was unmarked, indicating that it had made contact with the seal sleeve. A second wireline run was made and again the HPC failed to seat, even when the sandline was worked vigorously to dislodge the unknown obstruction. When the HPC had been recovered about half way to the surface, the sandline parted at the sinker bars and the entire assembly fell back to the BHA. This effectively terminated coring operations in Hole 523.

Since the HPC had failed to seat, it was possible to circulate with the mud pump and an attempt was made to drill ahead and to touch basement, which was judged to be within a few meters. As drilling began, however, the pipe began to pressure up and the pump was stopped. After about 1.5 meters penetration, something hard was apparently contacted by the bit, then more soft drilling followed for an additional "dry-drilled" 1.5 meters. At this point a last attempt was made, with apparent success, to pressure the pipe and fire the piston corer. Operations ceased at a total depth of 193.5 meters and the drill string was pulled.

On recovery it was found that the HPC had apparently arrived at the bit in a stroked-out condition. The inner barrel, hanging below the bit had been bent by the attempt at drilling ahead and the lower five feet subsequently had been cut off by the bit, leaving the remainder of the assembly stuck firmly in the bit.

A magnetic particle inspection of the BHA connection was then completed. The vessel departed for Site 524 at 1110 hours, May 20 after a one hour post-site survey.

SITE 524 - WESTERN CAPE BASIN

The final Leg 73 drill site was located about 315 miles east of Site 523 and about 790 miles west-northwest of Capetown near the foot of the eastern slope of the Walvis Ridge. The location was reached 33 1/4 hours after departure from Site 523 and a positioning beacon was launched at 1935 hours, May 21.

The drill plan called for hydraulic piston coring of a second hole following an initial rotary cored hole. The BHA was therefore made up to include a hydraulic bit release and a special convertible head sub to enable conversion to the HPC mode without making a round trip.

The pipe trip began in good weather, but the passage of a front resulted in increasing winds and seas as the trip progressed. Localized squalls associated with the front produced winds in excess of 40 knots. The force of the wind was great enough that one engine/generator normally used for drilling operations was required to supplement those used for stationkeeping. It was therefore necessary to delay commencement of coring operations for 4 1/2 hours while conditions moderated.

While vessel motion and positioning remained marginal, it was judged that they had improved sufficiently to conduct a vessel and drill string motion instrumentation test before spudding in. The power sub was picked up, the instrumented inner barrel pumped down and the instrumented drill pipe joint put into the string. When the core barrel landed, it was noted that circulation was plugged off. Motion and stress data were then recorded while the bit was suspended just above the seafloor. When recording time had run out on the instrumented drill pipe section, the bit was quickly lowered to 4800 meters in an attempt to recover a seafloor core (PDR depth was 4796 meters). The instrumented pipe section was then set back and the sandline was run to retrieve the inner barrel. The inner barrel was found to be stuck firmly at the bottom of the pipe. The safety shear pin of the overshot failed during efforts to jar the barrel loose with the wireline jars and it was necessary to pull the sandline and redress the overshot. As the sandline had not been pulled to the safe limit on the first try, it was felt that chances of recovering the barrel were still good. On the second attempt, the overshot would not engage the pulling neck. The sandline was pulled and the overshot replaced, but the third attempt was also unsuccessful at engaging the inner barrel. It was therefore necessary to make a wet pipe trip to recover the instrument package and to regain operating capability. On recovery, suspicions were confirmed that the cap sub of the instrument pressure case had become firmly jammed in the special convertible head sub due to lack of diameter clearance. An accumulation of pipe rust above the pulling neck had obstructed the overshot on the second and third retrieval attempts. The instrument's battery had gone dead during the pipe trip, causing the data to be lost and no core was found in the inner barrel.

The drill string was immediately run back in considerably improved weather and Hole 524 was spudded at 1147 hours, May 23 after a loss of 23 3/4 hours. The first core barrel was retrieved after the bit had been lowered to 4806.5 meters and signs of contact had been noted on the weight indicator. Only a handful of sediment was recovered because the flapper-type core catcher had stuck open but the water depth was set at 4805 meters on the basis of sediment adhering to the inside of the lower 1.5 meters of the plastic liner.

Conventional coring operations proceeded smoothly through firm ooze, chalk and some turbidites with good recovery and little core disturbance. An interval rich in volcanic sand turbidites between 135 and 160 meters BSF threatened to cause hole cleaning problems, but the hole was flushed clean with mud and drilling conditions improved with depth. A thin basalt sill was penetrated at 279 meters BSF and coring continued for an additional 70 meters through a sequence of sills and volcanogenic sediment. An increase in drilling torque was noted on the final two cores and it was feared that the bit bearings were failing. Early failure was expected since the basalt drilling was being done under conditions of severe vessel heave without benefit of the heave compensator. On further investigation, however, the higher torque was found to be limited to the sediment intervals and the bit was apparently in good condition when operations were terminated due to scheduling considerations.

HOLE 524A

The bit was pulled clear of the seafloor and immediately respudded. The second hole represented an attempt to recover shallow sediments that had been missed in the first hole and that lay below previously encountered chert/limestone strata (therefore inaccessible to the piston corer). The bit was washed down to 28.5 meters BSF and two successive cores, comprising an additional 19 meters, were taken. Unfortunately the heave conditions and relatively soft sediment combined to produce cores that were mostly too highly disturbed for the desired paleomagnetic measurements.

A hydraulic bit release go-devil was then pumped down the pipe and the bit, with associated components, was released at the bottom of the hole in preparation for conversion to HPC operations.

HOLE 524B

With operating site time running out, the pipe was again pulled above the seafloor. The HPC conversion collet was run in on the sandline and emplaced without incident. The vessel was offset 100 feet to the south to avoid disturbance from the previous two holes.

Last minute problems in dressing the HPC assembly resulted in a loss of 1 1/4

The corer was then run down the pipe and the first core attempt was "fired" with the end of the pipe at 4803 meters. Three meters of sediment core were recovered, establishing the water depth at 4084.5 meters. A total of seven HPC cores were taken from Hole 524B before it was necessary to cease operations at a total depth of 29.3 meters to meet scheduling commitments.

When the drill string had been recovered, several high-priority work items were accomplished while the ship remained on station on a stable heading. These included dumping the old sandline, transferring a new sandline from the hold to the catwalk for installation and removal of No. 7 D.C. generator from its mount to permit further progress on the installation of an A.C. unit.

The CHALLENGER departed Site 524, after a brief post-site survey, at 0756 hours, May 28, enroute for Cape Town, South Africa. A sonobuoy survey was also made as the vessel departed and a good seismic refraction record was obtained.

SITE 524 to CAPE TOWN

Light southerly winds and nearly calm seas prevailed for the first day after the vessel got under way from Site 524 and a speed of over nine knots was made good. On the second day, however, the winds increased and shifted to the south east. By the third day, the headwinds had reached 30 knots and, combined with rough seas, held the CHALLENGER's speed to less than seven knots. These conditions persisted, with only slight moderation, until the approaches to Cape Town Harbor were reached.

Leg 73 ended at 1418 hours, June 1, with the first mooring line over at Berth E, Duncan Dock, Cape Town.

DRILLING AND CORING EQUIPMENT

The standard DSDP bottomhole assembly was utilized at Holes 519A and 522B. This consists of a bit, bit sub, one 8 1/4" drill collar, coring top and head subs, three 8 1/4" drill collars, one five-foot stroke bumper sub, three 8 1/4" drill collars, two bumper subs, two 8 1/4" drill collars, crossover sub and one 7 1/4" drill collar. At Sites 520 and 524, a convertible head sub and hydraulic bit release assembly were substituted for the standard coring head sub and the bit sub, respectively. The hydraulic piston coring assembly used at Hole 519 consisted of bit, bit sub, one 8 1/4" drill collar, top sub, special HPC head sub, three 8 1/4" drill collars, one bumper sub, two 8 1/4" drill collars, crossover sub and one 7 1/4" drill collar. The same assembly was used at Sites 521, 522 and 523 with the exception that a second bumper sub was added between the drill collar stands to compensate for vessel heave.

The hydraulic bit releases operated according to plan, although it was necessary to set the bit on bottom both times to achieve release. The release in Hole 524A required about ten minutes of working and pressuring the pipe to activate the mechanism.

A test string of 62 joints of aluminum drill pipe was kept in the drill string at all times as part of a continuing evaluation program. No significant operational problems resulted from the use of the pipe.

Accumulations of rust flakes from the steel drill pipe continued to plague paleomagnetic studies, particularly in the use of the long core spinner. Various measures to reduce or eliminate the rust occurrence were tried with little success. The rust is apparently dislodged from the pipe walls by the continuous abrasion of the sandline during HPC operations. It would appear that the only chance of elimination of this problem would be through the use of an internally coated drill string.

No serious problems were experienced with the standard drilling and coring equipment. Most of the relatively minor problems that occurred were weather related failures in the rig and pipe handling equipment. The newly refurbished Bowen hydraulic system required only minor adjustments and now provides the driller with more precise control of pipe rotation.

The heave compensator was not used on Leg 73 due to damages sustained on Leg 72 and scheduled for repair in Cape Town. Although vessel heave was certainly great enough to warrant its use, bit runs were relatively short and reduction in bit life did not adversely affect the mission of the voyage.

CORE BITS

Only four bits were run on Leg 73. The special hydraulic piston core bit used for HPC coring on Legs 7 and 72 was again used on all principal HPC sites. It was retired after Hole 523 due to two loose bearings and cone breakage. Two rebuilt bits supplied by the SIO Marine Science and Development Shop were used for rotary coring. Their performance was satisfactory on the brief runs involved. A new Smith F94CK bit was run at Site 524. Performance was good and the bit withstood the pounding caused by severe vessel heave while basalt was being drilled. The total run was only a little over 20 hours before the bit was released, however.

SPECIAL TOOLS

The hydraulic piston corer saw its most extensive operational test since Leg 68, which was devoted strictly to piston coring. The HPC was used successfully on Leg 73 to core a total interval of 778.6 meters, much of which represented fairly well compacted Paleogene sediments. The average recovery rate over this interval was 88.1 per cent, and in general, there was very little disturbance. The employment of the HPC permitted detailed and extensive paleomagnetic measurements which contributed greatly to the success of the voyage.

While the value of the tool for certain applications in the upper sediment section was clearly demonstrated, the Leg 73 work highlighted several problems and limitations of the system. These include:

A. Persistent butyrate core liner failures when stiff sediments are being penetrated. These result in loss of core and difficulty in removing cores from the barrel with resultant core disturbance.

B. Strong suction resistance when core barrels are pulled from firm plastic sediment. The overpull from suction approached (and once exceeded) the tensile strength of the steel in the corer at Hole 523.

C. Susceptibility of the operation to adverse weather conditions. Coring done during periods when swell height exceeded six feet produced little science.

D. The need for an improved shear pin system. The threads holding the shear pins in place became worn and allowed the pins to back out of position. This allowed the corer to extend prematurely or at an insufficient pipe pressure for proper operation.

E. The need for a more positive relative orientation system. The aluminum ring system remains ambiguous and was discontinued about midway through Leg 73 at the request of the scientists. The results obtained did not justify the time and effort expended.

The wireline emplaced collet seal sleeve was employed successfully on two occasions to convert from rotary to piston coring following release of the bit. All components were recovered undamaged. This system appears to be fully operational and should save many hours of trip time in the future.

The downhole temperature probe was run on three occasions in Hole 522B. The first attempt was a combination run with the in situ water sampler. Unfortunately a faulty electrical connector inside the pressure case caused an open circuit and both instruments failed to operate. The heat flow equipment operated satisfactorily on two subsequent runs without the water sampler.

Three test runs were made with instrumentation designed to collect drill string stress and motion data. The drill bit motion instrument (DBMI) was basically an accelerometer package fitted into the top of an inner core barrel. It was run in conjunction with an instrumented drill string sub (IDSS), a joint of drill pipe at the rig floor fitted with strain gauges and a tension load cell. Two attempts, coordinated with coring operations in Hole 522B, were unsuccessful because the downhole recorder battery life proved to be much shorter than represented by the vendor and the data were lost before the core barrel had been recovered in the normal operational cycle. A third attempt, scheduled to be much shorter, was made prior to spudding Hole 524. It failed when the instrument pressure case jammed in the special HPC conversion head sub and a round trip was required to recover the tool. The battery again ran down and the data were lost.

DYNAMIC POSITIONING

Three ORE double-life and three Benthos positioning beacons were deployed on the voyage. Both the 16.0 and 13.5 kHz frequencies of both brands were used. All beacons produced strong acceptable pulses for the duration of site occupancy and no problems were experienced.

The vessel's dynamic positioning system functioned very well, considering that over 31 days were spent on-site in variable and sometimes unstable weather and swell conditions. The two most serious malfunctions occurred at the first drill site. On April 24, while positioning in the automatic mode, all power to the thrusters and main screws was lost. The officer on watch alertly switched to the manual mode and power was restored before the ship had moved far enough off site to affect operations. The trouble was traced to a faulty relay in the engine room, which was replaced while positioning continued in automatic. No time was lost. Two days later, while attempts were being made to adjust thrust and heading for changing weather conditions, the drill pipe was noted to be pulled to one side of the guide horn. A check with the computer room verified that the vessel was about 900 feet out of position, even though the pilothouse oscilloscope display showed no discrepancy. Operations were interrupted for 42 minutes (total DPS downtime for the leg) while the ship was repositioned using secondary displays. A defective cable running to the scope inside the pilothouse console was subsequently found and replaced. On seven widely scattered occasions during the operating leg, the DPS computer "hung up" and the positioning program was lost. In each case, bridge personnel shifted into the manual mode for a few minutes while the program was reloaded and there was no effect on operations. Several remedial measures have been taken to eliminate the problem and new diagnostic tapes have been developed. It is considered highly probable that the situation has been remedied, as technicians have been unable to induce a failure in test runs. The highly intermittent nature of the problem, however, makes it impossible to be certain that it has been resolved.

ENGINEERING

No significant problems were experienced with the ship's power generating, propulsion or auxiliary equipment. In general, the ship's major systems appeared to reflect high maintenance standards and were consistently dependable during the voyage.

The work load of the engine room staff was heavy, however, as work progressed on several modifications and improvements.

An extensive cooling system, which circulates treated fresh water to ship's machinery and scientific equipment, was completed. This installation will result in more efficient operation of the equipment and reduced maintenance for both GMI and SIO.

Considerable progress was made toward a major modification in the power generation setup, which will provide increased flexibility in electrical assignments and in power availability under operating conditions. Number 7 D.C. Generator was removed after the completion of site operations to begin the conversion of No. 7 Engine to an A.C. unit. Considerable modification is required, as the new A.C. Generator to be installed is of a different make from the other A.C. units on board. Removal of the A.C. Generator from the No. 10 "B" position was also begun. This generator will be offloaded in Cape Town for shop maintenance and cleaning. The D.C. Generator detached from No. 7 engine will be returned to the U. S. conversion to a two-bearing unit and will be reinstalled to the 10-B position to provide additional positioning power.

WEATHER AND CURRENTS

Considering the season and geographic location of Leg 73, the elements were exceedingly kind. A total of 12 1/4 hours weather downtime was accrued and nearly all of this was comprised of time spent waiting before the final two sites were spudded. The weather downtime figure is somewhat misleading, however, as vessel motion slowed trip and coring operations by several hours over the duration of the cruise. Timing was such that no holes were lost or terminated early due to weather conditions, although there were two or three close calls wherein positioning and vessel motion became marginal. Several weather fronts passed within about 100 miles of the CHALLENGER, but she repeatedly escaped most of their effects and continued operating.

Heavy swell systems spawned by the passage of storms in the southern ocean were common, but not constant, companions. At times the swells reached ten to twelve feet in height, making even routine coring operations difficult and adversely affecting core recovery and quality. Fortunately, however, the anticipated weather patterns which put wind and swell at nearly right angles developed on only two or three occasions.

All the drill sites lay along the trend of the South Atlantic convergence zone. Clouds and rain squalls were the rule rather than the exception and gusty winds in the squalls occasionally caused temporary positioning problems.

Currents at all sites were variable in direction with velocities generally less than one knot. Currents occasionally became a factor in positioning when wind and swell were at odds.

COMMUNICATIONS

Radio communications with San Diego were the most difficult in the recent history of the Project. A number of factors combined to hamper the exchange of message traffic. These included the remoteness and poor propagating characteristics of the operating area, transmitter and antenna problems at Scripps radio station WWD, difficulty in coordinating the brief communications "windows" with the operating schedule of WWD and interference from foreign commercial stations which share operating frequencies with WWD.

On most occasions it was possible for the CHALLENGER to clean daily outgoing traffic during the limited periods of favorable conditions, although in some instances the messages were sent "blind". There were occasions when several lower priority messages were backlogged, but it was necessary to send only three or four by commercial channels. Incoming traffic was more of a problem, however, and a few messages were received as much as 15 days late. By the end of the voyage, a fairly satisfactory arrangement had been worked out with the U. S. Navy for the handling of traffic to the CHALLENGER on the "mercast" broadcast. Efforts to use the Navy secondary circuit for two-way communications failed, largely due to jamming of the Navy frequencies by an unknown source.

Numerous personal phone patches were made by amateur radio operations to the U. S. for the benefit of those wishing to contact friends or family. The quality and number of these communications also decreased during the latter portion of the voyage when propagation conditions deteriorated.

PERSONNEL

The voyage was relatively long and work-intensive. After an initial nine day transit, there was little break in the workload until the end of the leg. The GMI crew, as usual, maintained a positive and professional attitude for the duration. The drilling crew, in particular, showed a marked increase in proficiency as the several men who were new in their positions on Leg 71 gained experience. The SIO technical staff handled a heavy workload with professional dispatch and the morale remained generally high. The scientific party, who enjoyed an exceptionally productive cruise, could scarcely record their major discoveries before more important ones occurred. They were generally a satisfied group despite certain disappointments that occurred during the course of the leg.

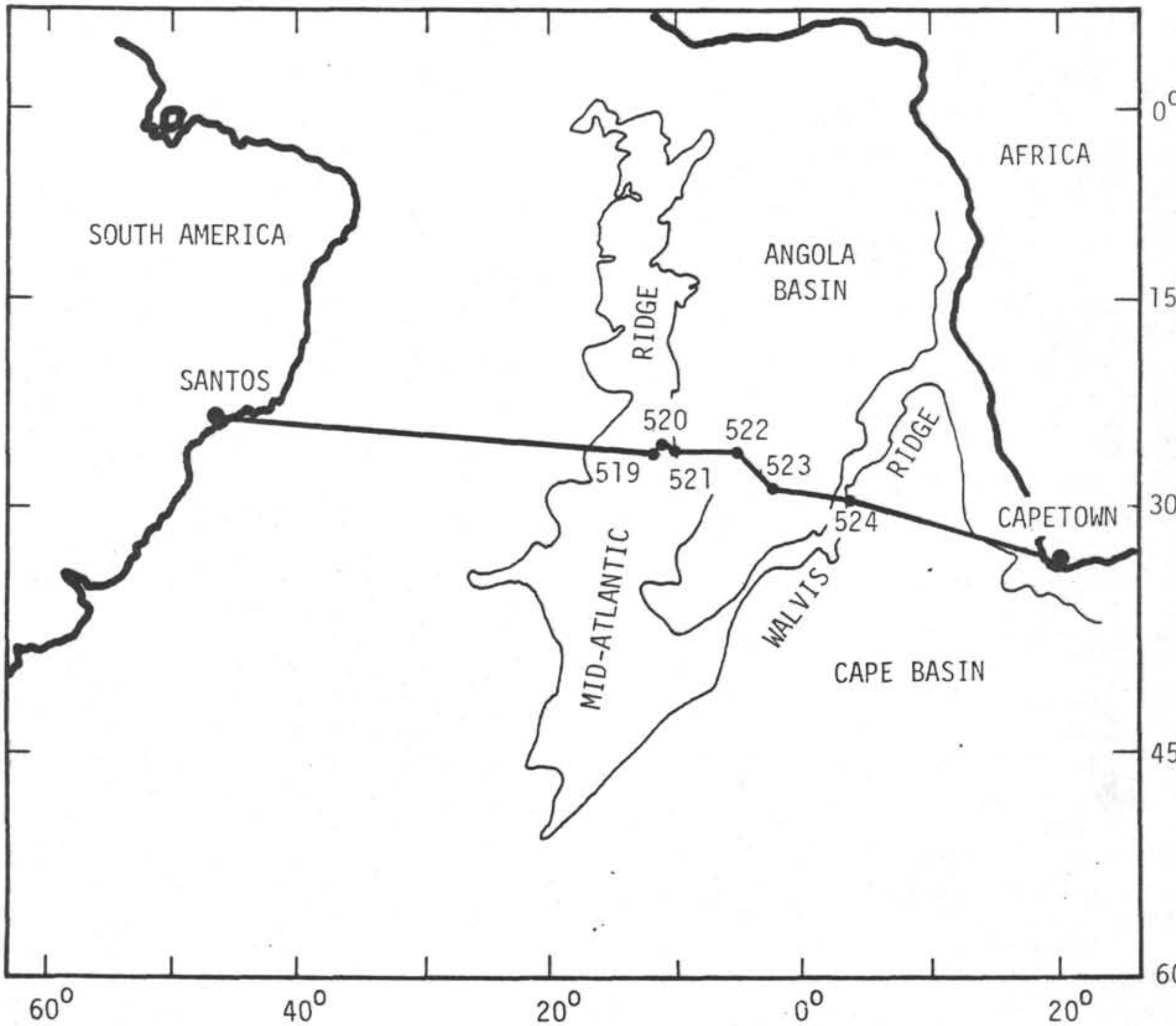
There were no injuries or illness of note, with the exception of one scientist who remained seasick for the entire voyage.

Glen N. Foss

G. N. Foss
Cruise Operations Manager
Deep Sea Drilling Project

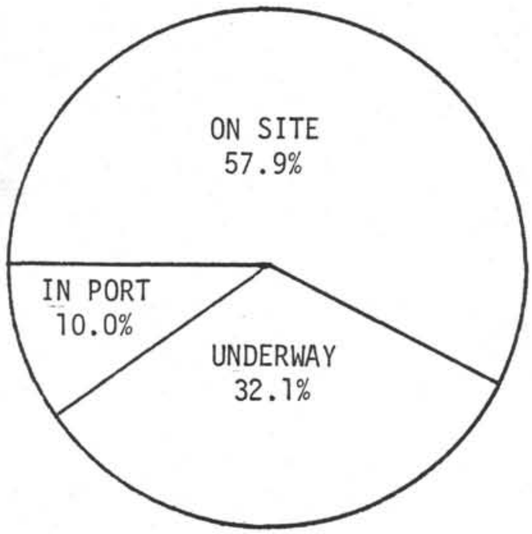
INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
OPERATIONS RESUME
LEG 73

Total Days (April 8, 1980 - June 1, 1980)		54.16
Total Days in Port		5.41
Total Days Under Way		17.38
Total Days On Site		31.35
Trip Time	5.9	
Drilling Time	0.6	
Coring Time	19.6	
Downhole Measurements	1.5	
Weather Downtime	0.5	
Mechanical Downtime	0.1	
Other	3.2	
Total Distance Traveled (Nautical Miles)		3652.7
Average Speed (Knots)		8.9
Sites Investigated		6
Holes Drilled		13
Number of Cores Attempted		286
Total Meters Cored		1474.6
Total Meters Recovered		1051.4
Percent Recovery		71.3
Total Meters Drilled		582.5
Total Meters of Penetration		2057.1
Percent of Penetration Cored		71.7
Maximum Penetration (Meters)		458.5
Minimum Penetration (Meters)		18.5
Maximum Water Depth (Meters)		4805.0
Minimum Water Depth (Meters)		3778.5

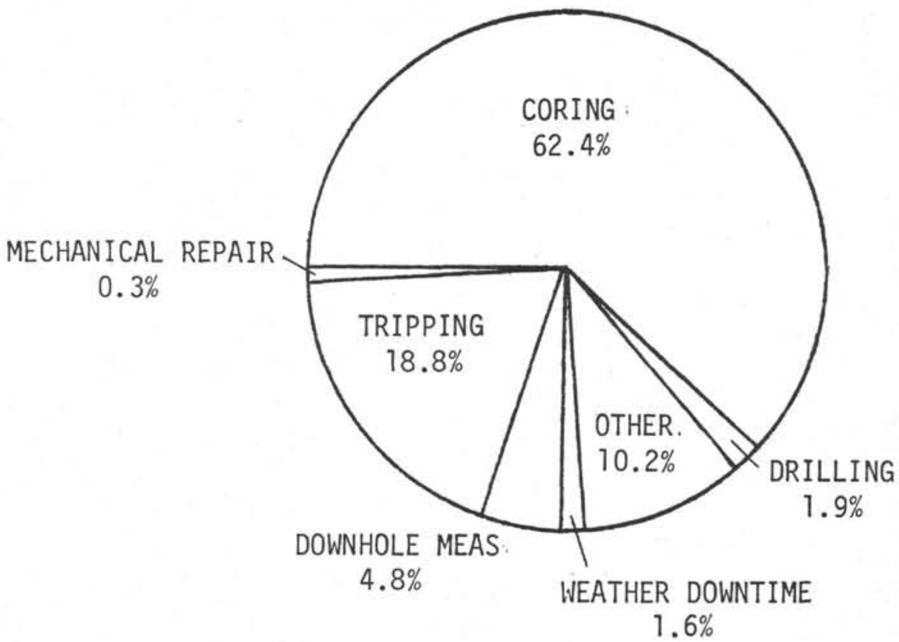


LEG 73 OPERATING AREA

TOTAL TIME DISTRIBUTION
LEG 73



ON-SITE TIME BREAKDOWN



DEEP SEA DRILLING PROJECT
TIME DISTRIBUTION
LEG -

Date	Site No.	Cruise	Trips	Drill	Core	Stuck Pipe	W.O.W.	Position Ship	Mech. Repair	Port Time	Re-Entry	Other	Total Time	Remarks
4/08/80 4/22/80		207.9								129.9		0.5	338.3	Santos to Site 519
4/22/80 4/25/80	519		17.7		45.4				1.1			9.1	73.3	HPC
4/25/80 4/27/80	519A		14.5	1.6	27.3				1.2			3.9	48.5	Rotary
4/27/80		8.3											8.3	519 to 520
4/27/80 5/01/80	520		10.3	7.3	57.9		1.0	0.2				5.2	81.9	Rotary
5/01/80	520A		6.6									6.6	13.2	HPC Conv.
5/01/80 5/02/80		8.9											8.9	520 to 521
5/02/80 5/03/80	521		10.5		26.8							3.3	40.6	HPC
5/03/80 5/05/80	521A		7.3		20.5							4.0	31.8	HPC
5/05/80 5/06/80		35.2											35.2	521 to 522
5/06/80 5/09/80	522		8.9		53.7							9.0	71.6	HPC
5/09/80 5/12/80	522A		9.0		44.4							3.7	57.1	HPC
5/12/80 5/14/80	522B		15.4	2.3	27.8			11.4				1.6	58.5	Rotary
5/14/80 5/15/80		22.4											22.4	522 to 523
5/15/80 5/20/80	523		18.9	1.5	74.5		6.4		0.4			18.6	120.3	HPC
5/20/80 5/21/80		33.3											33.3	523 to 524
5/21/80 5/26/80	524		12.1	1.8	77.2		4.8	24.2	0.3			4.0	124.4	Rotary
5/27/80	524A		0.2	0.2	3.4							0.7	4.5	Rotary
5/27/80 5/28/80	524B		9.1		10.6							7.0	26.7	HPC
5/28/80 6/01/80		101.1											101.1	Site 524 to Cape Town
TOTAL		417.1	140.5	14.7	469.5	0.0	12.2	35.8	3.0	129.9	0.0	77.2	1299.9	TOTAL

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
SITE SUMMARY
LEG 73

HOLE	LATITUDE	LONGITUDE	WATER DEPTH METERS	NUMBER OF CORES	CORES WITH RECOVERY	PERCENT OF CORES WITH RECOVERY	METERS CORED	METERS RECOVERED	PERCENT RECOVERED	METERS DRILLED	TOTAL PENET METERS	AVG. RATE PENET	TIME ON HOLE	TIME ON SITE
519	26° 08.20'S	11° 39.97'W	3778.5	37	37	100.0	151.6	138.4	91.3	0	151.6	-	73.3	-
519A	26° 08.20'S	11° 39.97'W	3778.5	9	9	100.0	84.0	61.4	73.1	96.0	180.0	15.3	48.5	-
	TOTAL			46	46	100.0	235.6	199.8	84.8	96.0	331.6	-	-	121.8
520	25° 31.40'S	11° 11.14'W	4217.0	31	28	90.3	246.5	69.3	28.1	212.0	458.5	29.2	81.9	-
520A	25° 31.40'S	11° 11.14'W	4217.0	1	1	100.0	2.4	2.4	100.0	16.1	18.5	-	13.2	-
	TOTAL			32	29	90.6	248.9	71.7	28.8	228.1	477.0	-	-	95.1
521	26° 04.43'S	10° 15.87'W	4141.0	21	21	100.0	84.0	75.4	89.7	0	84.0	-	40.6	-
521A	26° 04.54'S	10° 15.59'W	4140.6	17	17	100.0	71.1	64.3	90.4	0	71.1	-	31.8	-
	TOTAL			38	38	100.0	155.1	139.7	90.1	0	155.1	-	-	72.4
522	26° 06.84'S	05° 06.79'W	4456.6	39	39	100.0	148.1	137.8	92.7	0	148.7	-	71.6	-
522A	26° 06.84'S	05° 06.79'W	4456.6	31	30	96.8	109.0	97.9	89.8	47.0	156.0	-	57.1	-
522B	26° 06.83'S	05° 06.78'W	4456.6	6	6	100.0	40.5	25.3	62.5	129.9	170.4	8.1	58.5	-
	TOTAL			76	75	98.7	298.2	261.0	87.5	176.9	475.1	-	-	187.2
523	28° 33.13'S	02° 15.08'W	4572.0	50	49	98.0	182.5	149.2	81.9	11.0	193.5	-	-	120.3
524	29° 29.06'S	03° 30.74'E	4805.0	35	35	100.0	306.5	65.1	42.0	42.0	348.5	17.6	124.4	
524A	29° 29.06'S	03° 30.74'E	4805.0	2	2	100.0	19.0	9.9	52.1	28.5	47.5	60.7	4.5	
524B	29° 29.07'S	03° 30.74'E	4804.5	7	7	100.0	29.3	20.7	70.2	0	29.5	-	26.7	
	TOTAL			44	44	100.0	354.3	230.0	64.9	70.6	424.8	-	-	155.6
	GRAND TOTAL			286	281	98.3	1474.6	1051.4	71.3	582.5	2057.1			752.4

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
BEACON SUMMARY
LEG 73

SITE NO.	MAKE	FREQ. kHz	SERIAL NUMBER	SITE TIME HOURS	REMARKS
519	Benthos	16.0	009	73.3	
519A	Benthos	16.0	009	48.5	
				121.8	Strong for duration.
520	ORE	13.5	513	81.9	Double Life
520A	ORE	13.5	513	13.2	
				95.1	Strong for duration.
521	ORE	13.5	517	40.6	Double Life
521	ORE	13.5	517	31.8	
				72.4	Strong for duration.
522	ORE	16.0	478	71.6	Double Life
522A	ORE	16.0	478	57.1	
522B	ORE	16.0	478	58.5	
				187.2	Strong for duration.
523	Benthos	13.5	027	120.3	Strong for duration.
524	Benthos	16.0	022	124.4	
524A	Benthos	16.0	022	4.5	
524B	Benthos	16.0	022	26.7	
				155.6	Strong for duration.

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
BIT SUMMARY
LEG 73

HOLE	MFG	SIZE	TYPE	SERIAL NUMBER	METERS CORED	METERS DRILLED	METERS TOTAL PENET	HOURS ON BIT	CONDITION	REMARKS
519	MSDS	11 1/2	HPC	Maude	151.6		151.6		Point bkn off one cone.	HPC
519A	MSDS	9 7/8	RBF94CK	S5	84.0	96.0	180.0	11.8	T1BT-B35Q-0 1/8	All inserts bkn in drive row #3 cone.
520	MSDS	9 7/8	RBF94CK	S5	246.5	212.0	458.5	15.7	Unknown	Released in hole for HPC conversion.
520A	None				2.4	16.1	18.5	27.5		Open-ended HPC.
521	MSDS	11 1/2	HPC	Maude	84.0		84.0		Respud w/o inspection	HPC
521A	MSDS	11 1/2	HPC	Maude	71.1		71.1		One cone handy.	HPC
522	MSDS	11 1/2	HPC	Maude	148.7		148.7		Respud w/o inspection.	HPC
522A	MSDS	11 1/2	HPC	Maude	109.0	47.0	156.0		Two cones handy.	HPC
522B	MSDS	9 7/8	RBF94CK	S7	40.5	129.9	170.4	21.0	T2BT-B6-0 1/8	
523	MSDS	11 1/2	HPC	Maude	182.5	11.0	193.5		Worn out	HPC
524	Smith	9 7/8	F94CK	AN6454	306.5	42.0	348.5	19.8	Respud w.o inspection.	Cored about 24 M basalt in 8.5 hr; heavy swell, no H.C.
524A	Smith	9 7/8	F94CK	AN6454	19.0	28.5	47.5	0.5	Unknown	Released in hole for HPC conversion.
525B	None				29.5		29.5			Open ended HPC

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
OPERATIONS RESUME
LEG 74

Leg 74 has contributed greatly to the understanding of the Walvis Ridge. A series of five closely spaced sites were drilled down the flanks of this large, anomously shallow feature of the Eastern South Atlantic. An exceptionally well preserved and complete Oligocene section was recovered at two of the sites including the Eocene/Oligocene and Oligocene/Miocene boundaries. The much-desired Cretaceous/Tertiary boundary was recovered at all but one of the sites; that being Site SA II-7 where the ages of the sediments were all much younger.

It was also an exceptional cruise from an operational standpoint. Basement was cored on three of the sites. A fourth was terminated in carbonate rubble and sand which prevented any further penetration. The fifth site was terminated only because of time constraints. The uppermost sediments were piston cored on three of the sites.

Successful operation of the MOD II Wireline Pressure Core Barrel (PCB), the Drill Bit Motion Indicator (DBMI), Instrumented Drill String Sub (IDSS) and the Vessel Motion Instrumentation (VMI) was achieved.

The voyage commenced on June 1, 1980 at Cape Town, South Africa and terminated on July 24, 1980, at Walvis Bay, South Africa. The total length of the leg was 53.1 days, of which 31.7 days were spent on site, 5.1 days in port and 16.3 days underway. Although 15% downtime due to weather was anticipated only 2.1 days or 4% materialized. Mechanical breakdowns accounted for only 0.3 days.

A transit into Walvis Bay was made when a rotary helper was diagnosed as having infectious hepatitus. This medical transit resulted in the loss of 7.2 days. However, partial time compensation was received in the form of a four-day extension.

CAPE TOWN PORT CALL

Leg 74 began with the arrival of the GLOMAR CHALLENGER at Cape Town, South Africa. The first line on dock was at 1418 hours, June 1, 1980. As this port of call was serviced by a charter aircraft, only a minimum amount of freight was taken aboard.

Principal work items included:

1. Repair of the heave compensator piston rod and installation of a new piston lug nut, which was supervised by a representative of Brown Brothers, Inc.

2. Drill pipe inspection. No joints of pipe were found to require downgrading.

3. Recutting of connections on all ten of the heavy wall drilling joints (knobby drill pipe).

4. Service of the dynamic positioning computer by representatives of Western Computer. The No. 4 hydrophone was removed and replaced.

5. Completion of generator installation. To provide more flexibility in generator assignments, an AC generator was installed on No. 7 engine and the No. 10 DC generator was rewired for the functions of No. 7.

In addition to the above, tank T-52-L was degassed in preparation for the installation of the sewage disposal system (MSD), which was to be made operational during Leg 74.

CAPE TOWN TO SITE 525

After all port call activities had been completed, the CHALLENGER departed Cape Town at 1512 hours on June 6. The vessel departed with the understanding that thruster tachometer calibration tests, which could not be performed dockside, would be conducted outside the harbor. At 1603 hours, the vessel hove to and began to calibrate the thruster rpm indicators. At 1800 hours, with all tests completed, the CHALLENGER departed for Site 525 (SAII-1) with 45 GMI and 29 Scripps personnel aboard.

The CHALLENGER enjoyed good speed and fair weather enroute to Site 525, arriving in the operating area some three days and 16 hours from departure.

HOLE 525

Site 525 was the easternmost of all the sites to be drilled on Leg 74 and the highest on the Walvis Ridge transect.

The drill site was located on the first pass by navigation and seismic profiling. The positioning beacon was dropped at 0942 hours on June 10. One point six hours were then spent profiling and positioning the drill ship prior to the commencement of running drill pipe. With the exception of utilizing a pressure core barrel (PCB) core bit, the bottomhole assembly (BHA) was made up for standard rotary coring and the drill pipe was "strapped" as it was run into the hole. Prior to tagging bottom, the Bowen power sub and heave compensator were picked up and put into the string. A 9.5 meter punch core was taken at 2482.5 meters depth and 3.6 meters were recovered. This established the water depth at 2478.9 meters, slightly deeper than the 2477 meter water depth obtained with the precision depth recorder (PDR). This was the only core taken on Hole 525, as this hole was to be used strictly for heat flow measurements.

The heat flow tool, with the small probe compatible with the small diameter PCB core bit, was run in on the sandline. A 3/8" diameter brass shear pin was utilized for the first time to allow "jarring off" and leaving the heat flow instrument package downhole. This was accomplished after approximately 20 jars. The first heat flow measurement was taken at 2476.5 meters or 2.4 meters above the determined mudline. Successive measurements were then taken at 2481 meters (2.1 BSF), 2500 meters (21.1 BSF), 2519 meters (40.1 BSF), 2538 meters (59.1 BSF) and the final reading was taken at 2547.5 meters or 68.6 meters BSF. The pipe was then pulled, clearing the mud line at 2245 hours on June 10, terminating Hole 525.

HOLE 525A

At the completion of Hole 525, the drill pipe was "tripped" back to the mud line and a 80 meter offset due east was effected. Hole 525A was then spudded at 2300 hours on June 10. One core was taken to again verify that the mudline was still at the same depth. The pressure core barrel (PCB) was run in on the wireline for the second core. No attempt was made to release from the wireline. After landing, the drill pipe and wireline were slacked off together, punch coring a 6.0 meter core. The PCB was then retrieved without having rotated the drill pipe. Approximately 3500 lbs of overpull were required to unlatch. Upon arrival on deck, the pressure barrel showed no indication of pressure and 0.3 meter of core was recovered from below the ball valve. There was no evidence of any core having ever reached above the ball valve, indicating the valve had closed prematurely.

Since the upper sediments were to be hydraulically piston cored (HPC) upon completion of Hole 525A, a program had been established to spot core this interval. The program was as follows: standard core, PCB core #1, wash 32 meters, standard core, PCB core #2, wash 32 meters, standard core, DBMI #1, wash 59.0 meters and then begin continuous coring at 2644.0 meters (165.1 m BSF). The second PCB coring attempt was made by go-deviling the tool downhole. It was thought that surging in the drill pipe and/or lifting off bottom may have led to the premature closing of the ball valve on the first run. Upon recovery of the second PCB, there was evidence of pressure bubbling out of the bottom of the vent sub body extension. Approximately 1.5 meters of core were recovered from above the closed ball, but by then all pressure had bled off.

The first drill bit motion indicator (DBMI) run was made at 106.1 meters BSF. The vessel motion instrumentation (VMI) and the 30-foot instrumented drill string sub (IDSS) were run at the same time. No data were received on the DMBI unit as the tool failed to turn on. The VMI and IDSS tools gave good data.

The second DBMI run, again in conjunction with the VMI and IDSS tools, was taken at 260 meters BSF and met with the same results.

Two more pressure core barrel runs were made; one at 345.6 meters BSF and the other at 393.1 meters BSF. Both of these runs had signs of pressure bleeding off at the vent sub and indications that the ball had closed prematurely. Details on all the special tools tests will be forthcoming in the "special tools" section of the report

Continuous coring continued without any significant problems. Basalt was reached in Core No. 53 at 573.6 meters BSF. Coring was finally terminated at 678.1 meters BSF, over 100 meters into basement.

A wiper trip (short pipe trip) was made to ensure that the hole was open. Based on past experience with good hole conditions disrupted after flushing with mud, the decision was made to log without circulating mud downhole.

On June 15, at 1053 hours, the hydraulic bit release (HBR) go-devil was pumped downhole at 40 to 50 spm. After seating, the go-devil would not hold pressure. Upon pulling the go-devil out of the hole, it was found that the set of packing with the flare looking downhole was missing. All others were intact.

A second go-devil was pumped downhole; this time at only 20 to 25 spm. This time a seal was effected but the bit did not release. Drill pipe pressure was bled off and built up repeatedly but no release was obtained. After setting down on bottom and rotating several times, the drill pipe was re-pressured; still no release. Attempts were made to retrieve the second HBR go-devil. However, it would not come free. After having expended 4.5 hours and sheared two overshot pins, the decision was made to abandon logging and to pull the drill string. The bit cleared the seafloor at 1645 hours on June 15, terminating Hole 525A.

HOLE 525B

Upon completion of Hole 525A, the drill string was tripped and the bottomhole assembly (BHA) was modified for HPC operations. This consisted of removing the PCB core bit and installing the HPC core bit. The latch sleeve was replaced with an HPC seal sleeve and the hydraulic bit release was removed and replaced with a standard bit sub. An additional head sub was run above the bit sub to space the double pin sub connection of the HPC inside the core bit. It was hoped that this would eliminate a double pin sub failure such as was experienced on the previous leg. One stand of drill collars and two bumper subs were also removed from the BHA as is standard for HPC operations.

The drill string was then run, the Bowen power sub and heave compensator were picked up and Hole 525B was spudded at 0545 hours on June 16. At the start of Hole 525B, a modified version of the HPC system was being used. The modifications consisted of plugging the holes in the piston rod and drilling the dampening ports in the outer body instead. Also in use was the new drag block assembly designed to inhibit rotation of the HPC barrel and, hopefully, to improve the aluminum ring orientation reliability.

The first results of the modified system were not favorable. Since the outer body could no longer drain through the piston rod, it would remain full of water. When the time came to stroke the tool together, all the muddy water would be displaced out the holes at the top of the barrel, drenching the rig crew. After four runs downhole, the modified barrel became so silted up that it would not scope closed. The barrel was set aside and the backup unit was utilized.

Upon redressing, the modified barrel was found to have approximately one foot of sand and silt in the bottom of the outer body. Because of a shortage of spare parts, the decision was made to return the barrel to its original configuration as soon as possible. All holes were plugged in the outer body and the plugs were removed from the piston rod.

After Core No. 38, the second HPC unit would not stroke closed. It was again believed that sand was the culprit. Fortunately, by then the original unit was ready to go. Upon redressing the second barrel, a piece of rope was found in the outer body, jamming up the inner seal sub. No sand was in evidence.

Core orientation had shown no improvement with or without the drag block assembly and it was not unusual to see 20 or 30 or more marks on the aluminum ring. The multiple marking was believed to be strongly related to sea-state since the only time the rings became "readable" was when the sea state decreased dramatically. Since the improvement in weather was short lived, the orientation process was abandoned after approximately 36 hours.

The weather conditions, although not bad enough to suspend operations continued to wreak havoc on HPC operations. Piston coring took half again as long as normal due to the adverse conditions. Specific problem areas included: making and breaking the double pin sub connection, stabbing the piston head, opening and closing the wireline blowout preventer and reattaching the overshot prior to lowering the corer. All these operations are extremely difficult to do in rough weather.

Outside of three core liner failures in the first four cores, liner failures were not a major problem on this site. A system was initiated which utilizes an O-ring seal at each end of the core liner. Evaluation is not complete; however, it does appear to reduce the incidence of liner failure substantially.

Hole 525B was terminated at 285.6 meters BSF, after all the major scientific objectives had been met. Earlier while at this hole, one of the crew members was diagnosed by the ship's physician as probably having infectious hepatitis. It was decided that upon completion of the hole, the patient would be transported to Walvis Bay where a firm diagnosis could be made and proper medical care given.

At the request of the Chief Scientists, a positioning beacon was dropped prior to departure. They thought there was a very strong possibility that the vessel would return to this site before completing the leg. After spending 1.7 hours conducting a post-site (sonobuoy) survey, the vessel got under way for Walvis Bay, South Africa. Hole 525B was terminated at 0712 hours on June 19.

While enroute, the vessel made direct contact with the ship's agent and arrangements were made for transportation of the patient to a hospital. The ship was at anchor at 1254 hours on June 22. A replacement rotary helper was embarked and fresh fruits, vegetables and dairy products were loaded. After all the required paper work had been completed, the ailing rotary helper departed the vessel for transit to the local hospital.

A positioning beacon was "soaked" and the vessel got under way for Site 526 (SAII-7) at 1424 hours on June 22.

WALVIS BAY TO SITE 526

Due to high seas and strong headwinds, the vessel's speed was reduced to 7.5 knots while enroute to Site 526. After nearly four days transit, the CHALLENGER finally arrived at the site location and a beacon was dropped at 1148 hours on June 26. Two point seven hours were utilized profiling over the site and attempting to find an optimum heading which would allow operations to begin. At 1430 hours, the ship commenced waiting on weather as no acceptable heading could be found. Due to an adverse current, estimated at approximately 1.5 to 2.0 knots at 120°, the vessel was forced to take a heading of 135° to maintain position. This led to an unacceptable amount of rolling, 10° to 15°, generated by swells from 190° and 225°.

After a weather delay of 29 hours, it was decided to depart this site for Site 527 (SAII-5), which was approximately 15 hours steaming time away. It was hoped that during this time the swells would abate, allowing drilling operations to begin upon arrival. The vessel got under way at 1930 hours on June 27.

SITE 527

The CHALLENGER arrived at Site 527 (SAII-5) after steaming for 16 hours. A positioning beacon was dropped at 1128 hours on June 28. Three hours were used in pre-site surveying and searching for an optimum heading; again to no avail. Seven point five hours were expended waiting on weather before the swells began to abate enough for operations to begin. At 2200 hours on June 28, preparations were begun to run into the hole.

The BHA for Site 527 was the same as that on Site 525. This hole was to be rotary cored only, with limited basalt penetration.

Hole 527 was spudded at 0915 hours on June 29 in 4437 meters of water. Continuous coring was begun with very erratic results. The nannofossil ooze was extremely sensitive to water. Many cores came up as slurry and it was not uncommon to see core oozing out of the core catchers as the barrels were brought across the rig floor. This turned out to be a chronic problem throughout the leg.

The first of the special tools tests for this site was conducted on Core No. 10 at 85.0 meters BSF. To save time, the PCB and DBMI were run in tandem. Details of the run are found in the special tools section of the report.

Coring continued until 1524 hours on June 30, 1980. Core 19 was being pulled when the vessel lost all AC power. The vessel was put into the manual positioning mode immediately and the emergency generator was started. A few anxious moments were spent until 1545 hours when all power was restored. The vessel then went into the semi-automatic mode and coring operations were resumed. The origin of the problem was traced to a faulty component in the voltage regulator of the No. 2 AC generator. The maximum vessel excursion off the hole was estimated at 600 feet and there was no apparent damage to the hole or the drill string. Operations were again routine until Core No. 21. At that time, the sixth and final PCB run was made. While Core No. 21 was being retrieved, hydraulic fluid was discovered leaking from the heave compensator standpipe valve. The system was shut down immediately until the seals in the valve could be replaced. The heave compensator was back in operation again for Core No. 31. Basalt was recovered from 4778.5 meters (341.5 m BSF) in the core catcher of Core No. 38 and basement penetration began. By Core No. 40, the penetration rate had slowed to the point where the heavy drill pipe was put into the string. Total depth for the hole was recorded at 4821.5 meters (384.5 m BSF) with Core No. 44. The DBMI unit was also run on this core since data collected while drilling in basalt were highly desired. The run was successful. However, the "g" range on the accelerometer package turned out to be set too high for optimum data quality.

At 0925 hours on July 2, the HBR go-devil was pumped downhole. Upon seating, the go-devil failed to retain pressure. Repeated attempts at "pressuring up" eventually met with success and the go-devil seated. Multiple attempts at "sitting down" on the bit, rotating and repressurizing cycles failed to release the bit. At 2123 hours, it was decided to recover the go-devil and try another one. After two overshot pins were sheared attempting to dislodge the go-devil from its seat, it was agreed that bit release efforts should be abandoned. When the overshot was retrieved, the drill pipe connection was broken and water flowed from the pipe. Resultant attempts to pressure up on the drill pipe indicated that the core bit had released, leaving the pipe open-ended.

After verification had been made that the bit was gone, the hole was "slugged" with 40 barrels of gel mud and preparations for logging were begun. At 0445 hours on July 3, all was ready for the first temperature/density log run. It was discovered at that time that the logging winch would not shift into reverse to allow the tool to be run down the pipe. By 0630 that morning, the problem had been corrected and logging begun.

On the first run downhole gamma ray,and temperature curves were recorded. The density tool failed downhole and no data were recovered. On the second run into the hole, the gamma ray, sonic and caliper tools were operated. During this run, a temporary and intermittent power surge was causing electrical problems in the logging cab. The problem was eventually traced to the electric motor operating the automatic line oiler. This motor had frozen up and was the cause of the intermittent power surges. The motor was disconnected and the electrical problems were alleviated.

At 1845 hours on July 3, numerous attempts had been made to break through an open hole "bridge" at 4567 meters. The sonic tool was unable to do so and logging efforts were abandoned at that time. Only temperature, gamma ray and density logs were successfully run at Hole 527.

Several kinks were discovered during retrieval of the logging line. These apparently occurred during the unsuccessful and eventually aborted attempts to break through the bridge. Approximately 600 feet of logging line had to be cut off and the cable was reheaded.

Upon conclusion of the logging efforts, the drill string was pulled and, at 0512 hours on July 4, the vessel got under way for Site 528 (SAII-3).

SITE 528

Site 528 (SAII-3) was the middle site on the Walvis Ridge transect. Travel time was short as this site was only 41.3 miles from Site 527. At 1130 hours on July 4, a beacon was dropped. One hour was spent retrieving the profiling gear and positioning over the beacon. At 1230 hours the pipe trip commenced.

The operational plan for Site 528 was to wash through the soft upper sediments and then rotary core into basement. After the bit had been dropped and logging completed, the drill string would then be tripped back to the mudline and HPC coring begun using the "collet" system. The system had been used successfully before during Leg 73. The BHA required to run the collet HPC system consisted of the following: HPC bit; hydraulic bit release, outer core barrel, top sub, collet head sub, three 8 1/4 drill collars, one bumper sub, three 8 1/4 drill collars, two bumper subs, two 8 1/4 drill collars, crossover sub and one 7 1/4 drill collar.

At 1955 hours on July 4, Hole 528 was spudded. As preparations were begun for the wireline trip to recover Core No. 1, it was discovered that the hydraulic coring reel would not operate. Two hours and 45 minutes were spent unsuccessfully troubleshooting the coring reel. Finally at 2245 hours, the decision was made to rig the sinker bars and oil saver on the drawworks sandline so that operations could continue. At midnight on July 4, the drawworks sandline was run for the first core.

The inner barrel was retrieved with the core liner empty. It was deduced that the core had escaped during the sandline repairs. Therefore Hole 528 was respudded at 0145 hours on July 5. Eight meters of core were recovered this time, establishing the mudline at 3812.0 meters. The PDR had predicted 3810.0 as the seafloor.

Having established the mudline, the bit was washed ahead through the upper sediments. No rotation was used and core was taken to determine a stopping point compatible with piston coring.

While the washing operations were taking place, the problem with the coring reel was isolated and repaired. The problem turned out to be an air-activated valve, in the Bowen house, which had filled with water and locked up. After 1.7 hours of washing, a penetration of 122.0 meters had been reached. It was decided to begin continuous coring at this point, to ensure that the HPC and rotary coring operations would overlap. The wash barrel was retrieved and continuous coring was initiated from this point with the coring reel fully operational and in use.

Basement was reached in Core No. 39 at a depth of 4286.5 meters (474.5 BSF). The heavy wall drilling pipe was picked up almost immediately as the penetration rates were rather slow, averaging 164 minutes each for the first two cores.

While cutting Core No. 39, at 1605 hours on July 7, 1980, the acoustic signal was lost from the 16 kHz Benthos positioning beacon. The vessel was put into

The semi-automatic positioning mode and a 13.5 kHz beacon was quickly let go. All coring operations were ceased and the drill pipe angle was used as a positioning guide until 1645 hours. At that time the vessel was back in the automatic positioning mode and coring operations were resumed. This was the first failure of the new Benthos positioning beacons which had performed flawlessly up to that time.

At 0500 on July 8, core barrel No. 43 was pumped down and would not seat. After retrieving the barrel, a center bit assembly was pumped down to dislodge a suspected piece of basalt which had become lodged in the coring assembly. Upon recovery of the center bit, the barrel (No. 43) was again pumped downhole and coring operations continued after signs of normal seating were noted.

Coring operations were suspended after Core No. 47 at 1930 hours. Total depth was 4367.0 meters (555.0 m BSF), some 80.5 meters into basement. At this point, over 27 hours had been expended coring into basement.

Several changes were made for the resultant bit release operations. A 40 barrel slug of "guar gum" was displaced downhole at 60 spm to clean out any sand and/or cuttings which could inhibit the HBR go-devil from seating properly. The go-devil used was the older "heavy wall" style. The venting port at the base had been plugged and redrilled from the side. This was done to eliminate the potential of trapping sand in the port while the go-devil was being pumped downhole. Should sand accumulate in this port, it would plug off, preventing the water above the HBR sleeve from being displaced. This would hydraulically lock the sleeve and prevent it from shifting. The third change consisted of pumping the go-devil downhole at a maximum of 15 spm. Evidence from the first two go-devil runs on the previous site indicated a tendency for the seals to come off while being pumped downhole.

At 2006 hours on July 8, the go-devil was dropped. The guar gum and go-devil were both displaced from that point with 15 spm. At 2043 hours, the go-devil seated. Pressure was allowed to build up to 1800 psi and then the bit was placed "on bottom". Upon picking up from bottom, at 2045 hours, the bit released.

Because of the "open hole bridging" which had occurred during logging operations on the previous hole, it was decided to fill the hole with gel mud. The logging engineer explained that this would cause him no problem and that, in fact, by running an electric induction log he would have two resistivity curves; one at approximately 12 inches depth of investigation and one at 12 feet. This would allow resolution of the possible infiltration of the fresh water mud into the sediment.

After 200 barrels of gel mud were spotted, the heavy wall drill pipe was laid out and the Bowen sub and heave compensator were set back. The drill pipe was then pulled back to the logging point at 3021 meters and preparations for logging began.

At 0115 hours on July 9, logging operations commenced. On the first run downhole the gamma ray, temperature and density tools were run. The density tool failed downhole and no data were recovered. On the second run into the hole, the gamma ray, sonic and caliper tools were operated.

Weather conditions continued to deteriorate during the logging operations. The odometer failed on the first run downhole just as it had done on the previously logged site. The mechanical pivot arm holding the Gearhart-Owen depth indicator had to be removed because excessive ship's motion was making it swing around too much. This, in turn, was making it impossible to spool the cable on the drum correctly.

On the third run downhole, the Chief Scientists were made aware that, due to deteriorating weather conditions, this would probably be the last logging effort. The decision was made to rerun the now repaired density tool rather than the induction log. While logging on the third run, the tool apparently hung up downhole. Due to high load fluctuations on the weight indicator (plus or minus 500 pounds), this hesitation in tool motion went unnoticed and excessive line was slacked off in the hole. As a result, upon retrieval of the tool, it began dragging as it entered the BHA. Over four anxious hours were spent as the tool inched its way out of the hole. Upon arrival on deck, 2000 feet of logging line was found kinked or damaged to some degree. The tool itself had the calipers closed and was in fine shape. The density tool had again failed downhole with the result that only the gamma ray, sonic, temperature and caliper logs provided date.

By 2245 hours on July 9, all logging sheaves had been rigged down. The pipe was pulled clear of the mudline at 2236 hours and the vessel commenced waiting on weather.

HOLE 528A

While awaiting improved conditions, a 2400 foot east by 1800 foot north offset was entered into the positioning computor. This move was done in very small increments so as not to jeopardize the drill pipe. The offset was an attempt to miss a hard reworked sediment layer that had the potential to inhibit HPC operations on the next hole.

At 0439 hours on July 10, it was decided to resume operations as the weather appeared to be moderating. The HPC conversion collet was pumped downhole at 30 spm for one hour. No increase in pump pressure to indicate the collet's arrival at the core barrel was observed. Attempts to recover the go-devil failed when the sinker bars failed to reach the proper depth by approximately 130 meters. The coring reel weight indicator showed a weight loss but no go-devil was recovered. Although no hookload weight loss was apparent, it was feared that the outer core barrel might have broken off and that a bumper sub had bent. Since the weather was again deteriorating, swells were evident from three directions and the seas were confused, it was decided to recover the drill string rather than try to recover the go-devil a second time. At 1430 hours, the bit was on deck and the BHA was intact. The collet was found latched in the modified head sub just as it should have been.

In retrospect it was reasoned that the collet go-devil had not reached bottom after one hour and therefore no increase in pump pressure would have been noted. On inspection of the pulling neck on the go-devil, it was also decided that not enough chamfer was present to ensure positive latching of the overshot. It was decided that in future operations the go-devil will be wirelined downhole with approximately 30 spm.

Four additional hours were spent waiting on weather before it was felt that operations could be resumed. At 1830 hours on July 10, the crew began to run pipe. At 0030 hours the following morning, while running into the hole, operations were suspended to repair the pipe stabber head. Initial attempts to weld the unit failed, so the unit was replaced. At 0200 hours, the pipe trip was resumed. At 0540 hours on July 10, Hole 528A was spudded and HPC operations were begun. Several modifications to the HPC assembly were utilized on this site. O-ring seals were installed in the double pin sub and in a 9 3/4" inner barrel sub. These provided an O-ring seal at each end of the core liner.

Evaluation of the O-ring seal theory should continue for several legs. However, initial results indicate a marked decreased in liner failures when the O-rings are used.

Another 9 3/4" inner barrel sub was bored out 2 1/2" on the box end to accept a standard soft formation core catcher. This allowed the use of both dog and flapper type core catchers on each run. The results were dramatic with 100% plus recovery on the first day's use.

As on previous sites, the weather again caused problems in handling and operating the HPC hardware. From 0000 hours to 0600 hours on July 12, weather conditions continued to worsen. In conjunction with the weather, both the quality and recovery of the piston cores deteriorated.

By 0600 hours, the vessel was pitching more than piston coring operations could stand. At that time all operations were suspended and the vessel began waiting on weather again.

Contributing to the HPC operational problems was the fact that the strengths of the shear pins seemed to be very inconsistent. Both the 0.37 and 0.40 diameter pins were shearing at about 450 psi with two pins installed. This was much too low for proper performance. The pins were not backing out but were engaging all the way and were shearing cleanly. The allen heads were not broached too deep and there was no evidence of any premature loading. All indications were that the last batch of shear pins had been made of a weaker brass alloy.

By 1045 hours, it was decided to try operations again. The swells were abating, albeit very slowly. Continuous HPC coring was conducted, although somewhat slowly, until Core No. 24. At that time, the barrel had failed to shoot off properly twice. The barrel was laid down and the backup tool was run into the hole. On disassembly, HPC unit No. 1 was found to be locked up due to drill pipe rust around the inner seal sub. Routine coring again continued until 2245 hours on July 12 when the coring reel operator missed a "flag". The sinker bars were pulled into the oil saver which then broke the clamp and lodged in the blocks. On impact, the HPC barrel with Core No. 26 was released and free-fell downhole. By 2325 hours, the oil saver and clamp had been repaired. Core No. 26 was recovered without incident and operations continued. Core No. 30 was the last core taken on this site. Operations were terminated at 0720 hours when Core No. 31 was discovered to have not shot off. Total depth was 3956.0 meters or 130.5 meters BSF.

The Bowen sub was set back and pipe retrieval operations began. At 1330 hours, the rig floor was secured and at 1336 hours, the vessel got under way. As in the past, post-site sonobuoy profiling was conducted. This time with extremely successful results. At 1600 hours on July 13, the profile was ended and the vessel changed course to get under way for Site 526 (SAII-7). This site had been approached earlier in the leg; however, due to weather conditions, it was never spudded.

SITE 526

The trip back to Site 525 (SAII-7) was uneventful. The CHALLENGER made good speed and crossed over the beacon at 0320 hours on July 14. All indications were that the weather would be better than at any other time this leg. This was the primary reason for even attempting this site again. One point two hours were spent profiling the area after having crossed over the beacon. An additional 1.4 hours were then spent positioning the ship over the still-strong beacon. At 0554 hours, the pipe trip commenced under absolutely ideal operating conditions. The plan was to piston core while conditions permitted and then to rotary core later if conditions deteriorated. This additional pipe trip would not expend very much operating time since the water depth was only 1064 meters (PDR).

After the hole was supposedly "spudded" at 0920 hours on July 14, two "water cores" in a row were recovered. Since the PDR depth had been quite accurate at the other sites, something was suspected to be amiss. While hurriedly rechecking the PDR depth measurement, the real culprit was found. The driller and derrickman had both miscounted the drill pipe stands and had run one stand too few. This was immediately corrected and Site 526 was spudded at 1100 hours in foraminifer sands.

Success was short-lived as the second HPC attempted was extremely difficult to unseat and required 10,000 to 12,000 pounds of line pull to drag back to the surface. At 1210 hours, the barrel was back on deck and the inner barrel was found to be badly bent. Since penetration was only 6.3 meters below the mudline and the core catcher sub was undamaged, it was assumed that the vessel had taken an excursion after having shot off HPC No. 2. The bridge display, however, indicated that the vessel had been holding station beautifully within 10 to 20 feet.

Since no system malfunction was evident, a third attempt was made. The thinking at this point was that perhaps the sand was very resistant to penetration and the barrel had actually been shot in at a slight angle, bending on impact. Barrel No. 3, however, could not be lowered past a point in the drill string about 100 feet above the landing point. The hundred foot discrepancy put the corer suspiciously close to the location of the bumper subs in the HPC bottomhole assembly. As the hole was being spudded in relatively stiff sand and very shallow water, a bent bumper sub was the obvious conclusion. Repeated attempts to get past the "hang-up" point were made. Pressuring the drill pipe confirmed that the barrel was not seated and that the bit was not plugged. The bit was pulled clear of the mudline at 1240 hours, officially terminating Hole 526 and, at 1310 hours, the trip out of the hole began.

HOLE 526A

By 1540 hours, the BHA had been recovered and the core bit was on deck. Absolutely nothing appeared to be out of the ordinary. One point three hours were then spent on meticulously checking clearances of the HPC barrels in the BHA, stroking bumper subs, pressure tests and flapper, core bit and seal sleeve inspection. Two conclusions were evident. Either an obstruction in the pipe had cleared itself while pulling out of the hole or a wash pipe in one of the bumper subs had backed off.

Since time was of the essence, both bumper subs were laid down for later inspection. The crew picked up two alternates and proceeded back in the hole. A rabbit was run through the first few joints of drill pipe as an added precaution. At 2030 hours, the Bowen power sub was being deployed. The vessel suddenly and quite unexpectedly began moving rapidly off station. The current, which had been fairly strong and constant all along, had abruptly reversed its direction a full 180°. Before the vessel could be turned around, it was 700 feet "off the hole". Forty minutes were expended repositioning the vessel and at 2145 hours, Hole 526A was spudded.

The game plan was to wash 45 meters into the sediment. This would both bury the bumper subs and hopefully penetrate through the "troublesome" sand layers. One point eight hours were spent washing without rotation until 25.0 meters, when the bit suddenly broke out of the sand layer. The plan was altered and continuous coring began at 28 m below seafloor and continued very successfully until Core No. 19 was recovered at 1171.0 meters or 111.6 meters below seafloor. The liner on that run was completely shattered. Up to that time, recovery had been running at 106% with no liner failures. Quality was excellent. The only major problems had been the continued accumulation of drill pipe rust in the cores and inconsistent shearing pressures. The rust occurred in spite of this being the most shallow hole of the leg and of all rig floor efforts to remove loose particles.

Coring continued until Core No. 47, when two shots failed to get penetration. Core No. 46 became the last core of Hole 526A, terminating at 1294.3 meters (228.8 m BSF) in calcareous rubble. This hole had been the most successful of the leg with 200.8 meters cored and 206.6 recovered meters for an astounding 102.9% recovery rate. The dual core catcher setup really works. Liner failures were practically nonexistant, occurring only on Cores Nos. 19, 33, 35, and 41. In each case, the failures stopped when the O-rings were changed. Hole 526A was terminated at 0520 hours on July 16, as the bit cleared the mudline.

HOLE 526B

Hole 526B was spudded at 0615 hours. The purpose of this hole was a final attempt to recover the foram sand bypassed on HOle 526A. The complete interval from 6.3 to 28.3 m was cored. Recovery was an acceptable 61.4%. It appears that some forms of sand can be piston cored. With the objectives satisfied, Hole 526B was terminated at 0938 hours on July 16.

HOLE 526C

After a short, 8.1 hour round trip of the drill pipe, Hole 526C was spudded at 1745 hours on July 16. This hole was to be essentially an extension of Hole 526A. The principal objective was to wash down to the HPC penetration point and then to rotary continuously into basement. The following program was initiated: wash 33.0 meters, then rotary core ~~Nos~~. 1; 2, and 3; and ~~with No. 3~~ being a PCB/DBMI ~~test;~~ then proceed to wash an additional 138 meters and begin continuous rotary coring at 1260.0 meters or 194.5 meters below seafloor. Core No. 6 at 1279.0 meters was to be the second PCB/DBMI test of the hole--the eighth and sixth tests, respectively, of the leg. On the first test the DBMI got good data on the one "g" scale. The PCB recovered 100% core but no pressure when the tool failed to scope and the ball did not close. On the second run the DBMI failed to recover any data when a connection to the accelerometer package broke loose. The PCB had its first perfect run--nearly 100% core recovery at 1200 psi pressure. All systems functioned perfectly.

Coring continued uneventfully until Core No. 9 at 1298.0 meters (232.5 m BSF), when penetration of a high-porosity calcareous rubble zone interbedded with sand layers began. Coring continued with flushes of 50 barrels of gel mud after cores Nos. 13 and 19. Hole cleaning problems did not occur, but recovery in this layer was quite low at 17.0%. Basement had not been reached and it was not known how much deeper it might be. Since it was unlikely that a deep basement penetration could be sustained and more unlikely that logging could be accomplished, the decision was made to abandon the site. Core No. 21 was the last core recovered. Total depth was 1421.5 meters (356.0 m BSF) and at 1515 hours on July 17, the pipe trip began. Since this may well have been the last rotary-cored site of the leg, the BHA was magnafluxed coming out of the hole.

At 2218 hours the vessel got under way for Site 529 (SAII-2) for an abbreviated coring program utilizing the remaining available time.

SITE 529

The cruise to Site 529 (SA II-2) was uneventful. The threat of inclement weather never did materialize. The beacon, Benthos 13.5 kHz SN 014, was let go at 0700 hours on July 18, 1980 under perfect skies. A minimum of presite profiling was done since all available time was to be utilized for coring purposes. One point five hours were used to retrieve gear and position the ship prior to running in the hole at 0839 hours. There was not enough time remaining to core a substantial amount of basement or to log the hole. Therefore, the standard rotary bottomhole assembly was run without a bit release assembly. Since the majority of the hole would be soft to moderately stiff sediments, a Smith F93CK core bit was used.

Hole 529 was spudded at 1330 hours on July 18 and continuous coring was begun. The coring rate and recovery for this site were by far the best of any of our rotary drilled holes. This probably can be attributed to the almost perfect weather conditions and sea state. A psychologically "spirited" crew and the F93CK core bit contributed as well. Coring continued at an exceptional pace with an average penetration rate of 44.5 m per hour. Coring was terminated after Core No. 42 at a total depth of 3460.0 m or 417.0 m below seafloor (BSF). This was over 100 meters deeper than the scientists had expected to get on this hole and nearly all of the scientific objectives had been attained. AT 1730 hours on July 19, 1980, the crew began to pull out of the hole and to prepare for the long awaited trip into Walvis Bay, South Africa. All equipment was secured and at 2248 hours on July 20, the vessel began a post-site sonobuoy survey. At 0043 hours on July 21, the survey was complete and the vessel was underway for Walvis Bay.

SITE 529 TO WALVIS BAY

Light winds and moderate seas prevailed as the vessel departed Site 529 for Walvis Bay, South Africa. For the first day, under sunny skies, the vessel made 10.2 knots. Toward the end of the second day, however, strong southeasterly winds of 30 to 32 mph arose bring with them 6-8 foot seas. The vessel's speed of advance was slowed to 7.2 knows delaying arrival by eight hours. Leg 74 ended at 1728 hours, July 24, 1980 as the first line was secured at Walvis Bay, South Africa.

DRILLING AND CORING EQUIPMENT

Several diverse bottomhole assemblies were utilized on Leg 74. The shorter "piston coring" assembly was used on Holes 525B, 526, 526A, 526B, and 528A. This consisted of a HPC core bit, bit sub , one 8 1/4" drill collar, top sub, head sub with seal sleeve, three 8 1/4" drill collars, two bumper subs, three 8 1/4" drill collars, crossover sub and one 7 1/4" drill collar. An extra head sub was placed in the assembly just above the bit sub. This was to allow spacing the double pin sub connection of the HPC inside the core bit, protecting it from potential lateral loading and resultant failure. This addition worked well and should be a standard part of the HPC assembly in future operations.

The standard rotary bottomhole assembly was used on five holes. Holes 525, 525A, 526C, and 527 used the special 2 1/8" I.D, pressure core barrel (PCB) core bit. The other, Hole 529, made use of a standard F93CK core bit since there was to be no PCB testing and the hole was to be predominantly sediment drilling. This hole was also the only rotary drilled hole to utilize a standard bit sub rather than a hydraulic bit release. The rotary drilling assembly consisted of the following: bit, hydraulic bit release, one 8 1/4" drill collar, top sub, head sub, three 8 1/4" drill collars, one bumper sub, three 8 1/4" drill collars, two bumper subs, two 8 1/4" drill collars, crossover sub and one 7 1/4" drill collar.

A special head sub modified to accept a collet to be utilized in HPC operations was used on Site 528. The plan was to drop the bit off at the conclusion of the rotary drilled hole, pump down and latch in the collet, retrieve its running tool and begin HPC operations without tripping the drill pipe.

The hydraulic bit releases were operated successfully on two occasions with total failure on a third. The major problem with the failed attempt appeared to be sandy cuttings downhole preventing proper go-devil seating. In addition, it appeared that the seals would start to come off the go-devils if they were pumped downhole at more than 15 spm.

The aluminum drill pipe test string was not utilized on this leg. Most of the Leg 74 holes were in relatively shallow water and on the deeper holes logging was of prime interest. Because of an already recognized problem with seal removal on the HBR go-devils, it was felt that exposing the same to a smaller inside diameter was unwarranted and would unnessarily jeopardize the prime objectives of the site.

HEAVE COMPENSATOR

The heave compensator was a valuable piece of equipment throughout the leg. With large swells very much a part of our daily operations, the heave compensator provided the driller with much more precise weight control than he would have had other wise. With the exception of a standpipe manifold leak, no major problems were experienced with the HC system. It was utilized on all rotary drilled holes except the last one and that was only because the drilling was to be in soft sediments the entire hole.

HYDRAULIC PISTON CORING OPERATIONS

Several modifications were tried as part of a continuing program to upgrade the piston coring program. The first modification was to dampen the HPC impact at the end of its stroke by drilling holes in the outer body rather than the piston rod. This would allow use of a special "vented" piston head which would hopefully solve the liner collapse problems experienced in the past. This mod was short lived as the holes allowed a build-up of sand in the system which locked it up after only four runs.

The second mod was that of incorporating a new "stronger" drag block assembly in the system to reduce or eliminate the multiple marks on the orientation rings by preventing rotation on the corer. There was no significant reduction in the multiple marking problem which became so severe that all efforts to orient the piston cores were abandoned after the first site and were not attempted for the remainder if the leg.

The third modification was to provide an O-ring at each end of the core liner. The intent was again to prevent core liner failure. This modification was evaluated over several sites and it appears to significantly reduce the incidence of liner collapse.

A fourth modification was that of boring out an additional 9 3/4" inner barrel sub to accept a standard dog-type core catcher. This allowed running both flapper and dog-type core catchers together. The merit of this was demonstrated on Hole 526A where 102.9% recovery was obtained in over 200 meters of coring.

The HPC collet system was tried on Site 528 and worked well mechanically. However the site was terminated due to bad weather before the actual HPC operations could be tried.

The most pressing problem with the HPC system is the need to eliminate the threaded connection at the double box sub. This must be replaced with some form of quick disconnect. A secondary problem is that of inconsistent shearing performance of the shear pins. Drill pipe rust problems in cores persist despite all efforts.

CORE BITS

The core bits used on Leg 74 were principally of the Smith F94CK type. On four occasions the smaller 2 1/8" I.D. PCB bit was used. All bits performed admirably and spent many hours coring basalt with good recovery and no failures.

SPECIAL TOOLS

A wide array of special tools were run, including the Pressure Core Barrel (PCB), Drill Bit Motion Instrument (DMBI), Instrumented Drill String Sub (IDSS), and Vessel Motion Instrument (VMI). All of the above enjoyed both success and failure throughout the leg. Detailed reports on each tool are included herein.

A method of "jarring off" and releasing wireline tools downhole was tried with the heat flow tool. This entailed lowering the tool on the wireline and then jarring down to shear a smaller (weaker) overshot pin, thus leaving the tool downhole. Although nearly 20 jars were required to get off the heat flow tool, this promises to be a valuable operational technique for the future. Slightly modified tools and some practice in operation technique should improve this method of downhole tool deployment to an acceptable standard.

DRILL BIT MOTION INSTRUMENT

The DBMI did not actuate on the first run. The unit drew no current from the battery charger after the run. The battery was found to be too short to reach the connector. Shims were installed in the cap screws to solve this problem. On the second run the unit also did not turn on. At this point the unit was opened and troubleshot. First about a foot and a half of wire was removed from the battery side of the on/off switch. This was presumably put in to check the charge current. Then several broken wires and open circuits were found and repaired. The unit appeared to be operational at this point. On the third run, the unit turned on while still falling. Part of the way through the run it turned off. This took place, as nearly as can be figured, on impact. The solder post at the accelerometer output broke loose and was replaced with a plug. The DBMI seemed to be loading the whole memory with one valve as soon as it turned on. A faulty external reset was replaced.

On the fourth run, the DBMI seemed to have worked, though the range scale was too high. Later the unit was turned on to be recalibrated and did not work. The amplifier output was incorrect for 8.5 minutes, then correct for 8.5 minutes. One gate in IC 20 was leaking through to the amp zero switch, shorting that imput to ground.

On Run No. 5, the accelerater output plug came off. This plug should be secured to the board with RTV to prevent it from pulling off again.

INSTRUMENTED DRILL STRING SUB.

There was no trouble with the downhole electronics. On run No. 4, the IDSS didn't turn on due to broken wires for the external clock.

The strain gauges for torque and tension on primary and secondary channels in the five foot instrumented sub did not work properly. RCAL and zero readings differ greatly from the box readings.

DYNAMIC POSITIONING

Benthos positioning beacons were used exclusively this leg. Four single life--two each 13.5, and two each 16.0 kHz, were used as well as two each 13.5 double life and one each 16.0 kHz double life. All but one were very strong and reliable performers. That one, a 16.0 kHz double life SN 010 failed quite suddently after 76.5 operating hours on Site 528.

The vessel's dynamic positioning system performed very well. The thrusters in particular were constantly being operated to their limits by consistently strong currents and winds. Multiple swells were the rule rather than the exception resulting in vessel headings which heavily taxed the thruster performance. Nevertheless these headings were required to minimize the roll and pitch of the vessel, and thus extend operating time in the face of ever-present inclement weather.

ENGINEERING

Only one significant problem was experienced with the ship's power generating system. That was described earlier as a complete AC power failure initiated by a faulty component in the voltage regulator in the No. 2 AC generator. This was corrected in short order by the very efficient and capable engineering crew.

In general, the ship's major systems were dependable, freeing personnel to work on the Marine Sewage Disposal System which is now nearly complete. All that is lacking for the system to be operational is a few valves which are to be brought to the Walvis Bay port call.

LOGGING

Logging was attempted on Sites 527 and 528. Various degrees of success and failure were achieved on both.

On Site 527, the total interval to be logged was 275.5 meters of which 43.0 was basement. On the first run the temperature and gamma ray tools were deployed successfully.

Prior to the second run the Gearhart-Owen computer began tripping on and off line. The problem was traced to a frozen motor on the automatic line oiler of the logging winch. After the motor was disconnected there were no further problems.

On the second run downhole, the density and caliper tools were run. The density tool worked but no caliper trace was recorded. The problem was traced to a broken wire inside the tool.

On the third run the sonic, gamma ray and caliper tools were run. These tools did not reach bottom, hitting a bridge just 21.0 m into open hole. When the tools were recovered there was a kink in the logging line 600 feet from the cable head. Logging operations were then terminated. The damaged line was cut off and the cable was reheaded.

Prior to dropping the HPR go-devil at Hole 528, forty barrels of guar gum were displaced to clean the hole. In addition, 200 barrels of gel mud were spotted in the hole. This was an attempt to keep the hole from bridging as it had on the previous site.

The total interval to be logged as 446.0 meters, of which 80.5 meters was basalt. The first tools downhole were the temperature, gamma ray and density. The tools were prone to hanging up on ledges on the way downhole but eventually reached bottom. Very little fill was evident as the tools got to within two meters of bottom. (This was opposed to over 30 meters of fill on Site 527.) On the first run the temperature and gamma tools were again successful but the density tool failed. Upon retrieval of the tool, several broken wires were discovered. In addition a set screw had backed off, allowing a caliper linkage pin to move and disconnect the linkage. On the second run downhole, the sonic, gamma ray and caliper tools were run successfully. Since the weather was deteriorating, a choice had to be made as to which tools would be run on the final logging effort. The decision was to try a new density tool rather than to run the induction log. This run was not successful since the tool apparently just barely got into open hole (approximately 20 m). Because of high load fluctuations on the weight indicator, i.e.

± 500 lbs, it was not realized at the time that the tool was not going downhole. The tools were pulled out of the hole with great difficulty and 2000 feet of line was found to be damaged with kinks and "cat tails". This line was cut off and the cable reheaded.

It became evident after the second attempt at logging on this leg that some form of guidelines need to be developed for allowable weight fluctuations during logging operations. The rough weather experienced on Leg 74 made logging almost impossible. In addition the logging tools need to be made heavier, thus providing more of an indication when a bridge or obstruction is encountered.

WEATHER AND CURRENTS

The weather picture for Leg 74 was one of extremes. It was either extremely good or extremely bad. Although only 2.1 days of downtime due to weather were logged, it nevertheless had an impact on operations throughout the leg. A strong one to one and one half knot current was prevalent on most of the sites. The exceptions were Site 527 and 529 where the current was negligible. On Site 526 the current was actually estimated, by vessel drift, at 2.8 knots.

Multiple swell conditions, usually from the south, southwest and southeast complicated operations on most of the sites. The vessel almost always had one of these swell trains on its beam since the prevailing winds and current were usually from the south or southeast. The vessel would roll as a result. Occasionally the winds would swing around from the north after the passage of a front. This actually improved the conditions temporarily by helping the vessel position into the strong current. On Hole 528A operations were halted due to excessive vessel pitch which made piston coring operations extremely dangerous.

Beginning with Site 526 (the second time) on July 14, 1980, the weather turned decidedly better. It remained excellent for the final Site 539. The expected 15% downtime due to weather was not approached.

COMMUNICATIONS

Communications were difficult this leg because of poor propagation between the vessel's location and stations normally worked. There was a "window" of about one hour per day, between 1300-1400 gmt, during which Scripps Radio (WWD) could be worked both ways. WWD could always hear us better than we could hear them, due to better antennas for receiving. Work with the Navy direct was impractical due to the poor signals with Greece (NGR). Mercast had only one usable frequency (13372.5) and not only was reception often very poor, but there were delays of three to five days in the system. On July 8, a message was copied which was originated (filed) on July 3.

In spite of the above a large volume of traffic was handled directly with radio Scripps (WWD) during the brief time available. Only one message, a GMI serial, was significantly delayed. Considering the circumstances, communications were good.

There were no equipment failures. The ship's antenna system, which was overhauled at the start of the voyage, performed well. However it suffers from a "blind spot" in transmitting, due to the 30 plus degrees ahead obstructed by the derrick. Provision of a rotatable directional aperiodic antenna atop the derrick would be an excellent addition for voyages requiring highly effective antennas. If provided, this antenna should be "hinge mounted" so that it could be readily lowered to a horizontal position in order to clear bridges, cables, etc., encountered in some situations, such as the Panama Canal Zone.

PERSONNEL

This voyage was work intensive. All the sites were within one quarter to one half days steaming time from each other, leaving little time for presite planning or equipment maintenance.

The GMI crews battled constant inclement weather conditions early on, and went about their tasks with professionalism beyond reproach. As working conditions improved these men became even more proficient. One Hole, 526A, pays tribute to their efforts where over 200 m of sediment were piston cored with oner 100% recovery. In a thiry-hour period, 46 cores were recovered averaging less than 30 minutes per core. On the last site of the leg, the scientific staff was elated at penetrating over 100 meters beyond that they had hoped for, this time with a very respectable 74.3% recovery rate for rotary coring.

The SIO technical staff, as always, handled their tasks diligently and contributed to the high morale throughout the leg despite several setbacks early in the leg.

The only illness of note was that of a rotary helper, who was diagnozed as having infectious hepatitis and was dispatched to a hospital in Walvis Bay.

Michael A. Storms

Michael A. Storms
Cruise Operations Manager
Deep Sea Drilling Project

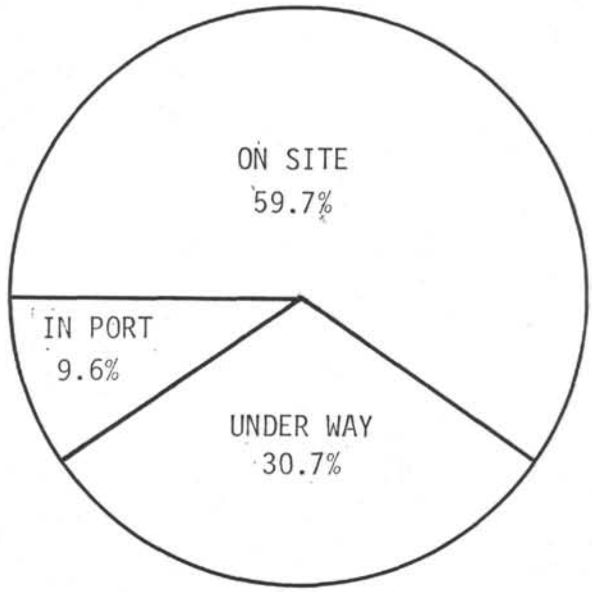
INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
OPERATIONAL RESUME
LEG 74

Total Days (June 1 - July 24, 1980)		53.1
Total Days in Port		5.1
Total Days Underway		16.3
Total Days On Site		31.67
Trip Time	5.45	
Drilling Time	.56	
Coring Time	19.70	
Downhole Measurements	2.29	
Weather Downtime	2.14	
Mechanical Downtime	.28	
Profiling & Vessel Positioning	.95	
Other	.30	

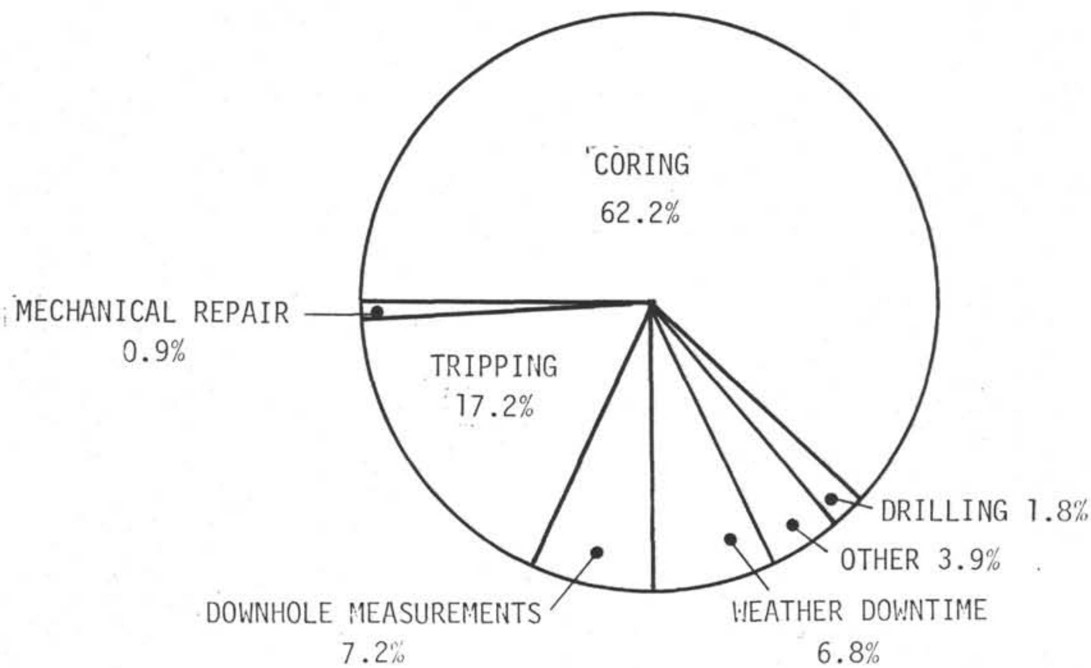
Total Distances Traveled (Nautical Miles)	3536.1	
Average Speed (Knots)	9.0	
Sites Investigated	5	
Holes Drilled	11	
Number of Cores Attempted	356	
Total Meters Cored	2572.8	
Total Meters Recovered	1829.5	
Percent Recovery	71.1	
Total Meters Drilled	565.9	
Total Meters of Penetration	3138.7	
Percent of Penetration Cored	82.0	
Maximum Penetration (Meters)	678.1	(525A)
Minimum Penetration (Meters)	6.3	(526)
Maximum Water Depth (Meters)	4437.0	(527)
Minimum Water Depth (Meters)	1065.5	(526)

TOTAL TIME DISTRIBUTION

LEG 74

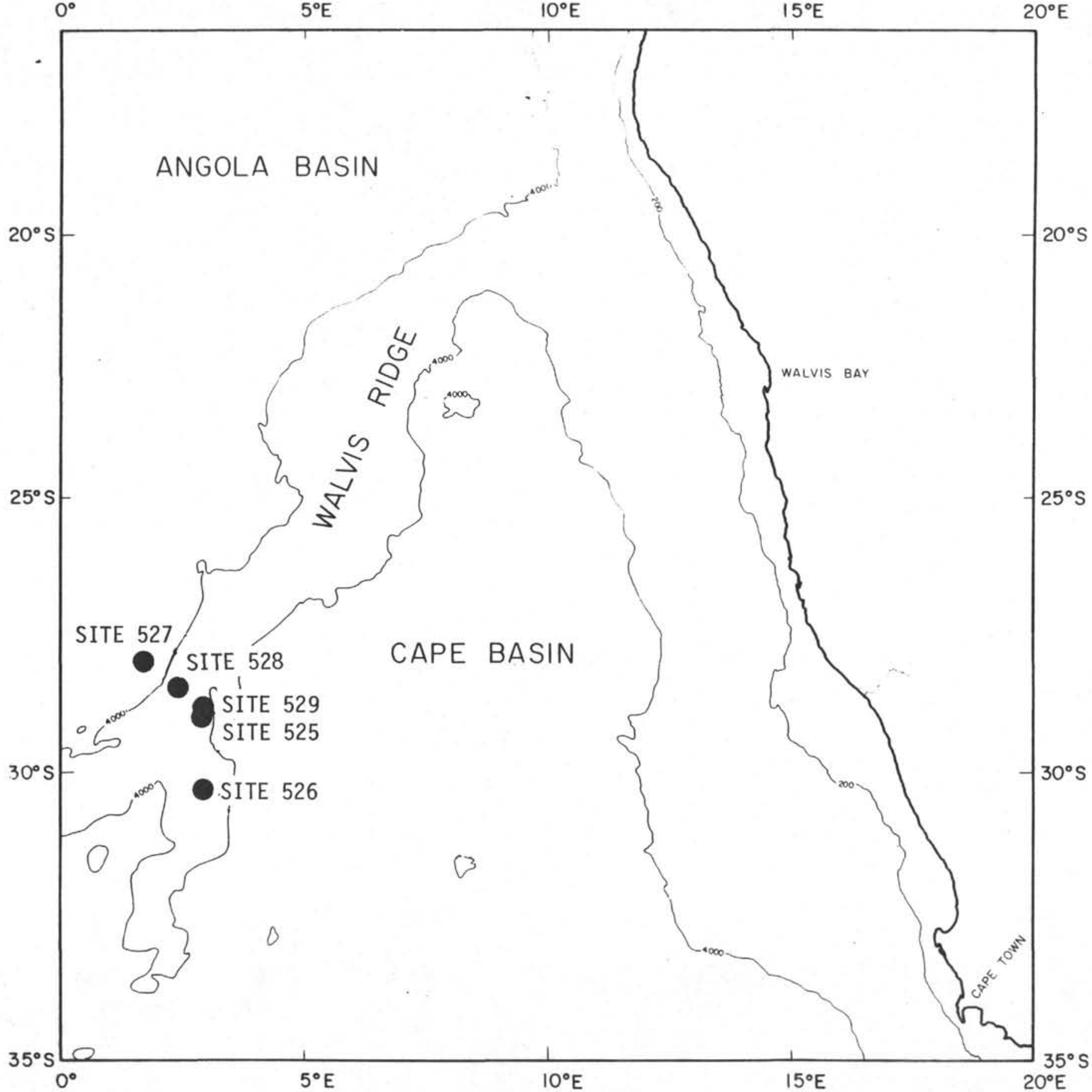


ON-SITE TIME BREAKDOWN



DEEP SEA DRILLING PROJECT
TIME DISTRIBUTION
LEG - 74

Date	Site No.	Cruise	Trips	Drill	Core	Stuck Pipe	W.O.W.	DOWNHOLE MEAS.	Mech. Repair	Port Time	PROFILE POSIT. SHIP	Other	Total Time	Remarks
6/01/80 6/06/80										122.4			122.4	Cape Town Port Call
6/06/80 6/10/80		90.1											90.1	Under Way Site 525
6/10/80	525		7.0		1.0			3.7			1.6		13.3	Heat Flow
6/10/80 6/15/80	525A		14.6	5.6	96.2			1.0					117.4	DBMI/IDSS
6/15/80 6/19/80	525B		15.4	0.5	61.4						1.7	3.8	82.8	Fishing For Rope Socket
6/19/80 6/22/80		77.7											77.7	Under Way Walvis Bay
6/22/80												1.5	1.5	Walvis Bay Anchorage
6/22/80 6/26/80		93.4											93.4	Under Way Site 526
6/26/80 6/27/80	526						29.0				2.7		31.7	More Time On 526 Later
6/27/80 6/28/80		16.0											16.0	Under Way Site 527
6/28/80 7/04/80	527		14.3		82.7		7.5	24.5	0.4		3.0		132.5	Logging HBR
7/04/80		6.3											6.3	Under Way Site 528
7/04/80 7/08/80	528		15.7	2.1	89.4		1.3	24.2	4.0		1.0		137.7	
7/09/80 7/13/80	528A		22.8		44.5		13.3		2.2		2.3	2.8	87.9	HPC Collet OPS
7/13/80		11.4											11.4	Under Way Site 526
7/13/80 7/15/80	526		5.1		1.7						2.6		9.4	Total 41.1 526
7/15/80 7/16/80	526A		8.7	1.7	28.7						0.7		39.8	
7/16/80	526B		1.8		3.2								5.0	
7/16/80 7/17/80	526C		11.3	3.6	18.0						3.8		36.7	Magnaflux BHA & Bowen
7/17/80 7/18/80		8.7											8.7	Under Way Site 529


ANGOLA BASIN
WALVIS RIDGE
CAPE BASIN
WALVIS BAY
CAPE TOWN
SITE 527
SITE 528
SITE 529
SITE 525
SITE 526
4000
200
0°
5°E
10°E
15°E
20°E
20°S
25°S
30°S
35°S

DEEP SEA DRILLING PROJECT
TIME DISTRIBUTION
LEG - 74

Date	Site No.	Cruise	Trips	Drill	Core	Stuck Pipe	W.O.W.	DOWNHOLE MEAS.	Mech. Repair	Port Time	PROFILE POSIT. SHIP	Other	Total Time	Remarks
7/18/80 7/21/80	529		8.3		52.0						3.4		63.7	
7/21/80		23.3											23.0	Under Way 529 Walvis Bay
7/22/80		23.0											24.0	"
7/23/80		23.0											24.0	"
7/24/80														"

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
BEACON SUMMARY
LEG 74

SITE NO.	MAKE	FREQ. kHz	SERIAL NUMBER	SITE TIME HOURS	
525 (A,B)	Benthos	13.5 S	SN 026	236.3	
	Benthos	16.0 S	SN 020	-0-	Dropped on departure/anticipating return to site later.
526 (A,B,C)	Benthos	16.0 S	SN 021	514.5	Dropped earlier in leg/returned to spud.
527	Benthos	13.5 S	SN 025	137.5	
528	Benthos	16.0 D	SN 010	76.5	Failed after 76.5 hours.
	Benthos	13.5 D	SN 013	141.3	
529	Benthos	13.5 D	SN 014	63.7	

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
BIT SUMMARY
LEG 74

HOLE	MFG	SIZE	TYPE	SERIAL NUMBER	METERS CORED	METERS DRILLED WASHED	METERS TOTAL PENET.	HOURS ON BIT	CONDITION	REMARKS
525	Smith	9 7/8	PCB	AR2693	3.6	65.0	68.6	0.4	T-1, B-1, IN	Mudline core then HF only.
525A	Smith	9 7/8	PCB	AR2693	555.1	123.0	678.1	30.6	T-1, B-2, IN	Rerun
525B	MSDS	11 1/2	HPC	AMY	227.0	58.6	285.6	N/A	Good	
526	MSDS	11 1/2	HPC	AMY	6.3	0	6.3	N/A	Good	
526A	MSDS	11 1/2	HPC	AMY	200.8	28.0	228.8	N/A	Good	
526B	MSDS	11 1/2	HPC	AMP	22.0	6.3	28.3	N/A	Good	Drilled out of sequence after 8
526C	Smith	9 7/8	PCB	AP9230	185.0	171.0	356.0	3.1	T-1, B-2, IN	Site 528.
527	Smith	9 7/8	PCB	AR2693	384.5	0	384.5	17.5	Released	48.5 total rotating hours at release.
528	Smith	9 7/8	F94CK	AE3385	441.0	114.0	555.0	26.7	Released	
528A	MSDS	11 1/2	HPC	AMY	130.5	0	130.5	N/A	Good	
529	Smith	9 7/8	F83CK	626KR	417.0	0	417.0	9.4*	Total hours 29.8, one cone in loose, T-2, B-5	*Run total of 20/4 hours on Legs 71 & 72 - rerun.

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
SITE SUMMARY
LEG 74

HOLE	LATITUDE	LONGITUDE	WATER DEPTH METERS	NUMBER OF CORES	CORES WITH RECOVERY	PERCENT OF CORES WITH RECOVERY	METERS CORED	METERS RECOVERED	PERCENT RECEOVERED	METERS DRILLED	TOTAL PENET METERS	AVG RATE PENET	TIME ON HOLE	TIME ON SITE
525	29° 04.24.S	02° 59.12'E	2479.0	1	1	100.0	3.6	3.6	100.0	65.0	68.6		13.3	
525A	29° 04.24'S	02° 59.12'E	2479.0	63	63	98.0	555.1	406.7	73.2	123.0	678.1	22.2	117.4	
525B	29° 04.24'S	02° 59.12'E	2479.0	53	53	100.0	227.0	181.7	80.0	58.6	285.6	HPC	82.8	
525 TOTAL				117	116	99.1	785.7	592.0	75.3	246.6	1032.3	22.2		213.5
526	30° 07.36'S	03° 08.28'E	1065.5	2	2	100.0	6.3	3.6	57.1	0	6.3	HPC	41.1	
526A	30° 07.36'S	03° 08.28'E	1065.5	46	46	100.0	200.8	206.6	102.6	28.0	228.8	HPC	39.8	
526B	30° 07.36'S	03° 08.28'E	1065.5	5	4	80.0	22.0	13.5	61.4	6.3	28.3	HPC	5.1	
526C	30° 07.36'S	03° 08.28'E	1065.5	21	19	90.5	185.0	70.9	38.3	171.0	356.0	114.8	36.7	
526 TOTAL				74	71	95.9	414.1	294.6	71.1	205.3	619.4	114.8		122.7
527	28° 02.49'S	01° 45.80'E	4437.0	44	43	98.0	384.5	243.9	63.4	0	384.5	22.0	132.5	137.7
528	28° 31.49'S	02° 19.44'E	3812.0	47	47	100.0	441.0	272.8	61.9	114.0	555.0	20.8	131.2	
528A	28° 31.16'S	02° 18,97'E	3825.5	30	30	100.0	130.5	116.5	89.3	0	130.5	HPC	89.2	
528 TOTAL				77	77	100.0	571.5	389.3	68.1	114.0	685.5	20.8	0	220.4
529	28° 55.83'S	02° 46.08'E	3043.0	44	42	95.5	417.0	309.7	74.3	0	417.0	44.5	63.7	65.7

DEEP SEA DRILLING PROJECT
LOGGING SUMMARY
LEG 74

HOLE	TOTAL DEPTH (M)	WATER DEPTH (M)	OPEN ENDED PIPE AT (M)	FLUID IN HOLE	BIT SIZE	TOTAL TIME FOR LOGGING (HOURS)	RUN NO.	LOGS RECORDED	FROM (M)	TO (M)	OBSERVATIONS
527	4821.5	4437.0	4546.0	seawtr	9 7/8	26.1	1	Gamma Ray	4546.0	4789.0	
								Temperature	4546.0	4789.0	
								Density			Failed
							2	Density	4546.0	4789.0	
								Caliper	4546.0	4789.0	Failed
							3	Sonic			Unable to get to bottom.
								Gamma Ray			Bridge at 4567.0 m.
								Caliper			
											600 ft of logging line damaged.
528	4367.0	3812.0	3921.0	gel mud	9 7/8	24.2	1	Gamma Ray	3921.0	4365.0	
								Temperature	3921.0	4365.0	
								Density			Failed
							2	Sonic	3921.0	4365.0	
								Gamma Ray	3921.0	4365.0	
								Caliper	3921.0	4365.0	
							3	Density			Attempted - never got downhole.
											Approximate depth 3940.0 m.
											2000 ft of logging line damaged
											± 500 lb wt fluctuations on
											Martin-Decker.

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
OPERATIONS RESUME
LEG 75

Leg 75 of the Deep Sea Drilling Project was the last of four legs designed to study the late Mesozoic and Cenozoic paleoenvironments in the South Atlantic Ocean. Of the four sites programmed for the leg only one, in the Angola Basin, was successful in drilling a section deep enough to reach igneous material after penetrating into the Albion of Early Cretaceous age. The next site, on the Walvis Ridge could not be drilled due to the lack of a thick enough sediment section to support the drill string. The last hole was drilled at a previously drilled site (362) and attempted to recover undisturbed sediments with the hydraulic piston coring equipment and this was also a success. It was also a trouble free cruise, with good weather and no large mechanical problems.

The leg started on July 24, 1980 at Walvis Bay, South Africa and ended September 6, 1980 in Recife, Brazil. Total length of the leg was 43.9 days, of which 26.1 days were spent on site, 2.9 days in port, and 14.9 days underway. There was no weather downtime and mechanical breakdown only 0.15 days.

WALVIS BAY PORT CALL

Leg 75 began when the first line went ashore at 1728 hours, July 24, 1980 at Pier 6 in Walvis Bay, South Africa. Following the crew change, the next day, work began on the main work item for this port call which was the changing of the seals on No. 2 bow thruster. While this work was being done the air freight was loaded aboard. The work on the thruster was completed late on July 26. The following morning the ship was turned in order to use a crane for changing the No. 3 hydrophone on the starboard side. This work was completed by 1600 hours and with the pilot aboard the last line was cast off at 1612 hours, July 27, and the ship departed Walvis Bay for Site 530.

HOLE 530

Upon completion of the work on the bow thruster, the replacement of No. 3 hydrophone and the onloading of necessary supplies, the GLOMAR CHALLENGER departed Walvis Bay, South Africa at 1612 hours on July 27, 1980. A routine test of the propulsion system and the thrusters was made about 1 1/2 hours after departing and then a course of 308° was set for Site 530. After traveling about 364 miles, the positioning beacon for this site was dropped at 0917 hours on July 29.

The drill string was made up and measured as it was run to begin the drilling operations. Hole 530 was officially spudded at 2344 hours, July 29. A mudline core was cut and established the water depth at 4645.5 meters. The bit was then washed in without rotation to a depth of 4769.5 meters. This was done to establish how much casing could be used in case a re-entry cone would be required to achieve complete geological information for this site. A second core was then cut and recovered from 4760.5-4770.0 meters. Following this the heat flow/pore water sampler was made up and lowered on the sandline.

After the sampling process had been completed it was discovered that the sandline could not be recovered. This line was pulled until the shear pins in the overshot sheared and it was recovered. Two additional attempts were made to retrieve the sampling tool but in both instances the pins were again sheared. It was then decided to pull the drill string, and the bit was brought to the derrick floor at 1954 hours, July 30.

When the bit was on deck it was found that the probe had been broken off about 6 inches below the probe support ring. This could not be pulled through the core guide of the bit until part of it had been removed with a cutting torch. No definite reason could be given for this tool failure other than the possibility it had encountered a hard boulder in the sediment section being investigated.

HOLE 530A

After removing the broken heat probe, the drill string was again made up and run into 4615.0 meters. No offsets had been made from 530 because of its shallow penetration. The heave compensator and power sub was picked up and Hole 530A was spudded at 0727 hours, July 31. No mudline core was taken because the mudline had been established in Site 530. The drill string was then washed to 125.0 meters without rotating to determine the amount of casing that could be used if it became necessary to set a re-entry cone to complete the scientific objectives for this site.

Contiuous coring began at this depth and continued until a depth of 1121.0 meters had been reached. While coring this interval a slug of 20 barrels of guar gum mud was spotted after every other core beginning with Core No. 67. This procedure seemed to maintain better hole conditions and a more rapid drill rate. The drilling was stopped 1121 meters because the geological information required had been obtained and the last nine meter core required 745 minutes to cut, which indicated that the bit was worn out.

Upon completion of the drilling a wiper run was made and when the bit was back on bottom the hole was circulated clean with 80 barrels of guar mud to ensure good hole conditions for the downhole logging program which was the next scheduled operation. Before the bit was released and the pipe pulled to logging depth a series of heat flow measurements were made at different depths inside the pipe. Following this, the bit release go-devil was dropped and the bit was released. The pipe was then pulled two joints off bottom to 7744 meters and a gamma/neutron log was run inside the pipe. This was done to ensure that a complete log of the cored interval was obtained in the event the hole bridged after the pipe was pulled to logging depth. On completion of this log run the bottom of the drill string was pulled to 4843 meters for the open hole logging program.

The logging sequence was to be gamma/density/temperature log, gamma/sonic, gamma laterolog, gamma induction, and a final temperature log. All of these tools were successful except the gamma/density which encountered a bridge in the hole and the electronics pad and the radioactive source attached to it were broken off and left in the hole. The balance of the logs were run with varying degrees of success due to the continued filling of the hole and therefore a shortening of the logged interval.

After the logging was completed the hole was abandoned with a cementing program due to the loss of the radioactive source which was found to have been forced into the sediments at 4986 meters. This program consisted of a 100 sack plug of cement from 5488.5 to 5429.5, a 200 sack plug from 5042.0 to 4924.0 and the final 100 sacks from 4747.5 to 4645.0 or the seafloor.

Following this the drill string was pulled and the hole was abandoned at 0345 hours August 15, when the bit was pulled clear of the seafloor.

HOLE 530B

Before the final cementing of Hole 530A, a hydraulic piston coring collet was seated in the head sub of the bottomhole assembly, which would allow hydraulic piston coring in the follow up hole. While the drilling line was slipped the ship was offset 100 feet east of Hole 530A and the pipe was then run in to 4641.0 meters. This hole was spudded at 0938 hours, August 15 and established the mudline at 4643 meters.

The hole was then continuously cored to a subbottom depth of 180.6 meters with few problems. After Core No. 18 had been cut the pump handle for pressuring up and releasing the pressure on the new hydraulic blowout preventer (BOP) broke and could not be repaired. This system was then connected to the hydraulic system of the pipe stabber motor and this proved to be a great improvement for opening and closing the BOP rams. The addition of "O" rings in the top and bottom subs of the core barrel apparently decreased the problem of cracked and imploded liners because only three cores were recovered with some cracking. After reaching the total depth of 180.6 meters the drill string was recovered and the bottomhole assembly was magnafluxed when it reached the derrick floor. Hole 530B was officially abandoned at 1424 hours, August 18.

SITE 531

Site 531 was located about 30 miles south-southwest of Site 530. This transit was made in 8 1/2 hours and an additional half hour survey was made following the beacon drop.

The drill string was made up and run in to 1258.0 meters where the heave compensator and the power sub were picked up, and the hole was spudded at 0842 hours, August 19, after two water cores were recovered. However, only a meter of penetration was possible before very hard material was encountered, and core recovery consisted of 0.02 meters of soft ooze. This thick sediment cover would not allow sufficient support for the BHA and the hole was officially abandoned at 0848 hours, August 19.

HOLE 531A

Due to the thin sediment section in Hole 531, the vessel was offset 1000 feet on a bearing of 105°, in hopes of improving on this condition. Due to the shallow water, this was the maximum offset that could be made using the beacon that had been dropped.

The drill string was then run back to 1277.0 meters and the hole was officially spudded at 1231 hours, August 19. Again, after the pipe had been lowered only one meter, very resistive material was encountered, and when the core barrel was recovered, it contained only 0.27 meters of the same soft ooze. Because of the lack of sediment support the decision was made to leave this site and it was officially abandoned at 1618 hours August 19.

SITE 532

Due to time constraints and the water depths at the remaining sites scheduled for Leg 75, a telephone call was made to La Jolla for permission to alter this program. Approval was obtained to do a piston coring program at Site 362, which had been rotary drilled on Leg 40. This site was located about 53 miles easterly from Site 531 and was reached after 6 1/2 hours. The positioning beacon was then dropped. After the profiling gear had been recovered and the ship started to return to the beacon drop area, it became apparent that the beacon had failed, and a second beacon was dropped.

Only hydraulic piston coring was to be done at this site so the bottomhole assembly began with a 11 1/8" HPC bit and then the shorter (75.87 meter) BHA was made up. A 12.0 kHz pinger beacon was attached to the drill string 250 meters above the bit to assist in determining the best place to take the mud line core.

This depth was established and Hole 532 was spudded at 0737 hours, August 20. The hole was continuously cored to 250.8 meters with few problems. The shear pin size and number of each was changed as the sediments became stiffer. The "O" rings in the core barrel continued to decrease the number of fractured liners as there were only five with some cracks after 61 cores were taken. After the core at 250.8 meters had been recovered the bit was pulled above the mud line and the hole was abandoned at 2209 hours, August 21. Coring was discontinued at 250 meters because this was the distance from the bit that the 12.0 kHz beacon was attached.

HOLE 532A

When the bit had cleared the mud line the ship was 200 feet south of Hole 532. A mud line core was taken with the bit positioned two meters higher than at 532 to allow for overlap of the cored intervals. The hole was then spudded at 2250 hours, August 21. This hole was then continuously cored to a depth of 199.6 meters to provide uncut cores for physical property measurements when these cores could be examined on shore. Again only a few liners were cracked when the cores were recovered. The only delay was for about 40 minutes when worn rams were replaced in the hydraulic wireline BOP. After the core at 199.6 meters was recovered, the bit was pulled above the mud line and Hole 532A was officially abandoned at 0205 hours, August 23.

HOLE 532B

After clearing the mud line the pipe was pulled until the 12 kHz beacon was in the moonpool. It was removed and the drill string was lowered to 1338.5 meters where the mud line core had been obtained for Hole 532A. While the pipe was pulled and lowered, the ship was moved another 100 feet south. This hole was spudded at 0709 hours, August 23 and would be drilled until it was necessary to pull pipe and depart for Recife, Brazil. These cores were taken for geochemical analysis on shore and were not split. But core splitting and examination began again with Core 57 (232.4-235.8 m) and continued to total depth. Again no major problems developed with only occasionally fractured liners. The only major difference was when it became necessary to change to 3 - .40 shear pins beginning with Core No. 61 at a subbottom depth of 247.2 meters due to stiffer sediments. The hole was cored to a total depth of 291.3 meters where it became necessary to stop due to time commitments for port arrival. This hole was officially abandoned at 0354 hours, August 25 and the ship departed at 0422 hours.

DRILLING AND CORING ASSEMBLIES

Two different bottomhole assemblies were utilized during the leg. For the conventional rotary coring the standard bottomhole assembly was used which consisted of: the bit, hydraulic bit release assembly, head sub, outer core barrel, top sub, HPC collet head sub, three 8 1/4" drill collars, one 5' bumper sub, three 8 1/4" drill collars, two 5' bumper subs, two 8 1/4" drill collars, one crossover sub, and one 7 1/4" drill collar. This configuration was implemented on Holes 530, 530A, 530B (except for the bit, which was released for hydraulic piston coring), 531, and 531A.

For the hydraulic piston coring the bottomhole assembly was comprised of: the HPC bit (AMY), bit sub, outer core barrel, top sub, seal sub, three 8 1/4" drill collars, two 5' bumper subs, two 8 1/4" drill collars, one crossover sub, and one 7 1/4" drill collar.

HYDRAULIC BIT RELEASE

A hydraulic bit release assembly was incorporated into the drill string for all the holes drilled at Sites 530 and 531. It was actuated to release the bit only once; at the termination of Hole 540A.

Considering the numerous days of drilling that the HBR was subjected to before the bit was released, the HBR performed near perfectly.

After the HBR go-devil was seated, three attempts were required to shift the HBR and release the bit. Various tactics were employed to induce the HBR to shift, including putting weight on the bit with the drill string pressurized, rotating the bit with weight on it while the string was pressurized, and alternately depressurizing the string while adding weight to the bit.

On the third attempt the HBR shifted and the bit released successfully.

HYDRAULIC PISTON CORING

The hydraulic piston corer was operated at Hole 530B and at all three holes (532, 532A, and 532B) of Site 532. Overall 230 cores were recovered. The deepest penetration was at Hole 532B where the 74th and final core reached a subbottom depth of 291.3 meters. Shear strengths were measured in excess of 2000 gm/cm^2 at both Sites 530 and 532.

Recovery at the four holes was 85.9% for Hole 530B, 92.7% for Hole 532, 80.7% for Hole 532A, and 81.6% for Hole 532B; the composite recovery for the four holes was 88.4%.

Several modifications to the HPC operations were introduced for this leg. The results were quite rewarding.

The first modification involved installing a Bowen Hydraulic Blowout Preventer for the existing manually operation BOP. It was connected atop the Bowen power sub prior to the first piston coring operation.

The hydraulic BOP was provided for two primary purposes: 1) rig time would be economized, and 2) it would be much safer to operate than the manual BOP.

The hydraulic BOP would save time, it was argued, because instead of a person having to go up to the manual BOP and battle the elements to crank the value handwheels shut (and then open again), the hydraulic rams could be operated remotely from the rig floor. However, the hand pump furnished with the hydraulic BOP had such a small capacity that it required no fewer than 60 strokes (approximately 2 minutes) to operate in each direction. The new BOP was not very time saving at first.

It became apparent that the hydraulic BOP may be compatible with the hydraulic systems of the pipe racker and stabber. The hydraulic system of the stabber was modified to serve as a hydraulic power source for the BOP. A supply line and a return line were tapped off from the stabber unit. The time to actuate the values was only moderately reduced, though, to about 60-90 seconds in each direction.

The safety afforded by the hydralic BOP compared to its manual counterpart is immeasurable. The entire opening and closing sequence is executed from the rig floor, obviating the need for a person to be hoisted up to the BOP. This is a precarious venture and the risks are increased exponentially as weather conditions deteriorate.

A second modification to piston coring that was initiated on Leg 75 was the use of "table shucks" to break and make the lower core barrel connections. Previously the lower section was disconnected while it was suspended in the drill pipe at the tool joint. Now for piston coring, adjacent to the rotary table are two oversized pipes that extend 2 1/2 feet up from the rig floor and approximately one foot below it. The retrieved HPC core barrel is lowered into one of the pipes and disconnected, while in the other pipe a redressed lower core barrel is clamped off and ready for use. The piston head of the HPC tool is stabbed into the readied core barrel and it is made up to the cap sub. The entire assembly process of scoping together, cocking and orienting is conveniently done at eye level. Again the two factors of time-saving and safety are greatly realized.

A third modification of the HPC was the use of 'O'-rings in the lower core barrel. As with Leg 74 'O'-rings were installed at either end of the butyrate core liners in an effort to reduce core liner failures. The incidence of liner failures was vastly reduced. Of the 230 cores recovered only 18 had liner failures. Of those failures in most cases the 'O'-rings were found either to be damaged or dislodged from their 'O'-ring grooves; i.e., an effective seal had not been maintained downhole. In summary the 'O'-rings worked very well.

The final new modification of note here is the HPC collet. The HPC collet was designed so that piston coring can be conducted after the bit is released at the conclusion of rotary coring. Heretofore, a time-consuming pipe trip was required if a site was to be both rotary cored and piston cored, due to the incompatibility of the different sized inner core barrels. With the HPC collet, collet landing tool, and the HPC modified head sub, piston coring can be achieved by releasing the bit, then seating the HPC collet in the modified head sub.

The HPC collet was utilized once during the leg; at the completion of Hole 530A. Hole 530B, therefore, was piston cored after the conventional bit was released.

Trouble was encountered while seating the collet with its landing tool. After three attempts it was discovered that four of the eight fingers on the collet were so depressed from their original position that the collet would not latch into place. When the other collet was deployed, it landed and seated on the first attempt. It had been wirelined downhole.

BITS

Only three bits were used on Leg 75; two F93CK and the special hydraulic piston core bit. The first F93CK was a rebuilt bit supplied by Scripps Marine Science and Development Shop. It did an excellent job of drilling with a total of 90.66 rotating hours and 1246 meters of penetration before it was released for a logging program. The second F93CK was a rerun but did no drilling because Site 531 had only about one meter of sediments over some very hard material. It was then pulled and not used again when the site was abandoned. The last bit was used at Site 532 for over 740 meters of coring. It performed well and was in good condition when it was recovered.

BEACONS AND DYNAMIC POSITIONING

During the leg, four Benthos beacons were used for positioning at three sites. All worked well except the 16 kHz beacon dropped on the approach to Site 532. When the ship returned to the drop zone this beacon was dead and a 13.5 kHz beacon was dropped and used for positioning. Good positioning and acquisition was enjoyed at all sites aided by good weather and sea conditions.

One problem did develop with the computer while preparing to move from Site 531A to 532. The problem was traced to a card failure in the CPU which was replaced and checked prior to spudding Site 532.

LOGGING

Logging was attempted only at Hole 530A and was successful to a degree. Following the completion of the coring operation a wiper run was made and then the hole was circulated clean with 80 barrels of guar mud. Before the bit was released a series of heat flow measurements were made at different depths inside the pipe. Following this the bit was released and the pipe was pulled two joints off bottom. The gamma/neutron tool was rigged because the scientific staff wanted a log of the complete cored section in case the open hole logging was affected by bridging or other hole problems. After this was recovered the pipe was pulled to 4843.0 meters for open hole logging. The first tool to be run was the gamma/density/temperature. When this tool was lowered it stopped at 4921 meters due to bridging in the hole. The tool was pulled and a clean out run was made to bottom and the hole circulated with 40 barrels of mud. The pipe was then pulled to 4956.5 meters and the tool was again made up and run in the hole. The tool stopped again at 4961 meters or only about 5 meters below the bottom of the pipe. The tool was raised and lowered a couple of times to see if the tool would go through the sediments but this was unsuccessful and the tool was pulled to the derrick floor. When it was recovered it was discovered that the electronics pad and the radioactive source attached to it had broken off and had been left in the hole. Plans were made to cement the hole after the logging was completed. Another clean out run was made to bottom and the pipe was run to 5270 meters. This depth was arrived at after checking the physical properties measurements and placing the bottom of the pipe where the sediments were firmer.

The gamma/sonic was then rigged and run to 5585 meters where it stopped due to fill. This log was run successfully to the bottom of the pipe and then recovered. While pulling this tool the gamma detector located the source from the density tool at 4986 meters which would help in the final cementing program of abandonment. The gamma/induction log was run next from 5557 meters to the bottom of the pipe and recovered. The gamma/laterolog/neutron log was run next followed by the temperature tool which was the last tool to be run. Each log run bottomed about 30 meters shallower than the previous run due to continued filling of the hole.

COMMUNICATIONS

Communications with WWD in La Jolla for the outgoing traffic was transmitted only by voice. Incoming traffic was by voice from WWD and some CW by the Navy Mercast System. There was a short communication window of about one to one and a half hours corresponding to 7:00 and 8:00 a.m. San Diego time. During this time all outgoing traffic was sent and the Project's messages were received except those that had been received from Mercast. Some delays in receipt of messages was experienced due to voice fade out of WWD and Mercast technical problems. Some radio telephone calls were made via WWD and some through the commercial circuit in Cape Town, South Africa. In addition personal calls were made via out amateur radio station and were appreciated by all those people who used it. No equipment problems developed during the leg.

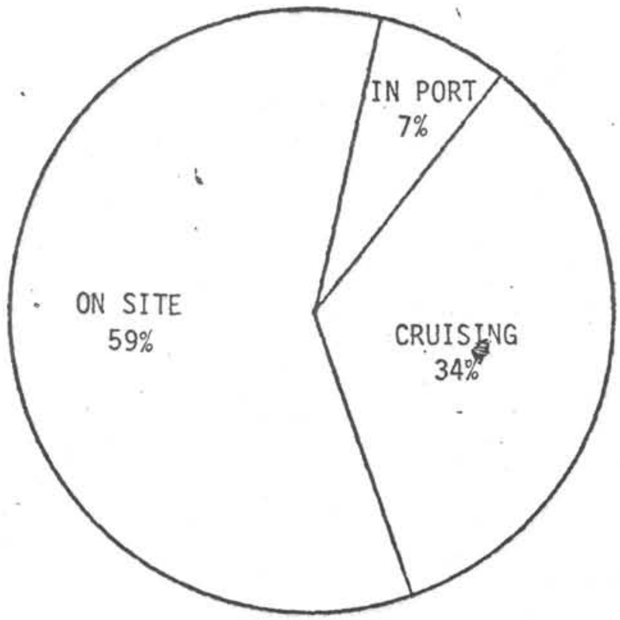
R. R. Knapp
Cruise Operations Manager
Deep Sea Drilling Project

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
OPERATIONS RESUME
LEG 75

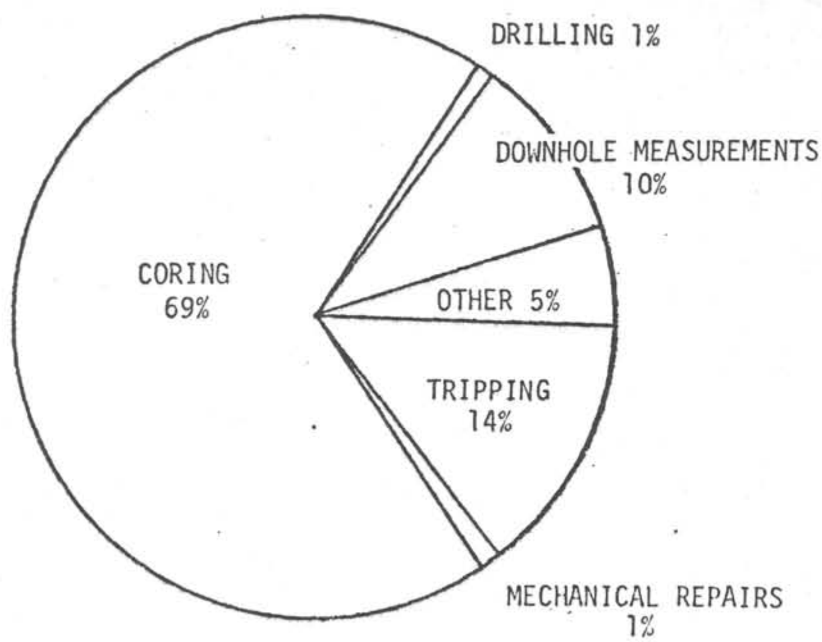
Total Days (July 24, 1980-September 6, 1980)		43.9
Total Days In Port		2.9
Total Days Cruising Including Site Survey		14.9
Total Days on Site		26.1
Trip Time	3.7	
Drilling Time	.2	
Coring Time	18.1	
Mechanical Repair	.2	
Downhole Measurement	2.6	
Other	1.3	
Total Distance Traveled Including Survey (Nautical Miles)		3221.4
Average Speed (Knots)		9.2
Number of Sites		3
Number of Holes Drilled		8
Number of Cores Attempted		342
Number of Cores With Recovery		328
Percent of Cores With Recovery		95.9
Total Meters Cored		1931.3
Total Meters Recovered		1444.62
Percent Recovery		74.8
Total Meters Drilled		239.0
Total Meters of Penetration		2170.3
Percent of Penetration Cored		88.9
Maximum Penetration (Meters)		1121.0
Minimum Penetration (Meters)		1.0
Maximum Water Depth (Meters)		4645.0
Minimum Water Depth (Meters)		1339.5

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT

TOTAL TIME DISTRIBUTION
LEG 75



ON SITE TIME BREAKDOWN
LEG 75



DEEP SEA DRILLING PROJECT
TIME DISTRIBUTION
LEG - 75

Date	Site No.	Cruise	Trips	Drill	Core	Stuck Pipe	W.O.W.	DOWNHOLE MEAS.	Mech. Repair	Port Time	PROFILE POSIT. SHIP	Other	Total Time	Remarks
7/24/80 7/27/80										70.7			70.7	
7/27/80 7/29/80		41.3										.8	42.1	
7/29/80 7/30/80			19.4	3.2	3.2			4.7	2.0			2.1	34.6	
7/30/80 8/15/80			29.3	2.5	257.4			57.6				21.0	367.8	
8/15/80 8/18/80			9.8		67.4							5.5	82.7	
8/18/80		8.6										.6	9.2	
8/18/80 8/19/80			7.3		.5							1.4	9.2	
8/19/80			6.2		.5							.8	7.5	
8/19/80		6.6										.3	6.9	
8/19/80 8/21/80			6.7		37.5				1.6			1.2	47.0	
8/21/80 8/23/80			1.4		26.2							.3	27.9	
8/23/80 8/25/80			8.8		41.0								49.8	
8/25/80 9/06/80		298.1										.5	298.6	

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
BEACON SUMMARY
LEG 75

SITE NO.	MAKE	FREQ kHz	SERIAL NUMBER	SITE TIME HOURS	REMARKS
530	Benthos	16.0	008	34.6	
530A	Benthos	16.0	008	367.8	
530B	Benthos	16.0	008	82.7	
				485.1	No problems.
531	Benthos	13.5	017	9.2	
531A	Benthos	13.5	017	7.5	
				16.7	No problems
532	Benthos	16.0	012	- -	Beacon pulse never detected after it wa: dropped.
532	Benthos	13.5	016	47.6	
532A	Benthos	13.5	016	27.9	
532B	Benthos	13.5	016	49.8	
				125.3	No problems.

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
SITE SUMMARY
LEG 75

HOLE	LATITUDE	LONGITUDE	WATER DEPTH METERS	NUMBER OF CORES	CORES WITH RECOVERY	PERCENT OF CORES WITH RECOVERY	METERS CORED	METERS RECOVERED	PERCENT RECOVERED	METERS DRILLED	TOTAL PENET METERS	AVG. RATE PENET. M/H	TIME ON HOLE	TIM ON SIT
530	19° 11.26'S	09° 23.15'E	4645.0	2	2	100.0	11.0	9.2	83.6	114.0	125.0	208.3	34.6	
530A	19° 11.26'S	09° 23.15'E	4645.0	108	107	99.0	996.0	619.46	62.2	125.0	1121.0	12.4	367.8	
530B	19° 11.26'S	09° 23.17'E	4643.0	48	44	91.6	180.6	155.08	85.9	--	180.6	HPC	82.7	485
531	19° 38.44'S	09° 35.31'E	1284.0	1	1	100.0	1.0	0.02	2.0	--	1.0	60.0	9.2	
531A	19° 38.48'S	09° 35.47'E	1279.0	1	1	100.0	1.0	0.27	27.0	--	1.0	60.0	7.5	16.
532	19° 44.61'S	10° 31.13'E	1340.9	61	59	96.7	250.8	232.44	92.7	--	250.8	HPC	47.0	
532A	19° 44.64'S	10° 31.13'E	1339.5	47	42	89.4	199.6	161.15	80.7	--	199.6	HPC	27.9	
532B	19° 44.66'S	10° 31.13'E	1339.5	74	72	97.3	291.3	267.00	91.7	--	291.3	HPC	49.8	124.
				342	328	95.9	1931.3	1444.62	74.8		2170.3		626.5	626.

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
BIT SUMMARY
LEG 75

HOLE	MFG.	SIZE	TYPE	SERIAL NUMBER	METERS CORED	METERS DRILLED	METERS TOTAL PENET.	HOURS ON BIT	CONDITION	REMARKS
530	RB	9 7/8	F93CK	S-12 MSDS	11.0	114.0	125.0	0.6		
530A	RB	9 7/8	F93CK	S-12 MSDS	996.0	125.0	1121.0	90.06	Released	
531A	Smith	9 7/8	F93CK	646KR	1.0		1.0		T1-B2-SEI	Sediment too thin to rotate.
531A	Smith	9 7/8	F93CK	646KR	1.0		1.0		T1-B2-SEI	
532	MSDS	11 1/2	HPC	AMY	250.8		250.8	HPC		
532A	MSDS	11 1/2	HPC	AMY	199.6		199.6	HPC	good	Bit shows little wear.
532B	MSDS	11 1/2	HPC	AMY	291.3		291.3	HPC		

DEEP SEA DRILLING PROJECT
LOGGING SUMMARY
LEG 75

HOLE	TOTAL DEPTH (M)	WATER DEPTH (M)	OPEN ENDED PIPE AT (M)	FLUID IN HOLE	BIT SIZE	TOTAL TIME FOR LOGGING (HOURS)	RUN NO.	LOGS RECORDED	FROM (M)	TO (M)	OBSERVATIONS
530A	5766.0	4645.0	In Pipe	Sea Wtr	9 7/8	8.0	1	GR/N	4600	5700	
	5766.0	4645.0	4957	Sea Wtr	9 7/8	1	2	Temp	4400	5766	Could not get down
	5766.0	4645.0		Sea Wtr	9 7/8	not run	3	COL/GR	5766	4975	CDL pad lost
	5766.0	4645.0	5270	Sea Wtr	9 7/8	7.5	4	BHC/CL/GR	5595	5259.7	Source at 4986 m (reheaded)
	5766.0	4645.0	5270	Sea Wtr	9 7/8	5.9	5	IEL/GR	5560	5270	
	5766.0	4645.0	5270	Sea Wtr	9 7/8	6.8	6	LL/GR/N	5547	5269	
	5766.0	4645.0	5270	Sea Wtr	9 7/8	6.3	7	Temp	4400	5505	

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
OPERATIONS RESUME
LEG 75 - TRANSIT

The Leg 75 transit covered the period from the Recife, Brazil port call to the commencement of the Norfolk, Virginia shipyard period. The ship disembarked the scientific staff and roughly half of the technical staff at Recife, with a skeleton crew of technicians remaining aboard for the transit.

RECIFE, BRAZIL - PORT CALL

The Recife, Brazil port call began with the first mooring line ashore at 1027 hours September 6, 1980. During this port call, 286,315 liters of fuel was received, fresh provisions were onloaded and the logging cable reel was replaced.

The ship departed the next day, September 7, 1980 at 0929 hours enroute to Norfolk, Virginia.

TRANSIT - RECIFE TO NORFOLK

The transit covered 3597.5 nautical miles and required 15 days to complete. Since the ship would be undergoing an extensive overhaul (including drydocking) in the shipyard at Norfolk, the transit time was utilized to fully prepare for this overhaul.

Shipboard preparations for the shipyard included disassembling the drawworks, and overhauling various engine room components. Additionally, components of the Schlumberger logging unit and the B.J. Cementing Unit were disassembled in preparation for offloading in Norfolk for machine shop refurbishment.

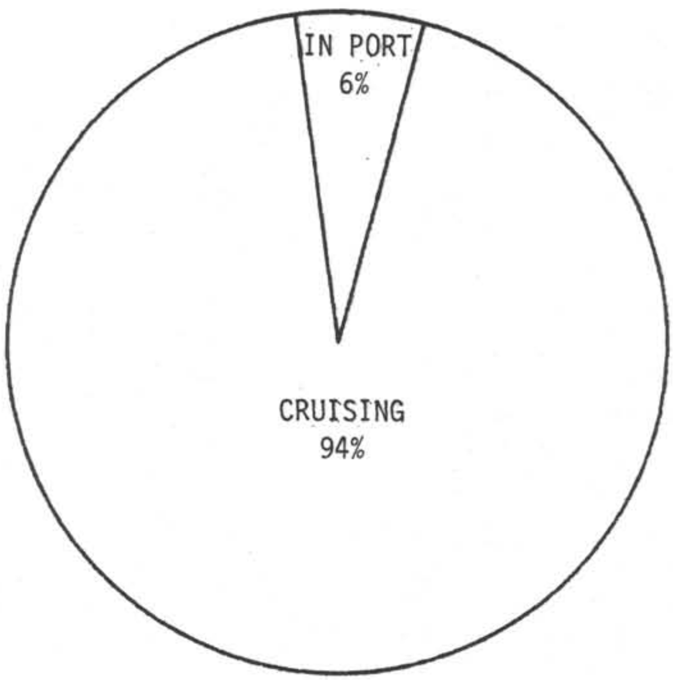
The transit ended at 1324 hours, September 22, 1980 when the first line went ashore at Pier No. 1, Norfolk Shipbuilding Yard, Norfolk, Virginia.

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
LEG 75 - TRANSIT

TIME DISTRIBUTION

DAYS IN PORT	.96
DAYS IN TRANSIT	15.2
TOTAL TIME	16.16

TOTAL TIME DISTRIBUTION
LEG 75 - TRANSIT



INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
OPERATIONS RESUME
LEG 76

The 76th scientific voyage of the GLOMAR CHALLENGER revisited an area of earlier expeditions to probe the oldest sediments of the Atlantic Ocean, to study the history of the western Atlantic continental margin and to answer important questions about the geochemistry of the sediments. Four holes were drilled at two sites with greatly contrasting scientific and technical emphasis. Operational highlights included the first and highly successful recovery of core under in situ pressure, recovery of gas hydrates and the setting of the longest casing string (531 meters) in Project history. The third deepest DSDP hole ever drilled was left for subsequent deepening.

The voyage commenced on September 22, 1980 at Norfolk, Virginia and terminated on December 1, 1980 at Port Everglades, Florida. Total length of the leg was 69.9 days; of which 38.8 days were spent on site, 18.7 days in scheduled port calls and 5.8 days in transit. 6.8 days were lost due to mechanical breakdowns.

NORFOLK PORT CALL

Leg 76 began with the arrival of the GLOMAR CHALLENGER at Berth One of the Norfolk Shipbuilding and Drydock Company yard, Norfolk, Virginia. The first mooring line was put over at 1324 hours, September 22, 1980. The vessel went into drydock on September 25 and then moved to shipyard Berth Four on October 1.

Major work items for the port call included standard drydock jobs such as hull cleaning and painting; U.S. Coast Guard inspection; inspections and maintenance on the derrick, crown block, rotary table and weight indicator and magnetic inspection of the steel drill string. All four positioning thrusters were overhauled and/or replaced and their propellors were repitched. Two Caterpillar engines, five D. C. generators, two A. C. generators and four drilling equipment D. C. motors were overhauled and major maintenance was performed on the logging and cementing units. The field coils in the rig's auxiliary electric brake were replaced due to an internal short detected on the previous voyage.

The 570 meter test string of aluminum drill pipe was offloaded for testing, along with cores and scientific samples and miscellaneous GMI and SIO freight. The vessel was loaded to capacity with fuel and lube oil, fresh water, bentonite and oilfield cement. In addition a major resupply of food, consumables, coring and laboratory equipment and positioning beacons was made.

On October 6, during preparations to get under way for sea trials, the bearing on newly-overhauled D.C. generator No. 3 failed catastrophically, causing damage to the armature shaft. The generator was removed to the shipyard machine shop for repair and, as a backup measure, an additional generator was sent by truck from GMI fleet spares in Houston. It was decided that sea trials and thruster calibration could be accomplished in the interim and that the ship would return for the generator installation. Arrangements were made for pilot and tugs, but departure was delayed for about 30 minutes by a fuel pump leak on newly-overhauled engine No. 5. The leak was arrested, but the engine was secured as a precaution. Then, just as the final line was let go, the ground fault relay tripped on propulsion motor No. 1, leaving the vessel with no power to the port shaft. The starboard shaft could not provide sufficient power to maneuver in the tidal current of the Elizabeth River and the ship was forced to return to Berth One of the shipyard with the aid of a tug.

Generator No. 3 was repaired during the ensuing 52 hours and the bearing of D.C. generator No. 5 (also newly-overhauled) was replaced due to an unusually high running temperature.

The spare generator from Houston was onloaded and installed and the CHALLENGER departed for sea trials at 0100 hours, October 9. The vessel stopped off Cape Henry light for 1 1/4 hours to "swing ship" for calibration of the magnetic compass. The pilot and compass adjuster were then disembarked and the ship continued into open waters for sea trials. About 15 hours were spent in testing the electric and mechanical viability of the vessel's propulsion, thruster and drilling systems, and in calibration of thruster and main shaft response to the dynamic positioning system. During this time a hot-running bearing was being replaced on the motor powering the rig's Bowen Hydraulic system. Test running of the motor following the replacement revealed that the new bearing also ran at an abnormally high temperature. This was the third bearing installed since the motor's overhaul during the port call and it was concluded that the motor itself was faulty. An emergency phone call was made to Houston and the vessel headed back to port to await the arrival of a replacement motor being flown from Houston. The CHALLENGER arrived at Berth "A" of the shipyard at 0235 hours, October 10. The motor arrived that afternoon and was installed and tested during the night. The vessel departed the shipyard for the third time at 0610 on October 11.

NORFOLK TO SITE 533

Transit speed outward bound from Norfolk was impeded by headwinds, by crossing the Gulf stream and by the practice of proceeding at reduced shaft RPM until recently overhauled machinery could be "broken in". At one point the vessel was stopped and about 45 minutes were spent in final calibration of main shaft tachometers. Speed over ground was held to 7.8 knots for the first 1 1/2 days, but all factors reversed themselves and 10.4 knots was made good for the final half day of the transit leg.

At 0138 hours, October 13, the CHALLENGER turned to parallel a reference seismic profile and reduced speed. At 0240 hours an acoustic positioning beacon was launched at Site 533, located about 255 miles southeast of Cape Fear, North Carolina and 340 miles east of Brunswick, Georgia.

HOLE 533

An additional six hours were spent on seismic surveying in the vicinity of the drill site, with two sonobuoy refraction profiles included. On positioning the vessel over the beacon, a surprisingly strong (approximately 1.5 knot) current from the north northwest was noted, which slowed the initial positioning procedure. At 1000 hours, stable automatic positioning had been achieved and the pipe trip began. The trip was interrupted for a total of 3 1/4 hours for repairs to the drawworks auxiliary electric brake and to the pipe-racker skate cable.

Hydraulic piston coring started slowly due to a drill pipe rust accumulation which jammed the corer internally after the second core and prevented proper operation of the corer. A second hydraulic piston corer (HPC) unit was deployed and operations then proceeded smoothly.

About 140 meters of Pleistocene mud was cored with no particular difficulty. An unconformity was then crossed into noticeably stiffer Pliocene clay. The degree of compaction of these sediments was approaching the limits of the HPC's penetrating ability when the decision was made to terminate piston coring and switch to rotary coring operations.

When the final piston core had been recovered, the hole was filled with heavy mud from its total depth of 167.5 meters to the seafloor. The drill string was then recovered and the bit arrived on deck at 0600 hours, October 16.

HOLE 533A

After a 1 1/2 hour delay for minor rig repairs, a standard rotary coring bottom-hole assembly was assembled with a special pressure core barrel bit and the drill string was run back to the seafloor.

Hole 533A was spudded at 1725 hours, October 16. The hole was drilled to 142.5 meters below seafloor (BSF) with one "wash core" and one unsuccessful heat flow/ *in situ* pore water sample attempt in the drilled interval. Continuous coring began at this point and continued through a monotonous interval of Pliocene clay. Five cores were cut (four successfully) with the pressure core barrel and three successful temperature probe measurements were taken within the cored interval. "Icy"gas hydrates were recovered in core No. 13 from about 238 m BSF. Coring was terminated at 399 meters BSF to conform with depth limitations imposed by JOIDES and SIO Safety Panels.

The hole was then flushed with bentonite and guar gum muds in preparation for logging and a hydraulic bit release (HBR) go-devil was pumped down the pipe to actuate the HBR and release the terminal drilling equipment for logging. The go-devil landed and held drill pipe pressure, but the assembly failed to separate and release the bit. After 20 minutes of attempting to jettison the bit by manipulating the drill string and mud pump, an attempt was made to recover the go-devil with the sandline so that a second go-devil could be tried. The go-devil was found to be stuck firmly in place and the overshot safety shear pin failed. Three more runs were made with the sandline, but the overshot could not be dislodged. Additional attempts to release the bit by pressuring the drill pipe were made at total depth and again before the bit was pulled clear of the seafloor. With the drill pipe plugged by the go-devil, it was not possible to log the hole or to plug it according to plan. Also because of the obstruction, the pipe trip was "wet" with 90 feet of water cascading onto the rig floor as each stand was broken--except for the final stand of drill collars. When the BHA was recovered, the bit and associated components were gone, apparently having fallen off only a few meters below the keel. The CHALLENGER departed Site 533 at 2345 hours, October 19.

SITE 533 to SITE 534

A few minutes after the vessel was under way, it was necessary to take No. 3 engine off line because of low oil pressure. The cause was investigated and a few hours later it was learned that at least two of the main bearings had failed. This meant that the engine would be out of service until the ship could return to port for the parts and extra labor needed for a complete overhaul. The ship retained full operational capability for drilling in good weather conditions, however, as No. 3 is normally assigned to propulsion or a stern thruster.

The prime drill site of Leg 76 was located about 140 miles northeast of Great Abaco Island in the Bahamas and about 280 miles east of Cape Canaveral, Florida. The transit south to Site 534 was made on five propulsion motors. Good weather prevailed and an average speed of 8.3 knots was realized. Speed was reduced to about six knots for the final hour to synchronize arrival on site with a satellite navigation fix. A 13.5 kHz positioning beacon was dropped at 2012 hours, October 20.

HOLE 534

The acoustic beacon signal was "watched" as it fell to the seafloor and as the seismic gear was retrieved. The signal was strong and normal until about the time the beacon reached bottom, but then it faded rapidly. The beacon could be received well enough at a distance to get a relative position, but the signal would be lost when the vessel closed to less than 1000 feet. The ship was maneuvered to a position nearly directly over the first beacon and a 16 kHz beacon was launched 2 1/2 hours after its predecessor. No problems were noted with the second beacon.

Since this was to be a re-entry site, it was necessary to make a pipe trip to determine the exact water depth and the depth to which 16-inch conductor casing could be set. The drill pipe was measured on the initial pipe trip. The drill pipe pinger was strapped to the pipe to be used as an aid in determining water depth, but the pinger failed at some time during the trip. Based on a water depth of 4983 meters calculated from the precision depth recorder (PDR) reading, the bit was lowered to a depth of 4986.5 meters and the inner barrel was retrieved. 2.1 meters of calcareous ooze was recovered, fixing the water depth at 4984.5 meters.

A jet-in test was then conducted to determine setting depth for the conductor casing. With no rotation and a maximum pump rate of about 325 GPM, the bit reached a depth of 87.5 meters BSF before progress was arrested, although several somewhat resistant strata were penetrated in the lower 20 meters.

While these tests were in progress, a communication was received from Project Management directing the vessel to proceed to Port Everglades, Florida for repairs to No. 3 engine. The drill string was recovered and the ship departed for port at 2245 hours, October 21.

SITE 534 to PORT EVERGLADES

To avoid steaming against the flow of the powerful Gulf Stream, a route was chosen around the east side of the northern Bahama Islands and then westward through the Northwest Providence Channel. The smooth seas and very light winds encountered at the drill site persisted for the voyage into Port Everglades and an average speed of 8.8 knots was made good with, again, only five engines on propulsion.

It was necessary for the vessel to heave to for one hour outside the harbor entrance until the assigned berth was vacated by another ship. The first mooring line was put over at 1624 hours, October 23 at Berth One, Port Everglades, Florida.

PORT EVERGLADES PORT CALL

A work crew from a Miami Caterpillar representative arrived at the vessel shortly after the arrival in port. They immediately began reassembly of No. 3 engine, which had been torn down by ship's personnel. Crews were kept working on a 24-hour basis until the overhaul was complete. Other work items accomplished included replacement of No. 8 D.C. generator bearing (which had been running abnormally warm) and overhaul of the main circulating water pump, mud pump No. 1 and both heave compensator air compressors. The re-entry cone and casing were moved onto the dock for final preparation for re-entry operations. The drill water tanks were topped off with fresh water and various fresh food items were loaded. With repairs completed, the vessel departed her berth at 1230 hours, October 28.

PORT EVERGLADES TO SITE 534

The CHALLENGER proceeded north along the Florida coast to take advantage of the following Gulf Stream and then turned northeast after passing the northern Bahamas. An average speed of 9.7 knots was made good over the 315 mile transit.

The towed geophysical gear was brought aboard prior to arrival on site. The vessel navigated directly to the site and the signal of the acoustic beacon was acquired at a distance of two miles. The ship was holding station over the beacon in the automatic mode at 2200 hours, October 29 and deployment of the re-entry cone began.

HOLE 534A

The cone was keelhauled into position beneath the moon pool and six joints of 16-

inch casing were made up to the casing hanger joint without incident. The BHA was then assembled and latched into the casing. This assembly was then latched into the cone and the trip to the seafloor began. The trip was slowed somewhat by the "floating" tendency of the re-entry cone.

The PDR depth reading was 4981 meters from the rig floor, compared with 4983 at Hole 534 offset 150 feet to the west. A 12 kHz pinger attached to the cone indicated a depth of 4976. Hole 534A was spudded at 2154 hours, October 30 and the conductor casing was jetted in by using the rig's mud pump with no rotation of the drill string. Penetration came to a halt when the mudskirt of the cone reached 4976 meters. This seafloor depth was confirmed by the coincidence of the pinger's initial and reflected pulses on the PDR. With the casing shoe at 5062 meters, a wireline trip was made to release the cone/casing assembly with a shifting tool. As soon as release had been confirmed by loss of drill string weight and rotating torque, the string was free for drilling ahead.

A 14 7/8 inch hole was drilled to the surface casing point of 5507 meters. A sequence of clays and chalks was penetrated with no drilling problems and drilling parameters indicated limestone beds in the last few meters. No cores were taken during the drilling, but limestone was found at the bottom of the inner core barrel that had been in place for the duration.

The hole was flushed with bentonite mud and the drill string was recovered to run surface casing.

FIRST RE-ENTRY - SURFACE CASING

Fifty four joints (531 m) of 11 3/4 inch surface casing were made up and hung off in the moon pool in 12 1/2 hours. The operation was slowed somewhat by the rusted condition of about half of the casing. A special drill pipe BHA was made up to extend from the float shoe to the casing running tool and the casing was attached to the drill string. A routine pipe trip was then made to re-entry position.

The logging sheaves were rigged and the first re-entry sonar tool was lowered to the bit. The wireline trip was interrupted for one hour to adjust the brakes on the logging winch. Shortly after sonar scanning commenced, the tool failed to function properly. A few minutes later, all sonar presentation was lost and it was necessary to abort the re-entry attempt. The sonar tool was recovered and replaced by a backup tool for a total time loss of 7 3/4 hours.

Scanning with the second tool began at 1348 hours, November 2. Initial range to the re-entry cone target was 220 feet and four moves of the ship brought the casing shoe to within 50 feet of the cone. Further maneuvering was frustrated, however, by lack of response by the drill string to moves of the vessel. The extreme "stiffness" was attributed at the time to drag caused by the long casing string. It was necessary to move the ship at least 100 feet to initiate any response from the pipe. The pipe was finally made to swing across the cone after 9 1/4 hours of scanning, and the re-entry stab was made.

The sonar tool was retrieved and the re-entry was verified with an additional stand of drill pipe. The logging sheaves were rigged down and the casing was run into the hole. A bridge was encountered at 400 meters BSF. The power sub was then picked up and the casing was circulated to total depth at 531 meters BSF. When the shoe had landed, the casing was lowered an additional 1.8 meters to land the casing hanger in the lower portion of the re-entry cone. When proper weight indications were observed, the drill string was raised and increased weight noted to verify latch-in. Casing weight was then returned to the cone and the drill string was rotated to the right to release the casing.

The surface casing was then cemented into place with 350 cubic feet of 15 pound/gallon cement slurry. The cement was displaced into the casing/hole annulus with seawater and the special latchdown cement plug was landed at the shoe at 0645 hours, November 3.

The drill string was then pulled for the installation of a bit and coring BHA.

SECOND RE-ENTRY - SECOND BIT

The pipe trip and preparations for re-entry were routine and sonar scanning began at 0146 hours, November 5. The target was acquired at 200 feet and standard approach tactics began. The pipe was brought to within 40 feet of the cone in just over an hour but again the drill string proved to be exceptionally "dead". After hours of short moves with little or no effect at the end of the pipe, it was finally necessary to move the vessel in traverses of about 200 feet across the area of closest approach to the cone. This technique was eventually successful and the re-entry stab was made after more than ten hours of scanning and offsetting. It was suspected, however, that the vessel's position at the time of re-entry was not directly above the cone.

After re-entry had been verified by running three stands of pipe, an inner core barrel equipped with a center bit was pumped into place and the bit was run to 5475 meters. The heave compensator and power sub were then picked up. "Soft" cement was encountered at 5490 meters, becoming quite firm at 5496 meters. Cement, casing shoe and plug were drilled quite smoothly and new hole was made to 5512 meters. The center bit was retrieved and continuous coring began.

No core was recovered on the first attempt, but core No. 2 recovered 1.7 meters and recovery was normal thereafter. It was speculated that a piece of casing shoe or cement plug was trapped under the bit in the relatively soft formation and was not drilled up until several meters had been penetrated.

On four occasions in the first 360 meters of coring, pump pressure was high following the retrieval of core, indicating that the throat of the bit was plugged. This necessitated pumping down an inner barrel equipped with a bit deplugger to clear the obstruction each time and consumed a total of 9 3/4 hours.

Lithologies penetrated in the 485 meter bit run included chalk, limestone, shale, siliceous claystone and shale. The overall core recovery rate was 50.5 per cent. Recovery was only about 20 per cent in the Bermuda Rise formation, which consisted of siliceous claystone with chert.

On November 13, it was noted that core diameter was decreasing, indicating possible failure of bit bearings. Cutting structure damage was also suspected because of a disappointingly low rate of penetration through a limestone/shale sequence. The bit was therefore pulled after 38 rotating hours instead of the planned 50.

When the drill string had been pulled clear of the seafloor, a drill string motion instrumentation run was made. The test was unsuccessful, however, due to equipment problems.

The pipe trip was completed at 1630 hours, November 13. On inspection the bit was found to have three loose cones, but no cutting structure damage.

THIRD RE-ENTRY - THIRD BIT

The pipe trip back to the seafloor was delayed by about 2 1/2 hours when the glass rod used to hold the float valve open became dislodged or broken. The drill string began to float and it was necessary to fill the pipe and to pump down an inner core barrel to hold the flapper open. The inner barrel later had to be retrieved before further operations could proceed.

When the bit had neared re-entry position, a drill string instrumentation test was run. This time data were collected at all three stations.

Re-entry operations then proceeded without incident. Scanning and maneuvering of the vessel again were tedious, with the bit remaining essentially within 40 feet of the cone for three hours before a successful stab was made at 1930 hours, November 13. Total scanning time was nearly 8 1/2 hours.

As the bit was run into open hole, bridges were encountered beginning at about 800 meters BSF. At about 885 meters BSF, the hole was solidly obstructed and it was necessary to deploy the heave compensator and power sub. The bridge was washed out and little impediment was encountered to total depth, with only minor fill at the bottom.

The bottom of the hole was tagged at 5992 meters with 19.5 meters less pipe than had been used to cut the final core on the previous bit run. The depth discrepancy was attributed to the fact that strong subsurface currents experienced on the previous bit run had forced the vessel to position on offsets about 130 meters distant from those used on the new re-entry. The difference in depth resulted in a dual system of depth recording for the cores recovered from the hole as it would have been impractical to make such a large correction to the core and sample data collected previously.

As the heave compensator system was being pressured up in preparation for cutting the first core, the slave piston rod failed, rendering the compensator inoperative for the remainder of the voyage.

Coring proceeded smoothly through Mid-Cretaceous laminated limestone and shale until November 17, when core diameter was noted to be decreasing, along with recovery. Wind, sea and swell conditions were on the increase and, without heave compensation, were producing 30,000 pound drill string weight fluctuations. Since signs of bearing failure had already been noted and rapid failure was feared, the bit was retired after less than 30 rotating hours and only 225 meters of penetration.

The pipe trip was routine, except that the vessel changed heading to minimize roll after the bit had cleared the seafloor. The thrusters were unable to maintain position on this heading due to the force of the wind and the ship was allowed to drift off station.

On recovery the core bit was found to have one cone loose and another with a failed seal. It was replaced with a model having shorter cutting inserts. It was hoped that the anticipated lower penetration rate would be offset by a longer rotating life that would permit completion of the hole without another bit trip.

FOURTH RE-ENTRY - FOURTH BIT

Weather conditions had moderated sufficiently to allow the vessel to reposition and to maintain station on the optimum heading for the ensuing pipe trip.

When the re-entry sonar tool arrived at the bit and scanning began, no target was acquired and the presentation resembled that which is expected when the bit is just at the seafloor. One hour was spent in raising the pipe as high as possible, attempting to offset the vessel toward deeper water and checking the pipe tally. Finally the tool was raised into the pipe and seawater was pumped through the pipe at a high rate for a short time. On reseating the tool, a normal but somewhat weak and noisy presentation appeared, and the re-entry cone was detected at a range of 150 feet. As maneuvering to close the target proceeded, power to the tool began to fluctuate. Sonar presentation was lost after 125 minutes total scanning time and the tool was recovered for replacement with a backup tool.

Scanning recommenced with the new tool after a delay of five hours, during which a heading adjustment of 100 degrees had been dictated by changing wind and current conditions. The target was acquired at 160 feet and, after only three moves of the ship, the pipe passed over the cone to permit a successful re-entry stab. Scan time was 57 minutes. This was the first re-entry at Site 534 in which the drill string responded to vessel movements in the normal manner.

Following verification of the re-entry, the pipe was run into the hole to the same depth interval where obstructions had been encountered following the previous re-entry. Fewer bridges were encountered but the bit came to rest solidly at 5831 meters. When washing with the circulating head failed, it was again necessary to pick up the power sub. About 20 minutes were required to pass the apparent limestone ledge by rotating and working the pipe vertically. The bit was then washed to total depth at 6217 meters with only one other bridge "felt" at 6053 meters.

Coring proceeded without technical difficulty, except that the rate of penetration was much lower than anticipated. Within a few meters, the lithology changed to marly limestone and calcareous claystone and the short-toothed F94CK bit made as little as 1.4 meters per hour through the "tough" material.

On November 22, it was necessary to secure No. 2 engine for several hours to repair a leaking lube oil cooler. With the loss of the engine, there was insufficient power to continue drilling and to hold the vessel on station under existing weather and swell conditions. To avoid downtime and to divide remaining coring time with the final bit, the pipe trip was started without delay and with only six meters cut on core No. 98.

When the bit had been pulled clear of the seafloor, the inner barrel was retrieved and was found to be empty. A final coordinated drill string instrumentation run was made and the drill pipe was recovered.

The core bit was found to be in excellent condition after coring 127.5 meters in 40 rotating hours, but the throat was solidly plugged with claystone core. The bit was replaced with a longer-toothed type F93CK to achieve faster penetration through the shale that was being cored at the time.

FIFTH RE-ENTRY - FIFTH BIT

The BHA was magnafluxed as it was reassembled. During the ensuing pipe trip, a positioning beacon of the alternate frequency was dropped to replace the original beacon, dropped 33 days earlier, which was beginning to fade slightly. Positioning was switched over to the new beacon prior to the re-entry so that re-entry offsets on the beacon could be provided to the relieving crew.

After normal re-entry preparations, scanning was initiated and the re-entry cone target was detected at 200 feet. An arbitrary vessel move of 200 feet to the north was made and range to the target began to increase. It became obvious that the drill string was being moved almost directly away from the cone and the target was lost at 300 feet. The ship was then moved to 200 feet south of the original offsets. After some delay, the drill string followed the move and swung directly over the cone. The re-entry stab was made after 40 minutes of scanning.

The pipe trip to total depth was again slowed by bridges. Several obstructions were encountered, beginning at 5826 meters. The power sub was deployed to clear a difficult bridge at 5887 meters. The "wash" inner barrel was retrieved when the bit reached the bottom and a clean barrel was pumped into place. Although a slug of weighted mud had been pumped to clear the hole annulus, backflow of cuttings plugged the jets of the core bit on the ensuing connection, completely blocking circulation. It was then necessary to trip inner barrels again to unplug the bit before coring could proceed.

Coring began on a positive note with improving hole conditions and a considerable increase in penetration rate in Jurassic shale. After about 40 meters, however, very hard turbiditic limestones were encountered and the cutting rate slowed drastically to as little as 1.2 meters per hour. Shortly thereafter, core recovery dropped sharply, with less than one meter recovered in all subsequent cores. The material recovered and a gradual increase in penetration rate indicated that the proportion of shale was increasing with depth. The slow drilling rate and failure to recover full diameter core indicated partial obstruction of the core passage. The bit deplugger was run with all indications normal and it was inferred that there was damage to the core guide of the bit, probably inflicted by a broken piece of very hard limestone core.

On November 28, irregular drilling torque and recovery of reduced diameter core signaled progressive bit bearing failure and it was necessary to suspend coring operations until after the scheduled port call.

The drill string was recovered and the bit was found to be "well utilized" with all four roller cones quite loose. The core guide seemed in good condition, however, and the cause of the low core recovery was not apparent.

Before departing the site, the power sub/swivel assembly was magnafluxed and two additional stands of new drill pipe were made up. The CHALLENGER was under way for port at 1806 hours, November 29.

SITE 534 to PORT EVERGLADES

The same route was taken as on the previous transit. Wind and seas were favorable and a speed of nearly ten knots was made for the first day. On the afternoon prior to arrival in port, it was learned that port authorities had requested that the CHALLENGER delay her arrival due to port congestion. Speed was then reduced to schedule arrival at the pilot station at the time requested. Two engines were taken from propulsion to save fuel and consequently the average speed dropped to 9.0 knots for the transit.

The CHALLENGER arrived at Berth 3, Port Everglades, Florida, at 1000 hours, December 1, 1980

DRILLING AND CORING EQUIPMENT

Downtime attributable to rig equipment was exceptionally low considering that nearly 39 days were spent on site. On the initial pipe trip at Hole 533, the electric backup brake failed without warning and it was necessary to replace the trigger module. Fortunately only about 20 stands had been run and no damage resulted. Also required early in Site 533 operations, were repairs to the pipe racker skate line, the Bowen sandreel clutch and a seal in the linkage between the drawworks and the electric brake. Total time lost to the above casualties was five hours. The aggregate of on-site breakdown time for the remainder of the voyage was about one hour.

As the heave compensator system was being pressured up in preparation for coring following the third re-entry, the slave piston rod failed just below the piston This left the system without accumulator stroke indication and incapable of maintaining operating pressure. It was therefore necessary to dismantle the mechanism in preparation for repair efforts at the upcoming port call. The compensator had been in use for all previous drilling on the voyage with the exception of piston coring at Hole 533. It had operated effectively but had required considerable maintenance on control valve solenoids. Unfortunately the system was out of service for the hard, deep drilling of the last three bits in Hole 534A and for virtually all the weather conditions that resulted in enough heave to affect the drilling operations

The hydraulic bit release was deployed in Hole 533A, but failed to operate when the go-devil was pumped into place. The go-devil jammed and could not be retrieved for a second attempt.

The malfunction resulted in the inability to log the hole and its exact cause remains unknown.

During routine bimonthly magnaflux inspection of coring equipment, three 15-foot inner core barrels were found to show indications of fatigue cracks on the pin connection. The barrels (which had been in service for some time) were replaced, possibly averting an unplanned round trip or loss of a single bit hole.

BITS

The interbedded limestone/shale lithology encountered in Hole 534A provided a rigorous test for core bits. One F94CK (medium length chisel inserts) and three F93CK (long chisel inserts) bits were run in the indurated section. The latter model was preferred for its better penetrating ability in shaly lithologies, though penetration rates were lower than expected for all bits. The F94CK was a Smith Tool Co. production model while the F93CK's were fabricated in the SIO Marine Science Development Shop using new Smith cutter asemblies made up to recycled bodies. The F93CK bits all experienced bearing failure (loose cones) and were pulled after 38.1, 29.6 and 51.8 rotating hours. The F94CK was in excellent condition after 40 hours, but the rate of penetration had been unacceptably low.

SPECIAL TOOLS

The hydraulic piston corer was used at Hole 533 with excellent success. 167.5 meters of sediment was cored with very little core disturbance and core recovery in excess of 87 per cent. Exceptionally calm weather was an important factor in the good results as even moderate vessel motion has been found to degrade core recovery, quality and orientation. The only real problem experienced with the HPC system was internal jamming of the upper unit with drill pipe rust following the second core. The standby upper unit was deployed and the problem did not recur.

The pressure core barrel was used at Hole 533A and proved to be an unqualified success. Cores were recovered under pressure on four of the five attempts and there was some evidence that small amounts of gas hydrate were present in two of these cores. More detail on PCB operation, problems and sampling may be found in the accompanying report by Don Cameron.

The instrumented drill string sub (IDSS) was run once at Hole 533A and three times at Hole 534 A. The downhole bit motion instrument (DBMI) was run four times at Hole 534A. Some data were collected, which remain to be processed, but none of the runs appears to have been completely successful.

RE-ENTRY HARDWARE

No particular problems were experienced in deploying the re-entry cone and dual casing string. The rusted condition of the casing slowed the casing running operation somewhat and necessitated removing most of the thread protectors with a cutting torch.

The addition of a swivel directly beneath the 11 3/4" casing running tool decoupled the tool torsionally from the drill pipe BHA and was a great aid in engaging the casing string.

RE-ENTRY ELECTRONICS

Re-entry sonar tools failed on two occasions after the initiation of scanning. In the first instance, an improperly assembled motor shaft bearing resulted in excessive vertical play in the shaft and a damaged O-ring seal with resultant flooding of the motor. In the second case the motor was again flooded. A hole in the pressure compensation bladder allowed seawater to enter the motor housing.

BEACONS

The first acoustic positioning beacon launched was an ORE 16 kHz unit of the new self-contained configuration. The magnetic switch failed to shut the transmitter off following a predeployment test. The unit therefore operated in air for about 40 hours before the vessel arrived on site. The signal remained strong and completely satisfactory for the remainder of site occupancy. The switch would appear to be the only area of concern in the new configuration.

The second beacon, dropped on arrival at Site 534, was a Benthos 13.5 kHz unit. It appeared to lose signal strength drastically at about the time it arrived at the seafloor. When the vessel approached the beacon to take station, the signal level decreased to an inadequate level with decreasing horizontal distance. It was suspected that the beacon had come to rest on an irregular bottom feature or had otherwise lost its vertical attitude. A replacement beacon (Benthos 16 kHz) was dropped and performed well for 33 days until it was replaced by a 13.5 kHz ORE unit. The 16 kHz signal had nearly faded away after 50 days, when the vessel departed for port.

A 12 kHz drill pipe pinger (modified positioning beacon) was utilized on Holes 533 and 534 to provide greater accuracy in determining water depth. The pinger was effective in determining depth within one meter on the first attempt. On the second run, however, the pressure case flooded during the trip to the seafloor and pinger function was lost.

DYNAMIC POSITIONING SYSTEM

The positioning system performed well and reliably for the duration of the voyage. The vertical reference gyro failed on October 13 as it was energized at the first beacon drop. The system was switched to the backup VRG with no operational problem. On November 29, during the final pipe trip, the heading encoder unit in the pilot house console failed. Positioning was switched to the manual mode while the component was replaced and again there was no excursion or lost operating time.

ENGINEERING

The vessel's engineering department was beset by numerous major problems during the course of the cruise. Chief among these was the fact that all five of the single-bearing D.C. generators refurbished during the shipyard period developed anomalies of temperature and/or noise in the bearings. All but one of these bearings was changed during Leg 76. Bearing failures in the motor powering the main hydraulic plant forced the initial return to Norfolk for its replacement. Main bearing failure in No. 3 diesel engine necessitated the interim port call at Port Everglades. During this port call it was also necessary to replace one of the above-mentioned generator bearings and to overhaul the main circulating water pump.

Several lesser casualties requiring immediate attention were handled capably by the ship's engineers, but placed a considerable burden on their time and delayed other important projects, such as the overhaul of No. 1 evaporator plant.

WEATHER AND CURRENTS

Weather conditions were nearly ideal for most of the voyage and, except for isolated instances of interaction with strong surface currents, posed no operational problems until the final ten days on site. By this time seasonal weather patterns had begun to produce a strong northeasterly swell and increased local winds. This combination produced marginal operating conditions with respect to vessel motion and stationkeeping ability on two or three occasions. The most severe conditions occurred on the final day on site when a succession of squalls generated winds up to 50 mph and heavy rain.

Currents were an unexpectedly important operational factor at both drill sites. At Site 533 a surface current from the northwest to north persisted for the duration and was estimated to reach 1.5 to 2 knots occasionally. Effects on the drill string indicated that the current did not extend far below the surface, but that it would have rendered deployment of a re-entry cone or casing quite difficult. Positioning problems were minimized by exceptionally calm weather, but they developed with even a moderate wind at an angle with the current direction.

The situation at Site 534 was the reverse, with surface current essentially absent, but with strong subsurface forces acting on the pipe that generated serious concern for the well-being of both the drill string and the re-entry cone. The horizontal displacement and drag on the pipe hindered operations on the first three re-entries and forced the ship to move away from the re-entry cone position to reduce chafing at the guide horn while coring. Again the direction of flow was apparently from the northwest to north. The current forces proved to be transient, but persisted through the first week of November before virtually disappearing.

Transient currents, both subsurface and surface, reappeared during the final days on site. The surface current--from the southeast this time--complicated positioning for about two days.

COMMUNICATIONS

Radio communications with radio station WWD were carried out routinely. Only infrequent minor delays occurred and these were due to problems at WWD. The ship's high-powered primary (TMC) transmitter sustained three major breakdowns, but the newly reconditioned backup transmitter performed adequately while repairs were being made.

Numerous personal phone calls were placed via the ship's amateur radio operators and a highly cooperative "ham" network throughout the United States.

PERSONNEL

The voyage was a long one and time spent in shipyards and interim port calls has the effect of making time pass more slowly. Despite this, morale remained extremely high among all factions of the ship's company. The GMI crew handled the heavy workload with full professional cooperation. The scientific staff remained patient and understanding through the mechanical breakdown delays and the slower-than-anticipated drilling progress, even when it became apparent that most of them would have to depart before the ultimate objective was reached. The SIO technician staff displayed exceptional competence and maturity in dealing with a variety of scientific programs and work paces.

On November 22, an at-sea rendezvous was made with the ocean tug ORCA SUPPORTER for the purpose of a personnel transfer. A scientific investigator, a well log analyst, a logging engineer and a journalist were embarked and a scientific investigator departed on the tug.

No serious injuries or illnesses occurred. A marine technician suffered a severe leg laceration as a result of falling and striking a steel grating.

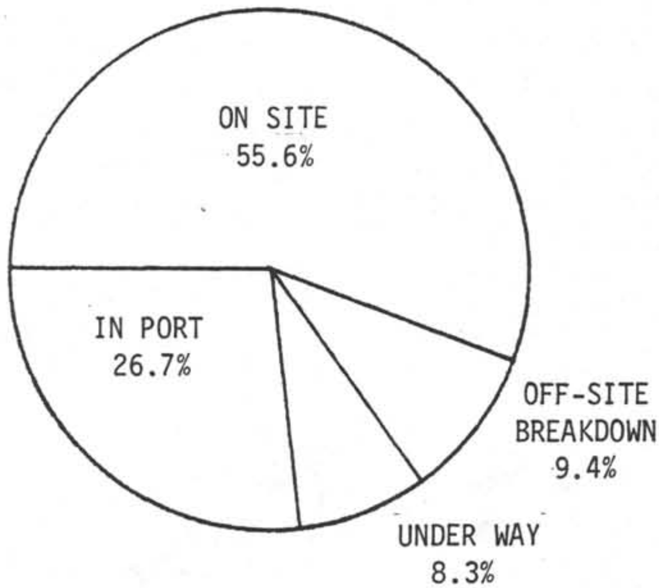
Glen N. Foss
Cruise Operations Manager
Deep Sea Drilling Project

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
OPERATIONAL RESUME
LEG 76

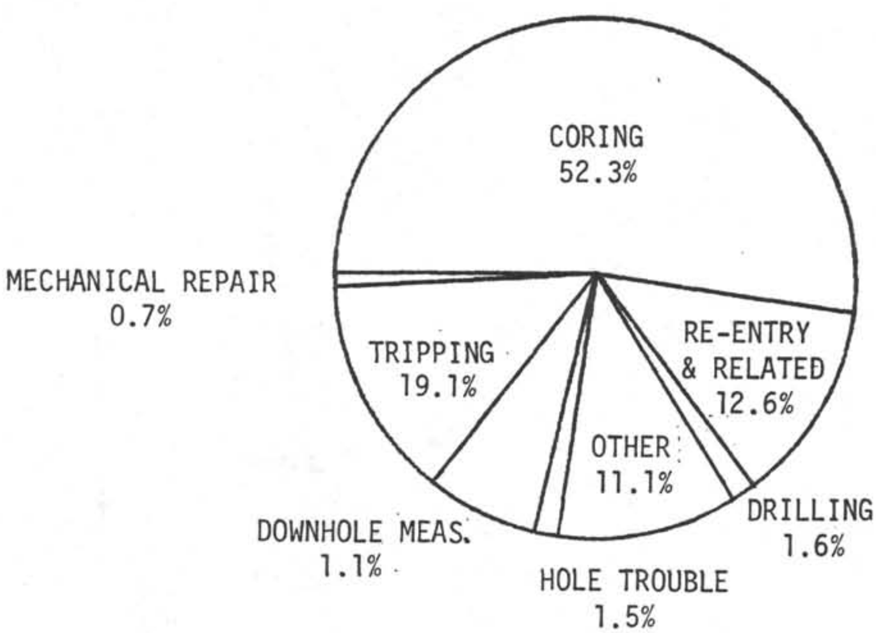
Total Days (September 22, 1980-December 1, 1980)		69.90
Total Days in Port (including sea trials)		19.80
Total Days Under Way		5.80
Total Days Off-Site Breakdown		6.57
Total Days On Site		38.83
Trip Time	7.4	
Drilling Time	0.6	
Coring Time	20.6	
Re-entry and Related	4.9	
Downhole Measurements	0.4	
Stuck Pipe and Hole Trouble	0.6	
Mechanical Downtime	0.3	
Other	4.3	

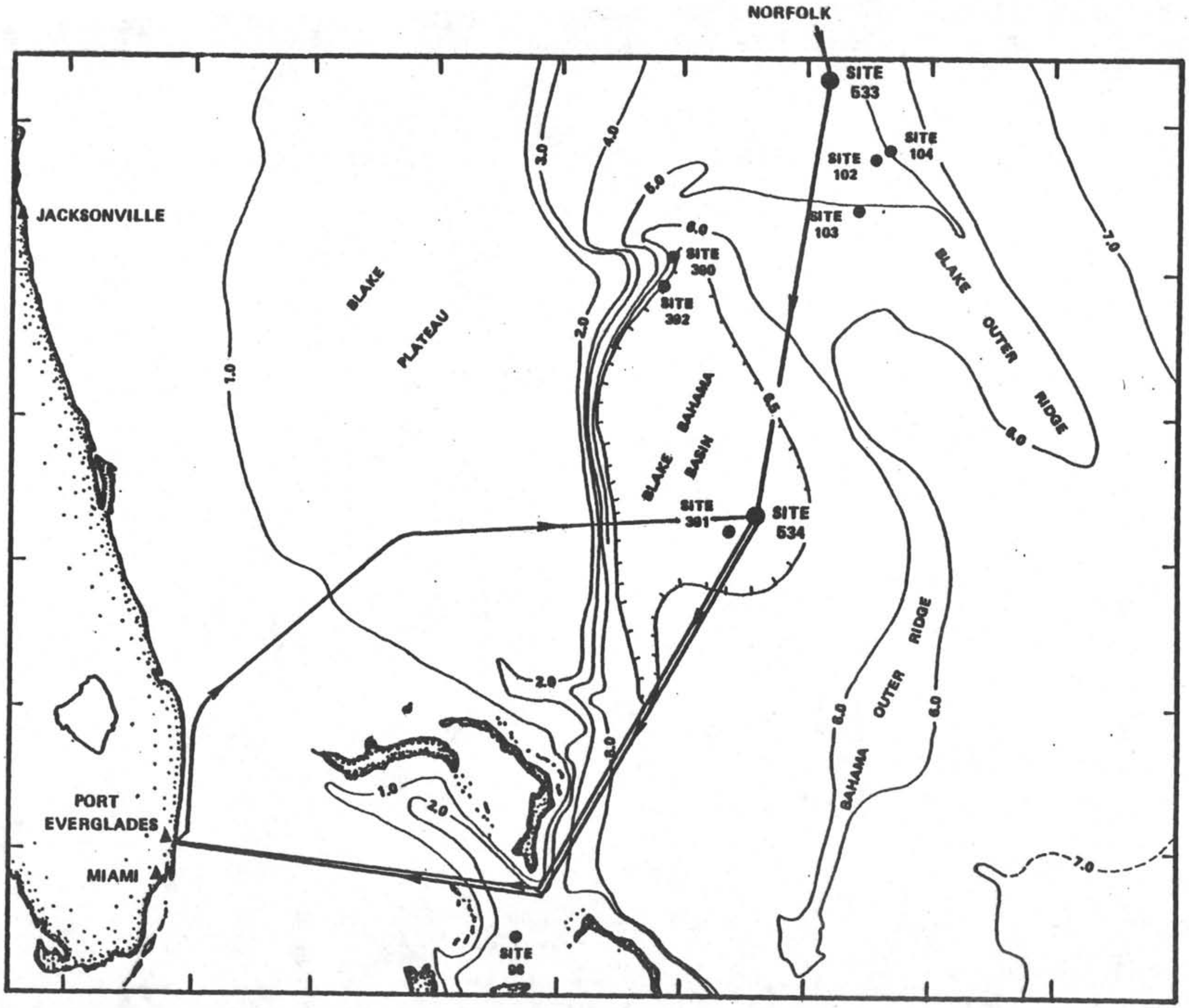
Total Distance Traveled (Nautical Miles)	1653.4
Average Speed (knots)	8.3
Sites Investigated	2
Holes Drilled	4
Number of Cores Attempted	193
Total Meters Cored	1455.0
Total Meters Recovered	937.0
Per Cent Recovery	64.4
Total Meters Drilled	762.0
Total Penetration, Meters	2224.5
Per Cent Penetration Cored	65.4
Maximum Penetration, Meters	1570.5
Minimum Penetration, Meters	87.5
Maximum Water Depth, Meters	4984.5
Minimum Water Depth, Meters	3193.8

TOTAL TIME DISTRIBUTION
LEG 76



ON-SITE TIME DISTRIBUTION





LEG 76 OPERATING AREA

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
BEACON SUMMARY
LEG 76

SITE NO.	MAKE	FREQ. kHz	SERIAL NUMBER	SITE TIME HOURS	REMARKS
533	ORE	16.0	102	75.3	Double life, new design; could not shut off after test, ran approximately 40 hours in mudroom.
533A	ORE	16.0	102	89.8	
				165.1	Total observed time approximate 205 hours, strong for duration.
534	Benthos	13.5	015	2.5	Faded on reaching seafloor; signal lost when ship over beacon.
534A	Benthos	16.5	011	806.9	Replaced #015; fading slightly when replaced 1335 hours, November 23.
534A	ORE	13.5	550	151.2	Double life launched 1054 hours, November 23; strong on departure.

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
BIT SUMMARY
LEG 76

HOLE	MFG	SIZE	TYPE	SERIAL NUMBER	METERS CORED	METERS DRILLED	METERS TOTAL PENET.	HOURS ON BIT	CONDITION	REMARKS
533	MSDS	11	HPC	AMY	167.5		167.5	NA	Good	HPC
533A	MSDS	9 7/8	PCB	AP9230	390.5	8.5	399.0	11.0T		3.1 hours previously; released
534	Smith	9 7/8	F93CK	646KR	2.1	85.4	87.5	30.7T	TO-B2SQ-I	29.8 hours previously; suitable rerun
534A	Smith	14 7/8	F94C	697AN	0	531.0	531.0	91.8T	TO-B4SF-I	84.1 hours previously; two cones handy
534A	MSDS	9 7/8	F93CK	S-21	479.7	5.3	485.0	38.1	TO-B6-I	3 loose cones; stabilizer pads overgauge
534A	MSDS	9 7/8	F93CK	S-20	225.0	----	225.0	29.6	TO-B5-0 1/8	One loose cone
534A	Smith	9 7/8	F94CK	AN6455	135.0		135.0	40.0	TO-B2SE-I	Throat plugged with claystone core.
534A	MSDS	9 7/8	F93CK	S-19	194.5		194.5	51.8	T1-B6-0 1/8	All cones loose

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
SITE SUMMARY
LEG 76

HOLE	LATITUDE	LONGITUDE	WATER DEPTH METERS	NUMBER OF CORES	CORES WITH RECOVERY	PERCENT OF CORES WITH RECOVERY	METERS CORED	METERS RECOVERED	PERCENT RECOVERED	METERS DRILLED	TOTAL PENET METERS	AVG RATE	TIME ON HOLE	TIME ON SITE.
533	31° 15.60'N	74° 52.19'W	3193.8	41	41	100.0	167.5	146.1	87.2		167.5		75.3	
533A	31° 15.62'N	74° 52.19'W	3194.0	29	29	100.0	258.7	213.4	82.5	140.3	399.0	50.5	83.8	
				70	70	100.0	426.2	359.5	84.4	140.3	566.5			165.1
534	28° 20.63'N	75° 22.93'W	4984.5	2	2	100.0	2.1	4.7	223.8	85.4	87.5	97.2	26.5	
534A	28° 20.63'W	75° 22.89'W	4976.0	121	118	97.5	1026.7	572.8	55.8	536.3	1570.5	9.4	740.3	
				123	120	97.6	1028.8	577.5	56.1	621.7	1658.0	14.0		766.8
	TOTALS			193	190	98.4	1455.0	937.0	64.4	762.0	2224.5			931.9

DEEP SEA DRILLING PROJECT
TIME DISTRIBUTION
LEG - 76

Date	Site No.	Cruise	Trips	Drill	Core	HOLE TROUBLE	W.O.W.	DOWNHOLE MEAS.	Mech. Repair	Port Time	REENTRY & RELATED	Other	Total Time	Remarks
09/22/80 10/11/80										448.8			448.8	Norfolk-incl Sea Trials
10/11/80 10/13/80		43.7										0.8	44.5	Norfolk to Site 533
10/13/80 10/16/80	533		14.4		42.9				4.1			13.9	75.3	HPC Hole
10/16/80 10/19/80	533A		15.5	1.7	46.4			7.7	1.0			17.5	89.8	Rotary Cored Hole
10/19/80 10/20/80		21.4											21.4	Site 533 to Site 534
10/20/80 10/21/80	534		17.8		2.1						1.5	5.1	26.5	Mudline Core & Wash-in Test Only
10/21/80 10/28/80									157.8				157.8	Transit Port Everglades & Repair
10/28/80 10/29/80		33.3											33.3	Port Everglades to Site 534
10/29/80 11/29/80	534A		130.5	13.3	396.4	13.8	1.0	2.2	1.1		115.5	66.5	740.3	5 re-entries
11/29/80 12/01/80		39.9											39.9	Site 534 to Port Everglades
TOTALS		138.3	178.2	15.0	487.8	13.8	1.0	9.9	164.0	448.8	117.0	103.8	1677.5	TOTALS

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
OPERATIONS RESUME
LEG 76 (CONTINUED)

The GLOMAR CHALLENGER arrived in Fort Lauderdale, Florida at 0938 hours, December 1, 1980 for a crew change and resupply port call. As the vessel was to return to Hole 534A, before proceding to Leg 77 sites, four scientists from the Leg 76 party remained on board.

In addition to routine maintenance activities, the heave compensator was repaired and a dynamometer check was made on the logging winch engine.

The ship departed at 0720 hours, December 5, 1980, and headed for Site 534A.

HOLE 534A

After cruising for about 36 hours, the beacon used for positioning at 534A was detected and the ship was positioned on it using the offsets that had been established when the last re-entry was made.

HOLE 534A (SIXTH RE-ENTRY ATTEMPT)

The drill string was madeup and run, and the re-entry sonar tool was lowered with operational checks being made at 1000 meter intervals. When the tool reached the bottom of the pipe and scanning began, no target was detected. At 1255 hours, a systematic search pattern was started to locate the re-entry cone. This search continued until 1700 hours when the drill pipe was raised two meters and when the tool lowered again it was found that the tool would not rotate. It was also discovered that the winch operator had not run to bottom and the tool had never been seated until this change in pipe depth. The sonar tool was then pulled to the rig floor to make an operational check on deck.

After the sonar tool was checked and found to be operational, it was again lowered to the bottom of the pipe. Again checks were made at 2000 and 4000 meters and the tool was operating correctly. When the tool was seated at the bottom, it would not rotate. It was then picked up three meters and rotation was regained. Four more attempts were made to lower the tool and have it rotate when seated, but each time it would not rotate. The tool was then pulled and when recovered, it was found to be badly grooved on the sides, When this damage was discovered a check was made of the bit being used and it was found that a PCB (Pressure Core

Barrel) bit had been used and had only a 2 1/8" diameter through the core guides and was therefore too small to allow the standard sonar tool to pass through it.

A new sonar tool was made up using a transducer designed for use with this particular bit. The tool was run to bottom with good operational checks made at 2000 and 4000 meters. However, when the tool was seated at the bottom it would not rotate. When it was picked up to check rotation, it required about a 2000 pound overpull to unseat it. The tool rotated when pulled up but would not when reseated. The decision was then made that the drill pipe be pulled and the bit changed. When the tool was pulled, it again required a 1500 pound overpull, and when recovered, it was found that the lower (45^{o}) scanning area had been broken off. The transducer had apparently caught in the flapper of the float valve during recovery.

The drill string was tripped, a new F94CK assembled and the drill string lowered to 4966.5 meters. The re-entry tool was lowered into the pipe but when checked at 1000 meters, it would not operate and was then pulled out of the pipe. When checked at the rig floor, the tool operated correctly, however, it was decided that it would be changed. A new tool was made up and run to bottom and when scanning started, the target was found to be approximately 200 feet away. The drill pipe was lowered to 4969.5 meters and final positioning began. After four hours and 22 minutes, the stab was made and after the re-entry tool was recovered, the re-entry was verified when two stands of pipe were lowered with no weight loss.

The re-entry sheaves were set back and the pipe run in to 5756.0 meters where the first bridge was encountered. The Bower power sub was picked up and the pipe washed and rotated to the old total depth of 6536.5 meters. The hole was circulated with 100 barrels of mud and continuously cored to a total depth of 6623.0 meters or about 30 meters into the basaltic crustal rock. The hole was again circulated clean and the drill string pulled to change the bottomhole assembly for logging.

HOLE 534A (SEVENTH RE-ENTRY ATTEMPT)

The drill string was then made up and again run into 4966.5 meters. The re-entry tool was then made up and when this tool was seated, the target was acquired at 125 feet. After the drill pipe and tool were lowered to stabbing depth, it rerequired six hours and 56 minutes before the stab could be made. The re-entry tool was pulled and re-entry verified when two additional stands were lowered with no weight loss. The pipe was then lowered to 5813 meters where the first bridge was encountered. The Bowen power sub was picked up and the hole cleaned out to 6620 meters. At this depth the hole was circulated with 100 barrels of mud. After this the bit was pulled to the top of this first logging interval (5927 meters) which was below the main area of bridging in the hole. Substantial drag on the pipe was noted as these 24 stands of pipe were pulled, some as high as 125,000 pounds over hanging weight. When logging depth was reached, a circulating head was installed and when pumping started the pressure indicated that the pipe was plugged. Eleven more stands were pulled and when circulated, the pressure indicated the pipe was still plugged. After the bit had been pulled into the casing shoe, a set of sinker bars were lowered on the sandline in an attempt to clear the pipe. This, however, was not successful on three attempts. The pipe was then pulled above the mudline and a standard core barrel, with a center bit attached, was dropped but it too failed to clear the plug. It was then decided that it would be necessary to pull the drill string to clear out the plug. When pulled to the derrick floor, the top of the plug was found at the top of the second stand of drill collars, i.e., about 230 feet of plugging material. This material included cuttings and rock fragments as large as 1" x 4" x 6". This rope was then cleaned so another attempt to log the hole could be made.

The drill string was again made up and run in to 4967.0 meters for re-entry. The re-entry transducer was madeup and run in the pipe. It operated as it was lowered with good checks at 1000 and 3000 meters, however, it could not be made to operate after it seated at the bottom of the pipe. It was pulled back to the derrick floor and was found to be inoperable. A second tool was then run to bottom after passing operation checks at 1000 and 3000 meters. When seated, the tool rotated but would not give a bottom response and it was also pulled to the derrick floor. An 8 1/4" extension was added to the assembly with the thought that for some reason the transducer was not extending far enough below the bit to receive a good response. But as in the two other attempts, the instrument was transmitting when seated at the bottom but was not receiving any signals. The tool was pulled to the derrick floor and a complete check of the tool, the display consol, the cable and the cable head was remade. After this was completed, the tool was again made up and lowered into position. This time everything was working properly and the cone was identified about 60 feet away. Final positioning began and after three hours and 19 minutes, the re-entry stab was made. The tool was pulled and again re-entry was verified when two additional stands of drill pipe were lowered.

The drill string was then run to 5780.0 meters where the first bridge was encountered, the BPS was picked up and the pipe washed in to 5926 meters. The BPS was set back and the logging sheaves were rigged. The gamma/density/temperature was lowered and tagged bottom at 6389 meters. The temperature log was recorded as the tool was lowered and a 10-minute temperature statistical check was made before the gamma-density log was recorded. This log was recorded and the tool was pulled to the derrick floor. While the tool was being recovered, the weather deteriorated, and the drill string had to be pulled into the casing to wait for conditions to improve.

After four hours the weather improved enough to attempt to log the upper part of the hole. The gamma/density was made up and run in the hole. It stopped at 5754 meters and the hole was logged up the casing shoe (5508 meters). After completing this log, the tool was pulled and was replaced with the gamma/sonic tool. While running in with this tool, an operational check was made and it was found that the gamma section was not working, so the tool was pulled back to the derrick floor. This section of the tool was replaced and again the tool was lowered in the hole. The gamma section again failed to operate properly when checked so it was decided that the gamma log recorder with the density tool would be run with the sonic log. The sonic log was lowered to 5745 meters where it stopped due to hole bridging. The section from this depth to the casing shoe was logged three times to be sure of good sonic values and then the tool was pulled to the derrick floor.

After the sonic tool was laid down and just the sheaves set back, the drill string was pulled to 5026.0 meters, just before the main area of bridging, and an attempt made to run the gamma/sonic as deep as possible. The tool stopped at 5978 meters and could not be worked below this depth. The tool was then pulled to the derrick floor and was laid down along with the sheaves. The BPS was picked up and the hole cleaned out to 6623 meters, circulated with 40 barrels of guar mud, and the pipe pulled to 6373.5 meters. The gamma/density tool was picked up and run in the hole, but stopped at a bridge at 6387 meters. A half an hour was spent trying to work through the bridge but all efforts were unsuccessful and the tool was pulled to the derrick floor and set aside.

A circulating head was attached to the drill pipe and two stands of pipe were added so that the pipe bottomed at 6430.5 meters. The gamma/density tool was picked up again and this time reached 6506 meters before it stopped. The interval, 6506 meters to 6430 meters, was then logged twice before the tool was pulled to the derrick floor. The drill pipe was then pulled for the last time and was found to be plugged as before in the bottom 34 meters of the BHA. The bit was at the derrick floor at 1630 hours and the site was abandoned at 1700 hours, December 19 when the ship departed for Fort Lauderdale.

The ship arrived in Fort Lauderdale on December 21, and Leg 76 officially ended when the first line went ashore at 1048 hours on this date.

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Cruise Operations Manager
Deep Sea Drilling Project

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
OPERATIONS RESUME
LEG 76 (CONTINUED)

Total Days (December 1, 1980-December 21, 1980)	20.03
Total Days In Port	3.9
Total Days Cruising Including Site Survey	3.16
Total Days On Site	12.97

Trip Time	5.12
Coring Time	2.36
Downhole Measurement	1.8
Waiting On Weather	0.09
Re-entry	2.97
Other	0.63

Total Distance Traveled Including Survey (Nuatical Miles)	656.9
Average Speed (Knots)	8.78
Number of Sites	1
Number of Holes Drilled	1
Number of Cores Attempted	9
Number of Cores With Recovery	9
Total Meters Cored	76.5
Total Meters Recovered	47.54
Percent Recovery	62.0
Total Meters Drilled	---
Total Meters of Penetration	76.5
Percent of Penetration Cored	100.0
Maximum Penetration (Meters)	76.5
Minimum Penetation (Meters)	---
Maximum Water Depth (Meters)	4976.0
Minimum Water Depth (Meters)	---

DEEP SEA DRILLING PROJECT
TIME DISTRIBUTION
LEG - 76 (CONTINUED)

Date	Site No.	Cruise	Trips	Drill	Core	Stuck Pipe	W.O.W.	Position Ship	Mech. Repair	Port Time	Re-Entry	Other	Total Time	Remarks
12/01/80 12/05/80										93.7			93.7	
12/05/80 12/06/80		34.0											34.5	
12/06/80 12/19/80	534A		122.9		56.5		2.3	43.2			71.3	15.0	311.2	
12/19/80 12/21/80		41.8											41.8	

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
SITE SUMMARY
LEG 76 (CONTINUED)

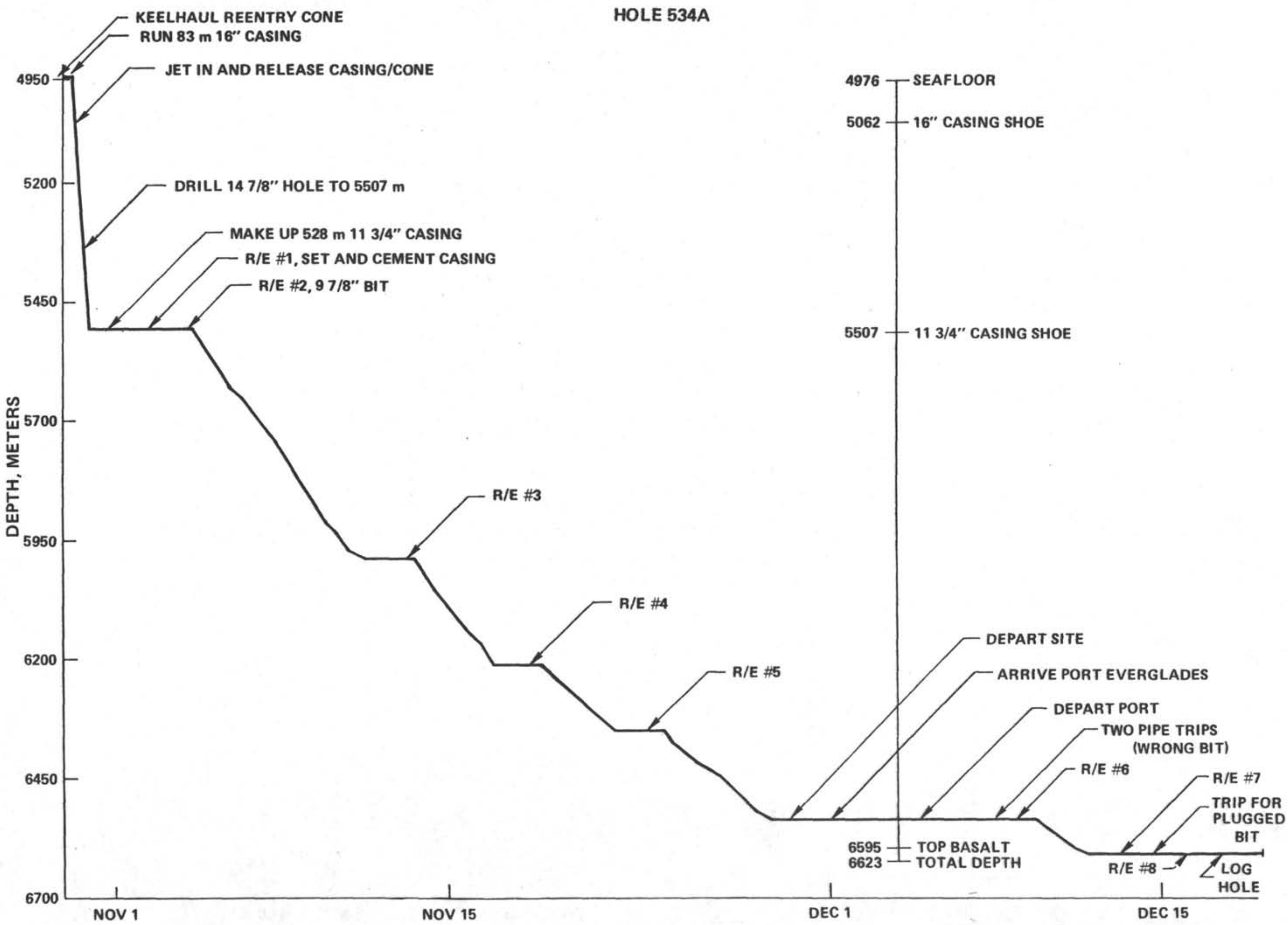
HOLE	LATITUDE	LONGITUDE	WATER DEPTH METERS	NUMBER OF CORES	CORES WITH RECOVERY	PERCENT OF CORES WITH RECOVERY	METERS CORED	METERS RECOVERED	PERCENT RECOVERED	METERS DRILLED	TOTAL PENET METERS	AVG RATE PENET	TIME ON	TIME ON
534A	28° 20.63'N	75° 22.89'W	4976.0	9	9	100.0	76.5	47.54	62.0	- - -	76.5	2.04	311.2	

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
BEACON SUMMARY
LEG 76 (CONTINUED)

SITE NO.	MAKE	FREQ kHz	SERIAL NUMBER	SITE TIME HOURS	REMARKS
534A	ORE	13.5	550	462.4*	Beacon dropped 1054 hours, November 23 151.2 hours before ship departed to change crews.* Working on site time.

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
BIT SUMMARY
LEG 76 (CONTINUED)

HOLE	MFG	SIZE	TYPE	SERIAL NUMBER	METERS CORED	METERS DRILLED	TOTAL PENET	HOURS ON BIT	CONDITION	REMARKS
534A	MSDS	9 7/8	F94CK	AE3396	76.5	- - - -	76.5	37.47	T1-B1-SE-0 1/16	


HOLE 534A
KEELHAUL REENTRY CONE
RUN 83 m 16" CASING
JET IN AND RELEASE CASING/CONE
DRILL 14 7/8" HOLE TO 5507 m
MAKE UP 528 m 11 3/4" CASING
R/E #1, SET AND CEMENT CASING
R/E #2, 9 7/8" BIT
R/E #3
R/E #4
R/E #5
DEPART SITE
ARRIVE PORT EVERGLADES
DEPART PORT
TWO PIPE TRIPS (WRONG BIT)
R/E #6
R/E #7
TRIP FOR PLUGGED BIT
R/E #8
LOG HOLE
4976 SEAFLOOR
5062 16" CASING SHOE
5507 11 3/4" CASING SHOE
6595 TOP BASALT
6623 TOTAL DEPTH
DEPTH, METERS
4950
5200
5450
5700
5950
6200
6450
6700
NOV 1
NOV 15
DEC 1
DEC 15

DEEP SEA DRILLING PROJECT
LOGGING SUMMARY
LEG 76 (CONTINUED)

HOLE	TOTAL DEPTH (M)	WATER DEPTH (M)	OPEN ENDED PIPE AT (M)	FLUID IN HOLE	BIT SIZE	TOTAL TIME FOR LOGGING (HOURS)	RUN NO.	LOGS RECORDED	FROM (M)	TO (M)	OBSERVATIONS
534A	6623	4967	5926	sea water	9 7/8	5.1	1	Temp.	5926	6398	
						4.9		CDL	6399	5950	
			5498.5			5.3	2	CDL/GR	5740	5500	
			5498.5			1.0	3	BHC/GR	1600	Surf	GR not working. Pull tool.
			5498.5			3.8	4	BHC/GR	5745	5484	
			5926			4.8	5	BHC/GR	- - -	- - -	Could not get tool down.
			6373.5			4.2	6	CDL/GR	- - -	- - -	Could not get tool down.
			6430.5			4.2	7	CDL/GR	6623	6430	

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
OPERATIONS RESUME
LEG 77

Leg 77 was originally scheduled to begin on December 1, 1980, in Fort Lauderdale, Florida. However, Leg 76 was extended to allow Site 534 to be completed and Leg 77 did not begin until the first line came ashore at 1048 hours, December 21, 1980, in Fort Lauderdale, Florida. Leg 77 had an original program that had drill sites in the Florida Straits and in the southeastern Gulf of Mexico. However, with the shortening of the leg, all the sites were concentrated in the Florida Straits area. Eight holes were attempted and three were drilled to their scientific objectives, two were terminated early due to plugging of the bit and sticking drill pipe. The remaining three had insufficient soft sediment at the surface to allow the bottomhole assembly to be drilled in safely. Downhole logging was to be attempted at the first site, but the bottomhole assembly broke off while the last core was being cut and logs could not be run. Logging was also planned for the last hole, however the bit would not release and the hole had to be abandoned.

The leg began on December 21, 1980, at Fort Lauderdale, Florida, and ended January 30, 1981, in San Juan, Puerto Rico. Total length of the leg was 40.13 days, of which 26.07 days were spent on site, 6.18 days in port, and 7.88 days under way. There was only 2.5 hours of weather downtime and no mechanical breakdown.

PORT CALL (End of Leg 76-Start of Leg 77)

The first line came ashore at 1048 hours, December 21, 1980 in Fort Lauderdale, Florida and the extension of Leg 76 was concluded. Leg 77 also began officially at this time.

The balance of the Leg 77 scientific party came aboard, but the ship could not depart due to necessary repairs required for No. 3 engine and generator. This repair delayed the ship's departure for six days. While this work was progressing, the Allison transmission from the logging unit winch was removed and serviced. Also a leak from the No. 7 fuel tank was discovered in the forward starboard hydrophone cylinder. 38,000 gallons of fuel was removed from the tank in order to locate the leak. Plans were made to repair the leak at the end of Leg 77. The engine room repairs were finally completed, and the ship departed when the last line was off at 1506 hours, December 27, 1980.

SITE 535

After cruising for about 40 hours, a 16.0 kHz beacon was dropped at 0810 hours on December 29 and Site 535 officially started.

The drill string was made up and measured as run to begin drilling operations. This hole was spudded at 1817 hours, December 29. A mudline core established the ocean bottom at 3455.5 meters. Continuous coring then began and continued uninterrupted to 714.0 meters subbottom. The upper ± 150 meters consisted of soft clay and mudstones, and the balance of the hole was made up of massive to thin bedded hard limestones. The coring rate through this lower section was slow but core recovery was excellent and averaged better than 71%. The bit also performed very well lasting for over 127 rotating hours.

After the core from 714.0 meters had been recovered, preparations were begun to condition the hole for a downhole logging program. However, while 40 barrels of mud were being circulated, one more core was requested. A new inner core barrel was dropped and coring began. After only about two minutes, pump pressure was lost as well as over 40,000 pounds of drill string weight. The drill string was immediately pulled and when the bottom of the pipe reached the derrick floor it revealed that the bottom joint of drill pipe had broken just above the pin end of this joint. The complete bottomhole assembly consisting of 9 drill collars, 3 bumper subs, the bit and bit release and various subs, had been left in the hole.

The ship was then secured for departure while a used sandline was dumped and a new beacon was soaked. Site 535 was abandoned at 2330 hours, January 8, 1981 when the ship departed for Site 536.

SITE 536

Site 536 was located 40.3 miles west southwest of Site 535 and the CHALLENGER arrived after steaming 6 1/2 hours. A 13.5 kHz beacon was dropped at 0545 hours, January 9, 1981.

A new sandline was spooled on to the coring winch before makeup of the new BHA was begun. Pickup and makeup of this new BHA required about 6 1/2 hours and then the balance of the drill string was made up and run. Site 536 was spudded at 2220 hours, January 9, and established the mudline at 2808.5 meters.

While coring the first 80 meters, heat flow measurements were made at 51.5 meters and at 80.0 meters. The first core after this measurement encountered the first shallow-water limestone debris and core recovery decreased dramatically. This rock type continued to be penetrated for over 100 meters deeper with recovery reduced to a total of 3.9% for this entire section. Three cores were cut below this point with increased recovery, but before each core could be cut, about five meters of fill had to be circulated out. In addition to this increased fill, the drill rate slowed and torquing increased. Therefore, after the core from a subbottom depth of 213.0 meters had been recovered, the decision was made to abandon this hole due to the increasing hazard to the drill string. The drill string was then pulled and the hole was officially abandoned at 1454 hours on January 11, when the ship was under way for Site 537.

SITE 537

After traveling approximately 30 miles west northwesterly from Site 536, a 16.0 kHz beacon was dropped at 1928 hours, January 11, 1981, for positioning at Site 537.

The ship was in an automatic positioning mode at 2024 hours and makeup of the drill string began. Site 537 was then spudded at 0654 hours, January 12, after waiting on the weather for approximately 1 1/2 hours. The mudline core established the seafloor at 3148.0 meters. The hole was then cored and washed to 92.5 meters below the seafloor where the limestone reef debris was again encountered, as at Site 536. This material was cored to a depth of 225 meters below the seafloor with very low recovery. After the core from 225 meters had been recovered, it was found that the bit was plugged and the drill pipe could not be rotated. After working the pipe for 35 minutes, with pulls of 500,000 pounds, which was about 125,000 pounds over the hanging weight of the drill string, both circulation and rotation were regained. With an additional 10 minutes of working the pipe, it was pulled free and the decision was made to abandon this hole because of the poor hole conditions. The drill string was then pulled and the site was abandoned at 2336 hours, January 13, 1981.

SITE 538

The next site to be investigated was on the Catoche Knoll located about 17 miles east southeast of Site 537. A 13.5 kHz beacon was dropped at 0302 hours on January 14 and two hours were spent positioning.

The drill string was made up and run to the depth indicated by the precision depth recorder for the mudline core. However, six water cores were taken before the mudline was established at 2882.5 meters, which was 52.5 meters deeper than that recorded by the precision depth recorder.

The mudline core required nine minutes to cut and it was decided that the rocks were too firm to spud in safely. The hole was abandoned at 1806 hours, January 14, when the bit cleared the mudline.

HOLE 538A

Following the decision to abandon Hole 538, the ship was moved with the pipe hanging 200 feet south and 2,000 feet east of the beacon. This area appeared to offer a thicker soft sediment cover as recorded by the 3.5 transducer. The seafloor depth was then calculated from the precision depth recorder and the mudline core was attempted. However, five water cores were again recovered before the mudline was established at 2801.0 meters. This difference was interpreted to be due to the irregular nature of the bottom which created a false picture due to side reflections from the irregular topography.

The first section cored was 190 meters of mudstones and chalks and this was followed by the shallow-water limestone debris which had been cored at Sites 536 and 537. Again the recovery dropped to about 5-8% while this section was cored. About 80 meters of this material was cored before hard basement igneous rock was reached. The bottom 50 meters of the hole was this igneous material which had a weathered appearance and was badly fractured. This fractured material required repeated slugs of guar mud to be pumped into the hole before each succeeding core was cut. Finally, however, the bit became plugged, after recovery of Core 36, and it was decided to abandon the hole rather than risk having the pipe stuck or damaged.

The drill string was then pulled and the hole abandoned at 2112 hours, January 17, 1981, when the ship departed for Site 539.

SITE 539

The next drill site (539) was located only about 41.5 miles easterly and the move to it was made in 6 3/4 hours. A 16.0 kHz positioning beacon was dropped at 0352 hours, January 18, and final positioning began. After 5.3 hours of positioning the ship, a site was selected that appeared to offer sufficient sediment cover to allow the BHA to be covered before anticipated hard rocks were encountered. The standard BHA was made up complete with a hydraulic bit release, to allow downhole logging when total depth was reached. The drill string was then added and Hole 539 was spudded at 1536 hours, January 18. The first core established the mudline at 3106.0 meters. The second core attempted could only penetrate another six meters before the rocks became too firm to continue drilling without the possiblity of damage to the drilling assembly and the hole was officially abandoned when the bit cleared the mudline at 1640 hours, January 18, 1981.

HOLE 539A

Following the abandonment of Hole 539, the bit was pulled to 3018.5 meters or 87.5 meters above the mudline. The ship was then moved from 540 feet north of the beacon to 320 feet south of it. From the seismic data being displayed, it appeared that there was sufficient soft sediment at this location to have good drilling conditions.

The first attempt to spud recovered only a water core. However, when the hole was spudded, after a joint of pipe was added, the bit again encountered very firm rock after only 7.5 meters of penetration. When the core barrel was recovered, it was found to contain a firm chalky rock, of Oligocene Age, which could not be drilled with only circulation and weight and it was then decided to abandon this area. The drill string was then pulled and the hole was officially abandoned when the ship was under way at 0223 hours on January 19, 1981.

SITE 540

The last site to be drilled on Leg 77 was located only 3.7 miles northeast of Site 539A. The ship traveled to this location in 1.2 hours and the 13.5 kHz beacon was dropped at 0300 hours, January 19.

The drill string was made up and the hole spudded at 1051 hours and recovered a 4.22 meter core, establishing the mudline at 2940.5 meters. The second core required 12 minutes of circulation and careful lowering of the drill pipe. There was some concern that the rocks at this location would again be too hard to core without damage to the drilling equipment. However, continuous coring continued slowly and finally enough of the BHA had been buried that the danger to the drill string had been removed. Two heat flow measurements were made at 52 and 71 meters, but the third one which was to be made at 90.0 meters was eliminated because the material being recovered was a white chalk and would probably have damaged the probe. Coring was discontinued at 745.5 meters to allow a downhole logging program to be conducted before the ship had to leave.

The BHA included a hydraulic bit release assembly and after the coring was completed, the hole was circulated clean with 40 barrels of mud and the 'go-devil' for releasing the bit was pumped down the pipe. However, after the tool had landed and the necessary pressure built up, the bit could not be released. After additional pressuring with no success, an overshot was lowered to retrieve the 'go-devil'. However, when the overshot was latched onto the tool, it was found that it could not be moved even with 8,000 pounds overpull exerted on the line. After about ten minutes of working the sandline, the shear pin in the overshot was sheared and the overshot recovered. After the shear pin was replaced and the overshot run back to bottom, it would not engage the stuck tool and was pulled back to the rig floor. When recovered, it was found to be full of line tar that had probably been squeezed out of the sandline when the heavy pulls were made. It was cleaned up and when lowered again, would not latch. It was recovered and an inner core barrel with short hard catcher teeth was attached to it. This assembly was then lowered and did engage the 'go-devil' but again this tool would not come loose even with an overpull of 9,000 pounds. The shear pins in the overshot were finally sheared and it was recovered. Since no alternative remained, it was then decided that the drill string must be recovered and the hole abandoned without logging. When the bit release was recovered and disassembled, it was found that the sleeve had shifted but the segments were tightly packed with very fine-grained sand. This prevented the bit from releasing.

BITS

A total of four F94CK bits were used on this leg while attempting to drill eight holes. The first bit used on Site 535 has a remarkable record of 127.7 rotating hours while coring 714 meters. This bit was not recovered due to the loss of the bottomhole assembly. Three other F94CK bits were used and performed well and had rotating times of 22.0 and 40.1 hours before they were recovered.

DRILLING AND CORING ASSEMBLIES

One basic bottomhole assembly was used during the leg. This was the standard BHA which consisted of: the bit, hydraulic bit release assembly, head sub, outer core barrel, top sub, head sub, three 8 1/4" drill collars, one 5' bumper sub, three 8 1/4" drill collars, two 5' bumper subs, two 8 1/4" drill collars, one crossover sub, and one 7 1/4" drill collar. This assembly was used at Sites 535, 536, 539, 539A, and 540. At Sites 537, 538, 538A, the hydraulic piston corer collet head sub was used in place of the regular head sub to allow HPC coring if it was desired after completing the regular rotary coring.

Upon completion of drilling at Site 540, the bit release "go-devil' was dropped but after pressuring up, the bit would not release. An attempt to recover this 'go-devil' and drop another failed when it could not be pulled loose even with a 8,000 pound overpull on the sandline. An additional complication developed due to line tar being squeezed out of the new sandline by this excessive weight pull. The overshot would not seat properly and an inner core barrel with short hard catcher teeth was dropped and did engage the 'go-devil' but again it could not be retrieved. The pin was sheared in the overshot and recovered and then the drill string was pulled and the hole abandoned. When recovered and disassembled it was found that the sleeve had shifted but the segments had been packed tight with fine sand and could not fall out and release the bit.

BEACONS AND DYNAMIC POSITIONING

During this leg six ORE beacons were used for positioning at six sites. All were single life and worked well, particularly the one at Site 535 which was in use for 255.3 hours. Good positioning and acquisition was enjoyed at all sites. This was somewhat unexpected because when the ship was in this area on Leg 10, considerable trouble was experienced in holding position in the automatic mode due to strong currents. There were some excursions of up to 200 feet on this leg but the drilling was never affected by these movements.

DOWNHOLE LOGGING

Logging was planned for all the holes drilled on this leg but none was attempted due to complications in preparing the holes for logging. The first hole scheduled for logging was Site 535 but the loss of the bottomhole assembly prevented the logging program. The remaining holes drilled were all too shallow for logging except Site 540 which was drilled to 745.5 meters below the seafloor and after the hole had been circulated clean, the bit release was dropped but the bit could not be released and the site had to be abandoned without obtaining logs.

COMMUNICATIONS

Communications with Radion Station WWD, following our departure from Ft. Everglades, was accomplished with no difficulties. Our working areas were ideally located for good CW transmitting and receiving. Our time difference was only three hours and messages could be answered the same day when necessary. The traffic load was about average from DSDP and somewhat down from GMI office. No equipment failures occurred during the leg. The normal amateur radio calls were made for many of the ship's compliment.

R. R. Knapp
Cruise Operations Manager
Deep Sea Drilling Project

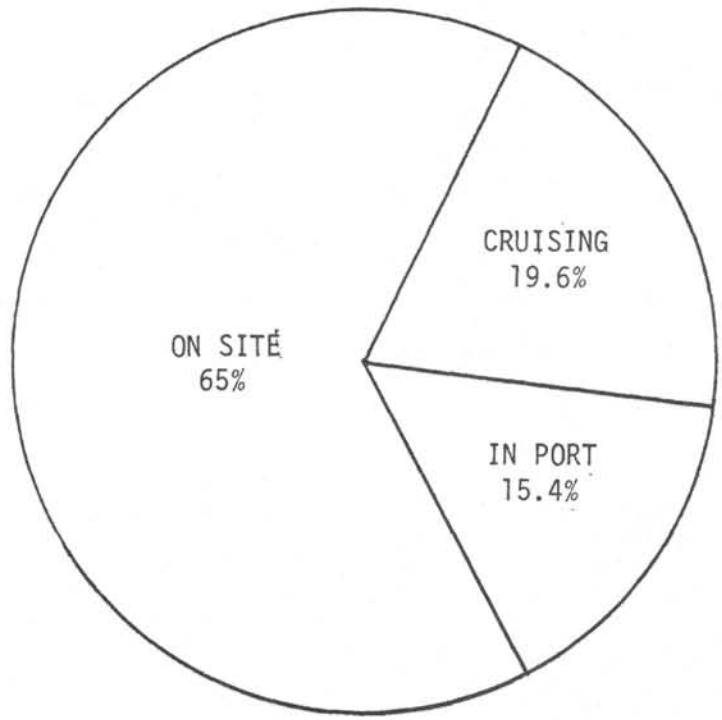
INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
OPERATIONS RESUME
LEG 77

Total Days (December 21, 1980-January 30, 1981)	40.13
Total Days in Port	6.18
Total Days Cruising Including Site Survey	7.88
Total Days On Site	26.07

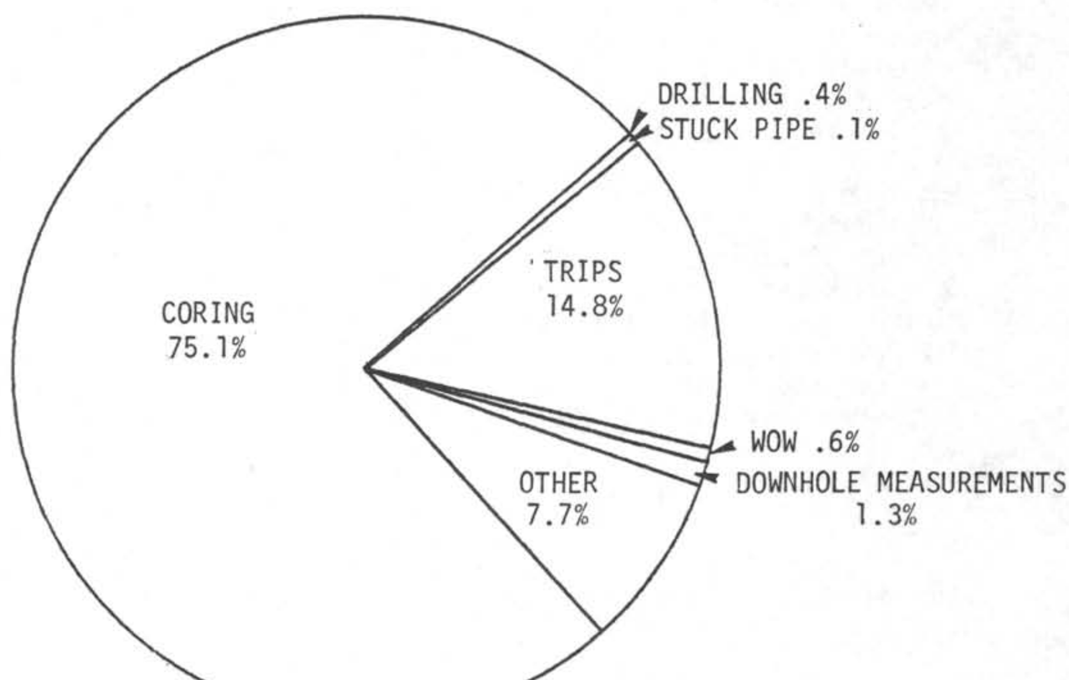
Trip Time	3.87
Drilling Time	.09
Coring Time	19.59
Downhole Measurement	.30
Stuck Pipe	.04
Waiting On Weather	.16
Other	2.02

Total Distance Traveled Including Survey (Nautical Miles)	1514.9
Average Speed (Knots)	8.48
Number of Sites	6
Number of Holes Drilled	8
Number of Cores Attempted	238
Number of Cores With Recovery	236
Total Meters Cored	2179.0
Total Meters Recovered	1076.87
Percent Recovery	49.4%
Total Meters Drilled	71.5
Total Meters of Penetration	2250.5
Percent of Penetration Cored	96.8
Maximum Penetration (Meters)	745.5
Minimum Penetration (Meters)	6.0
Maximum Water Depth (Meters)	3455.5
Minimum Water Depth (Meters)	2801.0
Total Penetration (Meters)	2250.5

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
TOTAL TIME DISTRIBUTION
LEG 77



ON SITE TIME DISTRIBUTION
LEG 77



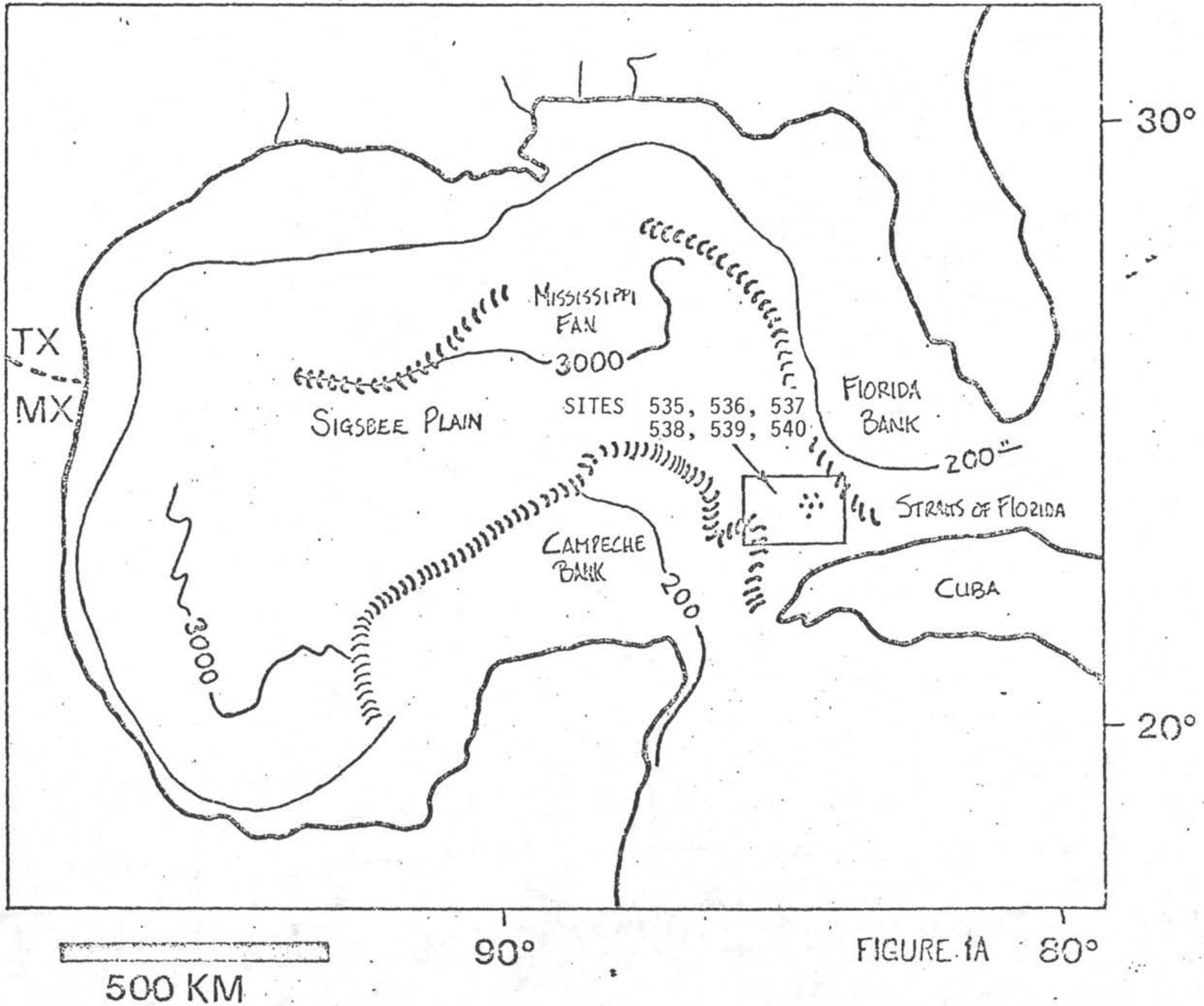

30°
20°
TX
MX
MISSISSIPPI
FAN
3000
SIGSBEE PLAIN
SITES 535, 536, 537
538, 539, 540
FLORIDA
BANK
200
STRAITS OF FLORIDA
CAMPECHE
BANK
200
CUBA
3000
90°
80°
500 KM

FIGURE 1A

DEEP SEA DRILLING PROJECT
TIME DISTRIBUTION
LEG - 77

Date	Site No.	Cruise	Trips	Drill	Core	Stuck Pipe	W.O.W.	DOWNHOLE MEASURE	Mech. Repair	Port Time	Re-Entry	Other	Total Time	Remarks
12/21/80 12/27/80										148.3			148.3	
12/27/80 12/29/80		41.0										.1	41.1	
12/29/80 01/08/81	535		19.6		231.3							4.4	255.3	
01/08/81 01/09/81		6.2											6.2	
01/09/81 01/11/81	536		17.1		30.4			4.0				5.7	57.2	
01/11/81		4.6											4.6	
01/11/81 01/13/81	537		14.4	2.2	29.9	.6	2.5					2.5	52.1	
01/13/81 01/14/81		3.4											3.4	
01/14/81	538		6.4		.7							8.0	15.1	
01/14/81 01/17/81	538A		9.9		57.7							7.5	75.1	
01/17/81 01/18/81		6.7											6.7	
01/18/81	539		6.4		1.1							5.3	12.8	
01/18/81 01/19/81	539A		6.8		2.0							.9	9.7	
01/19/81		1.1											1.1	
01/19/81 01/25/81	540		12.1		117.0		1.2	4.0				14.0	148.3	
01/25/81 01/30/81		126.0											126.0	

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
SITE SUMMARY
LEG 77

HOLE	LATITUDE	LONGITUDE	WATER DEPTH METERS	NUMBER OF CORES	CORES WITH RECOVERY	PERCENT OF CORES WITH RECOVERY	METERS CORED	METERS RECOVERED	PERCENT RECOVERED	METERS DRILLED	TOTAL PENET METERS	AVG RATE PENET M/H	TIME ON HOLE	TIME ON SITE
535	23° 42.48'N	84° 30.97'W	3455.5	79	78	98.7	714.0	505.07	70.7	----	714.0	5.6	255.3	255.3
536	23° 29.39'N	85° 12.58'W	2808.5	23	23	100.0	213.0	65.73	30.9	----	213.0	23.9	57.2	57.2
537	23° 56.01'N	85° 27.62'W	3148.0	17	16	94.1	153.5	15.87	10.3	71.5	225.0	17.3	52.1	52.1
538	23° 50.98'N	85° 10.26'W	2882.5	1	1	100.0	6.0	5.15	85.8	----	6.0	30.0	15.1	
538A	23° 50.95'N	85° 09.93'W	2801.0	36	36	100.0	332.5	137.67	41.4	----	332.5	13.2	75.1	90.2
539	23° 47.34'N	84° 25.19'W	3106.0	2	2	100.0	7.0	4.40	62.9	----	7.0	70.0	12.8	
539A	23° 47.20'N	84° 25.19'W	3099.5	1	1	100.0	7.5	7.23	96.4	----	7.5	90.0	9.7	22.5
540	23° 49.73'N	84° 22.25'W	2940.5	79	79	100.0	745.5	335.75	45.0	----	745.5	18.6	148.3	148.3
		TOTAL		238	236	99.2	2179.0	1076.87	49.0		2179.0	10.1	625.6	625.6

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
BEACON SUMMARY
LEG 77

SITE NO.	MAKE	FREQ kHz	SERIAL NUMBER	SITE TIME HOURS	REMARKS
535	ORE	16.0 SL	519	255.3	No Problems
536	ORE	13.5 SL	539	57.2	No Problems
537	ORE	16.0 SL	520	52.1	No Problems
538	ORE	13.0 SL	540	15.1	No Problems
538A	ORE	13.0 SL	540	15.1	No Problems
				90.2	
539	ORE	16.0 SL	521	12.8	No Problems
539A	ORE	16.0 SL	521	9.7	No Problems
				22.5	
540	ORE	13.5 SL	541	148.3	No Problems

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
BIT SUMMARY
LEG 77

HOLE	MFG	SIZE	TYPE	SERIAL NUMBER	METERS CORED	METERS DRILLED	METERS TOTAL PENET	HOURS ON BIT	CONDITON	REMARKS
535	Smith	9 7/8	F94CK	425RS	714.0		714.0	127.65	Unknown	Lost when BHA broke off.
536	Smith	9 7/8	F94CK	AE3377	213.0		213.0	8.9	TO-B1-SE 0 1/8-1/4	Rerun from 536 because in very good
537	Smith	9 7/8	F94CK	AE3377	153.5	71.5	225.0	13.1		condition on recovery.
								22.0		
538	Smith	9 7/8	F94CK	AN6399	6.0		6.0	.2	Rerun on Site 538A	Surface rocks too firm to drill safely.
538A	Smith	9 7/8	F94CK	An6399	332.5		332.5	26.1	TO-B1-SE-o 1/16	Bit in good shape when recovered.
										Some wear on stabilizer pads.
								26.3		
539	Smith	9 7/8	F94CK	AE3397	7.0		7.0	.1		No wear after 2 hours at 539/539A.
539A	Smith	9 7/8	F94CK	AE3397	7.5		7.5	.1		Will rerun on Site 540.
540	Smith	9 7/8	F94CI	AE3397	745.5		745.5	39.95	T1-B4-SE-O 1/8	Little wear or damage after coring
								40.15		a fair amount of chert.

DEEP SEA DRILLING PROJECT
TIME DISTRIBUTION
LEG - 77

Date	Site No.	Cruise	Trips	Drill	Core	Stuck Pipe	W.O.W.	DOWNHOLE MEASURE	Mech. Repair	Port Time	Re-Entry	Other	Total Time	Remarks
12/21/80 12/27/80										148.3			148.3	
12/27/80 12/29/80		41.0										.1	41.1	
12/29/80 01/08/81	535		19.6		231.3							4.4	255.3	
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01/11/81		4.6											4.6	
01/11/81 01/13/81	537		14.4	2.2	29.9	.6	2.5					2.5	52.1	
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01/17/81 01/18/81		6.7											6.7	
01/18/81	539		6.4		1.1							5.3	12.8	
01/18/81 01/19/81	539A		6.8		2.0							.9	9.7	
01/19/81		1.1											1.1	
01/19/81 01/25/81	540		12.1		117.0		1.2	4.0				14.0	148.3	
01/25/81 01/30/81		126.0											126.0	

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
OPERATIONS RESUME
LEG 78A

Leg 78A of the Deep Sea Drilling Project represented a renewed effort to study the mechanics and geology of active (subducting) crustal plate margins. The primary drilling objective was to penetrate through the toe of an accretionary prism, the Barbados Ridge. Once again the trench slope environment proved hostile to the drill, which made three penetrations well into the wedge but was stopped short of basement. Through excellent core recovery and observation of downhole pressure phenomena, important contributions were made to the understanding of "accretion in the act". A final drilling thrust seaward of the ridge penetrated the complete sedimentary section and well into basement with exceptional recovery of basalt structures.

The voyage commenced on January 30, 1981 at San Juan, Puerto Rico and terminated on March 12, 1981 at San Juan. Total length of the leg was 40.3 days; of which 23.6 days were spent on site; 11.3 days in port; and 5.4 days underway. Mechanical breakdowns accounted for the loss of 3.1 days.

SAN JUAN PORT CALL

Leg 78A began at 1448 hours, January 30, 1981, with the arrival of the GLOMAR CHALLENGER at the Old Army Terminal Pier, Catano, Puerto Rico. Major scheduled work items for the port call included repair of a leaking fuel tank, magnetic inspection of the drill string, installation of foundation equipment for the forthcoming DARPA seismic experiment and repairs to No. 2 Caterpillar engine. The latter item was upgraded to a major overhaul after the engine had been disassembled prior to arrival in port. On February 4, when most of the scheduled work had been completed, the topping lift control mechanism on the ship's large crane malfunctioned. This resulted in a heavy load being dropped, causing damage to the main deck hatch cover. Investigation determined that the crane needed to be overhauled for safe operation and that the hatch had to be repaired before the ship could sail. It was then found that No. 12 engine had sustained a heavy buildup of carbon, preventing proper operation and requiring disassembly for cleaning. These latter work items extended the port call from the scheduled five days to ten days.

The vessel moved to the adjacent Catano Fuel Dock at noon on February 4 and returned to the Army Pier early the next morning after taking on 167,000 gallons of diesel oil. During the port call, 255,000 gallons of fresh water were loaded, normal port cal logistics and resupply efforts were carried out and cores and miscellaneous freight were offloaded.

An additional day's delay occurred when the First Assistant Engineer resigned and it was necessary to send a replacement from California. When the new man arrived, tugs and pilot were called and the CHALLENGER departed at 1800 hours February 10.

SAN JUAN TO SITE 541

After the vessel was safely clear of San Juan Harbor traffic, a twenty minute stop was made to test the ship's thrusters and dynamic positioning system and to "soak" positioning beacons to be used on Leg 78.

The 500 mile transit from Puerto Rico to Site 541 was uneventful except that headwinds of up to 31 knots the first day were followed by swells of up to nine feet which persisted into the second day of site occupancy. This adverse weather combination held the CHALLENGER's average speed to 7.5 knots.

Following a 1 3/4 hour presite survey, a positioning beacon was launched at 1404 hours on Friday, February 13, about 135 miles east-northeast of the Island of Martinique.

SITE 541-FRONT OF BARBADOS RIDGE

Initial positioning of the vessel was complicated by divergent wind, swell and current directions and required two hours before the pipe trip could begin.

The pipe trip was lengthened by 4 1/2 hours as 41 suspect joints of drill pipe (as identified by the magnetic inspection in San Juan) were laid out. An inner core barrel was pumped down the pipe as the final preparation for spudding. No pressure indication of the barrel landing at the bit was noted after an appropriate interval of pumping. This indicated that the inner barrel had been stopped by a partial obstruction in the pipe or that it had been pumped out through open-ended pipe. An attempt was made to "find" the core barrel with the sandline and overshot, but when the length of the sandline exceeded that of the drill string, it was suspected that the hydraulic bit release had operated prematurely during the trip. The sandline was recovered undamaged.

The drill string was then tripped and, when the drill collars had been recovered, it was discovered that the outer core barrel had come unscrewed from the top sub and had been lost.

A new outer core barrel assembly was made up and the drill pipe was again run to the seafloor. Hole 541 was finally spudded at 1525 hours, February 15, at a depth of 4961 m.

Coring then proceeded smoothly and with excellent core recovery through about 215 meters of nannofossil-rich clay, followed by about 60 meters of clay. At this point a thrust fault was penetrated and the younger nannofossil clay sequence was re-entered. No drilling problems were experienced until a second major thrust fault was crossed at about 430 m below seafloor (BSF). Coincident with a very low recovery core (No. 46), high pump pressure and torquing and sticking of the drill string were noted. The hole was flushed with mud and three additional full cores were taken. Up to 18 meters of fill was encountered following the cores, despite repeated mud flushes, and sticking tendencies persisted on connections. Rotation could not be regained following the connection for core No. 50 and it was necessary to terminate coring operations. A short core was cut by drilling the power sub down to the limit of its travel on the guide rails.

The core was recovered and a hydraulic bit release go-devil was pumped down to actuate the release mechanism. About 20 minutes of manipulating the drill string and pump pressure were required before the bit and associated components were released. The pipe was then pulled until only the BHA remained in the hole and preparations were made for logging.

On the first logging attempt, temperature was being logged downward when the logging sonde was stopped by a soft clay "bridge" only 10 meters beyond the end of the pipe. When attempts to work the tool past the obstruction failed, the tool was recovered and a "short trip" was made. This consisted of running the open-ended pipe down to the top of the hole fill at about 415 m BSF and then pulling back to one stand (28.5 m) below its earlier position to keep the trouble spot behind pipe. A second logging attempt was aborted due to an electrical problem in the tool that developed about one third of the way down the pipe. The sonde was recovered and the trouble was traced to the sinker bar, which was replaced. On the third attempt, the sonde logged temperature to about 18 meters beyond the pipe before it again stopped in the soft clay. After numerous attempts to work the tool past the bridge, a static temperature check was made and log function was switched to the density-caliper-gamma ray mode in an attempt to log the approximately 46 meters of open hole that could be exposed by raising the pipe in the derrick. Unfortunately the tool had been damaged by the attempts to penetrate the bridge and no log could be recorded.

Operations in Hole 541 were terminated at this point and the drill string was recovered, with all pipe on deck at 0600 hours, February 21.

HOLE 542

The second drill site was selected about one mile seaward of Site 541 where the seismic reflector believed to represent the thrust fault fracture zone could be traced to a shallower depth. It was hoped that the less deeply buried clay would be deformed plastically and would be less likely to cause hole problems than the fractured claystone below 400 meters in Hole 541. The vessel was moved by using offsets and by monitoring the position display of the dynamic positioning system. The new acoustic beacon was dropped only 34 minutes after the move began. The position was refined by positioning system offsets during the ensuing pipe trip after reference profiles and Sat Nav fixes had been reviewed.

Hole 542 was spudded at 2321 hours, February 21, after a five hour delay caused by a malfunction in the Bowen power sub system.

The hole was drilled from the seafloor depth of 5026 meters to 202 meters BSF with three "spot" cores taken from the interval. Continuous coring then proceeded without incident to 240 meters BSF. A routine drift measurement at this point indicated that the hole angle was 7.6 degrees off vertical. This large deviation was undesirable and exceeded the acceptable angle for the downhole seismometer scheduled for implantation here. It was therefore necessary to respud the hole and to drill more vertically. The bit was pulled clear of the seafloor at 1748 hours, February 22.

HOLE 542A

Hole 542 A was spudded at the same location at 1823 hours, February 2. Three spot cores were taken from the drilled interval of 0-240 m BSF. A drift survey taken at 173.5 m showed an acceptable deviation of 2.3 degrees.

Continuous coring produced high core recovery with no hole problems until core No. 7 (287.5-297 m BSF). Recovery was low for this core and high pump pressure was noted as the next inner barrel was pumped into place. Three cores were taken with progressively more hole fill and sticking tendencies as in Hole 541 despite copious mud flushes. When 25 meters of hole fill were encountered following the retrieval of core No. 10, conditions were judged hopeless and operations were terminated. The drill string was recovered, with the bit arriving on deck at 1030 hours, February 24.

HOLE 542B

The vessel was offset 30 meters to the north to avoid the disturbed area of the two previous holes as preparations were made for a final attempt to penetrate the thrust fault plane and reach basement. The plan called for isolation of the unstable fault zone behind a short length of casing, attached to the BHA and drilled into place opposite the fault zone. The casing would then be released and would remain in place while normal coring operations proceeded to total depth.

Fourteen hours were required to assemble the 57-meter string of 11 3/4 inch casing with its special 17 1/2 inch drilling shoe and drive/hanger assembly. This included completely reconfiguring the BHA and attaching the casing to the BHA by means of a special lowering/drive sub. The ensuing pipe trip was routine and Hole 542B was spudded at 1037 hours, February 25.

No cores were planned until after release of the casing. Drilling proceeded to 110.5 meters BSF where, with the BHA safely buried, a deviation survey indicated an acceptable hole angle of 1.6°. Higher torque and a lower penetration rate than usual were noted, as expected, due to the 17 1/2 inch diameter drilling casing shoe. However, no drilling problems occurred during the 15 3/4 hours required to drill the casing shoe to 323.5 meters BSF.

At this point it was necessary to raise the drill string to bring a tool joint to the rig floor so that the pipe could be broken to introduce the inner core barrel carrying the shifting tool. Due to a misunderstanding, the pipe was raised to the second tool joint (as in standard coring procedure) instead of the intended four meters to the first tool joint. With the shifting tool in the string, the pipe was made up and found to be stuck, both vertically and rotationally. Simultaneously, it was noted that drill pipe pressure had jumped from zero to over 300 psi. Based on Hole 542A coring data, the casing shoe (at 310 m BSF) was about 10 meters below the estimated fault zone.

The shifting tool was lowered into the BHA and then pulled upward, engaging the internal sleeve of the lowering sub. The sleeve was stuck and could not be shifted upward. As the shifting mechanism is designed to release only after the sleeve has reached its full travel, it was necessary to pull and "work" the wireline until safety shear pins at one of two locations failed, releasing the wireline assembly. In this instance, pivot pins on two of the shifting tool dogs sheared and the entire shifting tool assembly was recovered. On three additional wireline runs and shifting attempts, the overshot shear pin failed leaving the inner barrel/shifting tool assembly in the pipe.

When hopes of releasing the casing string had faded, an attempt was made to free the casing and recover the entire drill string. The casing could be raised only four meters, returning to its original position without difficulty; 25 minutes of "working" failed to move it further or to achieve rotation. Remarkably, the ability to circulate had never been lost, although pump pressures were a few hundred psi higher than normal.

At this point a primacord wireline severing charge was rigged and run down the pipe to the BHA. The intent was to sever the drill string in the bumper sub just above the casing lowering sub and thereby recover the upper part of the BHA. Depth control for placement of the severing charge was uncertain due to several factors and it was later calculated that the first charge was fired in a drill collar. The drill string failed to part when the shot was fired; although as recorded at the driller's console, the pipe pressure dropped sharply from a static 350 psi to zero.

The only plausible explanation for this phenomenon was that the severing charge had ruptured the drill string and that water was flowing from the geopressured lower part of the hole, up through the pipe and out into the pipe/hole annulus. The casing/hole annulus had apparently become packed off above the pressured zone at the time the casing became stuck in the hole. Two additional attempts were made to sever the drill string, but both charges failed to detonate due to faulty blasting caps

At this time a through-pipe temperature log was run in an attempt to document the flow of water into the hole. It was reasoned that the relatively warm water flowing up the hole would produce a fairly constant anomalously high temperature for the entire borehole. The log recorded a normal appearing (though somewhat high) temperature gradient for the hole. It was therefore concluded that the core bit or lower BHA had become plugged off and that flow had ceased. This was supported by the fact that sediment/cuttings fill had been encountered at progressively higher points in the BHA on successive severing attempts.

A severing charge was then lowered for the fourth time and fired successfully to part the string in the drill pipe above the BHA. The remainder of the drill string was then recovered, with all pipe on deck at 0215 hours, February 28.

SITE 543

Site 543 was located about 12 miles north-northeast of Site 541 and seaward of the toe of the trench slope. Its primary purpose was to provide an undisturbed reference section for comparison with the disturbed and accreted sediments cored on the slope. The inability to penetrate to basement at the earlier sites dictated that Site 543 would also be the location for the downhole seismometer implantation.

The move and site approach consumed only two hours and a positioning beacon was launched at 0450 hours, February 28. The seismic gear was retrieved and on-site stationing began while the beacon was still falling. The beacon signal, which had originally been strong, faded completely after one hour and a second beacon (of alternate frequency) was dropped to replace it.

The pipe trip was extended by about 4 1/4 hours to assemble a new BHA to replace the one lost in Hole 542B. Several Sat Nav fixes were received during the trip and a positioning offset of 910 meters to the south was made to move the vessel onto a reference seismic profile.

Using the corrected precision depth recorder (PDR) reading of 5653 meters as a guide, an initial seafloor punch core was taken by lowering the bit to 5655.5 meters. Signs of "taking weight" were first noted on the rig weight indicator at about 5649 meters. On recovery, the inner core barrel was filled to its top, which had penetrated to 5646 meters. Water depth was therefore estimated at 5645 meters. Continuous coring then continued to 324 meters BSF without significant difficulty.

As core No. 34 was being recovered, the inner barrel suddenly became jammed in the drill pipe about 1500 meters above the bit. The overshot shear pin failed during attempts to free the inner barrel and the sandline was retrieved. A second inner barrel was pumped down to jar the first barrel loose, but without success. A second wireline recovery attempt also failed to move the stuck core barrel. It was then necessary to pull about 4200 meters of drill pipe to recover the core. The barrel was found to be jammed in place by a steel ball that had fallen down the pipe from the latch of the adjustable line wiper.

HOLE 543A

With the drill string cleared of obstructions, it was tripped back to the seafloor. A second attempt to recover a "mudline" punch core and to verify water depth was then made by lowering the bit to 5647 meters. On recovery, sediment was again found packed to the top of the barrel and water depth was revised to 5637 meters.

The hole was drilled, without coring, to 332 meters BSF. Considerable hole problems occurred below about 260 meters. Torquing and vertical sticking of the pipe, along with annular plugging, nearly forced abandonment of the hole at one point. The problems were attributed to adherence of sticky clay to the drill collars. Fortunately firmer sediments were reached near the end of the drilled interval and an improvement in hole conditions was noted after "working" the pipe and circulating mud slugs. The "wash" core barrel was recovered and continuous coring commenced. Core recovery for the lower sediment section was consistently below normal for unknown reasons. Basaltic basement was reached at 411 meters BSF. Good hole conditions and high core recovery prevailed on the basement rocks with penetration at a slow two meters per hour. Coring operations were terminated at 455 meters BSF due to time and scheduling considerations.

The core bit and associated components were released by activating the mechanical bit release with a wireline shifting tool. The open-ended drill string was then pulled to 280 meters BSF for logging. Due to the soft nature of the sediment, the pipe was left fairly deep in the hole to avoid the bridging and plugging tendencies of soft clay that have often frustrated logging attempts.

The temperature/density/gamma ray sonde was rigged and run down the pipe to 5600 meters, the starting point for the temperature log. When only about 20 meters of temperature log had been recorded and before seafloor depth had been reached, a downhole electrical problem developed that caused the loss of temperature logging capability. The equipment was switched to the density/caliper/gamma ray mode, but the problems remained. The logging tool was recovered and the trouble was traced to seawater in the DSDP-furnished sinker bar. A backup sinker bar was installed and a second attempt was made. An open-hole bridge was encountered just two meters below the end of the pipe. The sonde was worked through this and two other obstructions as temperature was logged to 375 meters BSF. A more substantial bridge at this point could not be penetrated after several attempts. A static temperature measurement was then recorded and the logging function was switched to the density mode to log up to the pipe. It was then found that the density log detectors had apparently been damaged by the rough treatment the tool had received in getting through obstructions. The logging sonde became stuck upon re-entering the drill string and could be moved neither up nor down. During attempts to dislodge it, the tool suddenly came free while under considerable pull. It was subsequently found that the caliper backup arm had been broken off and left in the hole. The caliper and gamma ray curves were good, however, and verified that the borehole was badly eroded with an average diameter of 13 to 14 inches. Density or sonic logs would therefore have been of little value in the sediment section. Since insufficient operating time remained to clean the hole and log the basement interval, the logging cable was then reheaded for the attachment of the Hawaii Institute of Geophysics (H.I.G.) ocean subbottom seismometer (OSS) package.

While the reheading and final instrument package tests were in progress, the power sub was picked up and the hole was cleaned to four meters above total depth. To avoid plugging the end of the pipe, high pump rates were used for cleaning the hole and downward progress was stopped at the first sign of contact on the weight indicator. Two joints of drill pipe were then set back, leaving just 22 meters of open hole.

At just past midnight on March 8, the seismometer was started down the pipe. Unfortunately the instrument met an obstruction at the end of the drill string and would not pass into open hole. It was concluded that, despite precautions, the end of the bit release top connector had become plugged with sediment and/or drill cuttings and that pump circulation was through the "windows" in the side of the top connector. After a few minutes of unsuccessful effort to get the instrument out of the pipe, it was recovered for an attempt to unplug the pipe. A specially-weighted junk inner core barrel section was assembled and pumped down the pipe at maximum pump rate. Pump pressure was abnormally high and no change in pressure was noted after an adequate interval of pumping. Accompanied by a great deal of anxiety, the seismometer package was again lowered through the pipe on the logging cable. At 0905 hours, the instrument passed out of the pipe.

It was then successfully emplaced in the open basalt hole and a series of tests were run.

With the seismometer finally in place, the logging cable was clamped off at the top of the drill pipe and cut. A special cable slip/pulling neck assembly was attached to the end of the in-hole portion of the cable. This was latched up to an overshot/swivel assembly on the sandline, the weight of the cable was taken by the sandline, and the clamp was removed. The logging sheaves were then rigged down and the slow process of stripping the pipe out of the hole began. The pipe trip proceeded smoothly, however, and over six kilometers of pipe were pulled past the cable in 16 hours.

The cable in the hole was then respliced to the remainder on the winch by means of a "torpedo" connection. Following tests of the downhole instrument package, the cable on the winch was slowly payed out while the ship was offset a total of 3.6 km from the hole. As this exceeded the maximum offset capability of the positioning system, it was necessary to drop a new acoustic beacon for station-keeping at the new location.

The accompanying vessel, M/V NORTH STAR, had emplaced an array of five ocean bottom seismometers (OBS) several miles across and centered on Site 543. Test charges were then fired to test the response of the OSS and communications between the two vessels in preparation for refraction profiling. At this point, the downhole seismometer data was found to be garbled and not usable. The data from one shooting line was taped in the hope that some data could be retrieved.

The CHALLENGER was then slowly moved back to the drill site as the logging cable was retrieved. The OSS was pulled from the hole without undue difficulty despite inability to retract the caliper arm. The instrument was on deck at 1945 hours, March 9 and the vessel got underway at 2006 hours.

SITE 543 to SAN JUAN

The CHALLENGER steamed about 20 miles north to rendezvous with the NORTH STAR, which was engaged in refraction shooting for the OBS array. Following transfer of personnel back to the NORTH STAR, the profiling gear was streamed and the CHALLENGER began a post-site profile that passed over Site 543. At 0056 hours, March 10, the survey was completed and course was set for the return to San Juan. Good weather prevailed during the transit and the vessel logged an average speed of nearly 9.5 knots. The first mooring line was put over at Pier 15, San Juan Harbor, at 0641 hours, March 12.

DRILLING AND CORING EQUIPMENT

The standard DSDP bottomhole assembly was used on all holes except 542B. This consisted of a bit, bit release, head sub, one 8 1/4 drill collar, coring top and head subs, three 8 1/4" drill collars, one 5-foot stroke bumper sub, three 8 1/4" drill collars, two bumper subs, two 8 1/4" drill collars, crossover sub, and one 7 1/4" drill collar. The BHA used with the drill-in casing system was spaced out to put the core bit and drilling casing shoe together and to provide a "stiff" BHA below the casing lowering sub. The BHA consisted of bit release, and outer core barrel assembly as above; five 8 1/4" drill collars; crossover sub; casing lowering/drive sub; profile head sub; two bumper subs; three 8 1/4" drill collars, and a crossover sub to drill pipe.

The loss of the outer core barrel on the first pipe trip resulted in an extra round trip and the loss of about 12 1/2 hours. The rotary shouldered connection between the drill collar and the top sub apparently had been made up shoulder-tight, but not torqued following magnetic inspection on the final pipe trip of Leg 77. The connection then simply backed off during the pipe trip.

The loss of Hole 543 is attributed to a worn line wiper ball latch. A steel ball about 11/16 inch in diameter became sufficiently worn to pass completely through its hole in the "cage" portion of the traveling sleeve. It then found its way into the drill pipe against great odds and wedged the latch assembly of a moving inner core barrel at a tool joint 144 stands down the hole. The ball could be released only after the wiper had been lifted clear of the nipple atop the rotary swivel. The line wiper is followed by the entire sinker bar/link jar/overshot assembly before the full four-inch opening is exposed.

A five-hour delay in spudding Hole 542 was caused by a malfunction of the hydraulic system driving the Bowen power sub. Most of the time was spent in troubleshooting the hydraulics and in identifying the problem, which was eventually isolated to the air-operated control valve. Foreign matter in the ship's air system had clogged the valve's regulators.

In general the coring system performed well and the average core recovery was among the highest ever for DSDP rotary coring legs.

CORE BITS

Four core bits were expended on Leg 78A, with one lost prior to spud-in. All were assembled in the SIO Marine Sciences Development Shop. Runs were short for the three bits used for coring and no signs of bit failure were noted. None of these bits were recovered as two were released for logging and one was left with a severed BHA.

BIT RELEASES

Hydraulic bit releases were deployed on each of the first four holes. On two runs no release was attempted, one bit was successfully released, and on two occasions the entire release assembly was lost. The HBR was operated successively in Hole 541, but only after about 20 minutes of manipulating string weight and pump pressure.

Since no more hydraulic units remained on board following the losses of this leg and Leg 77, a mechanical bit release assembly was run on Site 543. Disadvantages of the mechanical bit release include lack of positive indication of release and a tendency for the bore of the top connector to plug following release. Both became factors in the hole 542A operation but were overcome. Seven hours were lost when it was necessary to abort the initial OSS emplacement to deplug the top connector. An advantage of the mechanical bit release is its reliability and the unit was activated without undue difficulty.

SPECIAL TOOLS

The DSDP designed drill-in casing system was deployed for the first time and, although it ultimately failed, the feasibility of the concept was validated. A 57-meter string of 11 3/4", range two, 54-pound casing was made up and attached to the BHA with only minor problems. A completely routine pipe trip was made to the seafloor and the casing with its 17 1/2 inch drilling shoe was drilled 323.5 meters to a predetermined point below the zone of hole trouble. The sediment section penetrated was fairly soft clay and rate of penetration was less than one third that enjoyed with the 9 7/8" bit in Hole 542A, despite circulation with both mud pumps. Torque was high and extremely irregular, presumably due to the torsional spring effect of the casing string being driven only from the top. (It is recommended that a spline or similar method of keying the lower end of the casing string to the BHA be investigated before penetration of harder formations is attempted.) The high torque also caused the Bowen power sub to stall out when rotating speeds of less than about 60 rpm were attempted. This could be a problem in penetrating hard or irregular formations. The casing, as expected, eventually became stuck--but not until it had been successfully emplaced across the suspected fault zone. All phases of the operation with the exception of the release were successful and successful coring to greater depths could almost certainly have been accomplished. The release sleeve system is a simple and proven concept and the failure to shift is under investigation. A relatively simple solution is expected.

Emplacement of the H.I.G. seismometer package was accomplished without major difficulty once the bore of the bit release had been cleared. The pipe stripping operation had been done on three previous occasions on the CHALLENGER, but never by the Leg 78 drilling crew. The smoothness of the operation was a tribute to their ability and preparation. The laying of cable while offsetting the vessel likewise required close coordination between the winch and the pilot house. This was also handled professionally--including the dropping of a new positioning beacon and shifting to it for reference. With the unfortunate failure of the downhole instrument, it was necessary to reverse the above procedure to recover the cable and instrument. This was a "first" and was accomplished with no particular difficulty.

BEACONS

Five ORE acoustic positioning beacons were launched during the voyage. Four were of the standard DSDP configuration with two 16.0 kHz and two 13.5 kHz units used. The only malfunction was with the fifth unit, a special self-contained 13.5 kHz single life beacon. This was the first beacon dropped at Site 543. The signal appeared strong and normal at the time it was launched and adequate signal strength was maintained long enough for the ship to retrieve its seismic gear and return to the site by homing in on the beacon. However, the signal faded until it could be detected only intermittently an hour after drop-roughly upon reaching the seafloor at over 5600 meters.

LOGGING

Downhole logs were attempted at all three sites, but results were limited to three abbreviated temperature logs--one of which was run inside the pipe--and a short gamma ray-caliper presentation gleaned from an unsuccessful density log attempt. The principal problem, as so often in the past, was erosion and bridging in the holes with consequent inability to get the tools down to total depth. The development of this situation appears inevitable when an interval of soft marine sediment remains uncased while underlying harder sediments or basement rocks are drilled for extended periods with high circulation rates.

Two logging misruns resulted when seawater shorted the wiring through DSDP-furnished sinker bars. Several design weaknesses in the sinker bars have been identified and redesign is warranted.

SEVERING SYSTEM

Four time-consuming wireline runs were required before the drill string was finally severed and detached from the stuck casing string in hole 542B. The first charge was fired successfully, but it had been mislocated and fired in a drill collar which did not part. Depth control was poor due to inaccuracies in the logging line depthometers and lack of a proper collar locator display.

The second and third runs were misfires due to faulty blasting caps. The failures are being investigated, but the caps were five to six years old and may have exceeded useful shelf life.

DYNAMIC POSITIONING SYSTEM

The vessel's positioning system performed dependably for the voyage and caused no operational problems. The only cause for concern was a tendency for the display dot on the positioning scope to oscillate through a range of up to 140 feet. The movement does not represent actual ship motion and has little effect on the type of operations conducted on Leg 78A. However it would be an annoying and possibly delaying factor where precise positioning is required--such as in re-entry operations. The oscillation is considered to be the result of the vertical reference gyro inadequately compensating for ship's motion. It is especially pronounced in deep water operations when the ship is pitching considerably. The character and amount of the oscillation are altered, but usually not eliminated, by changing vertical reference gyros.

ENGINEERING

The propulsion, power generating, and auxiliary equipment were free of any problems of sufficient gravity to have operational impact after the vessel's departure from San Juan. However the crane overhaul and the decarbonizing of No. 12 engine mentioned earlier combined to delay departure from port by about five days.

Small amounts of water had been detected in the gearbox oil on two of the thrusters on Leg 77. The oil in all four gearboxes was monitored closely on Leg 78A and water concentrations remained at four per cent in stern Thruster No. 1 and two per cent in bow thruster No. 1.

WEATHER AND CURRENTS

Weather conditions improved dramatically over a short period of time with the arrival of "spring" in the operating area. A heavy swell from the northeast to east persisted into the second week of site occupancy with trade winds of 20 to 30 mph, mostly from the east ot southeast. On one or two occasions, operational limits for vessel motion/stationkeeping were approached when the angle between wind and swell opened. It was never necessary to interrupt operations for weather, however. Weather conditions were sunny and mild for the second half of the operating leg with sunburn the only negative factor.

Currents were generally from the east at 1/2 knot or less and were a positioning factor only as a complication to the wind/swell situation mentioned above.

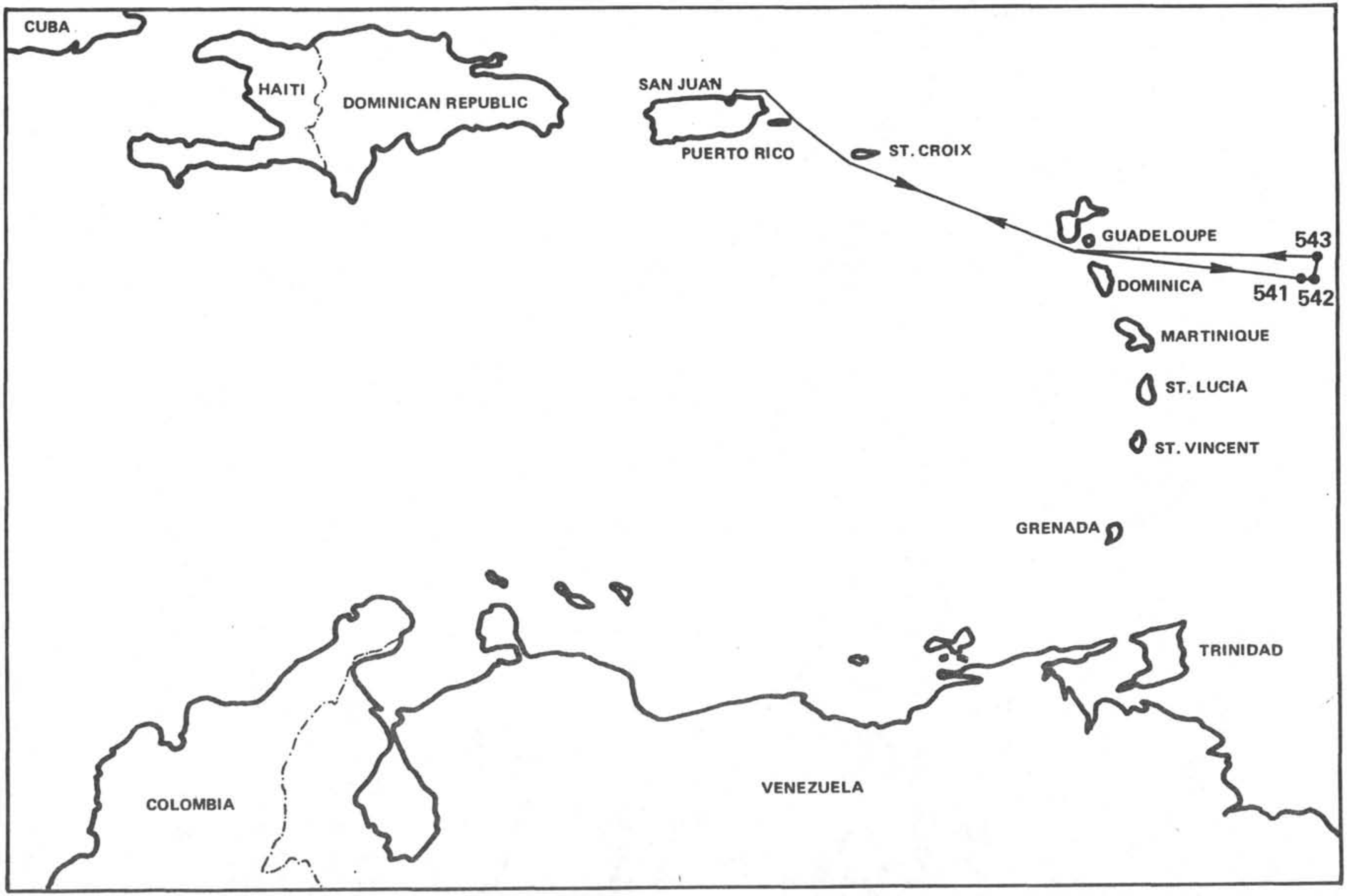
COMMUNICATIONS

Daily communications were maintained with Scripps radio station WWD for the transmission of Project business traffic. The traffic load was quite high due to the unusual operational and scheduling problems that were experienced. However there were no problems except on weekends when reduced staffing at WWD caused their operator to become somewhat overloaded. A few commercial phone calls were made to Project management when special circumstances arose and numerous private calls to foreign countries were made. The ship's surgeon, an amateur radio operator, made radio phone patches to the United States on a regular basis. These personal calls made a considerable contribution to shipboard morale.

PERSONNEL

Complete cooperation and professionalism were once again the style of the GMI marine and drilling crews. Their ability and positive attitude enabled them to adjust quickly to new operational procedures and to minimize the impact of the mechanical setbacks that occurred. There were no personnel-related problems other than the port departure delay in replacing the engineer officer who resigned. The scientific staff remained optimistic and philosophical despite the loss of some of their objectives to operational problems and a shortened operating schedule. They were a pleasure to work with. The DSDP technical crew dispatched their duties with enthusiasm and efficiency. Morale remained generally high throughout the ship for a relatively short but difficult cruise. There were no debilitating injuries or illnesses.

Glen N. Foss
Cruise Operations Manager
Deep Sea Drilling Project



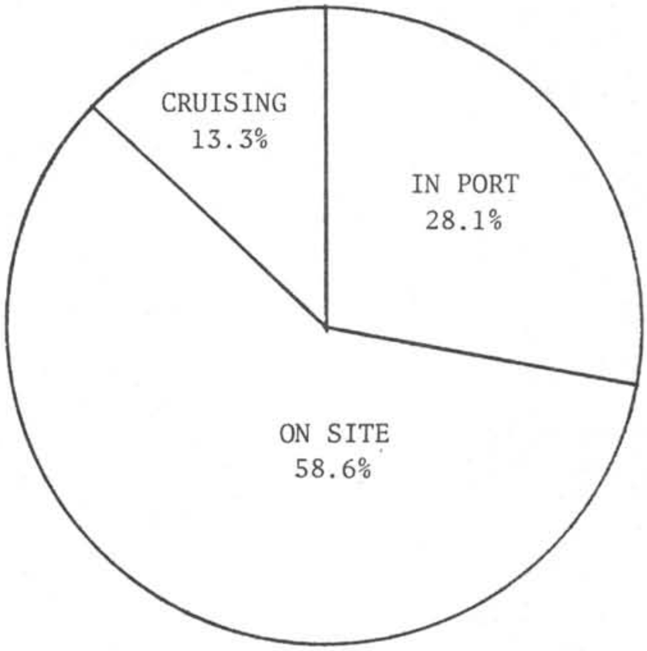
LEG 78 A OPERATING AREA

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
OPERATIONS RESUME
LEG 78A

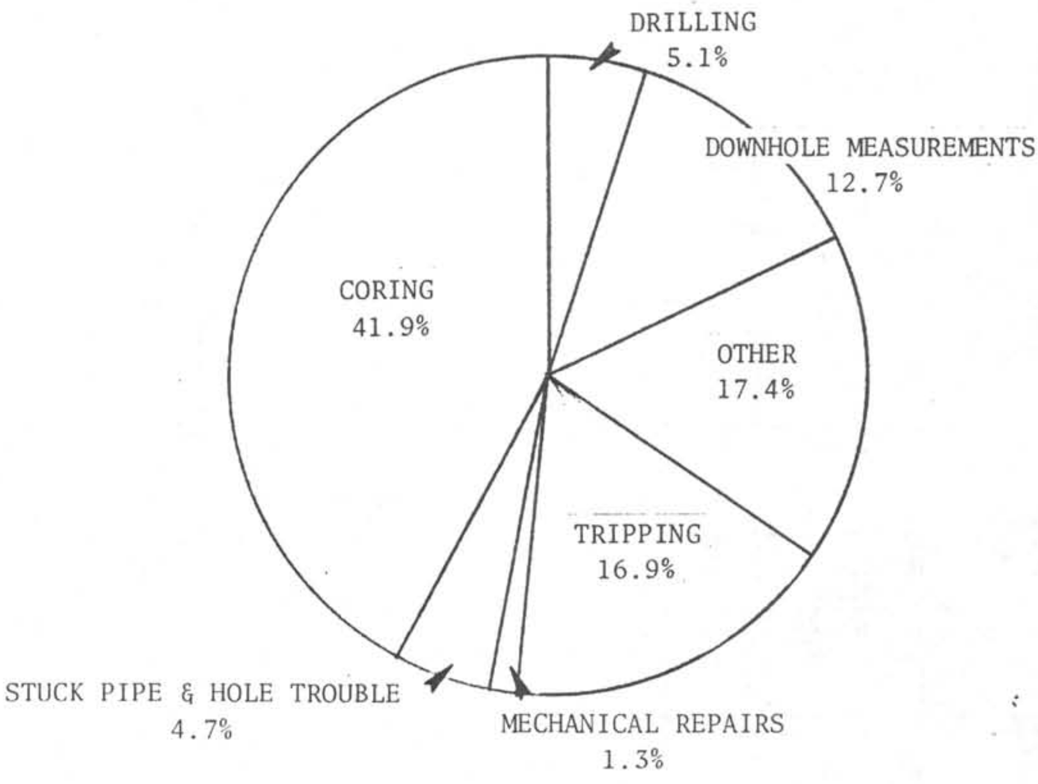
Total Days (January 30, 1981-March 12, 1981)		40.35
Total Days In Port		11.33
Scheduled Port Call	8.6	
Breakdown Delay	2.7	
Total Days Under Way		5.38
Total Days On Site		23.64
Trip Time	4.0	
Drilling Time	1.2	
Coring Time	9.9	
Downhole Measurments	3.0	
Mechanical Downtime	0.3	
Hole Trouble & Stuck Pipe	1.1	
Other	4.1	
Total Distance Traveled (Nautical Miles)		1063.3
Average Speed (Knots)		8.3
Sites Investigated		3
Holes Drilled		6
Number of Cores Attempted		118
Total Meters Cored		1106.0
Total Meters Recovered		841.4
Per Cent Recovery		76.1
Total Meters Drilled		1021.0
Total Meters of Penetration		2127.0
Per Cent of Penetration Cored		52.0
Maximum Penetration (Meters)		459.0
Minimum Penetration (Meters)		240.0
Maximum Water Depth (Meters)		5645.0
Minimum Water Depth (Meters)		4961.0

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT

TOTAL TIME DISTRIBUTION
LEG 78A



ON SITE TIME BREAKDOWN
LEG 78A



DEEP SEA DRILLING PROJECT
TIME DISTRIBUTION
LEG - 78A

Date	Site No.	Cruise	Trips	Drill	Core	HOLE TROUBLE Stuck Pipe	W.O.W.	Position Ship	Mech. Repair	SCHEDULED Port Time	Re-Entry	Other	Total Time	Remarks
1/30/81 2/13/81		67.8							66.0	205.8		0.3	339.9	San Juan to Site 541
2/13/81 2/21/81	541		23.8		85.0	8.6		26.2	2.9			37.4	183.9	Site 541
2/21/81		0.6											0.6	541 to 542
2/21/81 2/22/81	542		12.0	3.5	12.7	*		0.7	5.0			1.3	35.2	Hole 542
2/22/81 2/24/81	542A		11.0	4.1	20.8	3.1		0.7				1.0	40.7	Hole 542A
2/24/81 2/28/81	542B		17.5	15.7		11.8		7.5				35.8	88.3	Hole 542B
2/28/81		2.0											2.0	542 to 543
2/28/81 3/03/81	543		11.4		64.6			0.8				9.5	86.3	Hole 543
3/03/81 3/09/81	543A		20.9	5.5	54.9	2.3		36.9				12.5	133.0	Hole 543A
3/09/81 3/12/81		58.6											58.6	Site 543 to San Juan
TOTAL		129.0	96.6	28.8	238.0	25.8		72.8	73.9	205.8		97.8	968.5	

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
SITE SUMMARY
LEG 78A

HOLE	LATITUDE	LONGITUDE	WATER DEPTH METERS	NUMBER OF CORES	CORES WITH RECOVERY	PERCENT OF CORES WITH RECOVERY	METERS CORED	METERS RECOVERED	PERCENT RECOVERED	METERS DRILLED	TOTAL PENET METERS	AVG RATE PENET.	TIME ON HOLE	TIME ON SITE
541	15° 31.2'N	58° 43.7'W	4961.0	50	50	100.0	459.0	400.8	87.3	0	459.0	38.15	183.9	183.9
542	15° 31.2'N	58° 42.8'W	5026.0	7	7	100.0	66.5	66.5	52.6	173.5	240.0	87.8	35.2	
542A	15° 31.2'N	58° 42.8"W	5026	10	10	100.0	114.0	90.2	79.1	211.5	325.5	78.8	40.7	
542B	15° 31.2'N	58° 42.8'W	5026.0	0	0	- - -	0	0	- - -	323.5	323.5	25.9	88.3	
				17	17	100.0	180.5	142.8	79.1	708.5	889.0	45.8		164.2
543	15° 42.7'N	58° 39.2'W	5645.0	34	33	97.1	324.0	228.4	70.5	0	324.0	50.6	86.3	
543A	15° 42.7'N	58° 39.2'W	5637.0	17	17	100.0	142.5	69.4	48.7	312.5	455.0	17.9	133.0	
				51	50	98.0	466.5	297.8	63.8	312.5	779.0	24.6		219.3
			TOTALS	118	117	99.2	1106.0	841.4	76.1	1021.0	2127.0	36.3		567.4

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
BIT SUMMARY
LEG 78A

HOLE	MFG	SIZE	TYPE	SERIAL NUMBER	METERS CORED	METERS DRILLED	METERS TOTAL PENET	HOURS ON BIT	CONDITION	REMARKS
541	MSDS	9 7/8	F93CK	S-13	- - -	- - -	- - -	- - -	- - -	Lost before spudding.
541	MSDS	9 7/8	F03CK	S-14	459.0	- - -	459.0	12.0	Unknown	Released for logging.
542	MSDS	9 7/8	F93CK	S-16	66.5	173.5	240.0	2.7	Unknown	Respud without round trip.
542A	MSDS	9 7/8	F93CK	S-16	114.0	211.5	325.5	4.2	TO, BO-I	
542B	MSDS	9 7/8	F93CK	S-16	0	323.5	323.5	12.5	Unknown	Lost when stuck - string severed.
					180.5	708.5	889.0	19.5		
543	MSDS	9 7/8	F94CK	S-15	324.0	- - -	324.0	6.4		Respud without round trip.
543A	MSDS	9 7/8	F94CK	S-15	142.5	312.5	455.0	25.3	Unknown - no sign of failure	Cored 44 M basalt - released for logging
					466.5	312.5	779.0	31.7		

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
BEACON SUMMARY
LEG 78A

SITE NO.	MAKE	FREQ kHz	SERIAL NUMBER	SITE TIME HOURS	REMARKS
541	ORE	16.0	526	183.9	(Double-Life) Strong for duration.
542	ORE	13.5	547	35.2	(Double-Life)
542A	ORE	13.5	547	40.7	
542B	ORE	13.5	547	88.3	Strong for duration
			TOTAL	164.2	
543	ORE	13.5	101	1.0	(Single-life) Self-contained; signal strong at start; too weak after 1 hour.
543	ORE	16.0	522	85.3	(Single-life)
543A	ORE	16.0	522	133.0	Strong for duration
			TOTAL	218.3	
543A	ORE	13.5	551	8.0	(Double-life)

DEEP SEA DRILLING PROJECT
LOGGING SUMMARY
LEG 78A

HOLE	TOTAL DEPTH (M)	WATER DEPTH (M)	OPEN ENDED PIPE AT (M)	FLUID IN HOLE	BIT SIZE	TOTAL TIME FOR LOGGING (HOURS)	RUN NO.	LOGS RECORDED	FROM (M)	TO (M)	OBSERVATIONS
541	5420	4961	5081	seawtr	9 7/8	5.0	- -	Temp	4900	5091	Could not get down.
541	5420	4961	5108.5	seawtr	9 7/8	5.0	1	Temp	4887	5128	Could not get down - density tool failed. Rig sheaves, wiper trip
						5.5					misrun due to faulty sinker bar, etc.
542	5266	5026									No logs requested.
542A	5351.5	5026									No logs requested.
542B	5349.5	5026		seawtr		5.5	1	Temp	4935	5255	Through-pipe log before severing stuck pipe.
543	5969	5645									Logs not possible, core barrel stuck in pipe.
543A	6092	5637				6.6	- -				Misrun-water in sinker bar.
543A	6092	5637	5917.5	seawtr	9 7/8	3.0	1	Temp	5881	6013	Logged downward - could not get past btidge 80M from T.D.
543A	6092	5637	5889.0	seawtr	9 7/8	3.2	1	CDL-GR-CAL	6011	5891	Logged upward, density curves no good
						1.0					tool damaged supudding to get down rig sheaves, etc.

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
OPERATIONS RESUME
LEG 78B

Leg 78B of the Deep Sea Drilling Project was dedicated to conducting downhole measurements and experiments in Hole 395A to study the geophysical and hydrogeologic properties of the upper oceanic crust. The hole, situated on the western side of the mid-Atlantic Ridge, was drilled on Leg 45 in December 1975 and penetrated 664 meters below the seafloor.

Comprehensive heat flow/pore water and logging programs were accomplished. The logging included televiewer and a USSR supplied magnetometer surveys. The inflatable packer formation tester was used in an attempt to obtain information on the size, character, spacing, orientation and distribution of fractures and large scale porocity. An attempt was also made to fracture the crustal rocks.

In addition an experimental emplacement of a large diameter long-term downhole recording seismometer was conducted in conjunction with the Defense Advanced Research Projects Agency (DARPA).

The voyage commenced on March 12, 1981 at San Juan, Puerto Rico and terminated at Las Palmas, Canary Islands, on April 8, 1981.

The hole was located with remarkable ease and was found to be in excellent condition to a depth of 609 meters below the seafloor. Excellent weather conditions, while on site, contributed to good results being obtained in virtually all areas.

SAN JUAN PORT CALL

The GLOMAR CHALLENGER arrived at the San Juan drydock and shipyard, Puerto Rico at 0641 hours on March 12, 1981 at which time Leg 78B commenced.

The major work item for the port call was the installation of equipment to be used in the experimental emplacement of a long term downhole recording seismometer for the Defense Advanced Research Projects Agency (DARPA). An EM cable winch, A-frame with associated heave compensation cylinder and an instrument van were installed on the main deck port side immediately aft of the moon pool. The installation work proceeded smoothly and was completed by 0800 hours on March 14, 1981.

Number Two bow thruster tunnel was sealed off and the propeller and seal of the thruster gearbox were inspected for damage. This was deemed necessary as a plankton net had been drawn into the thruster during Leg 78A. No damage was found, however, and the seal and the guard ring were replaced.

A large amount of equipment and supplies were loaded including 50 joints of aluminum drill pipe for additional evaluation during coring operations.

The scientific party from Leg 78A and a number of coring technicians left the vessel and the scientists and engineers for Leg 78B embarked.

After a short delay caused by a power assignment problem in the engine room, the vessel departed for Site 395 at 1126 hours, March 14, 1981.

SITE 395 OPERATIONS - SAN JUAN TO SITE

The vessel cleared San Juan Harbor and a short stop was made while the thrusters and dynamic positioning systems were tested.

The 1160 mile transit to Site 395 was uneventful and was blessed with fine weather allowing for an average speed of 9.88 knots.

During the transit all tools and equipment for the various experiments to be conducted during the leg were prepared and tested. This included picking up and cycling the Lynes Packer as well as the DARPA seismic emplacement equipment.

At 1038 hours on Thursday morning, March 19, a positioning beacon was launched and the seismic gear retrieved. The vessel returned to the beacon and dynamic positioning was commenced.

LOCATING HOLE 395A

As soon as the vessel was positioning in automatic mode, the drilling assembly was picked up and drill pipe run to a depth of 4482 meters. The Precision Depth Recorder (PDR) water depth reading was 4500 meters, however, Leg 45 reported 4493 meters as the measured depth at Site 395A.

During the running of the drill string, seven Sat/Nav fixes were received and the position of the vessel determined to be 22° 45.325'N, 46° 04.902'W. This was only 157 feet from the position reported on Leg 45.

The scanning sonar equipment was rigged up and scanning for the cone, installed in December 1975, commenced. Although the tool checked out at various points during the trip down the drill pipe, the 45 degree transducer failed when landed in the bit. It was thus necessary to pull the tool from the pipe for repair. A spare tool was picked up and run in, however this tool failed when tested at a depth of 500 meters.

The transducer on the original tool run was changed and the tool run into the drill pipe. Once the tool landed at the bit, scanning commenced. No target was acquired and it was decided that an expanding square search pattern would be necessary. The vessel was moved 400 feet south and a target, easily identified as the cone, was acquired at a distance of 190 feet. After a total scanning time of 94 minutes, the hole was successfully re-entered.

HEAT FLOW - PORE WATER PROGRAM

As the hole had been undisturbed for five years there was a golden opportunity to obtain good temperature data and undisturbed borehole water samples to determine if there had been any up or down welling in the borehole.

The heat flow and pore water tool was pumped down to the bit immediately after re-entry had been verified. The drill pipe was slowly lowered 100 meters below seafloor (BSF) with three minute recording stops at 10 meter intervals. A water sample was taken at 100 m BSF. Unfortunately no temperature data was recorded, however a good water sample was recovered.

A second run was made with the tool while lowering the drill pipe a further 100 meters with similar recording and sample stations. On this run an electrical short resulted in false temperature readings and a valve failure caused the water sample to be lost.

Run No. 3 covered the zone 200-230 m BSF. The tool was run on the sandline whereas it had been pumped down on the first two runs. During recovery of the tool, the sandline parted some 1200 meters above the tool. The tool and sandline were successfully fished from the drill pipe and the tool retrieved.

A good water sample was recovered, however, once again the temperature data had been lost.

Run No. 4 was once again run on the sandline and a sample taken at 4864 meters. Good temperature data and water sample were obtained.

Run No. 5 to 5036 meters was also successful in obtaining good temperature data and a water sample.

LOGGING

On completion of the heat flow/pore water program, the bit was lowered to 5102.44 meters at which point a solid bridge was encountered. Considering the history of hole problems below this depth when the hole was drilled, it was decided that no attempt would be made to clean the hole to its original total depth of 5157 meters. The bit was released and the end of the drill pipe pulled up to 4587 meters, in the 11 3/4 inch casing, in preparation for logging.

The first logging run was a temperature log down and then a density-caliper-gamma log up. Good logs were obtained.

The second run was a sonic-gamma log combination and once again a good log was produced.

A gamma-neutron-guard tool was run third. Unfortunately the guard log failed due to a flooded bridle and the log had to be rerun. A good log was obtained from this second run.

The next log run was Soviet supplied magnetometer. Two separate runs were made; the first to measure fields and the second susceptibility. Good logs of the vertical field and susceptibility were obtained but X and Y horizontal field components were not recorded as the tool was rotating in the hole.

The final logging run was a borehole televiewer. Prior to running the tool the drill pipe was run to 5100 meters and the hole circulated with seawater for one hour to displace the mud from the annulus. This was done to improve the televiewer image. The drill pipe was pulled to 4587 meters and the televiewer lowered into the hole. Unfortunately, when the tool was downhole, its drive motor appeared to be rotating slower than normal and this resulted in a poor image. This was the first time the tool had been utilized at depths greater than 4000 meters and it is thought that the tool problem was related to pressure. The large size of the borehole also had an affect on the image. However the log was considered to be of sufficient quality to obtain the required information.

HYDROFRACTURE EXPERIMENT

The inflatable downhole formation tester was picked up and run to a point three meters above the re-entry cone. Sheaves for the electric wireline were rigged and the scanning sonar tool run and landed in the bit. Scanning for re-entry was somewhat complicated by vessel movement caused by a large northwesterly swell. When scanning commenced no mud ring was visible. All indications were that the sonar tool was operating correctly and when checking the drill pipe depth, it was found to be some 50 meters above the cone. The sonar tool was retrieved and two stands of drill pipe added to the string.

The sonar tool was then rerun and when scanning started, the cone was located at approximately 50 foot range. A number of small vessel moves were required in order to get the drill pipe to swing over the cone and after 118 minutes of scanning, re-entry was successfully accomplished.

After retrieving the sonar tool, the drill pipe was run in the hole to a packer setting depth of 5075 meters (bit at 5078 meters) and a "sampler go-devil" dropped. A five minute period for hydrostatic pressure recording was allowed before pressuring up the drill string to inflate and set the packer. A successful seat was obtained and the tool was left open for 30 minutes in order to collect a fluid sample and record the negative pressure pulse decay. The packer was then deflated by reducing drill pipe pressure and the sampler go-devil retrieved. A good fluid sample and pressure record were obtained from this run.

A "safety" go-devil was then pumped down and landed in the packer assembly. Two attempts were required before a good packer seat was acquired. The drill pipe pressure was then increased to 1650 psi to open the shear plug and expose the formation below the packer to drill pipe pressure. The pressure was held for approximately 75 minutes to record the pressure decay. The drill pipe pressure was then bled off before once again being increased this time to 2200 psi in an attempt to fracture the formation below the packer. No fracture was achieved. The packer was then deflated and the go-devil retrieved. An excellent downhole pressure record was recovered and surface pressures were also recorded.

The drill pipe was then pulled to 4675 meters for a second recording station. A safety go-devil was pumped down and an attempt made to set the packer. Packer depth was 4672 meters. The shear plug opened prematurely during this period and no seat was achieved. The go-devil was retrieved, dressed, tested and rerun. A successful packer seat was obtained and the tool allowed to stand for approximately 2 1/2 hours to record aquifer pressure. While preparing to pressure up the drill pipe to open the shear plug, the drill pipe pressure bled off indicating a leak in the system which caused the packer element to deflate.

The go-devil was once again retrieved, dressed, tested and rerun. When pressuring up in an attempt to reset the packer the tool would not hold pressure and increased rate of pressure bleed off indicated that the downhole leak was increasing. The go-devil was retrieved and as there was no evidence of any go-devil seals having failed, it was assumed that the packer had failed.

The drill pipe was thus pulled out of the hole, and a short hole (395B) washed to 70 meters to record heat flow 100 meters northwest of Hole 395A (see heat flow section). The drill string was then pulled and the packer recovered. Time constraints prevented rerunning the packer at this time and the experiment had to be aborted.

A rerun was made when time became available after the completion of the DARPA experiment.

The packer and same BHA as previously used were then picked up and run to a point three meters above the re-entry cone.

The scanning sonar tool was run and the cone located at a range of 40 feet when scanning commenced. Increasing wind speed and seastate complicated the re-entry somewhat, however, a successful stab was made after 184 minutes of scanning.

The packer was then run to 4675 meters and two attempts made to obtain a packer seat. Unfortunately the weather had deteriorated considerably and excessive vessel and pipe movement thwarted the operation. On the first attempt the shear plug was blown due to a pressure surge while inflating the packer. A second attempt was made and a momentary seat obtained, however, there was insufficient bumper sub action downhole to compensate for pipe movement and the packer was jarred loose. The inability to hold pressure indicated that the packer element had been damaged and the tool was thus pulled from the hole and the experiment finally abandoned.

The experience with the packer on this leg, while not entirely successful, did result in some excellent information being recovered and is probably the first time that positive seating was obtained. Good weather conditions with calm seas are imperative if good hydrofracture type information is to be obtained using this equipment.

MARINE SEISMIC SYSTEM INSTRUMENT IMPLANT - DARPA

A concept for implanting a large diameter, 20 cm, long term seismic recording instrument in a borehole using the GLOMAR CHALLENGER was successfully tested.

A special carriage was attached to the lower end of the drill pipe with the seismic instrument carried in a side pocket of this carriage. The EM cable to the instrument passed over an A-frame on the portside of the vessel, to its winch which was situated on the main deck. Once re-entry had been accomplished and the carriage landed in the re-entry cone, the instrument was released and run downhole. A series of seismic experiments were conducted before the instrument was recovered. Details of the operation are as follows:

A slotted re-entry stinger and the Borehole Instrument Package (BIP) carriage with control sub were attached to a bottomhole assembly consisting of four bumper subs and one 7 1/4 inch drill collar.

The EM cable was keelhauled such that it passed from its winch on the main deck over the A-frame on the port side and up through the guide horn to the rig floor. The BIP was attached to the cable and inserted into the side pocket of the carriage. The assembly was then carefully lowered through the rotary table and after hydraulic lines were installed on the control sub, the drill string was run to 4487 meters, some 4 meters above the re-entry cone. The EM cable was paid out simultaneously with the drill pipe, with tension being carefully monitored.

The scanning sonar tool was then rigged and run to land in the adapter plug in the shoe of the slotted stinger. When scanning commenced, the cone was located at a range of 30 feet. Some 51 minutes of scanning time, with two small vessel movements were required before the hole was re-entered. Care was taken to land the BIP carriage in the cone with as little force as possible. Calm weather at the time allowed this and the seismic instrument recorded an impact force of 6 g's with no damage evident to any of the instrumentation. The sonar tool was then retrieved.

A Baker latching tool with an Otis GS running tool attached were run on the sandline and latched into the adapter plug in the shoe of the stinger. The adapter plug was pulled up through the stinger and BIP carriage and latched in the control sub. The sandline was recovered and the drill pipe pressured up to 3500 psi. This activated hydraulic cylinders on the BIP carriage which in turn shifted the instrument laterally into the carriage allowing it to pass down through the stinger and into the borehole.

The instrument was run to existing total depth of 5103 meters and checked for operation. All systems appeared to be in good working order. The instrument was then raised some 500 feet uphole and the vessel offset 250 feet before raising the drill pipe and BIP carriage to clear the re-entry cone.

The BIP was once again lowered to bottom and the drill pipe then pressured up to 3000 psi to open the gate at the base of the carriage thus releasing the EM cable. The CHALLENGER offset an additional 300 feet and the drill pipe was pulled to surface.

The stinger and BIP carriage with control sub were removed from the drill string and laid down. Some slight distortion was evident at the flange between the stinger and the carriage. The slot through which the cable exited was closed slightly but fortunately not enough to prevent the cable from falling free.

The ship's propulsion systems were shut down for a 15 minute period to check for noise level to the instrument. The vessel drifted off location approximately 1000 feet during this period and was then moved an additional 2000 feet in a west-southwesterly direction while the EM cable was paid out and laid on the ocean floor.

The CHALLENGER remained in this position for 27 hours while shots triggered from a shooting ship USNS LYNCH, were recorded by the downhole instrument. High quality data was recorded during this period.

Once the shooting program was completed the CHALLENGER was moved back over the cone while the EM cable was simultaneously recovered. The EM cable continued to be pulled and the BIP pulled from the hole and recovered aboard the ship.

The deployment of this large diameter package was highly successful, however, extremely calm seas during the entire operation were a major contributer to this success. The concept has been shown to be feasible under ideal conditions, however a number of equipment and procedure changes were indicated for any future implantations.

SITE TO LAS PALMAS

The GLOMAR CHALLENGER departed site for Las Palmas during a period of strong north-easterly trade winds, and during the first 24 hours, an average speed of only 6.5 knots was made. Speed gradually increased as the winds calmed and the vessel averaged 8.95 knots over the entire transit, arriving in Las Palmas at 2033 hours on April 8, 1981.

During the voyage numerous maintenance items were accomplished and the hydraulic pumps in the Bowen unit serving the coring sandline winch were replaced with rebuilt units.

Leg 78B was the final leg on which Gearhart Industries would be the logging contractor. The logging tools were thus crated for return to vender's facility at Fort Worth, Texas and the logging cab and main deck van cleared for use by Schlumberger, the new logging contractor.

WEATHER

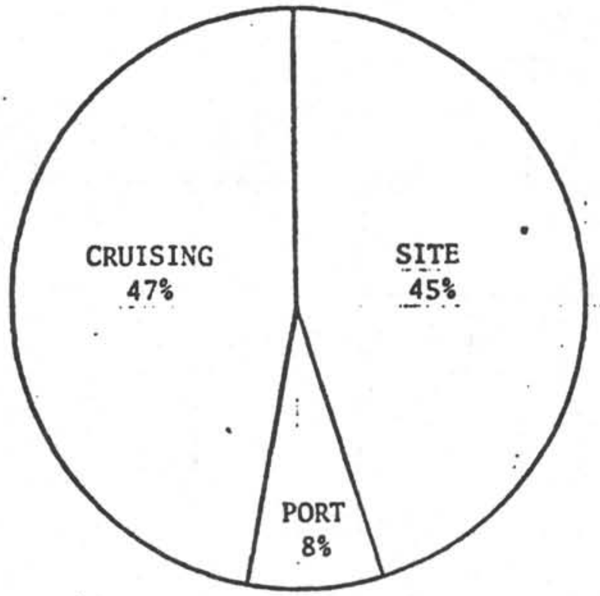
Weather conditions were ideal, with calm seas and light trades, for all but the last two days on site. During the final re-entry period the wind from the northeast picked up to 35 knots and together with a northwesterly swell, caused some stationkeeping problems which prolonged the re-entry and adversely affected the downhole packer experiment.

The strong trade winds continued for the first four days of the transit to Las Palmas before abating, however, a large northwesterly swell prevailed to within 200 miles of the Canary Islands.

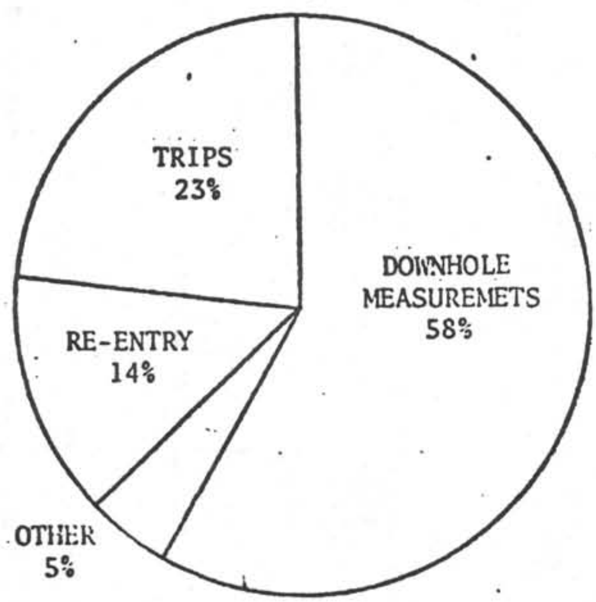
V. B. Robson
Cruise Operations Manager
Deep Sea Drilling Project

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
LEG 78B

TOTAL TIME DISTRIBUTION



ON SITE TIME BREAKDOWN
LEG 78B



DEEP SEA DRILLING PROJECT
TIME DISTRIBUTION
LEG - 78B

Date	Site No.	Cruise	Trips	Drill	Core	Stuck Pipe	W.O.W.	DOWNHOLE MEASURE	Mech. Repair	Port Time	Re-Entry	Other	Total Time	Remarks
3/12/81										17.25			17.25	San Juan, Puerto Rico
3/13/81										24.00			24.00	
3/14/81		12.5								11.50			24.00	
3/15/81 3/18/81		95.0											95.00	1 x 23 hr day
3/18/81		10.5	7.0								5.0	1.5	24.0	
3/20/81								11.0			13.0		24.0	HF/PW
3/21/81			2.5					21.5					24.0	HF/PW Logging
3/22/81								24.0					24.0	Logging
3/23/81			1.5					21.5				1.0	24.0	Logging Circ Hole
3/24/81			14.5					4.0			5.5		24.0	Logging
3/25/81			1.0					17.0			6.0		24.0	Hydrofrac
3/26/81			6.25					11.25				6.5	24.0	Offset,HF/PW Magnaflux BHA
3/27/81			17.0								5.0	2.0	24.0	Magnaflux DARPA
3/28/81								24.0					24.0	DARPA
3/29/81								24.0					24.0	DARPA
3/30/81			9.75					6.75			7.5		24.0	DARPA Hydrofrac
3/31/81		8.0	8.00					5.75				2.25	24.00	Hydrofrac DBMI
4/1/81 4/8/81		184.5											184.5	Cruising to Las Palmas

LOGGING SUMMARY

LEG 78 B

HOLE	TOTAL DEPTH (M)	WATER DEPTH (M)	OPEN ENDED PIPE AT (M)	FLUID IN HOLE	BIT SIZE	TOTAL TIME FOR LOGGING (HOURS)	RUN NO.	LOGS RECORDED	FROM (M)	TO (M)	OBSERVATIONS
395	DP 5102.8	4493	4587.5	SEA WATER	10.0"	58	1	HRT, ΔT	4440	5109	Good : 11 3/4" CSG SHOE AT 4605M
							2	ρ, cal, γ	5109	4603	ρ & cal Good; γ - poor
							3	Vp, cal, γ	5109	4603	Vp & γ Fair, No caliper signal
							4	LL, Φ, γ	5109	4603	Φ & γ Good; LL failed, short in bridle
							5	LL, Φ, γ	5109	4603	Good
							6	Magnetometer Hz	4603	5109	Good Hz
							7	Magnetometer Hz	5109	4603	Good Repeat
							8	Magnetometer X	4603	5109	Good
							9	HRT, ΔT	4565	5109	Good - Calibrated in Ice bath
							10	Televiewer	5109	4603	Poor - Tool rotating too slow.

NOTE: HOLE DRILLED TO 5157M ON LEG 45. BRIDGED AT 5102.8M D.P. MEASUREMENT

UBR 3/27

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
OPERATIONS RESUME
LEG 79

Leg 79 of the Deep Sea Drilling Project was planned to document the Jurassic environment of rifting, and the early subsidence history of a segment of the passive margin in the area of the Mazagan Plateau. Of the four primary sites programmed for this leg, two were drilled plus two alternates, with the latter of these two being drilled as a re-entry hole. All of these sites recovered material which added significant geologic information to this area. It was a trouble free cruise with good weather and no major mechanical problems.

The leg started on April 8, 1981 at Las Palmas in the Canary Islands and ended May 30, 1981 in Brest, France. Total length of the leg was 51.5 days, of which 34.2 days were spent on site, 8.7 days in port, and 8.6 days under way. There was no weather or mechanical downtime.

LAS PALMAS, CANARY ISLANDS - PORT CALL

Leg 79 began when the anchor was dropped in the harbor at Las Palmas, Canary Islands at 2033 hours, April 8, 1981. The following day the ship was moved to a berth on the Muelle de la Luz Pier. After mooring, the muffs were installed on the aft bow thruster to change the seals. While this was taking place, the DARPA experiment equipment was offloaded and some of the oncoming air freight was loaded. The ship remained at this berth three more days and then was moved to a refueling pier. Fuel was taken, additional supplies were loaded and the last of the scientific staff came aboard just before midnight on April 14th. The following morning, April 15th at 0738, the ship departed Las Palmas for Site 544.

SITE 544 (MAZ 3)

Upon completion of the work on the bow thruster, the offloading and onloading of equipment and supplies, and refueling, the GLOMAR CHALLENGER departed the port of Las Palmas, Canary Islands at 0738 hours, April 15, 1981. A routine check of the propulsion system and thrusters was made about 45 minutes after departing and then a course of 040° was set for Site 544. After traveling about 500 miles, the 13.5 kHz positioning beacon for this site was dropped at 1952 hours on April 17, 1981.

The drill string, which included 16 stands of aluminum drill pipe, was made up and measured as it was run to begin the drilling operations. The hole was not spudded until five water cores had been recovered at a depth of 3676.0 meters which was 59 meters deeper than the PDR had indicated for the mudline. This difference was attributed to the fact that the site was located on a sloping bottom and the depth indicated on the PDR was due to a false bottom reflection from an early arriving signal and not the true bottom reflection. Hole 544 was officially spudded at 1252 hours on April 18, 1981. However, after recovery of the first core it was decided that the hole should be abandoned. The reason for this was that the scientific staff felt, after checking their seismic records, that there would be insufficient soft sediments at this location to support the bottomhole assembly. The hole was officially abandoned at 1332 hours, April 18th.

HOLE 544A

In an effort to find a more favorable location, with a thicker soft sediment section, the ship was moved 780 feet south and 240 feet east of the original site. One water core was recovered before the mudline was established at 3617.0 meters when the hole was spudded at 1614 hours, April 18, 1981.

The hole was then continuously cored to a subbottom depth of 235.0 meters. After the last core had been recovered, the pipe was found to be stuck and was worked for ten minutes before it was released. Since the bit had drilled about 52 meters of basement igneous rock, and the recovery had decreased to about 5%, and most of the required scientific information had been obtained, it was decided to abandon this hole and begin a hydraulic piston coring program in the shallow sediments. However, when the overshot was lowered to retrieve the inner core barrel to allow the bit to be released, it was found to be stuck. Two attempts were made to recover the core barrel but each time the shear pins were sheared. After the second attempt had failed, the bit was pulled to the rig floor. This hole ended officially at 1412 hours, April 21, 1981, when the bit cleared the mudline.

HOLE 544B

When the bit was recovered, the inner barrel was removed from the bottomhole assembly with no trouble and no apparent reason for it not being able to be recovered with the overshot. The conventional bit was then replaced with the HPC bit "Amy" and the pipe was then run to a depth of 3615.0 meters or two meters above the mudline. The inner barrel was then lowered on the sandline, pressured up, the pin was sheared and this hole was officially spudded at 0505 hours, April 22, 1981. After the pin was sheared, it was discovered that the core barrel could not be recovered. Pulls to 11,000 pounds were made and finally the overshot shear pin sheared and it was recovered. The shear pin was replaced but after the overshot was lowered to the bottom, it would not engage the pulling neck on the core barrel. After picking up and setting down five times with no success, the overshot was pulled to the rig floor and the shear pin replaced. When it was lowered to the bottom again it did engage the core barrel but could not be recovered. After working the pipe for about ten minutes with pulls up to 11,000 pounds, the core barrel finally began to move and was pulled to the rig floor with the mudline core intact. The possible answer to the sticking and inability to latch onto the overshot was that rust had been knocked off of the drill pipe and caused the core barrel to be wedged in place, and a sufficient amount of it had accumulated around the pulling neck to prevent the overshot from latching.

The HPC coring then continued with no other mechanical problems. Twelve cores were cut and recovered with a total penetration of 39.3 meters. Coring was stopped at this depth because the sediments were too stiff to allow complete scoping out of the core barrel and recovery had decreased to less than two meters per coring attempt. Core orientation was not too successful due to the large number of marks (6-15) on the aluminum orientation ring. The drill string was then pulled and the hole was officially abandoned when the bit reached the rig floor at 0230 hours, April 23, 1981.

SITE 545 (MAZ-4

Site 545 was located 6.6 miles south-southeast of Site 544 but was not reached for eight hours because of an extended profiling program designed to give additional information for a new site which had not been presented to the Safety Panel for approval. Upon completion of this exercise, the positioning beacon was dropped at 1044 hours, April 23, 1981. After final positioning was completed the drill string was made up again, including the 16 stands of test aluminum pipe, and after recovering one water core the hole was spudded at 2047 hours and established the mudline at 3160.0 meters.

The hole was then continuously cored to a total depth of 701.0 meters. Recovery varied from good to poor with good recovery in the upper oozes and claystones, but decreasing dramatically when sections containing hard limestone cobbles were scattered through a softer type sediment. The soft sediment was not recovered due to the necessity for increased pump pressure to prevent plugging of the bit. Recovery, as well as core diameter, decreased as the bit condition deteriorated and coring was finally stopped when torquing indicated a possible loss of a cone or cones and core diameter had decreased to less than 4 centimeters. When the bit was recovered, after 82 hours of rotation, all of the cones were missing and the bit shanks holding the cones had been worn to about two thirds of their normal diameter.

This site was then abandoned at 0041 hours, May 1, 1981, when the ship departed for Site 546.

SITE 546 (MAZ-10)

Site 546 was in the area that had been surveyed while enroute to Site 545. It had not been included in the original prospectus but was approved by a radio message from the chief scientist at DSDP. The move to this location, which was 12.1 miles northwest of Site 545, required only two hours and a positioning beacon was launched at 0317 hours, May 1.

After the ship was in an automatic positioning mode, the drill string was made up. It again contained the 16 stands of aluminum drill pipe which are being tested on this leg. The spudding of this location was delayed due to a difference in the PDR depth and actual bottom. Three water cores were recovered before the hole was spudded at 1629 hours on May 1. Routine coring of sediments ranging from nannofossil oozes to firm claystone continued until about 155 meters below seafloor where salt was recovered. This material was recovered until the hole was abandoned at a total depth of 192.0 meters BSF at 0303 hours May 3, when the bit cleared the mudline.

HOLE 546A

When the bit had cleared the mudline, the ship was moved 50 feet northeasterly. The primary reason for drilling this hole was to take pore water samples and measure heat flow at three depths.

The bit was washed to 50 meters and the sampling tool was then lowered. After the sampling period was completed, the tool was pulled to the rig floor. A sample of fluid had been obtained and a temperature record. However, the tool had been damaged and when it was determined that it would take approximately 2 1/2 hours to repair it, the decision was made to abandoned this site.

The pipe was then pulled and when all was secure for departure, the site was offically abandoned at 1148 hours, May 3, 1981.

SITE 547 (MAZ 9)

Site 547 was a short move of 10.8 miles almost due east of Site 546. This area was reached after 2 1/2 hours of travel and a 16.0 kHz double life beacon was dropped at 1423 hours, May 3.

The standard BHA, including a hydraulic bit release and a hydraulic piston coring collet head, was made up and the drill string was run to the seafloor. Hole 547 was spudded at 2243 hours, May 3 in 3950.5 meters of water. Following the recovery of the mudline core, the hole was washed to 32.0 meters BSF without rotation to determine how much 16" surface casing could be set with a re-entry cone. The drill string was then pulled and when the bit cleared the mudline at 0018 hours, May 4, this hole was officially abandoned.

HOLE 547A

Following the completion of Hole 547, the ship was moved 50 feet west and Hole 547A was officially spudded at 0021 hours, May 4. Because the scientific program had planned to take HPC cores in the upper part of this hole, the bit was washed to 51.0 meters before the first core was cut. Two joints were then washed and the next cored interval recovered sediments with shear strengths of excess of those adaptable to the HPC equipment and then continuous conventional coring began.

This hole was cored to a total below seafloor depth of 744.5 meters. The bit was pulled at this depth because the penetration rate had decreased, as well as core recovery, which indicated that the bit could be worn out. However, when it was recovered after a total of 54.6 rotating hours, it was in good condition. The decrease in penetration rate could possibly be attributed to an increase in hole angle and a dragging effect on the bit. Three single shots were taken while coring and showed an increase from vertical to 6° + at 488.0 meters and 9 1/2° at 507.0 meters and finally more than 12° at 649.5 meters. When the bit was recovered, there was hard claystone packed under two of the four cones and could have affected their rotation.

Two drill bit motion tests were made while coring, but neither run provided satisfactory results. The drill pipe was pulled and Hole 547A was officially abandoned when the bit reached the derrick floor at 0100 hours, May 10.

HOLE 547B

Following the recovery of the drill string, a re-entry cone was picked up and keelhauled into position below the moon pool. Two joints of R-3, 16" casing were made up to the casing hanger joint and hung off above the cone while the new BHA was assembled. This assembly was then latched into the casing and both units were latched into the cone, and the trip to bottom began. While the cone and casing were being assembled, the ship was again moved 50 feet west. The hole was spudded at 1619 hours May 10, and the casing was washed in 28 meters. Due to the stiffness of the sediments encountered in the wash-in hole, a 14 7/8" bit was attached to the BHA and made a successful washing in of the cone easier. After the cone was in place, a shifting tool was run and the drill string was released from the casing. The drill string was then pulled to replace the 14 7/8" bit with a regular 9 7/8" coring bit.

FIRST RE-ENTRY - FIRST BIT

The new bit was made up to the BHA and the drill string was run into 3940.5 meters. The logging sheaves were then rigged and the re-entry tool attached to the logging cable and lowered into the drill pipe. When the tool had been lowered about 1000 meters, the weight indicator showed a loss in weight and it was feared that the tool had dropped off, so the cable was pulled. The tool was found to be in place when recovered. At the same time that the weight loss was noted the pressure gauge showed unusual increases and decreases. After the re-entry tool was recovered, the pressure was checked and found to be normal. However, to check for a possible obstruction in the pipe, an inner core barrel was lowered on the sandline and none found. The re-entry tool was then picked up and run into the pipe. After lowering it about 500 meters, an operational check was made and found that the tool would not rotate. The tool was then pulled and replaced with a new tool. When this tool was checked for rotation while lying flat it rotated as it should. However, when picked up and checked while hanging, it would not rotate which indicated the problem was in the cable head. The tool was then laid down and the cable reheaded. Following the re-heading, the re-entry tool was attached and operated as it should. It was then lowered to the bottom of the pipe, but when scanning began, no target was visible.

A systematic search was begun and continued for almost two hours with moves of 400 feet in all four directions from the offsets that were in use when the cone was emplaced. The tool was then pulled to the derrick floor and replaced. When this tool reached bottom and began rotation, the cone was observed at 150 feet. Positioning began and after 59 minutes, the stab was made. The tool was then recovered and a core barrel was pumped down while the logging sheaves were rigged down. When the core barrel was in place, the drill pipe was lowered and the re-entry was verified. Because this section had been cored in Hole 547A, the bit was washed to 211.5 meters before attempting to recover the washed core. The overshot was lowered but the core barrel could not be recovered and the shear pin was sheared. After replacing the shear pin, the overshot was lowered again and as the first time, the pin sheared before the core barrel could be picked up. A third attempt was made with the same results. After recovering the overshot, a second core barrel was dropped with the hopes that the impact would loosen whatever was holding the first core barrel. When the overshot was lowered again and engaged the upper core barrel, neither one could be moved and the pin was sheared again. After the overshot was recovered, the drill string was then pulled. When the BHA reached the rig floor and was disassembled, it was found that the liner in the first core barrel had shattered and a section of this, about 9" long and 3/4" wide, was caught between the core catcher sub and the throat of the bit. This small piece of plastic had kept the inner barrel from being pulled loose when pulls of as high as 11,000 lbs had been applied.

SECOND RE-ENTRY - SECOND BIT

In order to save time, a new bit and bit sub were installed on the bottom of the BHA. The stuck bit could be removed after the drill string had been made up and run in for re-entry. After the pipe was made up, the re-entry tool was lowered into place and the target was first observed at 130 feet. Positioning began and continued for four hours and 46 minutes before an attempt to stab the cone could be made. The tool was pulled out of the pipe and re-entry was verified when an additional stand was lowered and encountered no resistance. After five additional stands had been lowered, bridging developed in the hole, necessitating picking up the power sub and washing back to the old total depth. Continuous coring began at this point and nine cores were recovered. At this point it was decided to pull the bit because of slowing up of drill rate and also a continuing decrease in the diameter of the cores.

THIRD RE-ENTRY - THIRD BIT

After the bit, an F93CK was recovered, it was found that the bearings were badly worn and one cone was cracked. A new bit, an F94CK, was installed on the BHA and the pipe was run to the re-entry depth and the re-entry tool lowered to begin scanning. The target was immediately observed at 15 feet and after only 23 minutes and no positioning changes, the cone was stabbed. After the re-entry tool was retrieved, the re-entry was verified and eight more stands were run before bridging of the hole made it necessary to pick up the Bowen Power Sub and wash back to bottom. The hole was then cored to 1030 meters below seafloor before it was decided to pull the bit due to the extremely slow penetration rate. When the bit was recovered all of the bearings were gone and one cone was locked and could not be rotated. After pulling the pipe, the

BHA was magnafluxed as it was recovered and the site was terminated when the ship departed for Lisbon at 1434 hours, May 22, 1981.

LISBON PORT CALL

The scientific portion of Leg 79 ended about two days early due to the necessity of making a brief port call enroute to Brest, France. Due to uncertain labor conditions at Brest it was decided to stop in Lisbon and take advantage of their drydocking facilities. The ship arrived and was secured at a wharf in Lisbon Harbor at 1555 hours, May 24th. The following day the ship was moved to the drydock at 1845 hours. On May 26, the seals on both stern thrusters and one bow thruster were replaced by 1700 hours. The drydock was then filled, the port pilots came aboard, and the port time ended officially when the ship left the drydock at 1920 hours.

BEACONS AND DYNAMKC POSITIONING

During this leg, four ORE beacons were used for positioning at the four sites that were occupied. Two single life and two double life beacons were used and all performed very well. In fact, the 16 kHz double life beacon that was used at Site 577 performed so well that the gains were not changed during the 19 days while the ship was working at this site. The 13.5 kHz double life that had been dropped on April 23 was still operating when the ship passed over it on May 22 while profiling before departing for Lisbon.

The ship stayed well within positioning limits even during a nine minute power loss which occurred while adjustments were being made to the A.C. board. Good weather conditions also contributed to the good stationkeeping that was obtained on this leg.

BITS

Seven rotary bits plus the HPC bit were used on this leg: (4) F94CK, (2) F93 CK and (1) 14 7/8" F94. The first F94CK bit was used at Site 544 and penetrated 240 meters of which the last 53 meters was a hard gneissic rock. It was planned that this bit should be released and a HPC hole then cored. However, the last core could not be recovered and the drill string was pulled. This bit was replaced with the HPC bit and Hole 544B was cored to 39.3 meters. The next site (545), again used a F94CK and drilled to 701.0 meters in 81.98 hours. When the bit was recovered all the cones were gone and the bit shanks worn half away. At Site 546, the next F94CK cored to a depth of 192 meters and pulled after coring 37 meters of salt. The drill string was pulled above the mudline, then 546A was drilled to 50 meters for a pore water and heat flow sample. This same bit was then used to wash to the casing depth for a re-entry cone at Site 547. It was then used to core to 744.5 meters in the re-entry pilot hole. The total amount drilled with this bit was 1018.5 meters in 54.3 hours. When the bit was recovered it appeared additional hole could have been cored but the slow penetration and poor core recovery had prompted its removal.

The next bit used was a 14 7/8" bit which was used to wash in the casing and re-entry cone at Hole 547B. This bit was used because it was felt that it would provide better circulation for washing the casing through rather firm sediments.

The drill string was then pulled and F93CK bits assembled at Scripps Marine Science and Development Shop were used in the next two re-entries. The first one had to be pulled after drilling only 211.5 meters because the inner core barrel could not be recovered. When the bit was brought to the rig floor it was found that a piece of plastic from a shattered core liner in the liner barrel had wedged between the bit throat and the core catcher sub. A second F93CK from Marine Science Development Shop was then run and drilled and cored 592.0 meters in 30.1 hours before it was pulled. When it was recovered, the bits showed about half of the bearing life and had been used, but more important, one cone was badly cracked and could have caused some hole problems if coring had continued. The last bit used in this hole was an F94CK because limestones or basement rocks were anticipated just a few meters deeper. This bit was used for 77.6 hours and 226.5 meters of coring, and when recovered all the bearings were gone, one cone was locked, and all seals had failed.

DRILLING AND CORING EQUIPMENT

The standard bottomhole asembly consisting of bit, bit sub, head sub, outer core barrel, top sub, head sub, three 8 1/4" drill collars, one 5' bumper sub, three 8 1/4" drill collars, two 5' bumper subs, two 8 1/4" drill collars, a crossover sub and one 7 1/4" drill collar, was used on Holes 545, 546 and 547B. Holes 544, 544A, 547, 547A, used the BHA which included a bit release sub and the special head sub which has been modified to accept a collet to be used with HPC coring. This set up was planned to be used on Hole 544B but the inner barrel could not be recovered after cutting core No. 28 in Hole 544A and the drill string was pulled. The BHA was then changed to the standard HPC set up with a HPC bit and Hole 544B was cored to a depth of 39.3 meters below seafloor.

When the bit release was disassembled, it was discovered that some new spacers, which had been made up to take up the slop in the HBR, were badly managled with pieces of these spacers wedged between the bit disconnect and the top connector. With the difficulty involved in taking this assembly apart, it is doubtful that the bit could have been released.

The bit release was also made for use after the pilot hole was completed at Site 547 and before setting the re-entry cone, but was not used due to changes in the scientific objectives.

One other problem occurred when drilling with the first bit after the re-entry cone had been placed. The bit was washed and drilled to 211.5 meters below seafloor and then the plan was to retrieve the inner core barrel and take a spot core. However, the inner barrel could not be recovered even with pulls of 11,000 pounds on the sandline. After shearing the overshot pin three times the drill string was pulled. When the bit was recovered, it was discovered that the core barrel was stuck in the throat of the bit and was held there by a piece of shattered core liner from the core barrel.

In addition to the standard drill pipe, 16 stands or 439 meters of aluminum pipe was used in all of the holes except Site 547. This pipe is being tested to obtain engineering data related to future use of this type of drill pipe.

RE-ENTRY ELECTRONICS

Re-entry had not been planned for this leg, however, in an attempt to achieve the desired scientific results a re-entry cone was placed at Site 547. On the initial re-entry attempt the tool apparently stopped at about 1000 meters. There was irregularities in the pump pressure as well, so the tool was pulled. After determining that there was no problem in the pipe, the re-entry tool was run back in the hole.

After lowering it about 500 M an operation check was made and the tool would not rotate, and was then again pulled out of the pipe. When the tool was changed, and checked while hanging from the pipe at the derrick floor, it too would not rotate so it was laid down and the logging cable was reheaded. After the cable was reheaded the tool worked properly at the rig floor and was then lowered and seated in the bottom of the drill pipe. Scanning began, but no target could be detected, so a systematic set of moves was carried out. After two hours of searching without finding a target, the re-entry tool was pulled and the extension sub was changed to a longer type. When the tool was lowered after this the target was picked up at 100 feet and re-entry was obtained in 59 minutes. Two more re-entries were made with no more problems with the re-entry equipment.

COMMUNICATIONS

Radio communication at the beginning of this leg started with some difficulties due to radio propagation being down in the area that drilling was scheduled to be done. A sincere effort was made to establish CW communication with the Navy Station (NGR), which is the only Navy CW station in this part of the world, and it was found to be entirely inadequate for our needs. At this time the Coast Guard CW communications came to the rescue and agreed to help us with project traffic. One station was located in San Juan, Puerto Rico and another in Portsmouth, Virginia. The two time schedules which were agreed upon were at 9:00 p.m. and 2:00 a.m. our time. This system handled all of the outgoing traffic. The incoming messages were received from the mercast circuit. This method sent messages blind, automatically from a transmitter in Spain. There were also others available at different locations in different countries. The drawback to this system is the delay in receipt of messages at DSDP and the CHALLENGER. As a result of these problems, the message count was reduced.

A few commercial radio calls were made to the United States via Europe, and a number to some European countries. Many amateur radio calls were made, from our two amateur stations, to families of the people on board. No equipment failures occurred during the voyage.

PERSONNEL

No serious injuries occurred during this leg except two of the drill crew had minor accidents to their hands, but these were not serious enough to cause any lost working time.

The GMI crew turned in a superb effort. They were exceptionally helpful in the assembly and preparing the re-entry cone. This operation was unexpected because it was not part of the original scientific prospectus, but was deemed necessary by the Co-Chief Scientists to achieve their geological objectives. The scientific staff was most cooperative and enthusiastic about the results that were obtained even though the leg was shortened by two days to allow drydocking in Lisbon enroute to Brest.

The SIO technical staff again did an exceptional job in handling and processing all of the cored material with a high degree of efficiency.

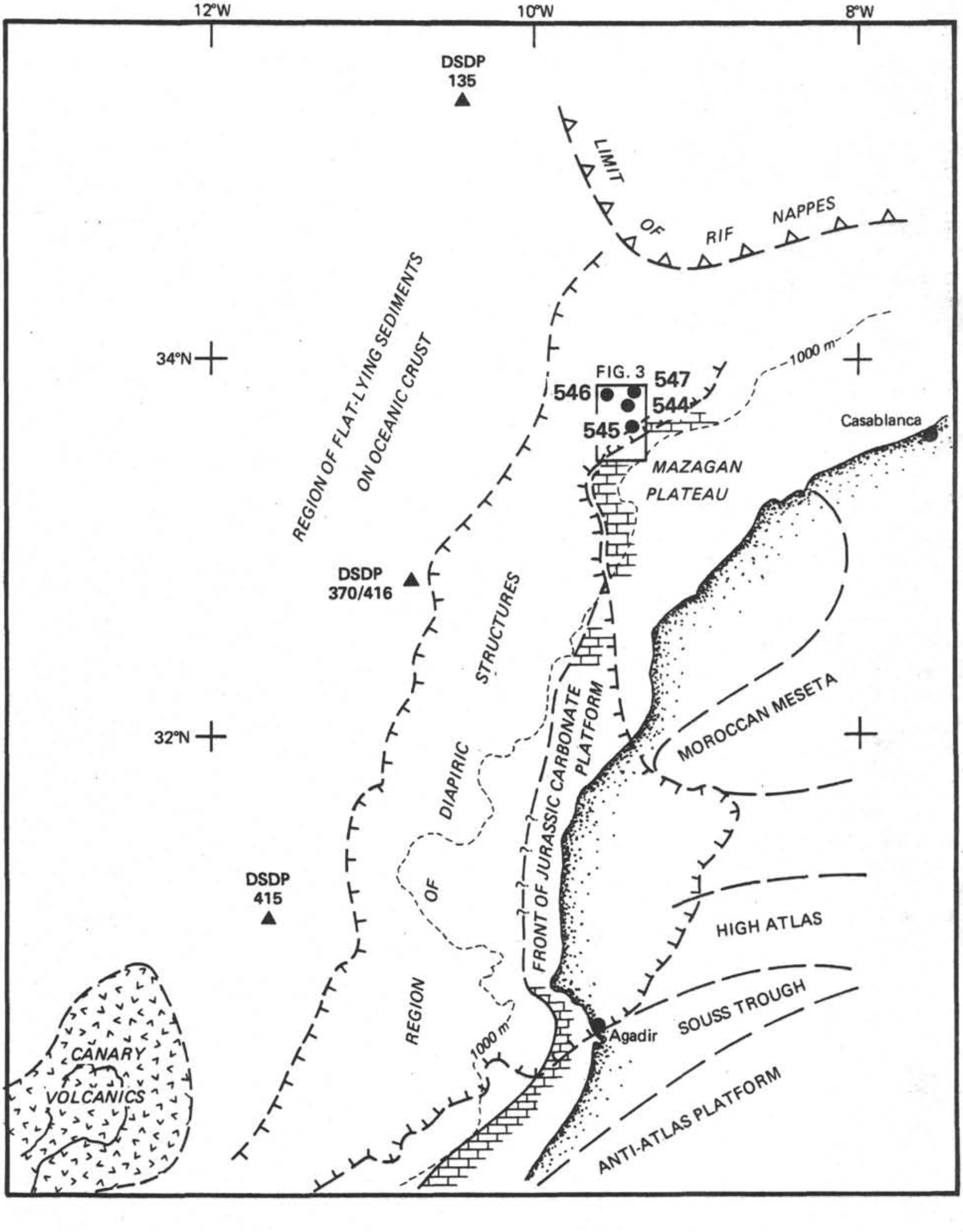
R. R. Knapp
Cruise Operations Manager
Deep Sea Drilling Project

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
OPERATIONS RESUME
LEG 79

Total Days (April 8, 1981-May 30, 1981)	51.5
Total Days in Port	8.7
Total Days Cruising (including site survey)	8.6
Total Days on Site	34.2

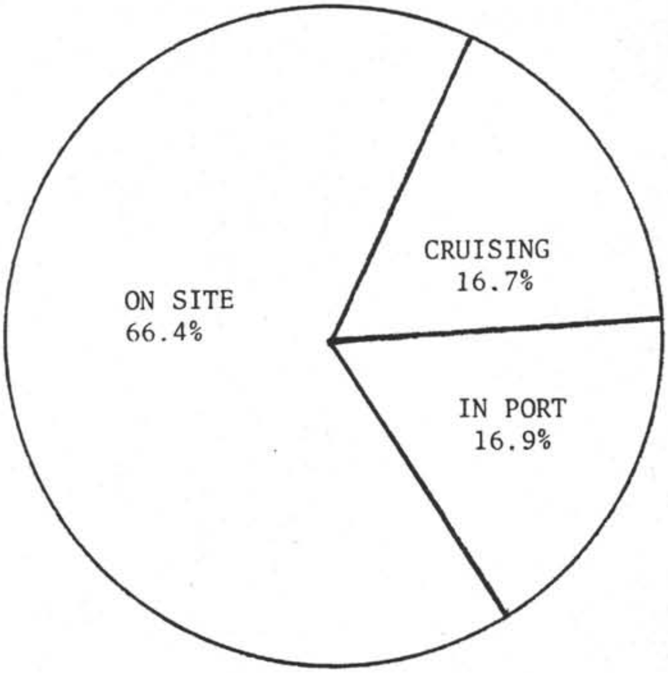
Trip Time	5.9
Drilling Time	1.3
Coring Time	23.3
Downhole Measurement	.09
Stuck Pipe	0
Wait on Weather	0
Re-entry	1.3
Other	2.3

Total Distance Traveled Including Survey (nautical miles)	1714.2
Average Speed (knots)	8.48
Number of Sites	4
Number of Holes	9
Number of Cores Attempted	247
Number of Cores With Recovery	246
Total Meters Cored	2155.8
Motal meters Recovered	1089.13
Percent Recovery	50.5
Total Meters Drilled	873.0
Total Meters of Penetration	3027.8
Percent of Penetration Cored	71.2
Maximum Penetration (meters)	1030.0
Minimum Penetration (meters)	5.0
Maximum Water Depth (meters)	4002.0
Minimum Water Depth (meters)	3160.0

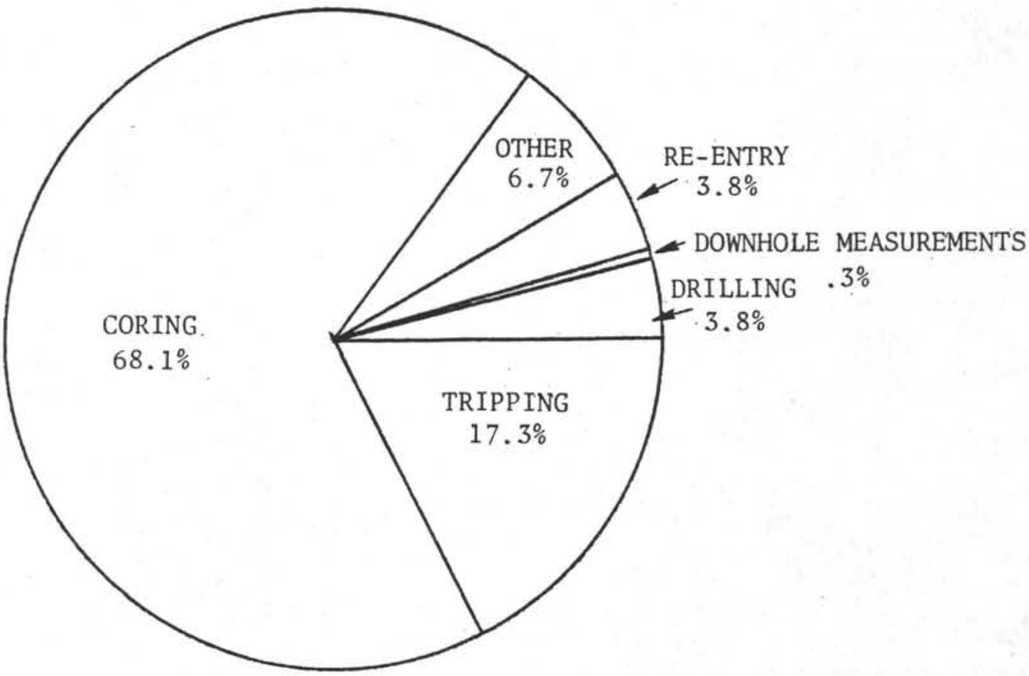

12°W
10°W
8°W
34°N
32°N
DSDP 135
DSDP 370/416
DSDP 415
LIMIT OF RIF NAPPES
REGION OF FLAT-LYING SEDIMENTS ON OCEANIC CRUST
FIG. 3
546
547
544
545
1000 m
Casablanca
MAZAGAN PLATEAU
REGION OF DIAPIRIC STRUCTURES
FRONT OF JURASSIC CARBONATE PLATFORM
MOROCCAN MESETA
HIGH ATLAS
SOUSS TROUGH
Agadir
ANTI-ATLAS PLATFORM
CANARY VOLCANICS

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
LEG 79

TOTAL TIME DISTRIBUTION



ON SITE TIME BREAKDOWN



INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
SITE SUMMARY
LEG 79

HOLE	LATITUDE	LONGITUDE	WATER DEPTH METERS	NUMBER OF CORES	CORES WITH RECOVERY	PERCENT OF CORES WITH RECOVERY	METERS CORED	METERS RECOVERED	PERCENT RECOVERED	METERS DRILLED	TOTAL PENET METERS	AVG. RATE PENET. M/H	TIME ON HOLE	TIME ON SITE HRS
544	33° 46.13'N	09° 24.29'W	3676	1	1	100.0	5.0	5.02	100.4	--	5.0	300.0	17.6	
544A	33° 46.00'N	09° 24.26'W	3617	28	28	100.0	235.0	83.1	35.4	--	235.0	6.85	72.7	
544B	33° 46.00'N	09° 24.26'W	3617	12	12	100.0	39.0	37.0	94.1	--	39.3	HPC	36.3	126.6
545	33° 39.86'N	09° 21.88'W	3160	75	75	100.0	701.0	353.71	50.5	--	701.0	8.5	182.0	182.0
546	33° 46.71'N	09° 33.86'W	4002	21	20	95.2	192.0	118.5	61.7	--	192.0	24.3	47.8	
546A	33° 46.71'N	09° 33.86'W	4002	--	--	--	--	--	--	50.0	50.0	166.6	8.7	56.5
547	33° 46.84'N	09° 20.98'W	3950.5	1	1	100.0	3.5	3.5	100.0	28.5	51.0	200.0	9.9	
547A	33° 46.84'N	09° 20.98'W	3950.5	73	73	100.0	674.5	333.5	49.4	70.0	744.5	16.2	144.7	
547B	33° 46.84'N	09° 20.98'W	3951.5	36	36	100.0	305.5	154.8	50.7	724.5	1030.0	9.4	301.6	456.2
			TOTAL	247	246	99.6	2155.8	1089.13	50.5	873.0	3027.8	10.8	821.3	821.3

DEEP SEA DRILLING PROJECT
BEACON SUMMARY
LEG 79

SITE NO.	MAKE	FREQ kHz	SERIAL NUMBER	SITE TIME HOURS	REMARKS
544	ORE	13.5 S.L.	542	17.6	
544A	ORE	13.5 S.L.	542	72.7	
544B	ORE	13.5 S.L.	542	36.3	
				126.6	Beacon worked well with no problems.
545	ORE	13.5 D.L.	552	182.0	No problems.
546	ORE	13.5 S.L.	543	47.8	
546A	ORE	13.5 S.L.	543	8.7	
				56.5	No problems.
547	ORE	16.0 D.L.	530	9.9	
547A	ORE	16.0 D.L.	530	144.7	
547B	ORE	16.0 D.L.	530	301.6	
				456.2	No problems. Did not even have to increase gains to keep on location.

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
BIT SUMMARY
LEG 79

HOLE	MFG.	SIZE	TYPE	SERIAL NUMBER	METERS CORED	METERS DRILLED	METERS TOTAL PENET.	HOURS ON BIT	CONDITION	
544	Smith	9 7/8	F94CK	AN6318	5.0		5.0	1 min		
544A	Smith	9 7/8	F94CK	AN6318	235.0			34.3		
								34.3	T1-B4-0	Rerun in Hole 544A.
544B			HPC	AMY	39.3		39.3	HPC		
545	Smith	9 7/8	F94CK	AN6343	701.0		701.1	81.98	All 4 cones destroyed.	Apparently cut cores after cones were gone.
546	Smith	9 7/8	F94CK	AN6344	192.0		192.0	7.9		Will rerun at Site 547.
546A	Smith	9 7/8	F94CK	AN6344		50.0	50.0	.3		
547	Smith	9 7/8	F94CK	AN6344	3.5	28.5	32.0	.2	T1-B3-SEI	Bit could have been run longer but appeared
547A	Smith	9 7/8	A94CK	AN6344	674.5	70.0	744.5	45.9		to be worn due to slow drill rate & low recovery.
547B	Smith	14 7/8	F94	697AN						Used.
547B	MSDS	9 7/8	F93CK	S-22		211.5	211.5	1.7	T1-B1-SEI	Washed & cored soft clays. Can use for R/R
547B	MSDS	9 7/8	F93CK	S-27	79.0	513.0	592.0	30.1	T1,B4-SEO 1/8	One cone badly cracked could have broken any time
547B	Smith	9 7/8	AE3399	AE3399	226.5		226.5	77.6	T1, B8-SFO 1/4	One cone locked, all bearings gone.

DEEP SEA DRILLING PROJECT
TIME DISTRIBUTION
LEG - 79

Date	Site No.	Cruise	Trips	Drill	Core	Stuck Pipe	W.O.W.	DOWNHOLE MEAS.	Mech. Repair	Port Time	Re-Entry	Other	Total Time	Remarks
4/08/81 4/15/81										155.0			155.0	
4/15/81 4/17/81		60.3											60.3	
4/17/81 4/18/81	544		9.0		.6							8.0	17.6	
4/18/81 4/21/81	544A		.8		67.3							4.6	72.7	
4/21/81 4/23/81	544B		18.8		14.0							3.5	36.3	
4/23/81		7.9										.3	8.2	
4/23/81 5/01/81	545		14.4		165.0							2.6	182.0	
5/01/81		2.6											2.6	
5/01/81 5/03/81	546		12.0		33.8							2.0	47.8	
5/03/81	546A		6.1	.3				2.2				.1	8.7	
5/03/81		2.6											2.6	
5/03/81 5/04/81	547		6.8	.7	.9							1.5	9.9	
5/04/81 5/10/81	547A		7.5	2.5	134.7								144.7	
5/10/81 5/22/81	547B		66.8	27.0	143.3						31.8	32.7	301.6	
5/22/81 5/24/81		47.7											47.7	
5/24/81 5/26/81										53.0			53.0	
5/26/81 5/30/81		84.8											84.8	

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
OPERATIONS RESUME
LEG 80

Leg 80 of the Deep Sea Drilling Project was a concerted effort to study the geologic history of the North Atlantic Ocean before, during and after the rifting that opened the ocean and separated Europe from North America. The coring program concentrated on four closely spaced sites located on the continental margin seaward of the Bay of Biscay and the Western Approaches Basin. The area known as the Goban Spur was selected because the sedimentary section was fairly complete, yet thin enough to be penetrated by the drill.

All four sites were cored to basement, with two bottoming in basaltic rocks, one in metamorphic quartzite and one in Paleozoic sandstone. In addition, two sites were piston cored and a highly successful logging program was carried out at three sites. Operational highlights included the first recovery of 9.5 meter piston cores with the variable length hydraulic piston corer, the first piston cores magnetically oriented in azimuth, and a successful fishing job for the recovery of an important logging tool.

The voyage commenced on May 30, 1981, at Brest, France and terminated on July 22, 1981, at Southampton, England. Total length of the leg was 53.1 days; of which 35.2 days were spent on-site, 8.1 days in a scheduled port call and 6.5 days in transit. Mechanical breakdowns accounted for 3.5 days.

BREST PORT CALL

When the vessel had safely cleared the traffic lanes off Cape Finisterre, a brief stop was made to test the thrusters and dynamic positioning system. The westward transit then resumed into an increasing southwesterly wind. Gale force winds and heavy seas persisted into the second morning, decreasing only as the first drill site was approached. Average speed was held to only 5.9 knots for this portion of the voyage. The vessel turned to the south-southwest at 1155 hours, June 9, to parallel a reference seismic profile. At 1410 hours a positioning beacon was launched to begin operations at Site 548.

HOLE 548

The initial drill site was located about 180 miles south-southwest of the southernmost tip of Ireland near the edge of the continental shelf. The precision depth recorder (PDR) indicated a water depth of 1251 m from the rig floor.

When the seismic gear had been retrieved and the vessel positioned over the acoustic beacon, the bottomhole assembly (BHA) was assembled and the drill pipe was run to just above the seafloor. As Hole 548 was to be the debut of the variable length hydraulic piston corer, about two hours were spent in deploying the coring assembly and in resolving minor handling problems. The corer was lowered on the sandline to the bit, which was positioned at 1250.5 meters for the first core attempt. The first 9.5 m core barrel was "fired" and retrieved with a recovery of 3.6 meters of sediment. Water depth was thus established at 1256 m.

Piston coring then proceeded with excellent recovery and minimal handling problems despite adverse weather conditions and swells to three meters. The 9.5 meter corer succeeded in penetrating to 108.5 meters through soft Pleistocene mud and silt. At this point, full stroke of the corer could no longer be achieved and a second unit, dressed for five meter cores was deployed. Coring continued in calcareous ooze to 211 meters below seafloor (BSF), where the sediment became too stiff for a five meter stroke. This was judged to be the best time to terminate piston coring operations and to convert to the more rapid rotary coring mode. The drill string was then recovered, with the bit arriving on deck at 1125 hours, June 11.

HOLE 548A

To accomplish the deeper coring at Site 548, the rotary coring BHA was assembled and run back to the seafloor. The vessel was offset 30 meters to the west to avoid the disturbed area of the previous hole and Hole 548A was spudded at 1800 hours, June 11. The hole was drilled without coring to 205.5 m BSF. Combination temperature/water sampler probe runs were made at 53.5 m and 110.5 m and a temperature probe was run at 167.5 m. Continuous coring was then conducted to total depth with an additional temperature probe run at 281.5 m.

The sediment section penetrated was soft carbonate ooze and chalk, with the exception of about 50 meters of semi-indurated clay. Penetration rate was consequently high and core recovery was greater than 73 per cent. Basement of quartzitic composition was encountered at 535 m BSF. Only broken rubble and cuttings were recovered from the 16 meters of basement penetrated. Hole angle had increased from 5.7 to 7.9 degrees off vertical within ten meters at the basement contact. This may have caused lateral bit movement which could have destroyed the core, but the failure to recover any full diameter core is not fully understood.

Mud flushes proved inadequate to keep the hole cleaned of the quartzite cuttings. Operational difficulties, such as torquing and sticking of the drill string, a plugged bit and difficulty in recovering the inner core barrel forced termination of coring operations.

An additional 50 barrel mud flush was pumped to prepare the hole for logging. Because fresh water-sensitive clays had been encountered, the hole was not filled with fresh water mud, although this would have been the optimum preparation for running the induction log. A go-devil was then pumped down the pipe to activate the hydraulic bit release. The bit and associated components were left at the bottom of the hole and the open-ended pipe was pulled to 173 m BSF for logging.

Two open hole logging runs were made. The first sonde (combination long spaced sonic and dual induction) encountered an obstruction at 210 m, but the heavy tool broke through and found the hole clear to 537 m. Both this and the subsequent compensated neutron/formation density combination log encountered good hole conditions. All four log presentations were of exceptional quality given the physical properties of the very soft sediments.

The drill string was then recovered and the GLOMAR CHALLLENGER departed Site 548 at 2220 hours, June 14.

SITE 549

Site 549 was located about 45 miles west-northwest of Site 548. The approach was executed by navigating to a point about 15 miles northeast of the proposed site, then turning onto a southwesterly course to parallel a reference seismic profile. Much of the transit was made at reduced speed to time arrival at the site shortly after the receipt of a scheduled satellite navigation fix. Since the vessel's pit log and LORAN C were not functioning, navigation was limited to dead reckoning and real-time bathymetry/seismics from CHALLENGER's profiles. Unfortunately the long-anticipated SATNAV fix was jammed by a "rogue" satellite. Bathymetry indicated that the ship would have passed over the site before another fix could be received, and a positioning beacon was dropped at 0513 hours, June 15. The SATNAV fix received only minutes later indicated that the beacon had been launched about one mile southwest of the geographic coordinates indicated by the reference profile. A beacon of the alternate frequency was prepared for launch while the vessel continued her survey course for four miles, then made a wide turn and approached the desired coordinates with good SATNAV control. It was then discovered that the seismic picture approved by the Safety Panel did not agree with that of the specified coordinates or that of the beacon location. Profiling continued and both locations were traversed a second time with the same result. Eventually a profile approximating that of the approved location was obtained and the second beacon was launched at 0826 hours, about 1-1/4 miles north-northwest of the specified geographic coorinates. The seismic gear was then retrieved and the vessel was positioned over the beacon. Pipe operations commenced at 0915 hours.

The PDR water depth at Site 549 was 2525 meters, and a mudline punch core was taken to determine true depth. On the first attempt the bit was lowered to 2533 m and the inner barrel was retrieved with no trace of sediment. One joint of pipe was added and a second attempt, to 2542.5 m, was made. A nearly full (9.4 m) core was recovered and water depth was established at 2533 m.

As subsequent hydraulic piston coring was planned, the soft calcareous ooze was drilled to 198.5 m BSF without coring. Three combination temperature probe/in situ water sampler runs were made in this interval. Because of various equipment problems, the only success was one good water sample. Continuous coring began at this point and continued to total depth. A successful temperature measurement was conducted at 236.5 m BSF. Two subsequent attempts failed, apparently because the sediment was too firm for the probe to penetrate. An interval of anomalously soft chalky ooze provided a final opportunity and a successful measurement was made at 417 meters to determine the geothermal gradient of the area.

Coring proceeded through varying chalk, mudstone and limestone units. Disappointingly low core recovery was achieved in units of sandy chalk, bioclastic reef-type limestone and silty mudstone. This is not unusual for the former two lithologies due to their friable natures. The mudstone, however, seemed well indurated and cohesive, and failure to recover it is not well understood. An increase in marly and clay rich sediments was encountered with depth and it became apparent that the bit cutting structure was far from optimum. Selected in anticipation of a limestone/coarse clastic sequence, the short-toothed bit made painfully slow progress through a long sequence of silty mudstones and clays. After about 65 rotating hours and 800 meters of penetration, reduced core diameter and irregular drilling torque indicated that at least one of the bit's four bearings had begun to fail. This situation persisted virtually unchanged for nearly 200 meters and 50 additional rotating hours. As core diameter and recovery began to decrease further, indicating progressive failure, the lithology became more sandy and the penetration rate increased temporarily. When 37 meters of the final rock unit (hard Paleozoic sandstone) had been cored, the penetration rate had slowed drastically and total failure appeared imminent. However all scientific objectives were declared fulfilled and coring was terminated after 126.3 rotating hours and a total penetration of 1001.5 meters. The final core arrived on deck at 1215 hours, June 26.

The hydraulic bit release go-devil was pumped into place at the bit and pressure was applied to shift the release mechanism. Repeated pressuring and manipulation of the pipe failed to release the bit, however. The overshot was run on the sandline to retrieve the go-devil so that a second release attempt could be made. The go-devil was engaged and had to be jarred loose from its position in the release mechanism. It was retrieved about 100 meters up the pipe against heavy frictional drag from the seals. At this point the safety shear pin of the overshot failed, releasing the go-devil. The overshot was retrieved and the shear pin replaced. On the second retrieval attempt, the overshot did not "take weight" until it had reached the approximate depth of the end of the drill string. After repeated efforts failed to engage the go-devil, the wireline packoff was energized and the mud pump was started. Circulation was established with pump pressure indicating open-ended pipe--a positive indication that the bit and associated components had been released.

The sandline was retrieved and the hole was then filled with bentonite mud in preparation for logging. The drill string was pulled, without incident, nearly to the intended logging position. The pipe suddenly became vertically stuck, apparently as the larger diameter BHA was pulled into a key seat at about 175 m BSF. A circulating head was attached and fluid circulation was found to be unimpaired. Nevertheless, 1-1/4 hours of working the pipe with overpulls of up to 200,000 pounds were required to free it. With the BHA free in the hole and the end of the pipe at 137 m BSF, the logging sheaves were rigged and logging operations began.

The first logging sonde was again the long-spaced sonic/dual induction/ gamma ray/caliper combination. Considerable difficulty was involved in deploying the heavy 22 meter logging tool on the pitching vessel and there was concern that the flexible sonic module had been damaged by bending. In-pipe checks soon showed all functions to be normal, however, and the sonde was run down the drill pipe. The open hole was found to be in good condition, with the exception of three spots where the tool stopped on bridges or ledges. In each case, the weight of the tool helped it to break through and it eventually reached a depth only 2.5 meters short of the driller's total depth. Excellent dual induction and gamma ray logs were recorded. The sonic velocity curve was extremely noisy and only the upper third of the log was usable. The logging sonde was then retrieved up the drill pipe. During the process of removing the tool from the pipe, it became fouled in the circulating head and the cable pulled tight. Before the winch operator could slacken the cable, the weak point of the cable head failed and the entire logging tool fell back down the pipe.

The fishing neck of the cable head was nearly the same size as a DSDP core and a fishing tool was assembled using a special slip-type core catcher made up on an inner core barrel. On the slight chance that the logging sonde might have lodged in the drill string, the fishing tool was lowered on the sandline. No weight loss was noted until the inner barrel had reached a depth approximately at the end of the drill string. The barrel was set down and picked up several times with no indication of engagement; then a sudden loss of weight indicated that the overshot pin had sheared and that the inner core barrel assembly had also been lost in the hole. The overshot was retrieved and was found to be packed with sediment.

The second scheduled logging tool contained radioactive sources, and the danger of its becoming fouled with the other tools in the hole was considered too great to risk a logging run. The drill string was then run back down the hole to endeavor to wash over and recover the logging tool and to plug the hole with cement. It was hoped that the inner core barrel would have passed beside the much longer logging sonde, leaving the fishing neck accessible. The pipe was stopped at 38 m short of total depth and the power sub was deployed. A shorter fishing tool using an identical core catcher was run on the sandline with no contact made. Three joints of pipe were added and the string was lowered with slow rotation and circulation, and a sandline "fishing trip" was made each time. The weight indicator showed contact when the pipe had been lowered to 17 m off total depth.

The fishing tool, which had been scarred by contact with steel on the previous run was lowered for a final attempt. After three or four vigorous stabs, the sandline weight indicator showed that the fish had been caught. It had been pulled only a few meters up the pipe, however, when it became jammed and could be moved neither up nor down. When attempts to free the fish failed, the overshot was worked vigorously to shear the pin and--it was hoped--to leave the fish in the pipe for recovery with the drill string. With the sandline back on deck, the pump was engaged at low volume and the pressure confirmed that the pipe remained obstructed. The drill string was then recovered and the complete logging sonde was found wedged in the BHA. The lowermost section had been crushed and buckled to the point where it would not pass through the bit release top connector and only about 35 cm of logging tool protruded from the pipe.

The BHA was partly disassembled for removal of the fish and then reassembled in the hydraulic piston coring configuration. At 0115 hours, June 28, the pipe trip for the second hole at Site 549 began.

HOLE 549A

During the pipe trip, a positioning offset of 30 m north was entered to locate the new hole away from the disturbed area of Hole 549. A PDR reading at the offset position indicated 2523 m. To allow for the eight meter depth discrepancy noted on Hole 549, the special piston coring bit was positioned at 2524.5 m in an attempt to recover seafloor sediment and to determine water depth precisely. The 9.5 m stroke to 2534 m produced only water and the procedure was repeated after one joint of pipe was added. The second attempt was made at 0930 hours, June 28. An 8.0 m core was recovered, establishing the water depth at 3525.5 m. The discrepancy between PDR and drill pipe depths is attributed to the sloping, irregular bathymetry of the area.

With favorable weather and sea conditions, piston cores of high quality were recovered to a depth of 103 m BSF. Core No. 12, punched from this depth, failed to achieve full stroke and only three meters were recovered. The 9.5 m corer was then set back and the 5.0 m unit was deployed. Only one full core was obtained with this unit before the firm chalky ooze became too stiff for a full stroke of the corer. The remaining 85 m gap in the Site 549 section--an important one--was cored with incomplete recovery ranging generally from 0.5 to 3.0 m per core. The core recovered was adequate for scientific purposes and total depth was reached at 196 m BSF, approximately at the beginning of the section cored in Hole 549. The drill string was then recovered and the bit arrived on deck at 0315 hours, June 30.

A brief post-site survey was made on departure from Site 549. The vessel proceeded northeast from the site as the seismic gear was streamed. At a distance of two miles, the ship turned back onto a course parallel with the reference profile to pass directly over the positioning beacon. This course was held for about five additional miles until the deeper water of the

European Basin was reached. The CHALLENGER then proceeded south for about 36 miles to a point 11 miles northeast of Site GOS-1 (550). The approach was again made parallel to a reference profile and the acoustic beacon was dropped at 0929 hours, June 30, on the first pass over the location. The ship continued profiling on the same course for about two miles before turning back toward the beacon.

As piston coring was planned for a second hole at Site 550, a BHA was made up containing the special components necessary for conversion to HPC operations. (This conversion eliminates a time-consuming round trip.) A routine pipe trip was then made and a seafloor punch core determined water depth to be 4432 m, as compared to the PDR reading of 4430.

The hole was then drilled, without coring, to 99.5 m BSF. A combination temperature/water sampler probe run was made and continuous coring commenced. The probe was also deployed at 156.5 and 213.5 meters, as coring operations proceeded smoothly to about 460 m BSF. Plastic liner failures on two consecutive cores then resulted in low core recovery and in a plastic/sediment mess jamming both operating inner core barrels. A slight delay ensued while an additional inner barrel was assembled. Below 498 m, three consecutive core attempts resulted in little or no recovery. The bit deplugger was pumped down and recovered. Clay on the deplugger indicated that the throat of the bit may have been plugged, and the following core attempt produced nearly full recovery. As the wireline trip for the next core was in progress, a warning of the imminent approch of gale force winds forced the decision to terminate coring operations at 536.5 m BSF. The core barrel was brought on deck (completely empty) at 1700 hours, July 4, and preparations were made for recovering the drill string.

The pipe trip was slowed somewhat by the weather and by vessel motion. When the pipe was clear of the seafloor, the ship's heading was changed to minimize roll and thus provide safer working conditions for the drill crew. The positioning system was unable to hold station on this heading and the vessel drifted slowly away from the drill site. When the BHA had been recovered, at 0445 hours, July 5, the beacon lay 11.3 miles to the southwest of the ship.

HOLE 550A

With all equipment secured, the CHALLENGER returned to the drill site to hold position until conditions were sufficiently improved for operations to resume. Wind and sea conditions improved rapidly through the morning. Pipe handling operations recommenced at 1215 hours, although a newly-arrived current precluded the ship's turning to the optimum heading to minimize roll.

A 50 foot (15.2 m) west offset was entered into the positioning system to eliminate the possibility of taking heat flow measurements too near the chilled borehole of Hole 550. Hole 550A was spudded at 2155 hours, July 5, and was drilled quickly to a depth of 95 m BSF. Penetration through the soft ooze was halted abruptly when the drill struck something anomalously hard. When the bit failed to break through after 15 minutes, drilling attempts were terminated out of concern that the bit could be deflected in the soft sediment, forming a "dogleg" in the hole that would cause problems later. The sediments at that depth were of early Pleistocene or late Pliocene age, and it was inferred that an ice-rafted boulder had been encountered. The bit was then pulled clear of the seafloor for respudding.

HOLE 550B

The positioning offset was changed from 50 feet west to 50 feet east. The difficult conditions of crossed wind, swell and current persisted, and nearly an hour elapsed before positioning was stable enough for drilling to begin. Hole 550B was spudded at 0048 hours, July 6, and drilled to 323 m BSF before the inner barrel was retrieved for a temperature probe run. An apparent boulder bed was again encountered at about 95 m, but resistance was not so solid as on the previous hole. The effect was that of cobbles rolling under the bit and slow penetration for 30 meters before disappearing.

The heat flow data were degraded by vessel heave resulting from a heavy swell. Although the heave compensator was in use, "friction spikes" in the temperature data resulted from movement of the probe in the firm sediment.

Drilling then continued through the previously-cored sediment section to 456 m BSF. Because of low core recovery near the bottom of Hole 550, continuous coring was begun at this point, some 80.5 m short of the total depth of Hole 550.

Coring was routine, with good recovery except for two instances when it was necessary to run the bit deplugger to knock clay plugs from the throat of the bit. In the first case, the depth correlated very closely with that of a similar occurrence in Hole 550, indicating that the problem was related to the nature of the material being cored. Clay, chalk and mudstone were cored to 658 m, where basaltic basement was encountered. The coring plan had included about 50 meters of basement penetration, but an unexpected mechanical failure forced a revision of the plan.

At 0445 hours, July 10, the lower drive shaft coupling of No. 2 bow thruster failed. This meant that on-site operations at Hole 550B could continue with one bow thruster only as long as exceptionally favorable weather persisted and that no new hole could be spudded until repairs had been made in port. Coring was therefore halted 26 m into basement, as preparations were made to release the bit and complete the logging program while the good weather held.

Again, the hydraulic bit release demonstrated its capricious nature as two go-devils were pumped into place for unsuccessful release attempts and then retrieved with the sandline. After 5 1/4 hours had been expended and prospects for dropping the bit seemed poor, an inner core barrel was pumped into place. It was reasoned that the landing impact of the heavy barrel and/or the stresses of rotary coring might effect separation if the internal mechanism had shifted (as in some cases in the past). In any event, remaining time could be spent productively in cutting another basement core until arrangements for the repair port call had been finalized. When the core had been retrieved, a third and final attempt was made to release the bit. Varying pipe pressures and weights were applied for about 10 minutes following the landing of the go-devil; finally the pressure bled off suddenly, indicating release of the bit.

The end of the drill string was then pulled to 119.5 m BSF for logging. Logging operations proceeded smoothly and three successful logs were recorded.

The drill string was then recovered and, following magnetic inspection of the BHA, the vessel departed at 0620 hours, July 12, for emergency repairs in Cobh, Ireland.

COBH PORT CALL

The nearest port to the operating area was Cobh, located on the southern coast of Ireland, about 290 miles to the northeast. Following winds and smooth seas enabled CHALLENGER to make the transit in 30½ hours with an average speed of over 9.5 knots. The first mooring line was put over at the Cobh Passenger Terminal at 1256 hours, July 13.

Representatives of GMI, San Diego and Schottel, Holland were on hand to coordinate thruster repairs and the entire effort of the ship's company was directed toward this end. While the damaged drive shaft was being removed, temporary covers were installed on the ends of the thruster tunnel. The tunnel was then pumped dry and the lower components of the thruster system were inspected and found to be undamaged. All parts required for installation of the spare drive shaft assembly were on hand, except for a spacer plate for the lower coupling. This was fabricated in the ship's machine shop, adding several hours to the port call. As a precaution, the stub shaft leading to the thruster gearbox was removed and the bearing and seals were replaced.

Logistical efforts were limited to the resupply of fresh fruit, vegetables and dairy products.

With the shaft installation complete, only testing for abnormal vibration or bearing heat or noise remained. As the shallow water and possible presence of harbor debris posed hazards to the thrusters, the testing was deferred until after departure. The vessel departed her berth in Cobh at 1122 hours, July 15, and proceeded to a point clear of the approaches to the River Lee estuary. After one and one half hours of functional and vibration testing, the ship was pronounced operational by the Chief Engineer and the Ship's Manager. The two GMI-San Diego personnel were disembarked to a small boat and CHALLENGER proceeded to sea.

SITE 551

The final drill site was located about 265 miles southwest of Cobh, and 25 miles north of Site 550. The weather was cooperative and the average speed of about nine knots was better than had been anticipated. Using satellite navigation, the vessel passed to the north of the proposed site, turned sharply back to parallel reference profile CM-10 and approached the site from the southwest. The approach from deep water aided in the identification of bathymetric features and the positioning beacon was dropped on the first pass.

The position of the drilling location, which was situated near the top of an escarpment, was critical. When the ship had taken station on the beacon, the PDR depth was checked against the bathymetry of reference profiles to determine the optimum position for minimum slope and sufficient soft sediment cover for BHA support. As only three operating days remained in the voyage, it was also necessary to drill where the total sediment section was thin enough to ensure penetration to basement in the allotted time. Offsets of 245 m east and 122 m north were entered during the pipe trip and the PDR depth (3897 m) was made to coincide with that of a "bench" noted on the profiles.

The coring program called for a seafloor punch core to determine water depth. Some PDR error due to slope was anticipated and the bit was lowered to 3908.5 m before the barrel was retrieved. This core barrel was empty and it was necessary to add a joint of pipe and to repeat the procedure before a core was recovered. The depth was then determined to be 3909 m.

The upper portion of the hole was drilled through soft oozes to 104 m BSF with two spot cores to check sediment age and to monitor for hydrocarbons. Chalk was then cored continuously to 142 m BSF, where basalt was rather unexpectedly encountered. Coring in the basalt was slow, but produced good recovery.

One core barrel apparently did not latch into place properly and was recovered empty. Seating pressure of the following barrel indicated a partial obstruction and it was necessary to clear the bit with a core breaker before proceeding. Four cores later, the bit was found to be completely plugged following retrieval of the core barrel. All efforts failed to establish circulation and the bit had been pulled about half way to the seafloor before a final attempt was made. The surging action of pulling pipe had apparently cleared the cuttings from the bit and circulation was broken. The bit was then run back to total depth and three more cores were taken before time expired.

The drill string was then recovered and, after a well-used sandline had been jettisoned, GLOMAR CHALLENGER departed for Southampton.

SITE 551 to SOUTHAMPTON

The final transit into port was made in exceptionally fine weather with a following breeze. On the morning of the second day, the vessel had averaged over ten knots and was significantly ahead of her anticipated track. This permitted the engineers to take No. 1 engine off line and to proceed on five engines with no delay in the scheduled arrival time. The engine was then dismantled as the first step of a "top overhaul" to be completed during the port call.

The final (505 mile) portion of the voyage ended at 1018 hours, July 22, with the first mooring line at Berth 104, West Docks, Southampton, England. This marked the official end of Leg 80.

DRILLING AND CORING EQUIPMENT

Various bottomhole assembly configurations were employed during Leg 80. The standard DSDP rotary coring assembly used at Holes 548A and 549 consisted of a bit release assembly, head sub (for spacing), one 8¼" drill collar (outer core barrel), top sub, head sub, three 8¼" drill collars, one 5-foot stroke bumper sub, three 8¼" drill collars, two bumper subs, two 8¼" drill collars, crossover sub and one 7¼" drill collar.

The BHA used for oriented variable length hydraulic piston coring required some improvisation, with stabilizers and head subs inserted for spacing to the proper length. The assembly used for VL/HPC work at Holes 548 and 549A with a piston coring bit was as follows: bit sub, two stabilizers, two 8¼" drill collars, top sub, head sub, one stabilizer, one 3.7 meter gammaloy (non-magnetic) drill collar, one 8¼" drill collar, two bumper subs, two 8¼" drill collars, crossover sub and one 7¼" drill collar. The standard BHA can be modified for conversion to HPC coring by the addition of a stabilizer, collet conversion head sub, stabilizer and gammaloy collar at the top of the first drill collar above the outer core barrel assembly. This was done at the final two sites, but piston coring was not elected at either site and the conversion was not done.

Hole 548 was a good test of the VL/HPC system. It was determined that the very long assembly could be deployed in the moderate to severe vessel motion conditions that prevailed. Handling procedures were awkward, as had been anticipated, but definitely manageable. The 9.5 m cores will save enough wireline time to offset the system's disadvantages at deep water sites where thick blankets of very soft sediments are present.

The core barrel quick disconnect feature and the new shear pin arrangement proved to be major improvements over the old system. Shear pins failed on three occasions at Hole 548 before the corer had reached the bit. This was attributed to the effects of surge in the pipe (due to vessel motion) acting on the great weight of the corer.

No significant mechanical problems were experienced with drilling and coring equipment. The hydraulic bit release was actuated successfully (eventually) at each of the three sites where it was deployed. None of the releases was straightforward and according to design, however, and serious questions remain as to the system's reliability.

CORE BITS

Core bits featuring various cutting structures were used. All were successful in that no holes were terminated due to bit failure. The shop-fabricated bit used in Hole 549 featured Hughes cutters with a cutting structure only slightly different from the more familiar Smith F94CK. The penetration rate was unexpectedly low in lithologies containing clay, however. Remarkably, this bit continued to core for over 60 rotating hours after reduced core diameter first signaled the failure of at least one bearing, and the site's drilling objective was reached. F93CK bits were used on the final two sites, and the long chisel cutting structure proved to be the most efficient for sediments of the leg operating area. Borh of these bits cored considerable intervals of basalt without damage to the cutting structure.

LOGGING

Well logs were recorded at Sites 548, 549, and 550, with a total of six logging runs made for a total open hole logged interval of 3377.5 m. No logging was done at Site 551 due to shallow penetration and time constraints. All the logs, with the exception of the sonic log at Hole 549, were of good quality.

Most of the technical problems encountered were caused either directly or indirectly by one component--the MCD three arm caliper/centralizer. Initial inspection revealed the caliper to be too large in diameter to pass through the drill pipe, and major modification in the ship's machine shop was eventually necessary before the two units on board could pass through all components of the drill string. The operating mechanism became fouled with sediment, resulting in a "shift" or displacement of the caliper data curve in each of the sonic logs run. Thus, despite careful calibration, the caliper data were subject to the uncertainties of correction using bit and pipe diameters. The MCD also provides centralization for the sonic velocity sonde, which is essential to control noise and prevent "cycle skipping". The sonic caliper log recorded in Hole 549 indicated that the springs of the single MCD unit being used for centralization were too weak to keep the long, heavy sonic/induction/GR tool from contacting the side of the hole. The hole was deviated about six degrees from vertical, and under bit-size readings of the caliper curve indicated that the caliper springs were being collapsed by lateral forces. Unfortunately, problems were also experienced with the performance of the caliper on the density/neutron tool--a device of a different design.

During logging operations at Hole 549, it was discovered that the MCD would not pass through the circulating head installed at the top of the drill pipe. This led to a change in recovery procedures and, ultimately, to the fouling and loss of the tool. The subsequent fishing job cost 5 1/2 hours of rig time and precluded further logging of the hole. One sonic tool and the only dual induction tool were damaged beyond shipboard repair and were unavailable for the remainder of the voyage. The success of the washover and recovery operation was due to good fortune and the availability of coring equipment that could be adapted for fishing. No fishing tools were provided in the logging contract.

The large logging tools now in use (up to 22 m in length and 1800 pounds in weight) have several advantages over the smaller, lighter sondes used in the past. They provide the capability of recording sonic velocity, resistivity, formation density and neutron porosity logs, with a redundance of gamma ray and caliper curves, in just two runs through the water column. In addition, the weight of the tools enables them to break through minor bridges and to push past obstructions that would stop smaller and lighter tools. This is an extremely important consideration in view of the poor hole conditions that normally exist in DSDP holes.

The principle disadvantage of these tool configurations is the difficulty of assembling and disassembling the sondes and the awkwardness involved in entering and exiting the drill pipe with them. This is particularly true of the sonic/dual induction assembly, which weighs 1800 pounds, is 22 m long and has a 24 m bridle attached. The suspended sonde is difficult to handle with any amount of vessel motion and has little rigidity. One sonic tool is thought to have been damaged during attempts to start it into the pipe. A lesser but sometimes important disadvantage of long sondes is that sensors located near the top do not record several meters at the bottom of the hole. This means that more "rathole" must be drilled if the top of the lowermost lithologic unit is to be logged.

The cooperativeness and ingenuity of the Leg 80 logging engineer, along with sophisticated computerized equipment, produced some breakthroughs in the utilization of log data. For the first time, sonic velocity logs reading directly in kilometers per second were produced along with computed acoustic impedance logs and crossplot presentations of various parameters.

DYNAMIC POSITIONING

The overall performance of the vessel's dynamic positioning system was very good, with no operational problems experienced. During the Site 549 occupancy period, it was necessary to change vertical reference gyro units on two occasions. This was done without interrupting operations.

There were also several instances of instability of the system wherein thrust was applied in reaction to obviously false displays of position error. This is an old problem that chronically reappears under conditions of deep water and considerable vessel pitch.

The positioning beacons deployed were all single life models manufactured by ORE. Both 13.5 and 16.0 kHz frequencies were used and absolutely no beacon problems were experienced.

ENGINEERING

Significant malfunctions of engineering equipment were limited to two big ones. The complete rebuilding of No. 4 engine at Brest had not been scheduled, but excessive wear was found in the main bearing mounting areas of the block. It was then necessary to wait for delivery of a new block and crankshaft from Belgium before reassembly could begin.

The failure of the lower drive shaft coupling on No. 2 bow thruster necessitated the emergency port call in Cobh and cost about 4 1/2 days in operating time. The exact cause of the failure is still under investigation but it appears that the two sets of gear teeth in the coupling were slightly misaligned vertically and thus not fully engaged. Both sets of teeth were completely stripped out as a result of the failure. This may have resulted from improper installation of the coupling hub on the shaft prior to the installation of the assembly during Leg 51.

COMMUNICATIONS

Communications were difficult during this leg. Except for one contact with Scripps Station WWD, all communications were via U. S. Coast Guard Stations and U. S. Navy Mercast broadcasts. Messages were transmitted from the vessel to U. S. Coast Guard Radio Station NMN, in Portsmouth, VA., for forwarding on government telex lines. A few messages were transmitted to NMR, San Juan, Puerto Rico, when NMN could not be raised. A number of sent messages were lost or garbled, apparently in the U. S. Coast Guard Facility at Long Beach, necessitating retransmission on requests for telex repeats by Long Beach. Working NMN frequently involved long periods of calling before the station could be raised, then delays of up to two hours at times, while NMN was busy during the period from 2300Z to 0100Z receiving observer messages from other vessels. Nightly schedules were arranged but seldom kept by NMN, who explained that there was an acute personnel shortage at the station. Once contacted, the inexperienced radio operators at NMN were often unable to copy code at more than about five words per minute. To further complicate matters, propagation conditions were generally poor due to heavy sunspot and aurora activity.

All received messages were on U. S. Navy Mercast broadcasts, sent blind three times daily, but with no repeats. Messages usually contained numerous errors. On several occasions one (and once, even two) of the three Navy Stations available (AOK, in Rota, Spain; GXH, in Thurso, Scotland; NGR, in Nea Makri, Greece) was off the air. Messages were frequently delayed, sometimes for as much as three days. A few messages were lost and repeats had to be requested causing further delays.

Numerous personal radiotelephone calls to Europe were made through commercial stations in France and England. Fairly regular schedules were also maintained for amateur radio phone patches to the United States. Ironically, personal communications were generally easier than those of an official nature. This was at least partly due to the limited frequency range available for contact with WWD.

WEATHER AND CURRENTS

Leg 80 was fortunate to exprience better-than-expected weather conditions for the location of the operating area. Adverse conditions prevailed for about the first week of on-site operations (Site 548) and for about a week during work at Site 550. During the latter interval it was necessary to abort Hole 550 with a resultant two day hiatus in coring operations. The maximum wind recorded on the voyage was 35 mph during this interruption.

Currents were generally from the west and were weak or absent much of the time. They seemed to increase in the wake of unstable weather, however, and became a factor in positioning on one or two occasions.

Tides are normally so slight as to be insignificant to DSDP operations. During Leg 80, several drilling depth discrepancies provided considerable evidence that a tidal range of at least three meters existed in the operation area. The range and times were in approximate agreement with the tide cycle at nearby points such as Cobh, Ireland, the Scilly Isles and Land's End.

PERSONNEL

The voyage was characterized by damp, chilly weather, but boredom was as scarce as sunshine. The operational tempo slowed somewhat after the first (shallow water) site. A heavy volume of scientific work was then enlivened by major discoveries, fishing jobs, weather delays and even folk concerts. The emergency port call at Cobh, though disastrous to the operating schedule, was a welcome respite for some who were beginning to show signs of "battle fatigue".

The scientific staff was an exceptionally cosmopolitan group who worked harmoniously to produce a prodigious volume of scientific findings. The DSDP technical staff, though inexperienced in some areas, was enthusiastic and soon provided cohesive and competent support. The GMI crew, as always, performed professionally and enthusiastically to support every aspect and objective of the cruise.

During the transit into Southampton, a seaman sustained a broken wrist and facial contusions in a fall down a weatherdeck ladder. Other less serious medical situations during the voyage included a sledgehammer accident that bruised the foot of a DSDP technician and a technician with a suspected kidney stone attack.

Glen N. Foss
Cruise Operations Manager
Deep Sea Drilling Project

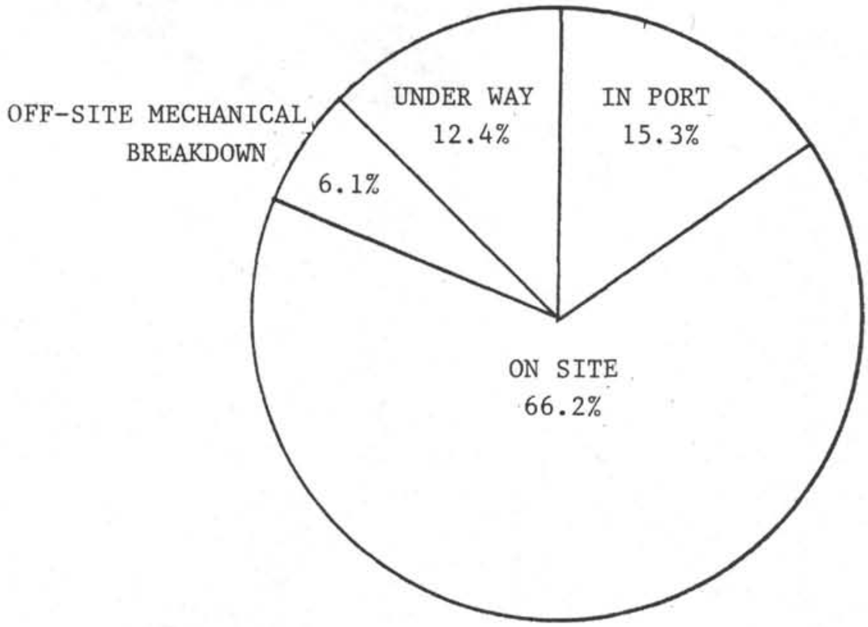
INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
OPERATIONS RESUME
LEG 80

Total Days (May 30, 1981-July 22, 1981)	53.09
Total Days In Port	8.13
Total Days Under Way	6.60
Total Days Off-Site Mechanical Breakdown	3.21
Total Days On-Site	35.15

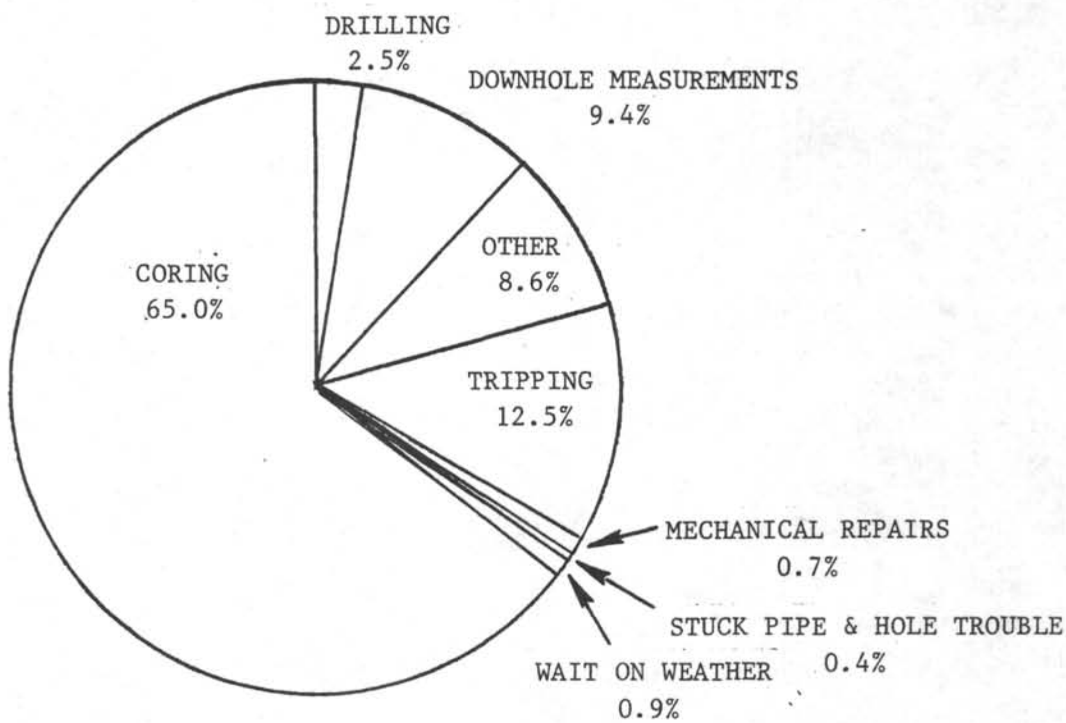
Trip Time	4.4
Drilling Time	0.9
Coring Time	22.9
Downhole Measurements	3.3
Mechanical Downtime	0.3
Hole Trouble & Stuck Pipe	0.1
Weather Downtime	0.3
Other	3.0

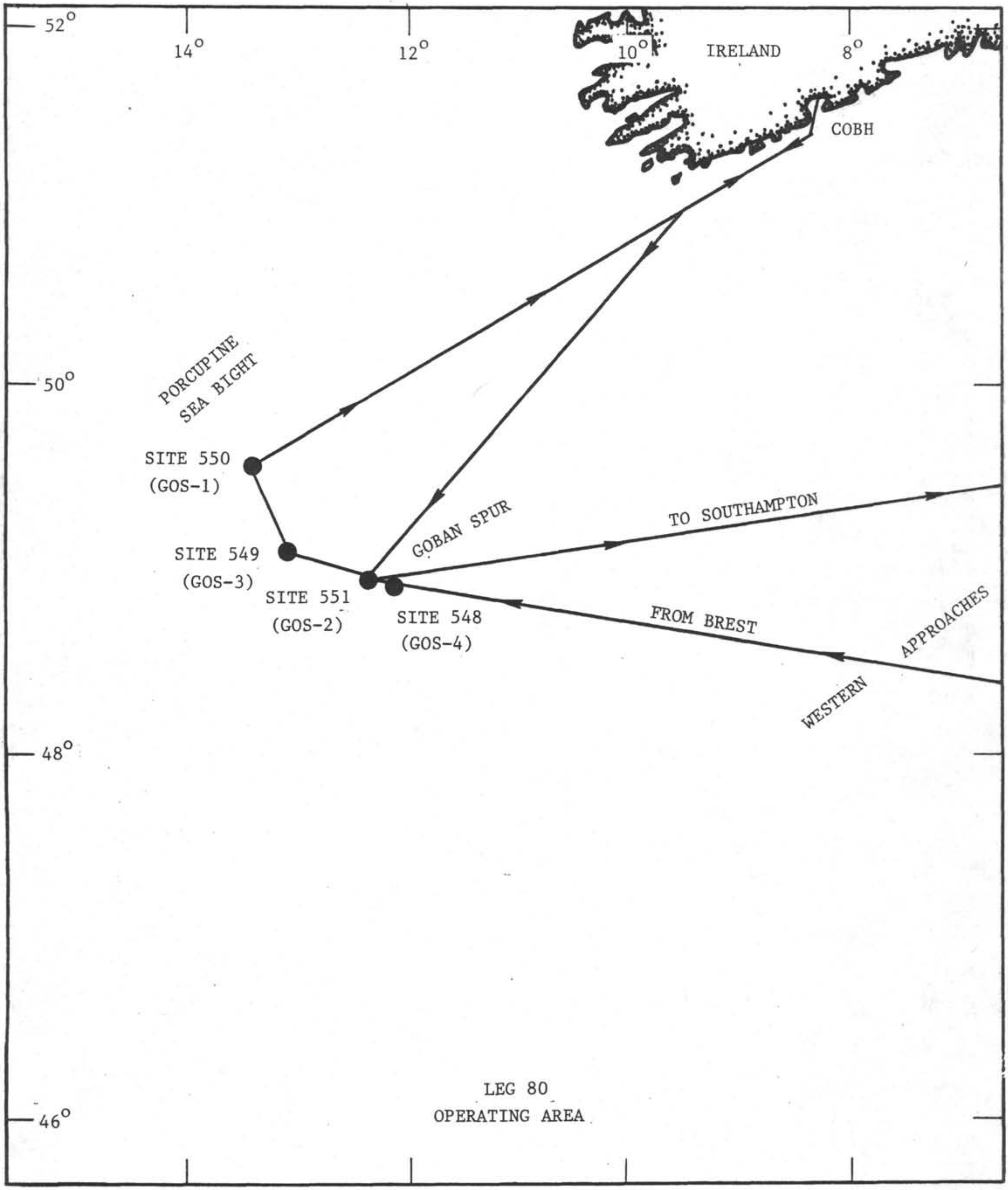
Total Distance Traveled (nautical miles)	1557
Average Speed (knots)	8.6
Sites Investigated	4
Holes Drilled	8
Number of Cores Attempted	306
Number of Cores Recovered	296
Total Meters Cored	2397.5
Total Meters Recovered	1493.0
Per Cent Recovery	62.2
Total Meters Drilled	1115.5
Total Meters of Penetration	3513.0
Maximum Penetration (meters)	1001.5
Minimum Penetration (meters)	95.0
Maximum Water Depth (meters)	4432.0
Minimum Water Depth (meters)	1256.0

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
TOTAL TIME DISTRIBUTION
LEG 80



ON SITE TIME BREAKDOWN
LEG 80




52°
14°
12°
10°
IRELAND
8°
COBH
50°
PORCUPINE SEA BIGHT
SITE 550
(GOS-1)
GOBAN SPUR
TO SOUTHAMPTON
SITE 549
(GOS-3)
SITE 551
(GOS-2)
SITE 548
(GOS-4)
FROM BREST
WESTERN APPROACHES
48°
LEG 80
OPERATING AREA
46°

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
SITE SUMMARY
LEG 80

HOLE	LATITUDE	LONGITUDE	WATER DEPTH METERS	NUMBER OF CORES	CORES WITH RECOVERY	PERCENT OF CORES WITH RECOVERY	METERS CORED	METERS RECOVERED	PERCENT RECOVERED	METERS DRILLED	TOTAL PENET METERS	AVG. RATE PENET	TIME ON HOLE	TIME ON SITE
548	48° 54.95'N	12° 09.84'W	1256	35	35	100.0	211.0	210.9	99.9	0	211.0		45.2	
548A	48° 54.93'N	12° 09.87'W	1256	38	38	100.0	346.0	246.5	71.2	205.5	551.5	42.4	82.9	
			Total	73	73	100.0	557.0	457.4	82.1	205.5	762.5			128.1
549	49° 05.28'N	13° 05.88'W	2533	99	93	93.9	812.5	369.7	45.5	189.0	1001.5	7.9	301.2	
549A	49° 05.29'N	13° 05.89'W	2535.5	42	41	77.6	196.0	144.4	73.7	0	196.0		54.2	
			Total	141	134	95.0	1008.5	514.1	51.0	189.0	1197.5			355.4
550	48° 30.91'N	13° 26.37'W	4432	48	46	95.8	442.5	262.6	59.3	94.0	536.5	36.4	115.3	
550A	48° 30.91'N	13° 26.39'W	4432	0	0	0	0	0	0	95.0	95.0	170.6	19.2	
550B	48° 30.96'N	13° 26.32'W	4432	30	30	100.0	264.5	177.9	67.3	456.0	720.5	14.2	150.3	
			Total	78	76	97.4	707.0	440.5	62.3	645.0	1352.0	34.0		284.8
551	48° 54.64'N	13° 30.09'W	3909	14	13	92.9	125.0	81.0	64.8	76.0	201.0	8.1		75.2
		FINAL TOTALS		306	296	96.7	2397.5	1493.0	62.2	1115.5	3513.0			843.5

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
BIT SUMMARY
LEG 80

HOLE	MFG	SIZE	TYPE	SERIAL NUMBER	METERS CORED	METERS DRILLED	METERS TOTAL PENET	HOURS ON BIT	CONDITION	REMARKS
548	MSDS	11	HPC	AMY	111.0	0	111.0		Good	HPC only.
548A	Smith	9 7/8	F94CK	AE3402	346.0	205.0	551.5	13.0	unknown-released for logging	No signs of failure.
549	MSDS	9 7/8	Hughes Cutter	H-2	812.5	189.0	1001.5	126.3	unknown-released for logging.	Reduced core diameter for last 50 rot. hrs. Rop & recovery abnormally low.
549A	MSDS	11	HPC	AMY	196.0	0	196.0		Good	HPC only.
550	MSDS	9 7/8	F93CK	S-22	442.5	94.0	536.5	16.4	TO-B1SE-I	1.7 hrs; 211.5 m previously
550A	MSDS	9 7/8	F93CK	S-22	0	95.0	95.0	17.0	----	Pulled only to seafloor.
550B	MSDS	9 7/8	F03CK	S-22	264.5	456.0	720.5	67.1	unknown	Released for logging. Core diameter 2 1/8" at T.D.
551	Smith	9 7/8	F93CK	646-KR	125.9	76.0	201.0	24.9	TO-B5-I	30.7 hrs; 1301 m previously.

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
BEACON SUMMARY
LEG 80

SITE NO.	MAKE	FREQ.	SERIAL	SITE TIME	
548	ORE	16.0	523	45.2	single-life
548A	ORE	16.0	523	82.9	strong for duration
			Total	128.1	good beacon
549	ORE	13.5	544		dropped in wrong place-no hole drilled
549	ORE	16.0	524	301.2	single life
549A	ORE	16.0	525	54.2	signal dropped significantly after 13 days
			Total	355.4	good beacon
550	ORE	13.5	546	115.3	single-life
550A	ORE	13.5	546	19.2	
550B	ORE	13.5	546	150.3	strong for duration
			Total	284.5	good beacon
551	ORE	16.0	525	75.2	single-life - good beacon

DEEP SEA DRILLING PROJECT
LOGGING SUMMARY
LEG 80

HOLE	TOTAL DEPTH (M)	WATER DEPTH (M)	OPEN ENDED PIPE AT (M)	FLUID IN HOLE	BIT SIZE	TOTAL TIME FOR LOGGING (HOURS)	RUN NO.	LOGS RECORDED	FROM (M)	TO (M)	OBSERVATIONS
548	1467	1256									No logs requested--HPC hole
548A	1807.5	1256	1429	sea water	9 7/8	3.2	1	SLS-DIT-GR CAL	1788	1428.5	Good logs-sonic velocities seem high wave form & variable density
											presentations included.
548A	1807.5	1256	1429	sea water	9 7/8	2.5	1	FGT-CNL-GR	1783.5	1428.0	Caliper shifted 1" too big, otherwise good log. GR & CNL logged to above
											seafloor.
						6.2					Release bit, flush hole, rig up, troubleshoot, rig down.
						11.9					
549	3534.5	2533	2642	gel mud	9 7/8	4.5	1	SLS-DIT-GR CAL	3532	2642	sonic poor-inadequate centralization GR logged to above seafloor
						5.4					
						15.5					
						25.4					
549A	2731.5	2535.5									No logs requested-HPC hole
550	4968.5	4432									Hole aborted by weather-unable to log
550A	4527.0	4432									Struck boulder at 95 M-no logs
550B	5152.5	4432	4523	sea water	9 7/8	6.4	1	SLS-GR CAL	5123	4523	Caliper shifted;GR run to 4518 m.
550B	5152.5	4432	4523	sea water	9 7/8	5.2	1	DLT-GR	5123	4523	Good log.
550B	5152.5	5532	4551	sea water	9 7/8	5.7	1	FGT=CNL	5123.5	4551	Caliper dead;GR run to 4528 m
						2.3					Release bit;rig up and down
						19.6					
551	4110.0	3909									No logs requested. Shallow penetration and time limitation.

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
OPERATIONS RESUME
LEG 81

During Leg 81, a transect of eight holes on four sites were drilled across the southwest margin of the Rockall Plateau microcontinent. This coring program was designed to document the history of rifting and subsidence and to examine the effects of changing climate and ocean circulation on the Tertiary sediments of the margin.

All four sites were cored into basement. Piston coring was conducted on two of the sites and a highly successful logging program was completed on two sites.

The voyage commenced on July 27, 1981, at Southampton, England and terminated on September 16, 1981, at Ponta Delgada, Azores. Total length of the leg was 55.88 days; of which 33.83 days were spent on site; 5.10 days in a scheduled port call and 16.95 days in transit. 3.26 days were spent waiting on weather.

SOUTHAMPTON PORT CALL

Leg 81 began officially when the first mooring line came ashore at 1018 hours, July 22, 1981, at berth 104 in Southampton Harbor, England.

The main maintenance item scheduled for port call was the overhaul of #1 engine. In addition, representatives of Schottel replaced the shaft and spacers on both bow thrusters.

The normal amount of freight was loaded and unloaded. In addition, both gel and barite storage facilities were filled to capacity. While this material was loaded, 324,471 gallons of fuel was pumped aboard.

When the last critical freight item had been received, clearance from the port authorities was requested and granted. Port call was then officially completed when the GLOMAR CHALLENGER departed her berth at 1236 hours, July 27.

SOUTHAMPTON TO SITE 552

After departing from the dock, and while the pilot was still on board, the ship was stopped and the compass was checked by swinging the ship. A representative of the company that had removed the compass, while in port, and serviced it was aboard and supervised this operation. After this check was completed, a test was made of ship's propulsion equipment. The ship then continued to the pilot station where the pilot disembarked and the ship continued toward its initial location. After traveling for over four days and about 950 miles, a positioning beacon was dropped at 1908 hours, July 31, to begin operations at Site 552.

SITE 552

After the seismic gear had been retrieved, the ship was positioned in the automatic mode over the acoustic beacon, and the BHA (bottomhole assembly) was assembled. The drill string was then made up and measured as it was run to begin drilling operations.

The PDR had indicated the ocean floor to be at 2301 meters, but after recovering one water core the mudline was established at 2315.0 meters when the site was spudded at 0439 hours on August 1, 1981. Since a Hydraulic Piston Corer (HPC) program was planned for this hole, it was washed from 2318.5 to 2366.0 m. A 9.5 m core was then cut and recovered and then the first heat flow measurement was made. The hole was then washed from 2375.5 to 2423.0 m, another 9.5 m core was taken and again this was followed by the second heat flow measurement. Three more 9.5 m cores were taken and then the third heat flow measurement. Following the completion of the last test continuous coring began and continued to 314.0 meters subbottom.

The upper 184 m of the hole consisted of oozes and chalks with some chert layers; recovery in this section was about 50%. The next 100 meters (184-284 m) was early Eocene calcareous tuffs and the recovery decreased to about 27%. This was probably due to soft material that was washed away due to the pump pressure that was necessary to prevent the bit from being plugged with harder interbedded material. Basalt was unexpectedly encountered at about 284 m and continued to about 304 m. While the last two cores were being taken (2613-2629 m), the weather began to deteriorate and positioning of the ship became more difficult with excursions of 200 feet or more. Finally at 0648 hours, August 3, the decision was made to discontinue drilling and retrieve the drill string while waiting for weather conditions to improve.

The hole was then officially abandoned when the bit reached the derrick floor at 1618 hours, August 3.

HOLE 552A

After waiting 16.5 hours, weather conditions had improved enough that the ship could be positioned effectively, and at 0848 hours, August 4, the make up of a new BHA for use with the new VL/HPC coring equipment was started.

The drill string was made up and run in to 2309.5 m which would allow a four meter core to be obtained as a mudline core. However, when the HPC assembly was lowered and seated, the system could not be pressured up. The tool was then picked up and reseated twice but neither time could it be pressured. It was then pulled to the derrick floor and when recovered, the tool was found to be scoped out. The shear pins were replaced and the tool was lowered to bottom again. When the tool was pressured it would not build up so the tool was pulled again. When it was recovered, it was found that the pins had not sheared. When the tool reached bottom again three attempts to pressure up were made but none succeeded and when the tool was pulled it was not recovered because the shear pin in the overshot had been sheared. These were replaced and when the overshot was lowered and latched to the core barrel, the pins sheared once again. The tool was pulled, the shear pins replaced, and the overshot was lowered again. This time the core barrel was latched onto and recovered. When it was brought to the derrick floor it was found to scoped out again but also the core barrel had failed just above the box on the outer body link and the piston rod was bent. The bent piston rod had prevented the failed core barrel from falling off and blocking the drill pipe. At about this time it was discovered that the collet head sub had been made up in the BHA instead of the HPC seal sub and this accounted for the inability to seat the HPC tool. As a last attempt before pulling the pipe, a collet was lowered to see if it could be engaged in the collet head sub. However, this was unsuccessful and the pipe was then pulled.

A round trip was made to exchange the collet head sub for the HPC seal sub. In addition the 9.5 meter HPC barrel was replaced by the 5.0 meter tool because the longer tool required a considerable amount of time to rebuild.

The pipe was lowered to 2313 m because the mudline was found at 2315 m in the original Hole 553. The tool was seated at this depth and then pressured to 1500 lbs. and the pins were sheared. However, when recovered, the core barrel was full and this indicated a shallower water depth. The pipe was raised to 2310 m and the tool lowered again. After a successful pressuring was done the core barrel was recovered and established the mudline at 2311 m and an official spudding of this hole at 1248 hours, August 5. The hole was then continuously cored to a total depth of 2494.5 m or 183.5 m BSF.

No problems developed other than the shear pin failure in the overshot before cores Nos. 25 and 28 could be recovered. The core recovery was very good, with an average of 99.7%. The coring was stopped when it was felt that sufficient scientific data had been obtained and then the hole was officially abandoned at 1000 hours, August 7, when the bit reached the derrick floor.

SITE 553

Site 553 was located five miles west-northwest of Site 552. Because of this short distance the profiling gear was not deployed and Loren C was used to navigate to the desired location. After traveling at five knots for 1.3 hours, the positioning beacon was dropped at 1205 hours, August 7. While the ship was being positioned, the beacon suddenly lost a distinct signal that the ship could be positioned on and a new beacon of the alternate frequency was dropped at 1316 hours. At 1348 hours, the ship was in its final position and make up of the drill string began. The drill string was run in to 2319.5 m and after waiting for approximately 20 minutes for the weather to improve, it was decided to attempt a mudline core in spite of 40 mph winds. The Precision Depth Recorder (PDR) had indicated a water depth of 2329 m, but two water cores were recovered before the third core established the mudline at 2339 m.

After the mudline had been determined, it appeared that positioning the ship would be possible for a washing in operation to determine the amount of casing that could be used with the re-entry cone that was to be deployed at this site. The drill string was then washed into 2398.5 m which indicated that 59.5 m of casing would be attached to the cone and washed in. While the washing in operation was done, drill pipe motion measurements were also taken with special instruments located in a joint of pipe at the top of the drill string and one located in the top of the inner core barrel.

After the washing in operation was completed, the drill string was pulled and the hole officially ended when the bit reached the derrick floor at 1007 hours, August 8.

HOLE 553A

Assembly of the re-entry cone commenced on August 8, 1981. When all preparations for keelhauling were complete, the sea conditions were not favorable. Nine hours later conditions had improved and keelhauling operations began. During the process of deploying the re-entry cone one crossbar, which holds the hang off cables, broke. Four incredible hours later the rig crew managed to get the cone back aboard the vessel and repairs were initiated. Again it was necessary to wait on weather, this time 16.5 hours while another storm front moved past the drill site. At 0630 hours on August 10, 1981, the keelhauling procedure was begun for the second time. By the following morning at 0100 hours, the cone had been landed, released, and the first core was on deck.

Since the site was to be piston cored at the conclusion of the rotary drilling, there was some washing alternating with heat flow measurements in the upper layers. Continuous coring began with core No. 4 at 179.5 m BSF. Coring continued without incident and basement was reached in core No. 38 at 504 m BSF.

Some torquing of the drill string began occurring with core No. 40 and 20 barrels of guar gum were spotted. This continued until the pipe became stuck while pulling core No. 43. After working pipe free, 40 barrels of gel were circulated downhole followed by 20 barrels of guar gum. The pipe was then pulled for a bit change.

After running back in the hole, the re-entry tools were rigged. The scanning sonar was found to be incorrectly functioning. After troubleshooting the tool, a bad cablehead was found. The logging cable was reheaded and the tool was run downhole. A good picture of the cone was immediately picked up at a range of 40 feet. Within 1 1/2 hours, the cone was stabbed. After rigging down the re-entry gear, the pipe was run to bottom. The heave compensator and Bowen power sub were picked up and coring was resumed. Core No. 44 was on deck at 1919 hours, August 14, 1981.

After cutting only three cores, the vessel was notified of a medical emergency. The wife of the Cruise Operations Manager was seriously ill and his presence was requested as soon as possible.

The rig crew immediately began to pull out of the hole and the ship was underway for Limerick, Ireland by 0930 hours on August 15, 1981.

SITE 553A TO LIMERICK AND RETURN TO SITE 553A

On August 16, 1981 at 1515 hours, the vessel arrived just off Loophead at the mouth of the Shannon River. There she was met by the tug "SEANAID" and the personnel transfer took place. The Cruise Operations Manager and the GMI third mate, who had a undiagnosed intestinal ailment, were debarked. A replacement Cruise Operations Manager embarked and the vessel was underway back to Site 553A at 1528 hours.

Bucking strong 40 knot headwinds and steadily rising (16 foot) seas, the vessel's speed rapidly dropped from 8 knots to 4.5 knots. The weather showed little improvement upon arrival at the site on August 20, 1981.

SITE 553A (Continued)

The beacon at Site 553A was readily picked up upon arrival. The seas and winds were beginning to diminish and it was only one hour after arrival at the site that the vessel was positioning in automatic. At 2155 hours on August 20, 1981, the bottomhole assembly was begun to be made up. This assembly was modified somewhat from that utilized earlier on this site. The stabilizers used to space out the VL/HPC were replaced with two sets of head and top subs. This was due to the hole cleaning difficulities experienced during earlier drilling of the site. A collet head sub was utilized to allow VL/HPC operations after logging without having to trip the drill pipe all the way to the vessel. A profile sub was run directly above the Hydraulic Bit Release (HBR) to provide a landing shoulder for the EDO re-entry tool. This would then allow the drill bit to be dropped off at the mudline rather than in the hole. A new F94CK core bit was used as 150 meters of additional basalt penetration was anticipated.

The pipe was run to bottom and at 0255 hours on August 20, preparations were begun to run in the EDO scanning sonar. At 0545 hours and immediately upon initiation, the scanning sonar picked up the re-entry cone at an approximate range of 100 feet. After maneuvering the vessel for approximately one hour, the pipe appeared to traverse directly over the re-entry cone and a stab was made. After retrieving the sonar tool an attempt to verify re-entry by running two joints of drill pipe was unsuccessful. The sheaves and circulating head were rigged and the sonar tool was once again run in the hole.

Scanning began for the second time at 0954 hours. The cone was again spotted immediately, this time at a range of 25-30 feet. There was some confusion, however, because there appeared to be many (4-6) reflectors--only two strong targets could be found. The pattern was quite different from the first attempt. All indications were that one reflector had been either knocked off or damaged during the initial re-entry attempt. A second stab was made at 1048 hours, but once again, at 1200 hours, verification of re-entry was negative. A third attempt at 1438 hours was verified successfully and preparations to run in the hole were begun.

The drill bit was washed to bottom and at 2200 hours, the cutting of core No. 47 at 2919.5 m was initiated. Since it was anticipated that penetration rates would be slow, the "knobby" heavy wall drill pipe was in use.

Coring proceeded with little or no problems through core No. 57. This brought the total depth of the hole to 3007.5 m or 668.5 BSF. Twenty barrels of guar gum was spotted between cores to enhance the removal of the drill cuttings. The drill string instrumentation suite (IDSS, DBMI, and SMDS) was run successfully during core No. 51.

Upon retrieval of core No. 57, it was necessary to lay down the 10 "knobby" drill pipe sections. Core No. 58 would then have to be cut 4.5 m to even up the differences in the connected length of the knobby joints and the 5" drill pipe.

After laying down the knobby joints and washing back to bottom, it became apparent that the pipe was plugged. Unable to circulate, the modus operandi was to systematically work the pipe up, down, rotate and pressure up. Thirty five minutes later circulation was regained and a wash barrel, full of fine grained basalt cuttings, was pulled.

The 4.5 m core No. 58 was then cut without incident. The "instrumentation suite" was again run on core No. 59.

At the conclusion of cutting core No. 59, the driller noticed a loss in pump pressure. Retrieving the barrel was extemely difficult requiring a pull of 11,000 lbs. before it came free and when the drill pipe connection on the rig floor was broken, the pipe was back flowing. When the driller set the drill pipe back on bottom, his pump pressure returned. All indications were that the HBR had prematurely released in the hole. Apparently the debris had packed off around the core barrel between the circulating ports of the HBR liner. The subsequent working of the pipe produced enough pressure through the lower set of ports to shift the sleeve releasing the dogs.

Alternatives were discussed as to the possibility of fishing the lost tools out of the hole. Finally, it was decided to flush the hole with mud, 50 barrels of gel followed by 40 barrels of guar gum; then fill it with mud and log. Seventy five barrels of gel were displaced in the hole and the pipe was tripped to 2822 m in preparation for logging. It was at this time, while setting back a single in the mousehole, that the pipe jumped out of the slips and one joint of 5" drill pipe was lost.

Three joints of heavy wall drill pipe were put in the string and the logging sheaves were rigged. The first suite of logging tools, consisting of sonic, dual induction, and gamma ray were run in the hole. The hole condition was excellent; no bridges were encountered in the open hole and the tools went all the way to bottom.

The second suite of logs consisted of sonic, gamma ray, and dual induction. Sonic was run a second time without centralizers. It was felt this was contributing to the noise level in the basalt section of the hole.

The third suite of logs consisted of density, gamma ray, and neutron. The density tool was not functioning correctly so the tools were pulled out of the hole. After changing the cablehead, the density tool was still not operating correctly so it was abandoned.

The next run included the sonic tool and gamma ray. Since noise still appeared to be a problem, new pads were run on the centralizers. The repeatability of the sonic records indicated that the so called "noise" in the record was most likely an artifact of the formation.

A temperature log and a gamma ray, neutron log were run while an attempt was made to repair the malfunctioning density tool.

One last try with the density tool, along with gamma ray and neutron proved to be successful. This completed a highly successful logging program. The hole conditions remained excellent with no apparent bridging. Approximately 22.9 m of fill was in the hole when it was abandoned at 1230 hours on August 25, 1981. After rigging down the logging sheaves, the three joints of knobby drill pipe were layed down. The mudline was cleared at 1330 hours.

The Bowen sub and torque arms were then picked up and preparations were made to run in and land the collet assembly for piston coring operations.

The collet assembly was emplaced and the running tool removed. Indications were the collet was installed normally.

After making up the orienting sinker bar assembly, the 9.5 m piston coring tool was picked up and run in the hole. After pressuring up and firing off the VL/HPC for core No. 1, it was difficult to unseat the tool. Upon retrieval it was found that the tool had not scoped out. Proper actuation for the tool on deck was checked and it was then run in the hole for a second time. This time the tool did not seem to be seated properly. It did not pressure up normally and at 2000 psi pressure it was questionable if it had sheared. Upon attempting to retrieve the tool, it was found to be stuck. While attempting to unseat the tool, the sandline parted approximately 250 feet above the rope socket. The drill string was then tripped back to the rig floor. Approximately 3500 feet of sandline was damaged and had to be cut off.

Upon reaching the surface the collet was found jammed in the collet head sub two inches from its landing shoulder. Two deep gouges on the I.D. of the collet spacer ring had stopped the collet from seating properly and therefore prevented proper sealing. In addition, it was found that the VL/HPC top sub O.D. was .002 thousandths larger than the collet I.D., i.e a jam fit. The tolerance problem and the inability of the collet fingers to engage their profile properly is what caused the VL/HPC to jam. The bit was on deck at 0030 hours, August 26, 1981, ending Hole 553A.

SITE 553B

It was decided to replace the collet head sub in the BHA with a standard head sub and seal sleeve for VL/HPC operations. The pipe was tripped back to bottom and a mudline piston core was attempted. When retrieved, the tool was found to have broken in half leaving the lower section on bottom. The arms of the quick release cap sub had broken completely off. It was discovered at this point that this particular component had been substantially heated and welded upon to straighten and repair it prior to its use.

The second tool was run in the hole and it obtained full recovery. Since the mudline could not be determined, a second core was attempted one joint of drill pipe higher. This time zero recovery was obtained. A third attempt was made with the drill pipe five meters lower and Hole 553B was officially spudded at 1035 hours on August 26, 1981.

Piston coring continued normally until core No. 5 was attempted. The pressure went up to 2000 psi and still no definitive shearing was detected. After bleeding off the pressure it was found that the barrel could not be unseated. The shear pin on the overshot sheared and the orienting sinker bar assembly was retreived. A set of jars and additional sinker bars were added in an attempt to recover the stuck barrel. After shearing the overshot shear pin two additional times, the effort was abandoned and the drill pipe was pulled out of the hole.

Upon reaching the surface the VL/HPC was found securely wedged in the top connector of the HBR. It could not be dislodged with 10,000 lbs. of pull at the rig floor. The tool did not appear to be scoped at all. Since the seas were building and the weather was rapidly deteriorating, it was decided to torch cut the inner core barrel just above the top connector. When the pipe was severed it immediately fell out of the top connector and went through the rotary table to the seafloor. The tool then scoped out fully and apparently on impact broke the swivel body. A sling on the lower section of the tool is all that kept this portion from dropping through the rotary table. There was no evidence of where or how the barrel became lodged in the top connector.

The rig floor was secured, a beacon soaked, and the vessel departed at 0134 hours on August 27, 1981 for Site 554.

HOLE 554

Cruising to Site 554 was short and to the point. The beacon, a 13.5 kHz single life was dropped at 0514 hours that same day. After returning to the beacon and positioning the ship, it was agreed that the sea state and resultant vessel motion prohibited running pipe and 4.8 hours were spent waiting on weather. At 1118 on August 27, work began on making up the BHA. Hole 554 was spudded at 2137 hours and continuous coring began. Eight cores later the weather had again deteriorated to the point that coring had to be discontinued. The pipe was pulled clear of the mudline at 0748 hours on August 28, 1981 ending Hole 554.

HOLE 554A

After clearing the mudline, three joints of heavy wall pipe were put in the string through the horn of the vessel and 4.3 hours were then spent waiting on weather. By 1203 hours the seas and winds had again subsided, the three joints of heavy wall pipe were layed down and Hole 554A was spudded at 1238 hours. The hole was then washed 76 meters to the termination depth of Hole 554 and continuous coring began. Successful heat flow measurements were taken after core No. 1 (85.5 m BSF) and No. 4 (114.0 m BSF).

Coring continued without incident until 0600 hours on August 29, 1981 when, after retrieving core No. 9 at 2745.5 m, the drill pipe became stuck. After working the pipe free, 75 barrels of gel mud were circulated downhole. Sticking problems continued to plague the next four cores. Even though 20 barrels of guar gum was circulated between each core, the pipe would stick each time the pumps were shut down. Recovery was very poor and it was evident that we were drilling through a very bad "rubble" area. The brecciated conglomerate material was loosely cemented. The angular fragments were not being cleared out of the hole and would consequently fall back in when the circulation was shut down for core retrieval. The pipe was badly stuck after core No. 13. This time, after working the pipe free, 75 barrels of gel were circulated downhole followed by 20 barrels of guar gum and another 50 barrels of gel.

Hole conditions seemed to improve temporarily with the cutting core No. 14. However, this was short lived as upon retrieving core No. 14, the pipe was once again stuck. This time it was 40 minutes before the pipe became free. At this point the decision was made to abandon the Hole at 2793 m total depth or 209 m BSF.

The drill pipe was pulled to 2695 m. The heave compensator and Bowen power sub were set back and the trip out of the hole commenced.

While drilling this hole, the already badly bent, guide rail on the heave compensator sustained further damage and became partially detached. The rig crew did a fine job of fabricating a new guide and installing it while underway to Site 555.

At 0051 hours on August 30, 1981, the bit was at the rig floor. The rig floor was then secured and a beacon soaked. At 0127 hours the vessel got underway for Site 555.

UNDERWAY TO SITE 555

The transit east to Site 555 was without incident. The Hydraulic Bit Release (HBR) run on Hole 554A was disassembled and checked for damage. For the abuse it had sustained downhole the unit was in fine shape. All O-rings were good and there was no foreign material anywhere in evidence in the tool. This unit was redressed, assembled and prepared for use on the next site. At 1704 hours on August 30, 1981, the 16 kHz single life beacon was dropped initiating Site 555.

SITE 555

By 1830 hours on August 30, 1981, the ship was positioning in automatic and the BHA was begun to be made up. The trip in the hole was uneventful and went relatively quickly due to the shallow (1669 m) water depth. After picking up the Bowen sub it was discovered that the maximum pump pressure that could be obtained was 150 psi at 50 strokes. The pumps were both checked as this seemed to indicate that the pipe was open ended. The pipe was pulled out of the hole and it was found that the hydraulic bit release had shifted releasing the core bit from the drill pipe.

A new bit and mechanical release assembly was quickly picked up and the BHA was again ready to run in the hole. At approximately 1000 hours the driller thought he lost weight while running a drill pipe stand at 1652 m. At first it was thought that perhaps an error had been made in reading the PDR. Three stands were pulled and a quick check indicated the PDR water depth of 1671 m was correct. For some unexplained reason the bumper subs had started working. It was decided to carefully begin running pipe again watching for some indication that the seafloor had been reached. No such indication was forthcoming and the trip was completed. At 1325 hours on August 31, 1981, Hole 555 was spudded.

An after the fact analysis of the situation indicated that the core barrel may not have been latched down. In that case it would tend to become unseated allowing the float valve flapper to close. Air would then be trapped in the pipe leading to a floating of the BHA. This phenomenon has been known in the past to cause a "working" of the bumper subs.

Successful heat flow measurements were conducted after cores No. 7, 9, 12, 17, and 22. The last measurement occurring some 243 m below the seafloor.

Continuous coring was conducted on this site with the exception of two washed intervals. These being from 1741 m to 1760 m and 1779 m to 1798 m.

The first contact with hard rock, a sandy mudstone, occurred in core No. 35 at 366.5 m BSF. Basalt was finally observed in core No. 68 at 680 m BSF. It was soon discovered that this was not basement as the coring eventually went back into sediments. This interbedding occurred continually until core No. 95 at 933 m BSF when it was felt that basement was finally reached.

Coring was eventually terminated at a total depth of 2633 m (964 m BSF) after 98 cores had been recovered.

At 0515 hours on September 7, 1981, the hole was flushed with 50 barrels of gel mud. The bit was released with the mechanical shifting tool at 0730 hours and preparations for logging began. The hole was filled with 215 barrels of gel mud, the heave compensator and Bowen sub were set back and the drill pipe was pulled to the logging point of 1869 m. No wiper run was made since the hole had been surprisingly free of sticking and torquing problems.

The logging sheaves were rigged and the sonic/gamma ray tool was run in the hole at 1225 hours. The tool was not functioning properly and was pulled back out almost immediately. At 1305 hours the tool was run back in the hole and encountered an inpenetrable bridge at 2345.0 m. The hole was logged from that point and the tool was back on deck by 1600 hours.

By this time the weather had deteriorated significantly with swells building and winds gusting to 40 knots. The vessel was positioning erratically and it was felt too risky to run the logging line downhole at this time. Waiting on weather was commenced at 1610 hours, September 7, 1981.

By 0930 hours the following morning the sea conditions had improved and the winds had dropped to their customary 20+ knots. The vessel had taken one excursion approaching 500 feet (most were 200 ±feet), off the hole during the night so there were some anxious moments as attempts were made to check the integrity of the hole and the drill string.

Very soon it became apparent that there was a problem downhole. The driller was unable to run pipe without losing string weight and the bumper subs working.

The hole was possibly bridged over. A core barrel was run in the hole to check the condition of the string. All was intact. Next two stands of drill pipe were pulled and then run back in again. Weight was lost at the same point. It was then decided to rig down the logging sheaves, pick up the Bowen sub and attempt to wash and/or rotate back to the original hole to total depth. After circulating and rotating one joint the pipe was free. Two more joints were run without circulating or rotating until a second bridge was encountered. A total of eight hours were spent cleaning the hole back to bottom encountering numerous bridges along the way. One hundred barrels of gel were circulated to flush the hole, the Bowen sub was again set back and at 2330 hours the pipe was pulled to the first logging point of 2382.0 m directly below the bridge encountered on the previous day. The intent was to run each of three logs at that point, moving the pipe one stand up each time to allow logging nearly through the bad interval to 2355 m. The upper part of the hole was then to be logged without having to worry about the lower section again bridging.

Severe back flow problems had been experienced throughout the duration of this hole including, during coring operations. The back flow at this point was aggravated even more, perhaps by the short drill string and sea state or possibly a slightly over displaced spit of mud. At any rate the logging effort was severely hampered by a continuous fountain on the rig floor. Eventually the "well" was brought under control, and a few minor tool problems were corrected. At 0330 hours on September 9, 1981, the sonic/gamma ray log was again run downhole. This time the interval logged was from 2255 m to 2596 m.

Time was now of the essence. Perhaps only two or three more logging runs could be made before starting out of the hole. It was decided to pull the pipe up to 1928 m for the remaining runs and gamble that the hole would stay open. The CNL-FDC/gamma ray/caliper log was run to 2576 m and the resistivity/gamma ray log was run to 2556 m. An additional sonic log was run to complete the logging program. The logging sheaves were rigged down and preparations made to pull out of the hole. At 1930 hours, a gusset holding the pipe stabber cylinder broke and operations had to be halted. An unexpected storm had come up from the south and the weather began to deteriorate significantly. It was at this point that the decision was made to defer all magnafluxing, pull out of the hole and get underway as quickly as possible. The inspection work to be done later on in the transit with calmer seas. By the time the bit disconnect was on deck at 2245 hours, the winds were gusting to nearly 60 mph. The vessel was underway for Ponta Delgada at 2300 hours on September 9, 1981.

UNDERWAY TO PONTA DELGADA

Save for the weather, the trip to Ponta Delgada was uneventful. Upon departing Site 555, the weather continued to deteriorate. Three successive storm fronts were encountered enroute, all of which did their best to reduce our speed of advance. It was not until the afternoon of September 14 that our speed made good actually broke 8.9 knots. At one point in transit, the vessel was bucking 45 knot head winds and was only making forward progress at the rate of 4.3 knots.

Due to the weather encountered, the ETA of the vessel was significantly delayed until very early on the morning of the 16th. To maximize the amount of available time for the following leg, it was decided to "heave to" temporarily and complete the previously delayed magnaflux program. This was also a good opportunity to dispose of the short sandline (10,000-11,000 ft.) on the coring reel. It was anticipated that the temporary stop would still allow for an 0600 arrival the morning of September 16, 1981.

The first line on the dock at Ponta Delgada occurred at 0523 hours on September 16, 1981, ending Leg 81.

DRILLING AND CORING EQUIPMENT

Several different bottomhole assembly configurations were used during the leg. In most cases variable length piston coring (VL/HPC) was desired after the rotary drilling was completed. This generally required the use of the collet head sub, bit release and stabilizers. Since the stabilizers were suspected of contributing to hole cleaning problems in the basalt drilling, they were replaced with head sub/top sub combinations.

The typical BHA used during Leg 81 consisted of the drill bit, bit release (both hydraulic and mechanical were used), profile sub, outer core barrel, top sub, latch head sub, top sub, head sub, one 8 1/4 drill collar, top sub, collet head sub, Monel drill collar, two 8 1/4 drill collars, one bumper sub, three 8 1/4 drill collars, two bumper subs, two 8 1/4 drill collars, crossover sub and one 7 1/4 drill collar.

This BHA was modified somewhat on Site 555 to allow for running the 5.0 m VL/HPC configuration after rotary coring. This BHA consisted of the drill bit, bit release, head sub, outer core barrel, top sub, three head subs, with a latch sleeve installed in the lowermost, top sub, collet head sub, Monel drill collar, etc. This assembly proved to be quite satisfactory and would have allowed 5.0 m VL/HPC operations without requiring spacer barrels, however, piston coring at this site was eventually cancelled.

The most noteworthy disadvantaged of the VL/HPC system rests with the difficult and awkward handling of the Kuster single shot orientation package. In rough weather, it is nearly impossible to insert the package unscathed into its sinker bar mounted pressure case even with the jars removed from the sinker bar assembly. It is also felt that the practice of leaving out the wireline jars is very bad and should be discontinued immediately.

The hydraulic bit release continues to be a mystery. During Leg 81, it seemed to have developed a "hair trigger" dropped off once during a drill string trip and another time while coring ahead. One unit was pulled from the hole after particularly rigorous drilling and was found to be in perfect condition with absolutely no foreign material in evidence. No attempt was made to release this unit downhole on this occasion.

CORE BITS

F93CK and F94CK core bits were both used successfully this leg. Those models fabricated at the Marine Science and Development Shop performed admirably. The F93 bit used on Site 555 was still going strong after 58.8 hours of rotating time and some 275 m of interbedded basalt/sediment drilling. The last 31 m of penetration was in a very hard massive basalt and yet the penetration rate averaged 3.02 m/hr. The core size ranged from 5.5-5.6 cm and the recovery was a phenomenal 84.7%.

LOGGING

Logging on Leg 81 was conducted on Hole 553A and Hole 555. Both efforts were highly successful. All logs were of very good quality. A total of 547 m were logged on Hole 553A; 727 m were logged on Hole 555. Some difficulties were experienced with the MCD caliper arms. The arms had all of the rubber padding worn away and it was felt that the rubbing of the pads against the basalt was contributing to a high noise level during the sonic logs. New arms were installed and were modified to fit through a collet head sub (3.875 I.D.). The modifications consisted of removing all of the rubber "backing" from the inside of the arms allowing them to contract further before contracting the spring assembly. This was quite successful and retained the maximum amount of O.D. padding for use downhole.

Another significant problem was experienced on Hole 555. The hole was backflowing considerably. This in addition to excessive vessel motion throughout logging made it very difficult to make up sections of the tools in the hole. As a last resort the tools used on Hole 555 were made up in the mousehole then transferred to the drill pipe. The problems experienced were not operationally insurmountable but the length of the tools was a definite disadvantage. All in all the logging program has taken a significant step forward.

DYNAMIC POSITIONING

The performance of the dynamic positioning system on this trip was exceptional. The system was consistantly being tested under adverse weather conditions. It performed admirably and with a high degree of reliability.

Both 13.5 kHz and 16.0 kHz positioning beacons were used as well as single and double life models in both frequencies.

One failure occurred. That was a 13.5 kHz double life beacon used on Site 553. This particular beacon started omitting a second pulse which confused the positioning computer. A second beacon had to be dropped at this site.

ENGINEERING

No significant malfunctions of equipment were experienced. Principle effort was expended on routine maintenance, preventive maintenance, and minor equipment repair.

A significant effort was put forth by the Global Marine electrician, oiler/machinist, First Assistant and Chief Engineer in the installation and outfitting of CNEXO van.

Saltwater supply and discharge lines were run to/from the van. A 125 psi air line was installed. Mountings were fabricated and installed for the fresh water cooling machine and the fresh water circulating pump. The cooler and pump were installed along with the necessary piping and tubing required to complete the system. The 50 cycle converter was hooked up and rewired for power and control. Control boxes were installed and power supply lines were run.

WEATHER

The weather experienced on Leg 81 was in general undesirable. Virtually 90% of the fronts progressing across the North Atlantic moved across our operating area. These storms would move west to east across Newfoundland then progress past the tip of Greenland and over the Rockall Plateau. The fronts would usually pass on 48 hour intervals bringing with them 25 - 35 knot winds. The swells were out of the southwest 5-8 foot in magnitude. On Sites 554 and 555, we also experienced a southeasterly sea. Fortunately, in most cases, the CHALLENGER was able to hold position and still operate effectively, experiencing only 78.2 hours downtime due to weather. On those occasions where operations had to be halted, it was usually due to the vessel not being able to hold station rather than excessive motion.

Rarely was the sun seen. The vast majority of days were spent in wind, fog, and/or rain.

COMMUNICATIONS

Communications throughout the leg were poor at best. No contact with WWD, the Scripps' radio station, was achieved. All traffic had to be routed through the Coast Guard which in itself was frustrating. Since there always seemed to be a tropical storm or hurricane present, the Coast Guard was extremely busy. Most of their operators were young, inexperienced, and not very capable of handling CHALLENGER traffic. Finding a decent communications band open was difficult. Sometimes messages would be delayed two or three days before they could be sent. Invariably the Coast Guard operator would not be able to handle the messages or it would become lost enroute to its destination.

PERSONNEL

Just as in the last voyage, this one was also characterized by damp, chilly weather. Sunshine was practically non-existent and the wind rarely dropped below 20 mph. With conditions such as these the technical staff was surprisingly able to keep their sense of direction (and honor). Duties were performed swiftly and effectively with a high degree of morale.

The scientific staff suffered many temporary lapses of morale as the majority of the leg was spent coring basement rocks without an Igenous petrologist aboard. The spirit and strong leadership of the Chief Scientists managed to keep them an effective and cohesive group, however, and helped to relieve some of the tension and disappointment due to the minimal piston coring performed.

Global Marine couldn't have been more supportive and professional. Every inch of penetration on this trip was tenaciously fought for. It was only through an outstanding effort on the part of every man on the GMI drilling, engineering and marine crews that basement was attained and "any" logs were obtained on the last Site 555. It is through efforts just such as this that make this Project so successful and rewarding.

R. R. Knapp, Cruise Operations Manager

M. A. Storms, Cruise Operations Manager

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
OPERATIONS RESUME
LEG 81

Total Days (July 27, 1981-September 16, 1981	55.83
Total Days in Port	5.10
Total Days Cruising Including Site Survey	16.95
Total Days on Site	33.83

Trip Time	6.16 Days
Drilling Time	0.67 Days
Coring Time	16.85 Days
Downhole Measurement	2.69 Days
Stuck Pipe	0.10 Days
Wait on Weather	3.26 Days
Re-entry	0.83 Days
Other	3.25 Days
Breakdown	0.02 Days

Total Distance Traveled Including Survey (nautical miles)	3368.4
Average Speed (knots)	8.36
Number of Sites	4
Number of Holes Drilled	8
Number of Cores Attempted	247
Number of Cores With Recovery	241
Total Meters Cored	2111.5
Total Meters Recovered	1181.2
Percent Recovery	55.9
Total Meters Drilled	410.0
Total Meters of Penetration	2517.0
Percent of Penetration Cored	83.9
Maximum Penetration (meters)	964.0
Minimum Penetration (meters)	28.5
Maximum Water Depth (meters)	2584.0
Minimum Water Depth (meters)	1669.0

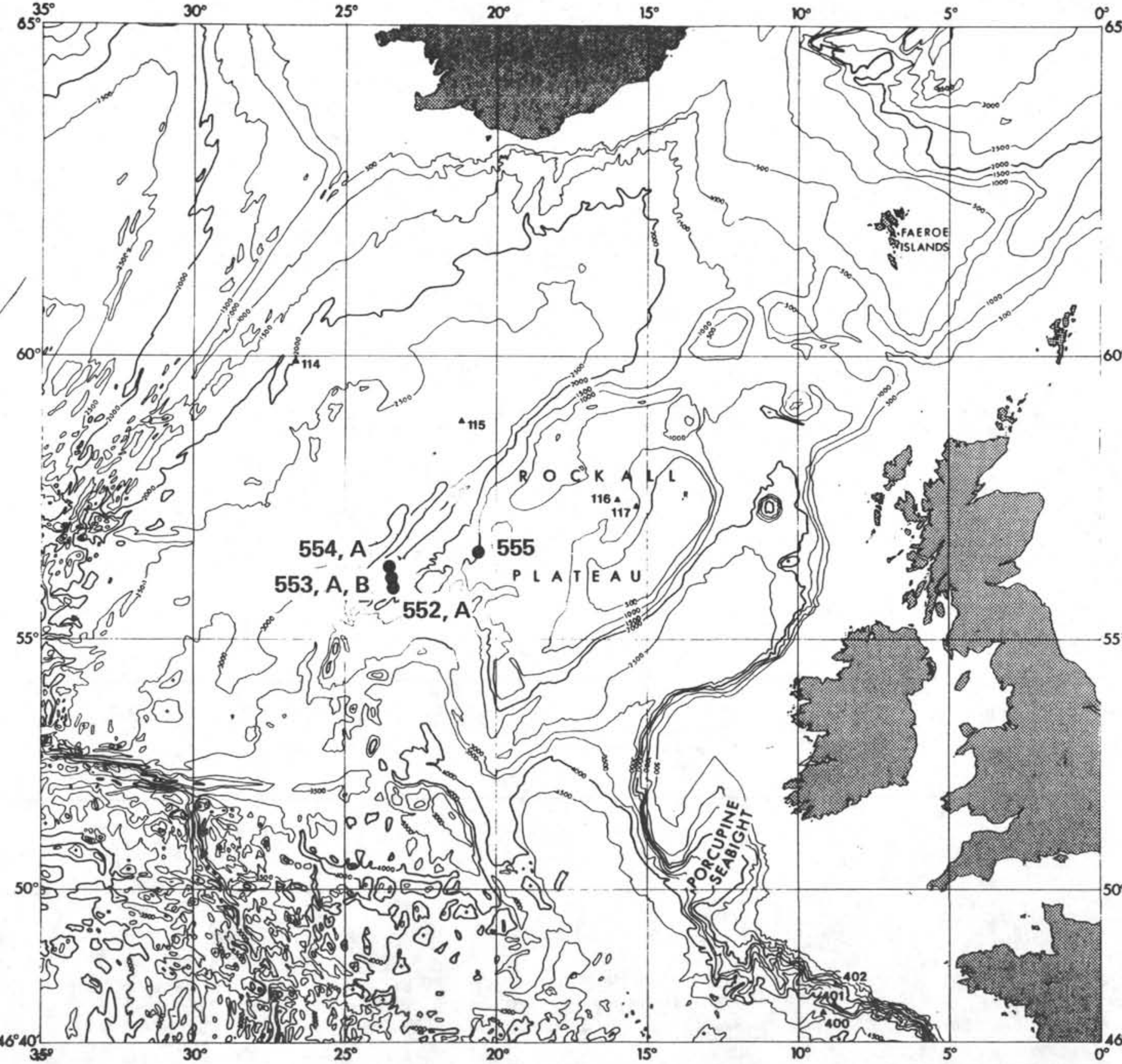


FIG.1

LEG 81 SITES

DEEP SEA DRILLING PROJECT
BEACON SUMMARY
LEG 81

SITE NO.	MAKE	FREQ. kHz	SERIAL NUMBER	SITE TIME HOURS	REMARKS
552	ORE	16.0 S.L.	527	69.2	
552A	ORE	16.0 S.L.	527	89.7	
			TOTAL	158.9	All systems worked fine.
553	ORE	13.5 D.L.	553	0	Operation of beacon became unusable and second beacon was dropped.
553	ORE	16.0 D.L.	531	22.0	
553A	ORE	16.0 D.L.	531	167.1	
	Cruising to Limerick & return			132.0	
553A	ORE	16.0 D.L.	531	123.3	
553B	ORE	16.0 D.L.	531	25.1	
			TOTAL	469.5	Still going strong.
554	ORE	13.5 S.L.	548	26.5	
554A	ORE	13.5 S.L.	548	41.7	
			TOTAL	68.2	
555	ORE	16.0 S.L.	528	245.9	Still strong signal at time of departure.

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
BIT SUMMARY
LEG 81

HOLE	MFG	SIZE	TYPE	SERIAL NUMBER	METERS CORED	METERS DRILLED	METERS TOTAL PENET	HOURS ON BIT	CONDITION	REMARKS
552	MSDS	9 7/8	F93CK	S-24	219.0	95.0	314.0	14.3	T0-B1-SEI	Appears usable for rerun.
552A	MSDS	11 1/8	HPC	AMY	183.5	---	183.5	HPC		
553	MSDS	9 7/8	F93CK	S-24	9.0	50.5	59.5	0.3	T0-B1-SEI	Rerun & will be used for 1st bit in 553A.
553A	MSDS	9 7/8	F93CK	S-24	408.5	151.0	559.5	17.2	T1-B8-SF-0 1/8"	
553A	MSDS	9 7/8	F94CK	AE3401	21.0	---	21.0	6.5	T1-B1-IG	Available for rerun.
553A	MSDS	9 7/8	F94CK	AN6400	102.0	---	102.0	25.2	Upgraded	Released in hole.
553B	No bit used on this hole. HPC operations with HBR Top Connector.									
554	MSDS	9 7/8	F94CK	AE3401	76.0	---	76.0	7.4	T1-B1-IG	Previous hours 6.5.
554A	MSDS	9 7/8	F94CK	AE3401	133.0	76.0	209.0	14.9	T1-B3-IG	Previous hours 7.4.
555	MSDS	9 7/8	F93CK	S-26	---	---	---	0	New	Dropped on trip in hole.
555	MSDS	9 7/8	F93CK	S-29	9.26	38.0	964.0	58.8	Upgraded	Released for logging.

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
SITE SUMMARY
LEG 81

HOLE	LATITUDE	LONGITUDE	WATER DEPTH METERS	NUMBER OF CORES	CORES WITH RECOVERY	PERCENT OF CORES WITH RECOVERY	METERS CORED	METERS RECOVERED	PERCENT RECOVERED	DRILLED	METERS	PENET	HOLE	SITE
552	56° 02.56'N	23° 13.39'W	2315	25	21	84.0	219.0	79.19	36.2	95.0	314.0	22.0	69.2	---
552A	56° 02.56'N	23° 13.39'W	2311	38	38	100.0	183.5	182.97	99.7	---	183.5	HPC	89.7	158.9
553	56° 05.32'N	23° 20.61'W	2339	1	1	100.0	9.0	8.33	92.6	50.5	59.5	300.0	22.0	---
553A	56° 05.32'N	23° 20.61'W	2339	59	59	100.0	531.5	288.97	54.4	151.0	682.5	27.0	290.4	---
553B	56° 05.32'N	23° 20.61'W	2338	4	4	100.0	33.5	33.23	99.2	---	28.5	HPC	25.1	337.5
554	56° 17.41'N	23° 31.69'W	2584	8	7	87.5	76.0	53.76	70.7	---	76.0	81.4	26.5	---
554A	56° 17.41'N	23° 31169'W	2584	14	14	100.0	133.0	29.52	22.2	76.0	209.0	28.1	41.7	68.2
555	56° 33.70'N	20° 46.93'W	1669	98	97	99.0	926.0	505.25	54.6	38.0	964.0	16.4	245.9	245.9
LEG TOTALS				247	241	97.6	2111.5	1181.22	55.9	410.0	2517.0	18.4	810.5	810.5

DEEP SEA DRILLING PROJECT
LOGGING SUMMARY
LEG 81

HOLE	TOTAL DEPTH (M)	WATER DEPTH (M)	OPEN ENDED PIPE AT (M)	FLUID IN HOLE	BIT SIZE	TOTAL TIME FOR LOGGING (HOURS)	RUN NO.	LOGS RECORDED	FROM (M)	TO (M)	OBSERVATIONS
553A	3021.5	2339	2466.0	gel mud	9 7/8		1	DDBHV, GR	3013.0	2466.0	Sonic, gamma ray
							2	DISFL, GR	2991.0	2466.0	Dual induction, gamma Ray
						36.5	3	HRT	3010.0	2466.0	Temperature
							4	CNL-FDC-GR		2466.0	Density, neutron, gamma ray
555	2633.0	1669	1869	gel mud	9 7/8		1	DDBHC, GR	2345	1869	Sonic, gamma ray, bridge at 2345
			2355	sea water			2	DDBHC, GR	2596	2355	Sonic, gamma ray, log below bridge
			1928			21.7	3	DISFL, GR	2576	1928	Dual industionm gamma ray
			1928	sea water			4	CNL-FDC,GR	2556	1928	Density neutron, gamma ray
			1928	sea water			5	DDBHC, GR	2536	1928	Sonic, gamma ray

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
OPERATIONS RESUME
LEG 82

The 82nd scientific voyage of the GLOMAR CHALLENGER revisited an area on the west flank of the Mid-Atlantic Ridge and south of the Azores Platform. This was the first DSDP expedition focusing primarily on detailed geochemical analysis of igneous rocks. Ten holes were drilled and cored at nine sites with six holes bottomed in basalt and three in gabbroic rocks. Successful open-hole logging programs were carried out at three sites. Operations were relatively trouble-free throughout the cruise and virtually all the scientific objectives were achieved.

The voyage commenced on September 16, 1981 at Ponta Delgada in the Azores and terminated on November 14 at Balboa, Panama. A brief port call for personnel transfer was made at Charlotte Amalie in the U. S. Virgin Islands. Total length of the leg was 59.6 days, of which 33.4 days were spent on site, 3.5 days in port and 22.1 days in transit. One day was lost to weather delays and 0.2 day to mechanical breakdowns.

PONTA DELGADA PORT CALL

The GLOMAR CHALLENGER's arrival in port had been delayed by one day by inclement weather during transit, and Leg 82 began at 0623 hours, September 16 with the first mooring line at Ponta Delgada Harbor, Sao Miguel, Azores Islands.

Crew change took place shortly after the vessel's arrival and port call activities then commenced with little delay. The scheduled workload was relatively light, with major items including replacement of the Bowen hydraulic plant motor, replacement of a bearing in drawworks "B" motor and magnetic inspection of drill pipe. On coming and offgoing freight shipments were handled and 257.000 gallons of fresh water were loaded. Good progress was made in all areas and the vessel was able to depart at 1214 hours, September 19, after only 78 hours in port.

PONTA DELGADA TO SITE 556

The initial operating area lay about 450 miles west-northwest of Sao Miguel. Strong winds, rough seas and heavy swells the first two days combined to hold the average transit speed to 7.6 knots, but conditions improved rapidly on the third day. Calm seas and only a moderate swell were found at the drill site. As detailed site surveys had not been provided, about five hours were spent in preliminary profiling before a positioning beacon was dropped at 0351 hours, September 22.

SITE 556

Though adequate for initial positioning, the beacon signal was found to be weak and abnormal. After refining the drill site location with a 300-meter south offset, a beacon of alternate frequency after the beacon had reached the seafloor and the offset was removed as the pipe trip proceeded without interrruption. Suspect joints of pipe identified during the magnetic inspection were removed during the trip and the drill string length was remeasured.

The precision depth recorder (PDR) reading was 3680 meters, corrected to the rig floor. A "mud line" punch core was attempted by lowering the core bit to 3687 meters and then retrieving the inner barrel. The barrel was recovered empty, however, and the procedure was repeated to 3696.5 meters. The inner barrel contained 6.1 meters of sediment and water depth was established at 3690 meters.

Soft calcareous ooze was then drilled to the basement contact a 461.5 meters below seafloor (BSF). Successful temperature probe measurements were taken at 97.5, 145 and 192.5 meters BSF. Operations were delayed by 6 1/2 hours following the third temperature probe run when a kink in the sandline became fouled in the line wiper during retrieval of the instrumented core barrel and the line parted at the wiper. Fortunately, the lower end of the line was jammed in the wiper and the instrument did not fall back down the pipe. However it was necessary to disassemble and clear the line wiper/wireline BOP assembly and then to retrieve about 1500 meters of damaged line before the instrument was recovered with data intact. The damaged line was removed from the sandline reel before operations resumed.

Basement rocks were continuously cored for an additional 178 meters. Good recovery and relatively slow penetration prevailed in the upper 95 meters in hard pillow basalts and basalt/sediment breccias. Below the basalt, weathered and altered gabbros were encountered which varied from soft and rubbly to very hard and dense. Most of this material was softer than the basalt and the penetration rate was generally much faster while core recovery dropped sharply.

Coring was terminated by bit failure when the cones locked up at 639 meters BSF after a good run of 57.4 rotating hours. The hole was then flushed with drilling mud in preparation for logging.

A "go-devil" was then pumped down the pipe to actuate the hydraulic bit release. This was accomplished without complication and the bit and associated components were left at the bottom of the hole. The open-ended drill string was then pulled to logging depth of 125 meters BSF. A full suite of well logs was recorded, consisting of sonic velocity-caliper-gamma ray, sonic wave form, laterolog-gamma ray, formation density-neutron porosity-gamma ray and temperature logs. All log attempts were successful and the first three sondes all reached depths within 15 meters of total depth. The temperature log tool was stopped by a bridge in the hole about 20 meters below the basement contact, however. On completion of the logging program, the remainder of the drill string was recovered, and the vessel departed Site 556 at 0848 hours, September 29.

SITE 557

Unexpected scientific results at Site 556 dictated retracing the ship's earlier track and drilling a site nearer the Azores. Site 557 was located only about 100 miles southwest of the island of Flores, the westernmost of the Azores. With the aid of following wind and seas, the 110 mile transit and survey were accomplished in only 12 1/2 hours. An acoustic beacon was dropped at 2119 hours, September 29.

The principal scientific objective at Site 557 was to sample basalt from the basement for geochemical analysis. Due to the impending approach of Hurricane Irene, the drilling program was streamlined to facilitate reaching basement as quickly as possible.

Hole 557 was spudded at 0647 hours, September 30 in an estimated 2155 meters of water. No time was spent on mud line or sediment coring as the sediment section was penetrated. The lower sediment column was unexpectedly thick and well indurated, and it was necessary to retrieve the jammed inner core barrel at 425 meters BSF when penetration became unacceptably slow. Drilling then continued at a faster rate, but with time running out. Hard rock was finally contacted at 460.5 meters BSF, at almost literally the last minute. Weather advisories indicated that there was not sufficient time to make a wireline trip and to recover the drill string before the onset of unsafe working conditions. Three meters of basalt were drilled and the pipe trip began immediately with the inner core barrel in place. The core bit was brought on deck at 2230 hours in rising wind and seas. The inner core barrel was opened and found to be filled with sediment core--with 1.2 meters of basalt at the bottom.

With the major site objective accomplished, the vessel was secured for heavy weather, and at 2300 hours, September 30, was under way headed into the wind to avoid the direct path of the hurricane. Sixteen hours after departure from the drill site, the CHALLENGER had moved a net distance of 17 miles to the southwest. At this time, conditions had improved sufficiently for full power to be applied to the propulsion motors and course was set for Site 558.

HOLE 558

The third drill site was located about 210 miles west-southwest of Site 557 and 135 miles southwest of Site 556. Average transit speed was held to 6.5 knots by rough seas and headwinds in the wake of the storm and after 7 3/4 hours of preliminary profiling, a positioning beacon was dropped at 0946 hours, October 3. On initial positioning of the vessel, a 760 meter offset to the east was entered to optimize the drilling location.

The initial pipe time was halted twice by a strong current which forced the vessel to take a heading nearly at right angles to the wind and swell. This dictated the unhappy choice between holding position with excessive vessel roll and heading into the swell while being pushed off location. Fortunately, the current abated while preparations were being made for spudding, and drilling began at 2122 hours, October 3.

No "mud line" punch core was desired, and the seafloor sediment was too soft to register on the weight indicator. Therefore the water depth was estimated at 3766 meters, based on the PDR reading. The bit was "washed" to 158 meters BSF before coring began, as the drill plan called for piston coring this interval before departure from the site. An additional 250 meters of soft calcareous ooze were cored continuously before basement rocks were encountered. Basement coring proceeded smoothly, except for recurring positioning problems resulting from the strong and unpredictable currents. About 110 meters of basalt (mostly pillow basalts) were cored. Below this, about 43 meters of serpentinized gabbro were penetrated before operations were terminiated because of slow penetration and low core recovery.

The core bit was released for logging, but only after great difficulty and after the second go-devil had been retrieved from the release mechanism. The open-ended pipe was puled to logging depth and logging operations commenced with the sonic velocity-caliper-gamma ray log. This tool was run to within 15 meters of total depth without much difficulty on the first pass. A second pass was required to log sonic wave forms, however, and on this attempt the sonde was stopped about 110 meters short of total depth by bridging in the hole. It became apparent that a "cleanout" trip would be required, but a temperature log was desired before temperature equilibration in the hole was destroyed. The slim, light- weight temperature tool was stopped only about 65 meters beyond the end of the pipe and little was learned from the log.

The open-ended drill pipe was then washed back to total depth without difficulty and 100 barrels of bentonite mud were circulated to clean the hole. After this 5 1/4 hours interruption, the logging program continued with the dual laterolog-gamma ray log. This sonde also reached a point near total depth, but a second pass for a repeat record and the next logging tool (formation density/neutron porosity/GR) encountered deteriorating hole conditions. A final attempt to record a temperature log also failed to penetrate the bridges in the upper sediment section. Weight fluctuations from vessel heave prevented logging personnel from detecting set-down of the light tool and the logging cable was overrun. This necessitated removal of 315 meters of damaged cable.

The logging sheaves were then rigged down and the drill string was pulled clear of the seafloor to officially end Hole 558 operations at 0400 hours, October 11.

HOLE 558A

Preparations were next made to spud a second hole at Site 558 for hydraulic piston coring (HPC) of the upper sediment section. The HPC conversion collet was run into place in the bottomhole assembly using the sandline and a special running tool, At the same time, the return of strong currents forced the ship to take a heading that resulted in rolls in excess of safe pipe handling limits. Spud-in was delayed for five hours until the current abated and permitted a more satisfactory heading.

Based on gamma ray log information from Hole 558, the first piston core was shot from a point several meters below the estimated water depth for the first hole and core recovery established the water depth at 3777 meters. It was noted on the first and succeeding cores that pipe pressure could not be built up to the level normally required to actuate the corer. However, the corer was repeatedly recovered stroked to its full extension and filled or nearly filled with core. On the 11th core, normal pressure indications were noted and the system functioned as designed thereafter. The maximum length (9.5 m) core barrel was still in use on the 17th core when a mechanical failure forced termination of the hole. The tension required to overcome suction and friction in withdrawing the core barrel from the sediment exceeded 80,000 lbs. and the dogs of the quick disconnect coupling were sheared off. This left the inner core barrel imbedded in the bottom of the hole. Core had been recovered from a point only 16 meters short of the beginning of the cored section of Hole 558 and the scientific objectives were considered to be achieved.

The drill string was recovered and the vessel was under way for Site 559 at 1800 hours, October 12. On disassembly of the bottomhole assembly, the conversion collet was found to have been damaged, apparently during its wireline trip down the pipe. The damage had prevented proper seating in the head sub and thus proper actuation of the piston corer.

SITE 559

The move of about 250 miles to the southwest was accomplished at an average speed of 7.8 knots, and a positioning beacon was launched at 0318 hours, October 14, after a three hour preliminary survey.

Site 559 set the operational pattern for a series of drill sites in which the primary scientific objective was the sampling and analysis of basaltic basement rocks. With sediment sampling and deep basement penetration deemphasized, these sites were completed in rapid succession, extending the areal dimension of Leg 82 investigations.

The hole was spudded at 1238 hours, October 14. As no mud line core was taken, water depth was established at 3766 meters, based on the PDR reading. The bit was jetted down through 236 meters of soft calcareous ooze and the inner core barrel was retrieved after two meters of hard drilling. The inner barrel contained basalt, and continuous coring then commenced. Coring continued through glassy and somewhat vesicular pillow basalt for an additional 63 meters before a scientific objectives were declared fullfilled and operatons were terminated. The basalt was penetrated at a relatively rapid 4.3 meters per hour, but core recovery was only 37 per cent. Reduced core diameter indicated progressive bit bearing failure, but drilling was stopped short of complete failure.

The drill string was then recovered and the GLOMAR CHALLENGER departed Site 559 at 0718 hours, October 16.

SITE 560

The next locality to be drilled was designated MAR-7 and lay about 105 miles east-northeast of Site 559. The beacon was dropped at 2239 hours, October 16, after two hours of profiling.

Operations proceeded smoothly and the hole was spudded at 0852 hours the next day in 3455 meters of water. The sediment section was again drilled without coring through 371 meters of soft ooze before the bit first contacted hard rock. An additional two meters were drilled through alternately soft and hard material. Continuous coring them produced a mixture of sediment/volcanic breccia and chunks of altered gabbro with a few pieces of basalt. This mixture gradually gave way to highly altered and serpentinized gabbro. It became apparent that "basement" at that location consisted of a talus slope and/or fault scarp. The material being cored was producing low penetration and recovery rates and was of little value to the scientific program. Therefore drilling was terminated at 421.5 meters BSF after 48.5 meters had been cored. The drill string was then pulled and the vessel departed Site 560 at 1244 hours, October 18.

SITE 561

The geophysical gear was streamed and 2/3/4 hours were spent in profiling the MAR-7 locality in search of a more suitable drill site. A new positioning beacom was dropped at 1522 hours at a location about ten miles west-northwest of Site 560.

The drilling/coring plan followed that of the previous two sites. Water depth was estimated at 3470 meters and 411.5 meters of ooze were drilled before the bit struck rock and the "wash" inner barrel was retrieved. Continuous coring then proceeded in highly fractured basalt. After only 15 meters had been cored, the drill string began to "torque up", indicating either hole problems or bit failure. The hole was flushed with mud to clean out cuttings, and the bit weight was varied--with the results indicating bearing failure and locked cones. This halted operations some what prematurely, but several meters of representative basalt core had been recovered.

The battered bit was brought on deck at 0245 hours, October 19, and the CHALLENGER departed for Site 562 some 30 minutes later.

SITE 562

The CHALLENGER made good an average speed of over nine knots and after a brief survey, an acoustic beacon was launched about 165 miles southwest of Site 561 at 0212 hours, October 21.

The operational pattern followed that of the preceding sites, with the bit "washed" down through 240 meters of soft ooze before basement was contacted and continuous coring was initiated.

The vessel's positioning system had performed in an erratic manner since arrival on the site. It was suspected that the problem was attributable to a somewhat abnormal beacon pulse, and a second beacon was dropped 16 hours after the first unit. The replacement beacon was found to have drifted about 245 meters east-northeast of the vessel and appropriate offsets were entered. Positioning problems ceased after referencing was switched to the frequency of the new beacon.

Coring in Hole 562 succeeded in obtaining scientifically suitable basalt at a 50% recovery rate. It was requested by science that coring continue in an attempt to sample a second geochemical unit in the same hole. This goal was attained and 90 meters of basement had been cored when the bit finally failed after a creditable 40 rotating hours in basalt.

The drill string was recovered, and the BHA was inspected magnetically for fatigue cracks or connection damage before the vessel departed the site at 1018 hours, October 24.

SITE 563

After a 12 hour transit and 1 1/2 hours of site survey profiling, a positioning beacon was launched about 110 miles west-northwest of Site 562. The locality, known as MAR-11, was the final area to be investigated on Leg 82. The drill plan included rotary coring the lower sediment section and then basement rocks to bit destruction. The bit would be released for logging after which the BHA would be converted for hydraulic piston coring and a second hole would be piston-cored to recover the upper sediment section.

Hole 553 was spudded at 1123 hours, October 25, and the hole was drilled to 156.5 meters below seafloor before the "wash" inner core barrel was retrieved. Calcareous ooze and chalky ooze were then cored continuously to the contact with basaltic basement at 364 meters below seafloor. The basalt proved to be some of the hardest drilling ever encountered in a DSDP hole. Core No. 25, the third basement core, required just under 10 hours of rotating time for nine meters of penetration.

The pipe became stuck during the wireline trip for Core No. 25. The pipe's position in the derrick provided little space for "working" the stuck pipe. The wireline trip was therefore completed and a single joint of drill pipe was laid out. The pipe was then freed almost immediately and no further sticking tendencies were noted. For reasons not understood at the time, the overshot had not engaged the inner barrel on the initial wireline trip. Two more attempts to retrieve the barrel were made without success. A check of circulating pressure then indicated open-ended pipe and it was inferred that the hydraulic bit release had actuated spontaneously. The drill pipe had since been lifted high enough to heave the bit at the bottom of the hole and the inner core barrel in open hole.

The pipe was lowered, with circulation and rotation, in an attempt to wash over the inner barrel latch with the bit release top connector. When the end of the pipe had reached a depth calculated to be two to three meters below the top of the inner barrel, a wireline trip was made and the inner barrel, with core, was recovered successfully.

The drill string was recovered and the vessel was underway to survey at 0530 hours, October 28.

SITE 564

Sampling a second geochemical basalt unit in the MAR-11 area was given high scientific priority, and it had therefore been decided to drill a second site instead of converting and piston-coring at Site 563. After 3 1/4 hours of profiling, a second drill site was located six miles north of Site 563, and an acoustic beacon was dropped.

Hole 564 was spudded in 3830 meters of water (by PDR reading) at 1743 hours, October 28, and was quickly drilled to basement at 284 meters below seafloor. Basalt was then cored continuously for an additional 81 meters with fairly good recovery and a much better penetration rate than in Hole 563.

Coring was discontinued a few hours ahead of schedule when a weather advisory was received predicting that newly formed tropical storm Jose would pass nearby within one day's time. Since sufficient basement has been penetrated to justify logging, plans were revised to concentrate on recording as many logs as possible before weather forced pulling the pipe.

The bit release go-devil was dropped immediately upon recovery of the final core and was pumped into place. The bit and associated components separated on the first attempt, leaving open-ended pipe to be pulled to logging depth.

The storm was monitored closely as logging operations progressed. With succeeding observations, it became apparent that Jose would remain quite localized in area and would pass clear of the drill site without significant effect on operations. This resulted in ample time for logging, but insufficient time for both logging and piston coring before departure for port. Consequently, some extra time was spent on making multiple log passes through the basement section and on a second temperature log run to study hydrothermal circulation phenomena. When a full suite of successful logs had been recorded, the pipe was recovered and the GLOMAR CHALLENGER departed the mid-Atlantic Ridge operating area at 0848 hours, November 1.

SITE 564 to CHARLOTTE AMALIE

Within a few hours after departure from Site 564, strong northeasterly tailwinds developed. The wind, pushing on the vessel's derrick and superstructure, boosted the speed of advance to over nine knots despite rough seas and large swells. With smoother seas and moderating tailwinds, even faster progress was made in the ensuing days. This permitted removing two engines from propulsion on the morning of November 6, thus saving fuel and still meeting the scheduled arrival time at St. Thomas Island. The transit was otherwise uneventful and the first mooring line was put over at 0630 hours, November 8, at Berth One, West India Dock Charlotte Amalie Harbor.

CHARLOTTE AMALIE PORT CALL

During the cruise an interim port call had been scheduled in the Virgin Islands and the voyage had been extended by six days to accommodate a visit by a delegation from the U. S. Congress. The congressional visit was subsequently cancelled, but the port call remained on the schedule since travel arrangements had been made for personnel palnning to disembark.

The stopover was handled smoothly and lasted just 5 1/2 hours. Sixteen members of the Leg 82 scientific and technical staff were disembarked. Two GMI crew members also departed, one for medical treatment and one for compassionate reasons. One replacement crew member, a French technician and a GMI electronics engineer boarded for the transit to Panama. In addition, much needed supplies of fresh food were loaded for consumption during the final week of the voyage.

CHARLOTTE AMALIE TO CRISTOBAL

After getting under way from Charlotte Amalie at 1200 hours on November 8, the CHALLENGER again found ideal steaming weather with following winds and currents. The Caribbean was crossed in 80 hours and the anchor was let go at 2000 hours, November 12, in the outer anchorage at Cristobal, Panama.

CRISTOBAL TO BALBOA

At 0600 hours the following morning, the vessel weighed anchor and moved to the Cristobal inner anchorage. The CHALLENGER remained at anchor from 0848 hours, November 13 to 0445 hours, November 14, when she began the Panama Canal passage. The canal transit was uneventful and Leg 82 came to its official end at 1647 hours, November 14, with the first mooring line at Dock Seven, Balboa Harbor, Panama.

DRILLING AND CORING EQUIPMENT

A variety of bottomhole assemblies was used during Leg 82, depending on planned operations following completion of rotary coring. One departure from the standard DSDP bottomhole assembly common to all sites was the addition of one 8 1/4" drill collar between the standard outer core barrel assembly and the lowermost stand of drill collars. The collar was added primarily to space out for the 21.5 meter variable length hydraulic piston coring assembly. When not in use for this purpose, the collar was left in the bottomhole assembly to provide additional weight for drilling the hard basalt.

The basic assembly used at Sites 559, 560, 561, 562, and 563, consisted of: bit, bit sub, head sub (for spacing), outer core barrel assembly, four 8 1/4" drill collars, one Baash Ross five-foot stroke bumper sub, three 8 1/4" drill collars, two bumper subs, two 8 1/4" drill collars, crossover sub and one 7 1/4" drill collar. At Site 557 a mechanical bit release was used in place of the bit sub to provide the option of logging on completion of drilling. The "all options" BHA deployed at Sites 556, 558, and 564, featured a hydraulic bit release, an HPC conversion head sub, two extra head subs and two stabilizers (for spacing) and a twelve-foot gammaloy drill collar for oriented piston core operations.

Bits were released via the hydraulic bit release on four occasions; three of these separations were intentional. The releases at Sites 556 and 564 were accomplished easily on the first attempt, although it was necessary to set the bit on bottom in both cases before separation occurred. At Site 558, the mechanism operated only after two go-devils had been deployed and retrieved and six hours had been wasted. Spontaneous actuation of the release at Site 563 aborted the coring program at that site, with some loss of scientific objectives. In all, there have been five instances of spontaneous HBR release, and all have occurred following periods of rough weather with considerable vessel heave.

The drill string heave compensator was used at all sites. The system functioned dependably and undoubtedly prolonged bit life under highly adverse drilling conditions. The compensator was out of service only briefly when power to the olmstead control valve was lost due to a damaged electrical cable.

The option to convert to hydraulic piston coring was exercised at only one site and met with only partial success. Inspection of the conversion collet had been damaged during its wireline trip down through the drill pipe. This prevented the collet from seating in its assigned position in the head sub and consequently interfered with proper pressurization and actuation of the piston corer. The extremely soft nature of the sediment facilitated recovery of core, though it was somewhat more disturbed and less completely recovered than normal. Routine function was eventually achieved, but coring operations were terminated prematurely because of an unrelated problem. The extreme force required to overcome suction caused the lugs of the quick release connector to shear off, leaving the core barrel in the hole.

CORE BITS

All the rotary drilled holes originally had been targeted for coring to bit destruction. However five of the nine holes were bottomed sooner because of weather, scientific priorities or premature bit release.

Two "recycled" bits, assembled at the Scripps Marine Science and Development Shop were run to destruction. These bits featured new Smith cutting assemblies welded into used bodies. They survived for excellent runs of 57.4 and 41.2 rotation hours, with the former cutting 178 meters of igneous rock. Two bits of similar fabrication using Hughes cutters were also deployed. The bit run in Hole 558 was still coring at total depth after 61.3 rotating hours and 155 meters of igneous rock. An identical bit was run at the next site and suffered bearing failure (one cone only) after 15.7 hours.

The last of the DSDP inventory of roller-bearing bits was used at Site 560. The hole was terminated after only 8.5 rotating hours when no basalt was found. The bit was inspected, found to be in excellent condition and rerun in Hole 561. Unfortunately the bearings failed and the cones locked up after only 6.7 additional hours, forcing somewhat premature abandonment of the hole.

Cutting structures comprised of short chisel inserts, rounded "button" inserts and a combination of the two (Hughes cutters) were used. Previous Project experience had indicated that chisel-insert bits penetrate somewhat faster, but have a correspondingly shorter rotating life in basalt. This generalization was not born out in the Leg 82 operation area--in fact, the lowest penetration rate was produced by a chisel-insert bit. However the variability of formation characteristics made any generalization difficult.

LOGGING

Successful logging programs were carried out at three sites with a total of 17 logs runs made for over 5500 meters of open hole logs. The program was relatively free of technical problems, but some inherent deficiencies in equipment were factors in the overall effectiveness of the effort.

The MCD caliper/centralizer continued to be a weakness in Schlumberger's otherwise dependable array of equipment. A multi-arm caliper is essential to provide hole size data and to centralize the sonic velocity sonde. Two of the three units on board had previously been modified in the ship's machine shop to reduce tool diameter and to permit passage through drill pipe. When both of these units had developed electrical problems in the caliper circuitry, it was necessary to modify the third unit for logging Hole 564. A usable but somewhat noisy caliper log was recorded. The MCD is subject to electrical problems and noisey and displaced caliper curves. Extensive modification is required because it does not meet the diameter specifications of the logging contract.

The high resolution thermometer (HRT) was used for open-hole temperature logs with fair success. This is a production-logging tool that is not particularly well adapted for DSDP purposes. Although calibration was checked and the tool's response seemed normal, temperature values were suspiciously low at all sites, including 556, where bottom water temperature probe instrument. The primary problem, however, is the light weight and small diameter of the sonde, which render it highly susceptible to obstruction by ledges and bridges in open hole. The accelerations of vessel heave acting on the weight of the cable made it extremely difficult to discern setdown of the tool by watching the weight indicator. The tool stopped at a bridge in Hole 558 and the cable was overrun. As a result, over 300 meters of logging cable was damaged and had to be discarded. A heavy carrying case for the HRT sonde has been improvised from a weighted inner core barrel. This increased tool weight to about 300 pounds and was used effectively in Hole 564.

DYNAMIC POSITIONING

Four of the 11 ORE acoustic positioning beacons deployed on the voyage produced abnormal signals. The common anomaly was a pulse width at or in excess of the maximum limit for the positioning system. The signals of two of these beacons, though marginal, caused no positioning problems. One beacon produced unstable positioning until it was replaced, and one was rejected by the computer from the outset. The apparent transducer fault is under investigation and a new lot of beacons will be loaded for Leg 83.

The ship's positioning system experienced a few minor problems, but only two short interruptions in operations occurred, totaling about 35 minutes. One vertical reference gyro failed during pre-cruise checkout and was replaced before departure from Ponta Delgada. A relay in an engine room switchboard failed the second day on site. The relay was quickly isolated and replaced. Late in the cruise, certain relays in the bridge console occasionally failed to reset properly. This was attributed to inadequacies in the ground return circuitry. The deficiency was investigated and upgraded during the final days of the voyage.

WEATHER AND CURRENTS

Leg 82 operations were conducted in the Atlantic's "hurricane alley" during the fall season, and the prevailing weather conditions were good--except during hurricanes. Hurricane Harvey passed over the first drill site while the CHALLENGER was enroute from the Azores and associated headwinds slowed the vessel's progress. It was necessary to abort Hole 557 just as basement was reached because of the apparently direct approach of Hurricane Irene. The storm finally veered from its track and passed about 180 miles from the vessel and maximum winds of only about 55 mph were experienced. Coring operations at the final site (564) were terminated a few hours early due to weather advisories received concerning the approach of tropical storms Jose. This storm formed only a few hundred miles from the drill site, but remained small in area and changed course to clear the site by 120 miles, with no further significant effect on operations. The progress of Hurricane Katrina was watched with interest as the vessel approached the Caribbean while in route for St. Thomas. This storm moved northward across Cuba, however, and was never a threat to the CHALLENGER. The analysis and advice provided by the onboard weather forecaster were invaluable aids in timing operations to provide for the safety of the crew and the drill string and to salvage scientific objectives.

Exceptionally strong diurnal current conditions were an important operational factor at Site 558, and the ship's positioning capability was taxed to or beyond its limits on several occasions. A total of 7 3/4 hours were lost when strong currents from the northeast quadrant would force the ship to take a heading "in the trough", thus causing vessel motion in excess of safe operating limits. Current was a relatively minor factor in positioning at the other sites.

COMMUNICATIONS

Radiotelegraph communications were quite difficult during all but the final two weeks of the voyage. It was necessary to continue to use the indirect Coast Guard/Navy Mercast arrangement for the first few days out from the Azores. Scripps satation WWD was worked directly from the mid-Atlantic operating area, but with great difficulty. Only the activation of the 22.419 kHz frequency made direct communication possible, as the three primary WWD frequencies were subject to heavy interference and were unusable most of the time. The radio officer's task was made more difficult by chronically poor propagation conditions resulting from frequent solar disturbances and by an abnormally high volume of message traffic

Numerous radiotelephone calls were made via commerical stations to Europe and via amateur radio patches to the U.S.A.

No serious communications equipment problems were experienced during Leg 82.

PERSONNEL

Leg 82 was a long and busy cruise, but there were few personnel-related problems. Most of those aboard were veterans of previous voyages and morale remained generally good despite such adversities as a one week extension and a food shortage which became relatively acute during the final weeks.

The multinational scientific team worked together enthusiastically to process and interpret a great deal of data from numerous sources. The DSDP technical staff and GMI crew, as usual, represented a vast pool of experience and supported the scientific effort in a thoroughly professional manner.

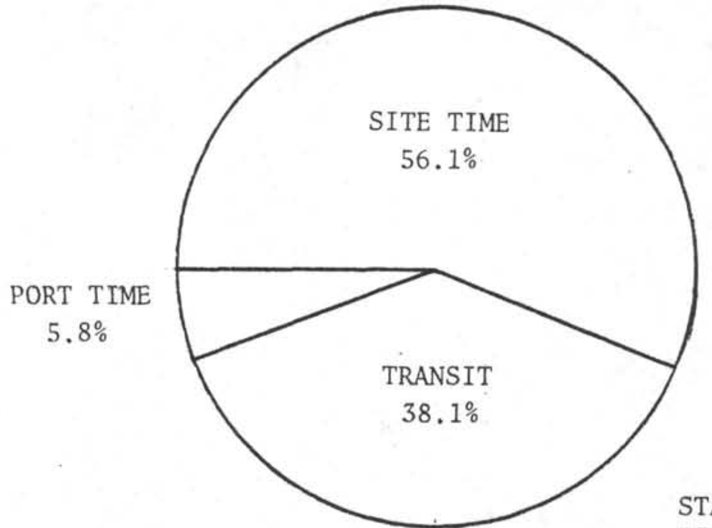
There were no serious injuries during Leg 82. One man was sent home from Charlotte Amalie with a respiratory condition. Another crew member left at the same time due to death and illness in his family.

Glen N. Foss
Cruise Operations Manager
Deep Sea Drilling Project

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
OPERATIONS RESUME
LEG 82

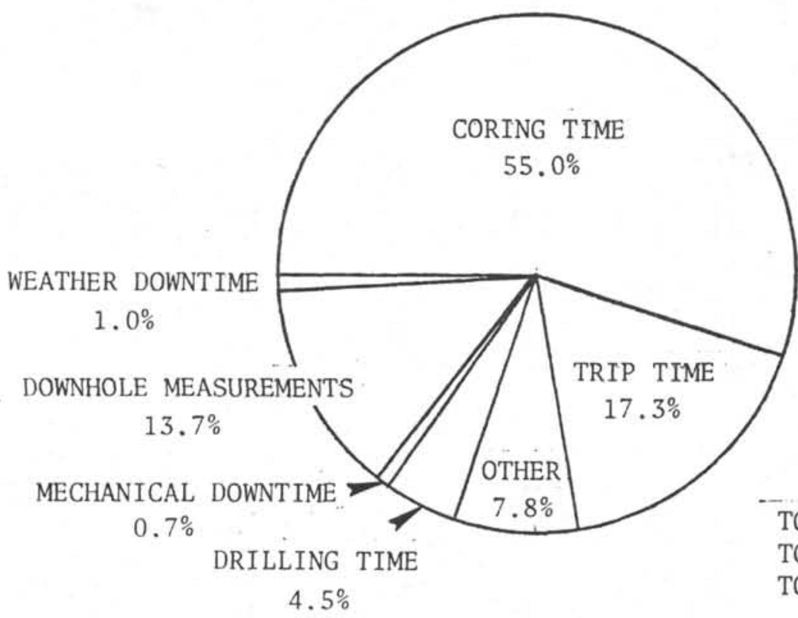
Total Days (September 16, 1981-November 14, 1981)		59.64
Total Days in Port		3.47
Total Days in Transit		22.74
Under Way	20.8	
Weather Downtime	0.7	
Detention & Other	1.3	
Total Days on Site		33.43
Trip Time	5.8	
Drilling Time	1.5	
Coring Time	18.4	
Downhole Measurements	4.6	
Weather Downtime	0.3	
Mechanical Downtime	0.2	
Other	2.6	
Total Distance Traveled (Nautical Miles)		4262
Average Speed (Knots)		8.5
Sites Investigated		9
Holes Drilled		10
NUmber of Cores Attempted		145
Total Meters Cores		1245.5
Total Meters Recovered		756.9
Percent Recovery		60.8
Total Meters Drilled		2777.5
Percent Penetration Cored		31.0
Maximum Penetration (meters)		639.0
Minimum Penetration (meters)		131.5
Maximum Water Depth (meters)		3830.0
Minimum Water Depth (meters)		2155.0

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
TOTAL TIME DISTRIBUTION
LEG 82

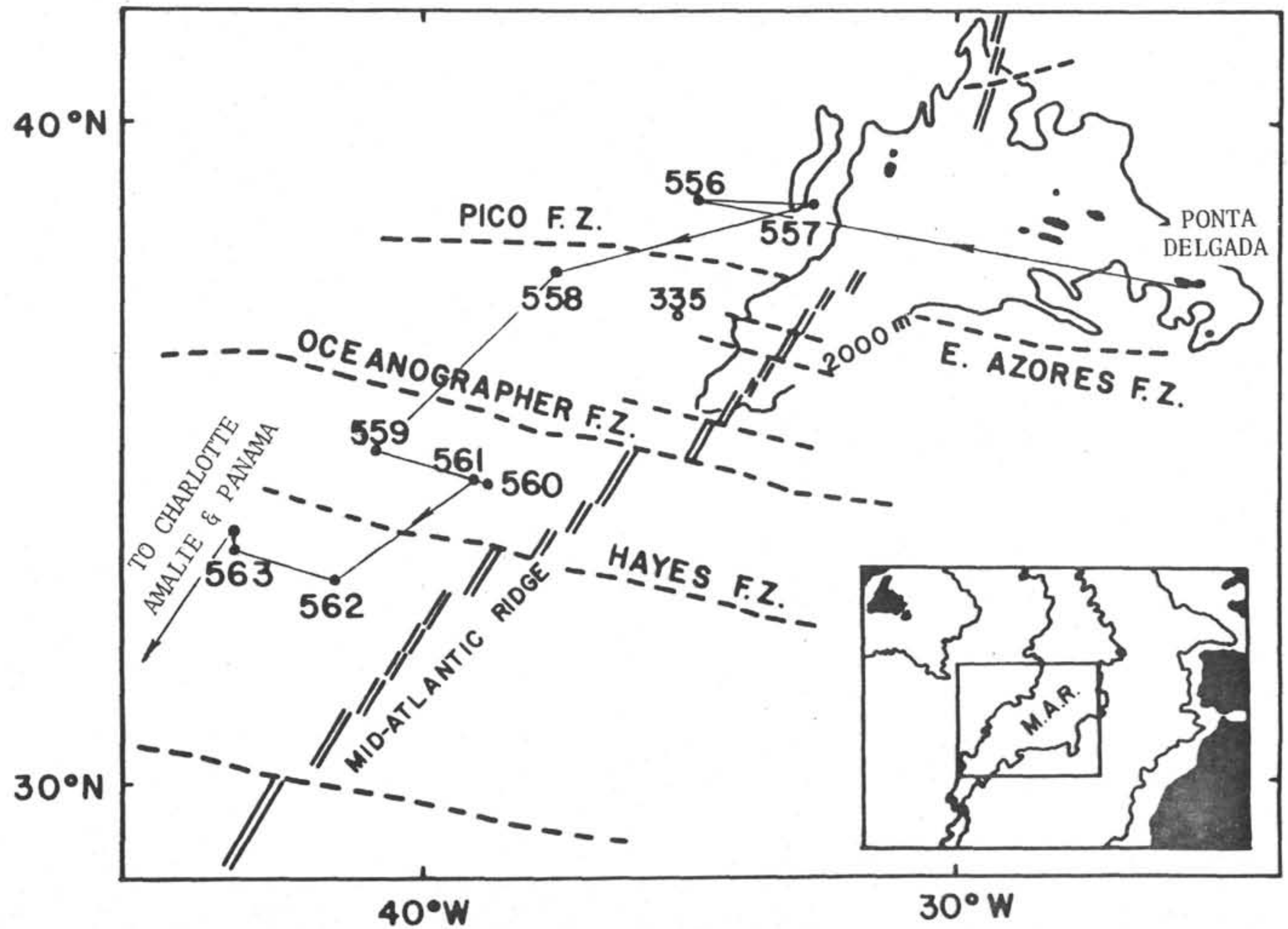


START LEG:	SEP 16, 1981
FINISH LEG:	NOV 14, 1981
TOTAL TIME:	59.64 DAYS

ON-SITE TIME DISTRIBUTION



TOTAL TIME ON SITE:	33.43 DAYS
TOTAL SITES:	9
TOTAL HOLES:	10



LEG 82 OPERATING AREA

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
SITE SUMMARY
LEG 82

HOLE	LATITUDE	LONGITUDE	WATER DEPTH METERS	NUMBER OF CORES	CORES WITH RECOVERY	PERCENT OF CORES WITH RECOVERY	METERS CORED	METERS RECOVERED	PERCENT RECOVERED	METERS DRILLED	TOTAL PENET METERS	AVG RATE PENET	TIME ON HOLE	TIME ON SITE
556	38° 56.4'N	34° 41.1'W	3690	22	22	100.0	184.0	85.2	46.3	455.0	639.0	11.1	172.9	172.9
557	38° 50.0'N	32° 33.6'W	2155	1	1	100.0	3.0	1.2	40.0	460.5	463.5	86.6	25.7	25.7
558	37° 46.2'N	37° 20.6'W	3766	44	44	100.0	403.5	239.2	59.3	158.0	561.5	9.2	186.3	
558A	37° 46.2'N	37° 20.6'W	3777	16	16	100.0	131.5	123.7	94.1	0	131.5	0	37.9	
			TOTALS	60	60	100.0	535.0	362.9	153.4	158.0	693.0	0		224.2
559	35! 07.5'N	40° 55.0'W	3766	8	8	100.0	63.0	23.5	37.3	238.0	301.0	19.2	52.0	52.9
560	34° 43.3'N	38° 50.6'W	3455	6	6	100.0	48.5	7.8	16.1	373.0	421.5	61.1	38.0	38.0
561	34° 47.1'N	39° 01.7'W	3470	3	3	100.0	15.0	6.0	39.7	411.5	426.5	63.4	25.8	35.8
562	33° 08.5'N	41° 40.8'W	3182	11	11	100.0	90.0	44.9	49.9	241.0	331.0	8.0	80.1	80.1
563	33° 38.5'N	43° 46.0'W	3796	25	25	100.0	226.0	190.6	84.3	156.5	382.5	18.1	77.6	77.6
564	33° 44.4'N	43° 46.0'W	3830	9	9	100.0	81.0	34.8	42.9	284.0	365.0	12.6	96.0	76.0
			TOTALS	145	145	100.0	1245.5	756.9	60.8	2777.5	4023.0	0	0	802.4

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
BIT SUMMARY
LEG 82

HOLE	MFG	SITE	TYPE	SERIAL NUMBER	METERS CORED	METERS DRILLED	METERS TOTAL PENET	HOURS ON BIT	CONDITION	REMARKS
556	MSDS	9 7/8	F94CK	S-6	184.0	455.0	639.0	7.4	brg failure-cones locked	178 m igneous rock - released for logging
557	Smith	9 7/8	F94CK	AE3401	3.0	460.5	463.5	5.5	T1-B5-I	rerun-Total 20.7 hrs; 769.5 m
558	MSDS	9 7/8	Hughes Cutter	H-3	403.5	158.0	561.5	61.3	Unknown	155 m igneous rock - released for logging
558A	None				131.5		131.5			open-ended HPC
559	MSDS	9 7/8	Hughes Cutter	H-4	63.0	238.0	301.0	15.7	T1-B7-I	one cone loose, shirttail mashed in; tooth breakage drive rows NR 1 & 2 cones.
560	Smith	9 7/8	9C	HG022	48.5	373.0	421.5	8.5	T0-B1SE-I	
561	Smith	9 7/8	9C	HC022	15.0	411.5	426.5	6.7	T3-B7-0 1/4	locked up & terminated coring rerun-total 15.2 hrs, 848 m
562	MSDS	9 7/8	F99CK	S-8	90.0	241.0	331.0	41.2	T1-B7-0 7/16	cones pinched in & locked against core guide
563	MSDS	9 7/8	F94CK	S-9	226.0	156.5	382.5	21.2	unknown-no sign of failure	released prematurely-HBR malfunction reason for 1.0m/hr rop in basalt not apparent
564	Smith	9 7/8	F99CK	SV840	81.0	284.0	365.0	29.1	unknown-some core diam. reduction	released for logging

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
BEACON SUMMARY
LEG 82

SITE NUMBER	MAKE	FREQ. kHz	SERIAL NUMBER	SITE TIME HOURS	REMARKS
556	ORE	13.5	549	1.9	Single life; weak signal, long PRF, poor envelope
556	ORE	16.0	535	171.0	Single life; good beacon
557	ORE	13.5	559	25.7	Single life; good beacon
558	ORE	16.0	532	186.3	Double life-strong throughout
558A	ORE	16.0	532	37.9	
			TOTAL	224.2	
559	ORE	13.5	554	52.0	Double life; strong throughout
560	ORE	16.0	533	38.0	Double life; strong throughout
561	ORE	13.5	555	35.8	Double life; strong throught; pulse width at max limit
562	ORE	16.0	534	8.1	Double life; pulse too long; caused unstable positioning
562	ORE	13.5	556	72.0	Double life; strong throughout
563	ORE	13.5	557	77.6	Double life; strong throughout, pulse width at max limit
564	ORE	16.0	536	96.0	Double life; strong throughout

DEEP SEA DRILLING PROJECT
LOGGING SUMMARY
LEG 82

HOLE	TOTAL DEPTH (M)	WATER DEPTH (M)	OPEN ENDED PIPE AT (M)	FLUID IN HOLE	BIT SIZE	TOTAL TIME FOR LOGGING (HOURS)	RUN NO.	LOGS RECORDED	FROM (M)	TO (M)	OBSERVATIONS
556	4329	3690	3787	sea water	9 7/8	5.4	1	DDBHC-GR-CAL	4318	3787	big shift in caliper readings - had to recompute
556	4329	3690	3787	sea water	9 7/8	3.0	2	SWF	4315	4100	
556	4329	3690	3787	sea water	9 7/8	6.1	1	DLT-GR	4315.5	3786	separation between long & short spaced LL curves due to decentralization
556	4329	3690	3796	sea water	9 7/8	5.3	1	FGT-CNT-GR CAL	4313	3796	GR logged to seafloor
556	4329	3690	3787	sea water	9 7/8	6.1	1	HRT-CCL	4168	3786	bottom water temp down to top at basalt - could not get past bridge -
											thermistor calibrated after log run
						2.5					release bit, flush hole, rig sheaves, work on winch
						28.4					TOTAL
557	2618.5	2155									no logs; aborted for weather
558	4327.5	3766	3863	sea water	9 7/8	5.6	1	DDBHC-GR-CAL	4312	3863	caliper noisy-electrical problem sonic noisy in bad parts of hole
558	4327.5	3766	3863	sea water	9 7/8	0.7	2	SWF	4245	4150	could not get down past 4345m
558	4327.5	3766	3863	sea water	9 7/8	5.2	1	HRT-CCL	3863	3956	could not get down past 3956m
558	4327.5	3766	3863	sea water	9 7/8	5.5	1	DLT-GR	4309	3863	good log-even SP worked
558	4327.5	3766	3919	sea water	9 7/8	5.7	1	FGT-CNL-GR	4209	3919	ran GR log to seafloor-broke caliper spudding tool; couldn't get down
											past 4209
558	4327.5	3766	3919	sea water	9 7/8	6.1	2	HRT-CCL	3956	3750	tool out of calibration-could not get down-overran cable-cut off 315m
											damaged wire
						7.1					rig sheaves-cleanout trip, etc.
558A	3908.5	3777				35.9					TOTAL - HPC hole - no logs
559	4067.0	3766									no logs requested
560	3876.5	3155									no logs requested

DEEP SEA DRILLING PROJECT
LOGGING SUMMARY
LEG 82

HOLE	TOTAL DEPTH (M)	WATER DEPTH (M)	OPEN ENDED PIPE AT (M)	FLUID IN HOLE	BIT SIZE	TOTAL TIME FOR LOGGING (HOURS)	RUN NO.	LOGS RECORDED	FROM (M)	TO (M)	OBSERVATIONS
561	3896.5	3470									no logs requested
562	3513.0	3182									no logs requested
563	4178.5	3796									no logs requested
564	4195	3830	3930	sea water	9 7/8	4.1	1	DLT GR	4183	3930	good log
564	4195	3830	3930	sea water	9 7/8	5.7	1	FGT-CNT-GR CAL	4179	3930	good log GR run to seafloor
564	4195	3830	3958.5	sea water	9 7/8	5.8	1	HRT	3820	4172	ran tool inside weighted inner barrel still some trouble getting down
564	4195	3830	3929	sea water	9 7/8	4.7	1	DDBHC-GR-CAL	4170	3929	good log-caliper somewhat noisy
564	4195	3830	3929	sea water	9 7/8	0.7	2	SWF	4174	4090	good log
564	4195	3830	3958.5	sea water	9 7/8	5.9	2	HRT	3820	4172	hit bridge at 4158m-made several stationary records at various points
						3.6					release bit-rig sheaves-troubleshoot electrical-rig down
						30.5					TOTAL
TOTAL	LOGGED	INTERVAL:	5833.5								

DEEP SEA DRILLING PROJECT
TIME DISTRIBUTION
LEG - 82

Date	Site No.	Cruise	Trips	Drill	Core	Stuck Pipe	W.O.W.	DOWNHOLE MEAS.	Mech. Repair	Port Time	Re-Entry	Other	Total Time	Remarks
09/16/81 09/22/81		65.4								77.8		0.3	143.5	Ponta Delgada to Site 556
09/22/81 09/29/81	556		17.0	6.9	91.4			38.8	2.3			16.5	172.9	Site 556
09/29/81		12.5											12.5	Site 556 to Site 557
09/29/81 09/30/81	557		13.0	8.7	2.2				0.2			1.7	25.7	Site 557
09/30/81 10/03/81		42.8					15.9						58.7	Site 557 to Site 558
10/03/81 10/11/81	558		9.8	1.6	122.1		2.6	37.4	3.2			9.6	186.3	Hole 558
10/11/81 10/12/81	558A		8.5		21.8		5.1					2.7	37.9	Hole 558A
10/12/81 10/14/81		33.3											33.3	Site 558 to Site 558
10/14/81 10/16/81	559		14.7	2.6	25.9	0.2		0.3				8.3	52.0	Site 559
10/16/81		15.4											15.4	Site 559 to Site 560
10/16/81 10/18/81	560		15.9	4.1	15.6			0.3				2.1	38.0	Site 560
10/18/81		2.7											2.7	Site 560 to Site 561
10/18/81 10/20/81	561		14.2	5.2	12.1	0.2						4.1	35.8	Site 561
10/20/81 10/21/81		23.0											23.0	Site 561 to Site 562
10/21/81 10/24/81	562		14.1	2.5	54.5	0.7		0.5				7.8	80.1	Site 562
10/24/81		13.6											13.6	Site 562 to Site 563
10/24/81 10/28/81	563		16.1	1.4	52.8	0.2		0.9				6.2	77.6	Site 563
10/28/81		3.3											3.3	Site 563 to Site 564
10/28/81 11/01/81	564		15.7	2.8	42.7			31.6				3.2	96.0	Site 564
11/01/81 11/04/81		286.6								5.5		30.9	323.0	Site 564 to Balboa

DEEP SEA DRILLING PROJECT

LOGGING SUMMARY

LEG 82

HOLE	TOTAL DEPTH (M)	WATER DEPTH (M)	OPEN ENDED PIPE AT (M)	FLUID IN HOLE	BIT SIZE	TOTAL TIME FOR LOGGING (HOURS)	RUN NO.	LOGS RECORDED	FROM (M)	TO (M)	OBSERVATIONS
556	4329	3690	3787	sea water	9 7/8	5.4	1	DDBHC-GR-CAL	4318	3787	big shift in caliper readings - had to recompute
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556	4329	3690	3787	sea water	9 7/8	6.1	1	DLT-GR	4315.5	3786	separation between long & short spaced LL curves due to decentralization
556	4329	3690	3796	sea water	9 7/8	5.3	1	CAL FGT-CNT-GR	4313	3796	GR logged to seafloor
556	4329	3690	3787	sea water	9 7/8	6.1	1	HRT-CCL	4168	3786	bottom water temp down to top at basalt - could not get past bridge -
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						2.5					release bit, flush hole, rig sheaves, work on winch
						28.4					TOTAL
557	2618.5	2155									no logs; aborted for weather
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											damaged wire
						7.1					rig sheaves-cleanout trip, etc.
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559	4067.0	3766									no logs requested
560	3876.5	3455									no logs requested

DEEP SEA DRILLING PROJECT
LOGGING SUMMARY
LEG 82

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564	4195	3830	3958.5	sea water	9 7/8	5.8	1	IRT	3820	4172	ran tool inside weighted inner barrel still some trouble getting down
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						3.6					release bit-rig sheaves-troubleshoot electrical-rig down
						30.5					TOTAL
TOTAL	LOGGED INTERVAL:		5833.5								

DEEP SEA DRILLING PROJECT
TIME DISTRIBUTION
LEG - 82

Date	Site No.	Cruise	Trips	Drill	Core	Stuck Pipe	W.O.W.	DOWNHOLE MEAS.	Mech. Repair	Port Time	Re-Entry	Other	Total Time	Remarks
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09/29/81		12.5											12.5	Site 556 to Site 557
09/29/81 09/30/81	557		13.0	8.7	2.2				0.2			1.7	25.7	Site 557
09/30/81 10/03/81		42.8					15.9						58.7	Site 557 to Site 558
10/03/81 10/11/81	558		9.8	1.6	122.1		2.6	37.4	3.2			9.6	186.3	Hole 558
10/11/81 10/12/81	558A		8.5		21.8		5.1					2.7	37.9	Hole 558A
10/12/81 10/14/81		33.3											33.3	Site 558 to Site 558
10/14/81 10/16/81	559		14.7	2.6	25.9	0.2		0.3				8.3	52.0	Site 559
10/16/81		15.4											15.4	Site 559 to Site 560
10/16/81 10/18/81	560		15.9	4.1	15.6			0.3				2.1	38.0	Site 560
10/18/81		2.7											2.7	Site 560 to Site 561
10/18/81 10/20/81	561		14.2	5.2	12.1	0.2						4.1	35.8	Site 561
10/20/81 10/21/81		23.0											23.0	Site 561 to Site 562
10/21/81 10/24/81	562		14.1	2.5	54.5	0.7		0.5				7.8	80.1	Site 562
10/24/81		13.6											13.6	Site 562 to Site 563
10/24/81 10/28/81	563		16.1	1.4	52.8	0.2		0.9				6.2	77.6	Site 563
10/28/81		3.3											3.3	Site 563 to Site 564
10/28/81 11/01/81	564		15.7	2.8	42.7			31.6				3.2	96.0	Site 564
11/01/81 11/04/81		286.6								5.5		30.9	323.0	Site 564 to Balboa

INTERNATIONAL PHASE OF OCEAN DRILLING

DEEP SEA DRILLING PROJECT

OPERATIONS RESUME

LEG 83

The 83rd leg of the Deep Sea Drilling Project was devoted to deepening and conducting a complex set of geophysical experiments in a hole on the southern flank of the Costa Rica Rift. The hole, 504B, was begun on Leg 69 and subsequently re-visited on Leg 70.

Coring operations deepened the hole to 1350 meters below the sea floor. Also an extensive suite of logging and packer experiments were conducted throughout all but the bottom 62.5 meters of hole. Even though there were two failures of the drill string, the penetration into the basement was almost double that previously achieved by the Project. Sixteen re-entries were performed, the hole was left in good condition and can be re-visited at some point in the future.

The voyage commenced on 14 November 1981 at Balboa Harbor, Panama, and terminated on 5 January 1982, again at Balboa Harbor. The total length of the leg was 52 days, of which 41 days were spent on site, five days on the scheduled port call and 6 days in transit.

Panama Port Call

Leg 83 officially began at 1647 hours on 14 November 1981, when the first line from the Glomar Challenger came ashore at Dock 7, Balboa Harbor, Panama. After taking on 341,000 gallons of fuel the ship was moved to Dock 8 allowing the usual on and offloading of supplies.

The major items of work accomplished during the busy port call schedule were as follows: a U.S.C.G. mid-period exam of the ship and fuel tank numbers J27F and J28F were inspected by the A.B.S. to obtain official certification for repairs made to the tanks.

Generator number 9 was replaced but the new unit was found to perform outside its standard operating specifications. The original generator was re-installed and will be replaced at a future date.

Due to the high downhole temperatures anticipated in Hole 504B, 2200 feet of high maximum working temperature (450°F) cable was spliced to the end of the cable presently in use.

Finally, the 48 joints of aluminum drill pipe on board the ship were offloaded onto the dock and an inspection was undertaken by a representative of the manufacturer, Reynolds Aluminum. The purpose of the inspection was to investigate the cause and severity of scaling on the drill pipe.

On 19 November the only major shipment outstanding was equipment for a downhole resistivity experiment. To take advantage of a low tide (necessary to enable the ship to pass below the Pan American Highway bridge at Balboa) it was decided to proceed outside the harbor anchor and await the arrival of the shipment.

The port call ended with the last line off the dock at 1632 hours, 19 November 1981.

Panama to Site 504

After departing from the dock, the ship proceeded five miles to the Balboa Merchant Ship Anchorage. After seven and a half hours at anchor the resistivity experiment equipment and an electronics technician were transferred to the ship from a launch. The anchor was weighed at 0110 hours, 20 November, and the ship began steaming to Site 504, the location of re-entry to Hole 504B.

After clearing the busy shipping lane to the Canal, a test of the ship's thrusters and dynamic positioning system was successfully conducted. While underway there were two periods of reduced speed to discard an old sandline and to deploy the seismic gear. Good weather and seas allowed for an average speed of 8.73 knots to the location. During the transit a new sandline was spooled onto the drawworks and regular maintenance was undertaken.

The seismic gear was retrieved prior to launching a positioning beacon at the estimated location of Hole 504B, at 1403 hours, 22 November.

Hole 504B: Re-entry No. 1

After returning to the beacon location the dynamic positioning system was switched to its automatic mode. The coring bottomhole assembly was picked up and drill pipe was run to 7 m above the mud line depth reported during Legs 69 and 70. While running drill pipe, the ship was moved to the hole location, 1°13.63'N, 83°43.81'W, with the aid of Sat/Nav fixes. The scanning sonar equipment was run and scanning began after the tool landed at the bit. The tool appeared to be working well but no echo from a cone was observed.

Finding Hole 504B was complicated by the close proximity (1000 feet to the west) of the re-entry hole 504A. An expanding rectangle search pattern was decided upon to locate the cone of either hole. After offsetting 1000 feet west, 200 feet south and then 400 feet east, an echo from a cone was observed.

At this point the scanning tool was found to have an effective range of 150 feet instead of the usual 300 feet. This resulted in a failure to locate the cone during the initial 1000 feet offset west. After an additional 3-1/2 hours of moving the ship short distances to swing the drill pipe, the hole was re-entered at 0632 hours, 23 November. Drill pipe was run 50 meters Below Seafloor (BSF) to confirm re-entry.

Temperature Survey and Borehole Water Sampling Program

The dual aim of the first suite of experiments was: (1) to determine, using a temperature profile of the hole, whether bottom water was still being drawn down the hole into a "capped" acquifer system (as was observed two years earlier during Legs 69 and 70) and, (2) to obtain borehole water samples for geochemical studies from several successive points down the hole.

After verifying re-entry the temperature survey and borehole water sampling tool, known as the Barnes-Uyeda tool, was dropped down the drill pipe to the bit. The drill pipe was then run to 194 m BSF in one stand intervals (28.5 meters) with a ten minute stop at each depth interval. At the final depth a borehole water sample was taken, the tool recovered and the results analyzed.

The temperatures recorded were similar to those obtained during Leg 70, indicating a continuing flow of bottom water into the acquifer system. In addition a 50 ml borehole water sample was recovered. In light of the results a large volume sample was not desired at this depth because only bottom water would have been collected.

The Barnes-Uyeda tool was again run, in a similar manner to the first run, to 451 m BSF. On recovery, both temperature data and a 125 ml water sample were obtained. At this hole depth the borehole water was stagnant, being below the acquifer, and a large volume sample was acquired using the packer sample go-devil. The tool was dropped and its seating confirmed, the pipe was then lowered to 479 m BSF and the sample taken. The tool was recovered with a 10-gallon water sample.

The third Barnes-Uyeda run was to a depth of 650.5 m BSF, again good temperature data was obtained but no sample was collected because of a faulty amphenol connector. The fourth and last run of the Barnes-Uyeda tool was to a depth of 736 m BSF. On recovery it was found that a faulty switch resulted in no temperature data being recorded and when the sample chamber was opened it contained 150 mls of steaming water.

The sampler go-devil was again dropped and seated in the drill bit. The pipe was lowered to 793 meters BSF, 43.0 m above the reported total depth of the hole, and the sample chamber opened. A 10-gallon water sample was recovered. A maximum reading thermometer had also been attached to the go-devil and the maximum temperature recorded on the run was 115°C.

The second run of the sampler go-devil completed the suite of experiments scheduled to be run prior to deepening the hole.

Hole 504B: Bit No. 1

To retrieve the sampler go-devil after its second run, the drawworks sandline was used because the coring sandline unit was inoperative due to a loss of hydraulic pressure from the Bowen Hydraulic Unit. A total of 5-3/4 hours was lost while attempts were made to find the cause of the pressure loss. To enable coring operations to begin, a hydraulic pump used to operate the pipe racking system was re-assigned to the heave compensator. The loss of pressure was subsequently found to have been caused by small pieces of a plastic-like material which clogged up various check and relief valves.

The heave compensator and power sub were picked up, an inner core barrel dropped and the pipe was 'washed' to bottom. Loose fill 4 m deep was circulated out and coring operations began at 1845 hours on 24 November at a depth of 4309.5 m (836 m BSF).

After 68.5 m had been cored, a leak in the stem between the power sub and swivel was observed. Further inspection revealed a one-inch lateral crack four inches below the box end of the power sub stem. To eliminate the risk of getting the pipe stuck in the uncased section of the hole when changing out the power sub, the drill pipe was pulled to position the bit inside the 11-3/4" casing. A total time of 12 hours was lost to replace the swivel and power sub, including time to pull the bit into the casing and run back to bottom.

Coring operations continued to 964.5 m BSF when the rotary torque began to increase and behave erratically. It was decided to pull the drill pipe and install a new core bit. A total of 15 cores were cut (Nos. 71-85) over an interval of 128.5 m. 33.52 m of core was recovered resulting in a 26.1% recovery rate.

The rocks recovered consisted of moderate to extensively altered pillow and massive basalts. The basalt in core numbers 71 through 76 appear to have been altered at relatively low temperatures (less than 150°C) whereas the basalts in core numbers 77 through 85 appear to have been more extensively altered as a result of temperature reactions in the 150°C to 250°C range. Also a zone of abundant sulphides was encountered in core numbers 80 and 81.

After the bit had cleared the mudline, a drill string motion experiment was run. This required dropping a Drill Bit Motion Indicator (DBMI) package to the drill bit, installing an Instrumented Drill String Sub (IDSS) in the drill string at the rig floor and recording the ship's motion by installing a Ship Motion Data System (SMDS) on the bridge. Various parameters are recorded by each instrument simultaneously over a 15-minute period. The data produced was returned to DSDP to be analyzed and used in comparison with a computer model.

Hole 504B: Re-entry No. 2- Bit No. 2

After the hydraulic bit release had been replaced with a bit sub and a new drill bit installed, the drill string was run to the re-entry depth 3 m above the core.

The EDO re-entry tool was run and seated at the drill bit. After 1 hour and 20 minutes of maneuvering the ship, the pipe was stabbed in the core at 1135 hours on 28 November. Re-entry was confirmed, the drill string was run to bottom and coring operations resumed.

Coring proceeded smoothly until the inner core barrel (ICB) retrieving tool was run to retrieve core number 96. The tool was run in the hole, latched to the ICB and pulled to the surface. It was found that the swivel connection at the top of the ICB had 'backed off,' leaving the barrel and core liner down the hole.

The pin end of an inner barrel sub was tapered and assembled on the end of an ICB. After pumping the fishing assembly down the drill pipe, intending to wedge the tapered pin in the box connection at the top of the ICB, the retrieving tool was run and the assembly pulled out of the hole. This first attempt failed and a new fishing assembly was run. It consisted of a wireline spear attached to the end of an ICB. The new assembly was pumped down the drill pipe, a retrieving tool run and latched to the fishing assembly. The spear was 'spudded' down in order to wedge it inside the ICB. Both assemblies were pulled out of the hole and coring operations resumed.

Coring continued to 4535.5 m when a sudden drop in pump pressure occurred and the drill pipe jumped slightly. The drill string weight indicator showed a 75,000 lb. reduction in string weight, which represented a severing of the drill pipe well above the drill collars. Study of the Totco drilling recorder revealed that over a 30 minute period prior to the failure, the pump pressure had dropped 250 PSI and the pump rate had increased by 15 strokes per minute.

The drill pipe was pulled out of the hole and inspection of the severed joint showed that failure was caused by a horizontal transverse crack whose outer edge was highly polished. The fatigue area measured one quarter of the circumference. The severed piece of pipe recovered measured 9.21 m, leaving an estimated 0.4 m of the joint in the hole (0.3 m of which was a tool joint). The 'fish' was made up of the bottom hole assembly and 39 joints of drill pipe.

Because there was only a short 0.1 m stub of 5" tube left on top of the tool joint, it was decided to run an overshot fishing tool which would catch the 7" tool joint. The fishing assembly picked up was the following: a 9-1/2" Bowen Series 150 overshot with 7" mill control guide and basket grapple, crossover sub, three 8-1/4" DC's, crossover sub, jars, crossover sub, three 8-1/4" DC's, two bumper subs, two 8-1/4" DC's, crossover sub, one 7-1/4" DC and drill pipe.

Hole 504 B: Re-entry No. 3 (Fishing)

The drill string was run to the re-entry depth and the EDO scanning tool run down the drill pipe and landed at the overshot. After 1 hour and 55 minutes of maneuvering the ship, the pipe was stabbed at 2310 hours on 1 December. With re-entry confirmed, the pipe was run to the top of the fish at 4048.25 m. While pumping and rotating slowly, the overshot was lowered over the drill pipe connection at the top of the fish. The drill pipe was then raised and a weight 50,000 lbs. over string weight was reached when the tool joint slipped out of the grapple. Subsequent attempts to latch the tool joint in the overshot were unsuccessful. The drill pipe was pulled out of the hole to modify the overshot assembly.

Hole 504B: Re-entry No. 4 (Fishing)

Measurement of tool joints in the drill string just above the severed joint and from visual inspection of the 7" grapple led to the conclusion that the diameter of the tool joints at the top of the fish had been reduced with use and were approximately 6-13/16". The 7" grapple used on the first run was designed to catch a minimum diameter of 6-29/32".

A grapple able to catch 6-13/16" was not available on the ship, therefore a 7" grapple was modified to catch a reduced diameter. The modified grapple was assembled in the overshot, and the same assembly used in the first run was lowered to the re-entry position. After one hour and 30 minutes of scanning, the hole was re-entered at 2010 hours, 2 December.

Again, while rotating and pumping slowly, the overshot was lowered over the top of the fish. The drill pipe was raised and the fish was picked up off the bottom of the hole. The pipe had to be worked through an area of high drag 5 m off bottom. Both the coring and fishing assemblies were pulled without incident. The fishing assembly was disassembled and the coring assembly was found to have its four bottom drill collars plugged with finely ground basalt. A total of 2-1/2 days were expended on the fishing operation.

Twelve cores (Nos. 86 through 97) were cut by bit No. 2 prior to the drill string failure. An interval of 97.5 m was cored, 27.02 m of which was recovery giving a 27.7% recovery rate. The average rate of penetration over the cored interval was 3.1 meters per hour.

The basalts drilled were a series of massive units interspaced with pillow lavas. All showed varying degrees of brecciation, this being more evident in the pillow sections. The massive units tended to be coarse grained with only occasional fining of the grain size.

Hole 504B: Re-entry No. 5 - Bit No. 3

The new bit, No. 3, was attached to the coring assembly and the drill string was run to the re-entry depth. 44 joints of drill pipe above the BHA were left out of the string and the difference was made up with used pipe from the rack. The EDO re-entry tool was run and seated at the bit. The transducer would not rotate when seated, but rotation was achieved when the tool was raised 1 meter. A failure to solve the problem necessitated pulling the tool to the surface.

No fault could be found in the EDO tool, therefore an inner core barrel fitted with a stinger, which would protrude through the bit, was pumped down to drill pipe. The first attempt to retrieve the core barrel was unsuccessful due to a faulty retrieving tool. A replacement retrieving tool was run and latched onto the core barrel. After unseating the barrel with an unusually large overpull of 2000 lbs, the barrel was retrieved. No cause for the overpull was found. The EDO tool was run again and rotation obtained without problem. The hole was re-entered at 0643 hrs. on 4 December, after 53 minutes of scanning.

After lowering the pipe to bottom, coring operations proceeded without incident until Core No. 104 had been cut. As occurred when retrieving Core No. 96, the swivel connection at the top of the inner core barrel unscrewed, leaving the inner barrel and core liner at the bit. An inner core barrel with wireline spear attached was again used to successfully retrieve the fish.

Coring with bit No. 3 was terminated at 4639.5 m after 14 cores (Nos. 98 through 111) had been cut. A total of 104 m was cored and 19.28 m recovered, giving an 18.54% recovery rate. The bit was rotated for 41 hours and 14 minutes with an average penetration rate of 2.52 meters per hour.

Massive basaltic units formed all the material recovered. Chilled intrusive margins became common and a fining of the grain size became evident in many of the coarse units. The change probably represented the top of the dyke section in the oceanic crust.

When the bit cleared the mud line, the drill string motion experiment was conducted for a second time. Again, useful data was successfully collected. On completion of the experiment the bit was pulled to the surface for replacement.

Hole 504B: Re-entry No. 6 - Bit No. 4

The new bit selected, a F94CK, was different from the previous three bits used, in that the core guide had a diameter of 2-1/8" rather than 2-7/16". It was felt that the reduced core diameter might help to improve the falling recovery rate. After installing the new bit, the pipe was run to the re-entry position and was stabbed at 0207 hrs. on 8 December, after 1 hour and 33 minutes of scanning. The pipe was lowered to the bottom of the hole and coring operations resumed.

Nine cores were cut over the total interval cored. The sections cut were each 4.5 m long rather than the usual 9.0 m, this being a further attempt to improve the recovery rate. Unfortunately, no improvement was observed from either the reduced core diameter on the reduced core length, the recovery rate from this section being 12.9%.

The rock recovered consisted of massive fine to medium grained basalts. Temperature alteration remained relatively minor. The drilled margins which were common, suggest a dyke instead of a pillow structure.

After dropping below one meter per hour, the drill bit was pulled to be replaced. The drill string motion experiment again yielded useful results when run with the bit above the mud line.

Site 504B: Re-entry No. 7 - Bit No. 5

The smaller core guide of Bit No. 4 offered no improvement in recovery, and may even have contributed to a reduction. Bit No. 5 reverted back to the size used in the first three bits, namely 2-7/16". Three hours of scanning was required prior to stabbing the pipe at 2054 hours, 10 December. The bit was run to bottom and 100 barrels of 12.0 pounds per gallon mud was circulated. The purpose of pumping the mud was to remove any of the tungsten carbide inserts broken off the previous bit and which might still be at the bottom of the hole.

Coring operations proceeded smoothly to 4727 m, when a decrease in the rate of penetration and an increase in torque indicated that the bit required replacing. Overall, the recovery rate was still a disappointing 12.5%, but the rate of penetration rose to 2.19 meters per hour.

The basic lithology of the cored section remained similar to that encountered over the bit no. 4 interval. That is, massive fine to medium grained basalts with minor alteration. Coring in a dyke structure was still suggested by the continued occurrence of chilled margins.

The fourth run of the drill string motion experiment again yielded good results. On inspection of the bit, it was found the middle rows of tungsten carbide inserts on each core were broken off. A similar loss of teeth had happened to both bit Nos. 3 and 4. The very hard nature of the basalts being cored was the cause of the badly worn bits.

Hole 504B: Re-entry No. 8 - Bit No. 6

With a new core bit installed, a F94CK, the drill string was run to the re-entry depth. Then the EDO re-entry tool was tested, lowered and landed in the bit. After only three minutes of scanning, which broke the previous record held by Leg 50 of five minutes for re-entry, the hole was re-entered at 0247 hours, 13 December.

The 13.5 kHz beacon dropped on arrival at the location was sending a rapidly decaying signal, therefore a 16 kHz Benthos double life beacon was launched during the re-entry procedure.

Coring operations commenced and proceeded smoothly to about the end of the fourth core cut by bit No. 6. Half a meter of core remained to be cut when a sudden drop in pump pressure was observed. The drill string was raised and a 45,000 lb. drop in total weight was noted. The loss in weight signifying a failure in the drill pipe just above the bottomhole assembly.

The drill pipe was pulled out of the hole and was found to have been severed 0.5 m below a female drill pipe thread connection. Thus the 'fish' consisted of 9.0 m of the severed joint, ten additional joints and the bottomhole assembly. The failure mode was similar in nature to the one which occurred earlier in the leg. That is, a horizontal fatigue crack which covered one quarter of the tube circumference. The wall of the tube was thin and badly pitted in the crack area.

Hole 504B: Re-entry No. 9 (Fishing)

With approximately 8.5 meters of the five inch drill pipe tube at the top of the fish, an overshot designed to catch it was assembled. The full assembly being: 8-7/8" Bowen Series 150 FS overshot with a 5" mill control and basket grapple, bit sub, three 8-1/4" DC, crossover, Jars, crossover, three 8-1/4" DC, one bumper sub, two 8-1/4" DC, crossover, and one 7-1/4" DC.

After running the fishing assembly to the re-entry depth, the pipe was stabbed at 0048 hours, 14 December after 54 minutes of scanning. With the overshot positioned just above the top of the fish, the Bowen power sub was picked up and used to pump and rotate the pipe slowly while lowering the overshot. The third attempt to latch the fish was successful and it was raised off bottom with little problem.

When laying down the ten joints and piece of drill pipe at the top of the fish, an additional fatigue crack was found in the severed joint and one each in three other joints. The time lost while retrieving the second fish was 1-1/2 days and a two day extension was added to the leg to make up in part the time lost during the fishing operations.

The recovery of the bottomhole assembly allowed retrieval of the fourth and last core cut by bit no. 6. The total interval cored was 34.0 m, 8.46 m of which was recovered, resulting in a much improved 24.9% rate of recovery. The bit was rotated 16 hours, giving a 2.12 meters per hour rate of penetration.

The basalts were again massive, fine- to medium-grained with the second last core (no. 129) producing the coarsest grained basalts seen so far in Hole 504B.

Hole 504B: Re-entry No. 10 (Logging)

The full suite of logs and the experiment phase were undertaken at this point, rather than at the end of the coring phase as had been planned originally, for a combination of reasons. First, it was felt that valuable lithological data was missing as a result of very low recovery rate. Secondly, the drill pipe's reliability was questioned in light of the two fatigue crack failures and the additional cracks in the pipe immediately above the bottomhole assembly.

A slightly modified bottomhole assembly was used for the logging program. Authorization was received to pick up a limited number of joints of new pipe and to cull any joints which looked suspect. Twelve joints of new drill pipe were positioned immediately above the BHA. All the drill pipe which had been below the cone when drilling was completed was left out of string. The difference was made up with pipe already on the rack and with another 12 joints of new pipe at the top of the string.

After the logging assembly was positioned at the re-entry depth, the EDO re-entry tool was lowered and landed in the clean-out bit. After 105 minutes of scanning, the hole was re-entered at 0820 hours, 16 December. Re-entry was confirmed and the drill string was lowered to the bottom of the hole. Fifty barrels of 12.0 pounds per gallon mud was pumped and displaced out of the hole with seawater. The water circulated was equal to twice the hole volume and not only cleaned the hole but cooled it.

The bit was pulled up inside the casing after circulation was completed and a temperature survey conducted using the Schlumberger temperature sonde. The maximum temperature recorded at the bottom of the hole was 95°C, the measurement being taken 5 hours and 15 minutes after circulation stopped.

On completion of the temperature survey, a trip was made to the bottom to cool the hole prior to running the temperature sensitive borehole televiewer. The tool functioned properly at the surface, but when a routine check was made with the tool in open hole, it failed. Subsequently the failure was found to have been caused by three set screws on the transducer motor shaft slip ring which had become unscrewed and damaged a teflon washer. Also, insulation on a transducer cable had been damaged causing the signal to be shorted out.

While repairing the televiewer, a Dual Laterlog sonde was run but a faulty capacitor in the electronics package resulted in false data being collected. A Dual Induction sonde was run next and a good log was obtained. After the sonde had been layed down, the televiewer was surface checked and found to be working again.

Prior to the second attempt with the televiewer, the hole was cooled again. Very good quality pictures were obtained from the open hole section apart from the bottom 200 meters where the compass did not operate consistently because of high temperatures. Pictures from the top 422 meters were recorded on polaroid film only as the video recorder had broken down when logging up the hole.

While running in the hole to re-record the bottom 200 m, resistance within the tool increased with temperature. The power limit of the surface equipment was reached and the tool would no longer rotate.

Following the televiewer, the long-spaced sonic sonde was run. A P-wave calibration log was obtained but the tool failed during the P-wave digitization log. When pulling out of the hole, the sonde became stuck in the clean-out bit, with no movement of the tool possible.

To avoid endangering the hole, the drill string was pulled clear of the mud line while 'stripping' over the cable (stripping involves clamping and cutting the cable every 28.5 m as the stands of drill pipe are pulled). After the ship had been offset from the hole, a circulating head was installed (the cable also was clamped at the surface) and an attempt was made to pump the sonde free. When this failed, the cable was tensioned to see if the tool could be pulled up, but the weak point in the cable head parted with 9000 lbs. pull. The risk of parting was taken in light of the probability that on parting the sonde would remain wedged in the bit.

The cut piece of logging cable was spooled onto the logging winch drum and the drill string was pulled. The centralizers at the top and bottom of the sonde consist of three bow springs in each assembly. One bow spring on each centralizer was broken and it was the bottom spring which was wedged in the bit. One half of a bow spring was missing and was either in the hole or on the sea bed.

Approximately 12,000 feet of logging cable was dropped a good distance from the cone and the 2200 feet of teflon cable was reheaded to the remaining 19,000 feet of cable on the drum.

Hole 504B: Re-entry No. 11 (logging)

The logging assembly was run to the re-entry depth and after 2 hours and 53 minutes of scanning, the hole was re-entered at 0805 hours, 20 December.

After the bit was positioned just inside the casing, the Schlumberger temperature sonde was used to obtain a downhole temperature profile. The temperatures remained low in and above the acquifer, showing that the draw-down of bottom water was continuing. The maximum temperature at the bottom of the hole was 133°C, the measurement having been taken 58 hours after circulation was completed.

A neutron log was made after completion of the temperature profile and upon its completion, a Schlumberger water sampler was run. Due to its light weight the tool repeatedly 'hung up' as it was lowered down the open hole and would not go below 4452 m. The sample chamber was opened and 650 ml of fluid was collected.

The temperature probe was run to obtain the final profile, but it failed while being lowered in the drill pipe. When retrieved, a broken wire in the cablehead was found and quickly repaired. Again, good temperature data was recorded and the maximum temperature at the bottom of the hole was 135°C, 82 hours after the hole was last circulated.

Prior to rerunning the long-spaced sonic sonde, the hole was cooled. The P-wave digitization and S-wave logs were recorded, this being the first time an S-wave log had been obtained in a sub-ocean hole. One of the bow springs in the top centralizer broke during the run and a 0.5 m piece was lost in the hole.

The equipment used in the large scale resistivity experiment was able to withstand a maximum temperature around 100°C, therefore a trip to bottom was made to cool the hole. Good data was collected from the complete open hole section.

The resistivity experiment completed the logging planned for the hole and the drill string was pulled to change the bottomhole assembly for the packer experiments.

Hole 504B: Re-entry No. 12 (Packer Run No. 1)

The Lynes inflatable formation packer was made up in the BHA, tested successfully and lowered to the re-entry depth. The EDO tool was landed in the logging shoe and the pipe was stabbed after scanning 45 minutes at 1443 hours, 23 December.

The drill string was lowered to the bottom of the hole then the heave compensator and power sub were picked up. A 40-barrel gel mud pill was circulated around the hole to get it as clean of cuttings as possible.

With the packer positioned two meters from the bottom, the 'sampler go-devil' was pumped down with the rig pumps and seated in the packer. The system was pressurized to 1000 psi to inflate the packer and after 15 minutes was increased to 1960 psi - to open the sample chamber. Due to a small leak, additional pumping was required to maintain the pressure for the one hour needed to collect the sample.

The packer deflated and the sample chamber closed when the pressure was bled off. Two attempts were made to unseat the go-devil, but in each case the inner core barrel retrieving tool safety pins sheared.

The second approach to unseat the go-devil without having the drill pipe clear the mud line was to pull 14 stands (400 m) of drill pipe and immediately run 10 stands (285 m) back in the hole. This created a 400 psi differential pressure acting below the go-devil. An attempt to pull the tool was unsuccessful and the only option left was pulling the drill string and breaking the go-devil out on the rig floor.

A thick mixture of thread dope and rust was found to have wedged the go-devil into the packer. The packer element was punctured and was replaced prior to being rerun. Thirteen gallons of water were recovered by the go-devil.

Hole 504B: Re-entry No. 13 (Packer Run No. 2)

The packer was satisfactorily surface tested after being redressed the drill string was lowered to the re-entry depth. After 63 minutes of scanning, the hole was re-entered at 0106 hours, 25 December.

The packer was positioned at 4007.7 m (bottom of the element) and the heave compensator and power sub were picked up. The 'safety' go-devil was dropped and pumped down using the rig pumps. After seating the go-devil, the BJ pump was used to inflate the packer by pressuring up to 1500 psi. After holding the pressure 10 minutes to allow the packer to inflate, it was increased to 2000 psi when the shear plug opened and exposed the formation to the drill pipe pressure.

The pressure was allowed to decay for 15 minutes before being built to 370 psi. The decay was recorded for 15 minutes, the pressure increased to 147 psi and a third decay of 12 minutes obtained.

Finally, a steady rate flow test was conducted. A flow rate of 105 gallons per minute with a 440 psi surface pressure (325 psi downhole) was maintained for 15 minutes and the pressure decay recorded for 34 minutes. Excellent decay curves were obtained but fluid appeared to leak past the packer elements when the surface pressure reached approximately 400 psi.

The packer was deflated, the go-devil retrieved and the drill pipe was run to re-position the packer at 4487 m. The 'safety' go-devil was dropped and seated in the packer. The drill string was pressurized to 1500 psi to inflate the packer and to check that full inflation had occurred, a pull of 10,000 lbs. was applied.

At 1800 psi, the shear plug opened but the pressure bled to zero immediately. A pump test confirmed that the packer element had failed. The go-devil was retrieved and the drill string pulled to replace the damaged element. When recovered, the top of the element was belled out and punctured, the result of the packer body moving up - which occurred during the pull test.

Hole 504B: Re-entry No. 14 (Packer Run No. 3)

The damaged element was quickly replaced and the drill string rerun to the re-entry depth. The pipe was stabbed at 0952 hours, 26 December after 45 minutes of scanning.

The packer was positioned at 4487 m and the 'safety' go-devil was pumped down and seated in the packer. A pressure of 1600 psi was applied and held for five minutes to allow the packer to inflate. At 1750 psi the shear plug opened, but the pressure immediately dropped to zero. A low circulating pressure while pumping meant that either the packer had failed or had not inflated.

The go-devil was retrieved and the pins which shear when deflating the packer were found to have failed either when the go-devil was dropped or when it landed in the packer.

Stronger shear pins were installed and the go-devil was run again. As before, 1500 psi was applied to inflate the packer but the pressure dropped slowly. An increase in the pressure to 1750 psi blew the shear plug and the pressure dropped to zero immediately. When circulating the pump pressure was again low. Inspection of the deflate shear pins revealed that they were intact and the only reasonable conclusion was that the packer element had been damaged.

When recovered, the rubber outer jacket of the packer element was completely missing as if it had "peeled off", yet the steel belt remained intact - further evidence to support the developing argument that the elements were sub-standard.

The time allocated to the experimental phase had almost all been used and did not allow the packer to be rerun. The remaining time was utilized by running to bottom with the drill string and obtaining a 650 ml water sample at 4747 m, with the Schlumberger water sampler.

After cooling the hole, the bit was positioned inside the casing, the televiewer was rerun over the bottom 200 m of hole, and good pictures were recorded. This concluded the experimental phase and the drill string was pulled to change to a coring bottom hole assembly.

Hole 504B: Re-entry No. 15 - Bit No. 7

The same bottom hole assembly and type of bit, a F94CK (which was used earlier in the leg) was made up and run to the re-entry depth. The pipe was stabbed at 0536 hours, 28 December, after only two minutes of scanning and in the process, breaking the record set by the eighth re-entry.

The bit was run to within 15 meters of bottom and the heave compensator and power sub were picked up. While circulating 100 barrels of mud, the bit was rotated to bottom. The pipe torqued up twice because of the junk in the hole, but was pulled free easily.

On reaching bottom, coring operations commenced and the pieces of spring and the rubber element posed no further problems. Coring proceeded relatively smoothly apart from one point when some large cuttings stuck the pipe and 100,000 lbs. overpull was required to free it.

Five cores, numbers 131 through 135, were cut before the penetration rate dropped below 0.5 meters per hour - a result of the bit being worn out. It had cored 34.5 m in total, 5.29 meters of which were recovered for a 15.33% recovery. The formation continued to be massive, fine- to medium-grained basalts and alteration increased with depth.

When the mudline was cleared while pulling out of the hole, the drill string motion experiment was conducted for the fifth time and as before good data was collected. The bottomhole assembly and Bowen power sub were both magnafluxed on this trip and no cracks were found in any of the connections.

Hole 504B: Re-entry No. 16 - Bit No. 8

On completion of the magnafluxing, a new bit was installed and the drill string was run in preparation for re-entry. The pipe was stabbed at 0030 hours, 31 December after a 13-minute period of scanning.

The coring proceeded with no problems over an interval of 28.0 m, cut in six sections, and 3.24 meters of core was recovered, the final depth of the hole being 4823.5 m. No significant changes in formation occurred, the rocks still were massive, fine- to medium-grained basalts.

Bit No. 8 was the final one run on Leg 83 and prior to leaving the hole it was flushed with a gel mud pill and circulated clean with seawater.

Site 504 to Balboa Harbor, Panama

The ship departed from Site 504 at 1352 hrs, 2 January 1982. Calm seas and a following current made for an average speed of knots. A slight departure from the direct route allowed a close view of the volcanic island, Isla de Malpelo. Throughout the transit, the rig crew were busy preparing the drawworks for a major overhaul.

The leg officially ended at 1554 hrs, 5 January, with the first line on Dock 8 at Balboa Harbor.

Coring Equipment

Essentially only one coring assembly was used during the entire leg, the only small change being in the first assembly used when a 'locked out' hydraulic bit release and a bit reference sub were substituted for the bit sub and head sub.

The coring assembly was: a 9-7/8" bit, bit sub, head sub, outer core barrel, top sub, head sub, four 8-1/4" DC, one bumper sub, three 8-1/4" DC, two bumper subs, two 8-1/4" DC, crossover sub, and one 7-1/4" DC. The hydraulic bit release, with set screws installed to ensure that it would not release, was used to provide a landing profile for the 'sampler' go-devil.

The main source of problems during coring was not the actual coring equipment but the five inch drill pipe. Two fatigue failures occurred and four days were spent on the fishing operations. Fortunately they were both relatively straightforward, but to achieve the first one the unrecommended practice of cutting and welding a basket grapple was necessary. In addition to the failures four other cracks were found in the joints of drill pipe included in the second fish. 157 joints of drill pipe were removed from the string and the difference was made up with 24 new joints and used drill pipe already made up on the rack.

The other periods of lost time occurred while repairing the Bowen hydraulic unit which had become clogged with a plastic-like material, while replacing the cracked power sub and fishing the inner core barrel twice after the swivel had unscrewed during coring.

The various methods used to improve the rate of recovery were as follows:

1. Using a bit with a reduced core guide diameter, this resulted in a decrease in recovery.

2. Cutting short sections, generally 4.5 m (half a knobby joint). This seemed to help, especially if a piece of core jammed at the beginning of a section.

3. Leaving out the plastic core liner - this also helped reduce the core jamming problem, but made handling of the core at the surface more difficult.

4. Running a light weight and slow rotary (20,000 lbs. weight and 55 RPM). This combination was the best for extending bit life and maintaining a reasonable (approx. 1 m/hr) rate of penetration.

Bits

The core bit used exclusively on Leg 83 was the 9-7/8" F94CK. The only difference was in the diameter of the core guide, bit no. 4 had a 2-1/8" guide compared with 2-7/16" for the others. It was hoped that the reduced diameter would help eliminate core jamming and thus increase recovery, but the opposite seemed to occur.

The basalts cored became harder with depth and as a result, more difficult to drill. The average rate of penetration progressively dropped and after about 30 rotating hours, the middle rows of teeth on each cone would have been broken off. When drilling hard basalts in the future, cones with more rounded inserts in the middle rows would be useful.

Logging

An extensive suite of logs was run during the leg, the Barnes-Uyeda and 'sampler' go-devil being run before coring commenced and the full set between the sixth and seventh bit runs. A total of 20 runs were made with varying degrees of success. The Dual Laterlog was the only problem sonde which could not be rerun as a temporary repair was only made close to the end of the site period.

The televiewer continued to be a rather delicate tool, but despite the problems, the pictures were the best ever recorded at sea. The MCD caliper/centralizers on the long-spaced sonic sonde were a problem (they also caused problems on Leg 82) because of three bow spring failures. The broken springs on the first run resulted in 12,000 feet of logging cable being destroyed when the sonde stuck in the BHA.

The high temperature cable, spliced to the existing wireline at the beginning of the leg, served its purpose but the splice had to be cut out and substituted with a torpedo connection because of a sea water leak.

The bottomhole assembly used for the main logging period was the following: 9-1/4" cleanout bit, five 8-1/4" DC, one bumper sub, three 8-1/4" DC, two bumper subs, two 8-1/4" DC, crossover sub, one 7-1/4" DC. The tungsten carbide matrix on the clean out bit extended into the bore and may have been a contributing factor to the bore spring failure. The bit was modified after the logging program so as to provide a smoother profile.

Packer Equipment

Three runs were made with the Lynes Inflatable Formation Packer but with only limited success. On the first run, the 'sampler' go-devil became wedged into the packer bore with a mixture of rust and pipe dope. When recovered the element was found to have been punctured at some stage in the experiment.

The first seating of the packer during the second run provided the only useful information concerning the physical properties of the rock. Using the 'safety' go-devil, four decay curves were obtained which were used to calculate the formation permeability. Unfortunately, the fluid leaked past the element when the differential pressure across it exceeded 400 psi and an attempt to fracture the rock was not possible.

On both the final two attempts to seat the packer failed because the element burst each time the shear plug blew. The most likely explanation of the problem is that the elements had not been vulcanized properly during manufacture.

The bottomhole assembly used on the first run was a logging shoe, mechanical bit release, head sub, packer, jars, crossover sub, two bumper subs, three 8-1/4" DC, one bumper sub, five 8-1/4" DC, crossover sub, one 7-1/4" DC. On the second and third runs, three of the group of five 8-1/4" DC's were moved down between the crossover sub and the two bumper subs.

All in all, the packer experiments were a big disappointment, although some good data was collected.

Heave Compensator

The heave compensator was used throughout the coring and packer operations. It performed reliably although the prevailing conditions were not too demanding, the maximum swell was only two meters.

Dynamic Positioning and Beacons

The dynamic positioning system worked very well throughout the leg. A worrisome intermittent glitch in the display unit on arrival at the site was soon tracked down to noise spikes from the console data lines. The problem was solved by filtering the lines.

Only two beacons were used during the leg, an ORE 13.5 kHz double life and a Benthos 16 kHz double life. Both worked well, and the second beacon was dropped because of a rapidly decaying signal from the 13.5 kHz unit. Each covered half the site time and the ORE beacon was still transmitting weakly upon departure of the site.

Weather

Superb weather was enjoyed through the leg, the average mid-day temperatures ranging from 75 to 80°F. A light, steady breeze produced pleasant working conditions, but was never a controlling factor in any of the operations.

Communications

Communications were good throughout the leg and the Scripps radio station WWD handled all the business traffic. Its volume was the lightest that the radio operator had experienced.

Because the leg took place during the holiday season, the many radiotelephone calls made via commercial and amateur radio patches were valued and appreciated.

Personnel

Despite being away from home for not only Thanksgiving, but Christmas and New Year's as well, morale on Leg 83 remained high throughout. In fact, many of the cruise veterans commented that it was their best cruise so far.

The scientific party worked well together and were supported by the invaluable efforts of the DSDP technical staff and the GMI crew, who saved the hole from being lost on several occasions.

Graham Norrie
Cruise Operations Manager
Deep Sea Drilling Project

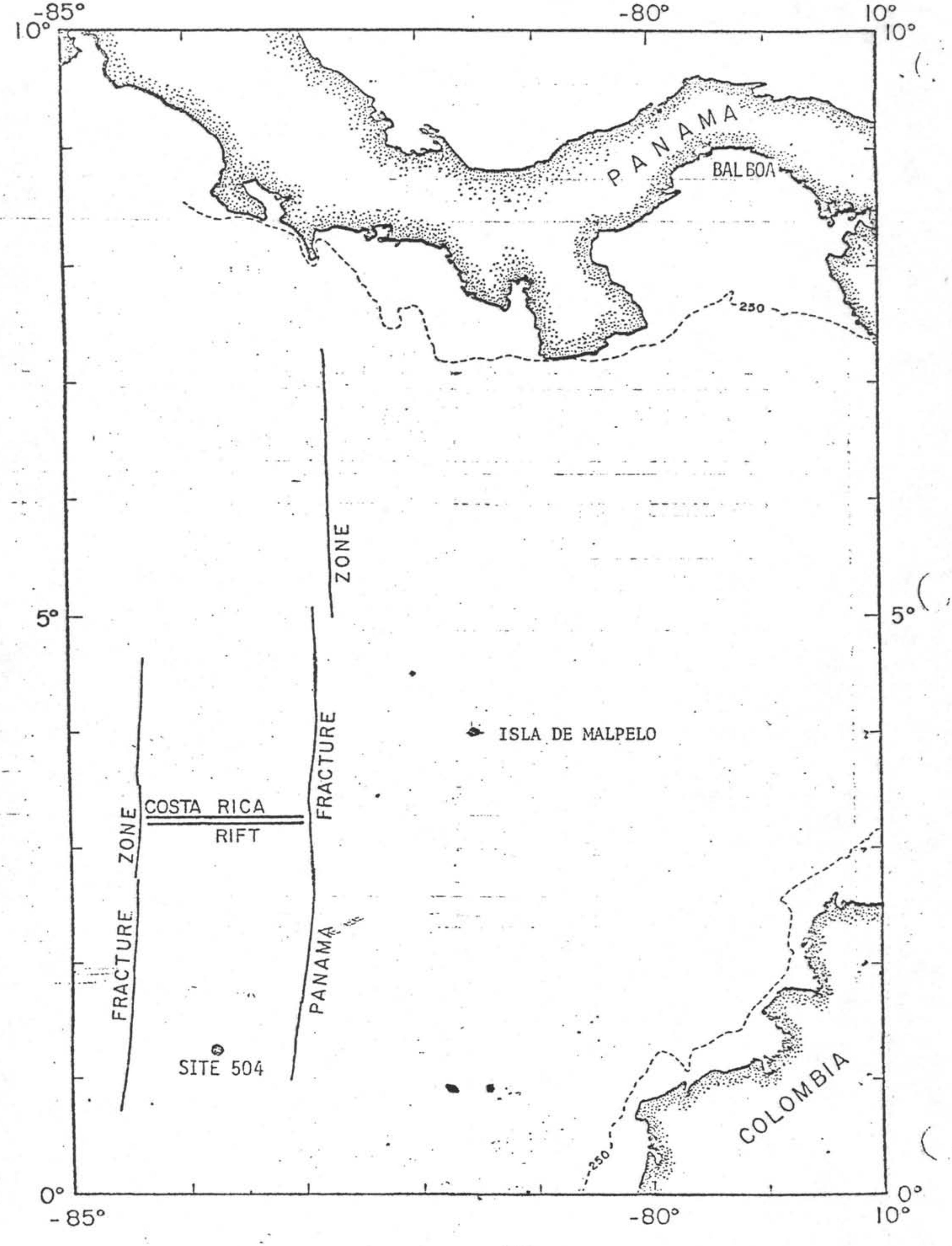
INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
OPERATIONS RESUME
LEG 83

Total Days (November 14, 1981-January 5, 1982	52
Total Days in Port	5
Total Days in Transit	6
Underway	5.3
At Anchor	0.7
Total Days on Site	41

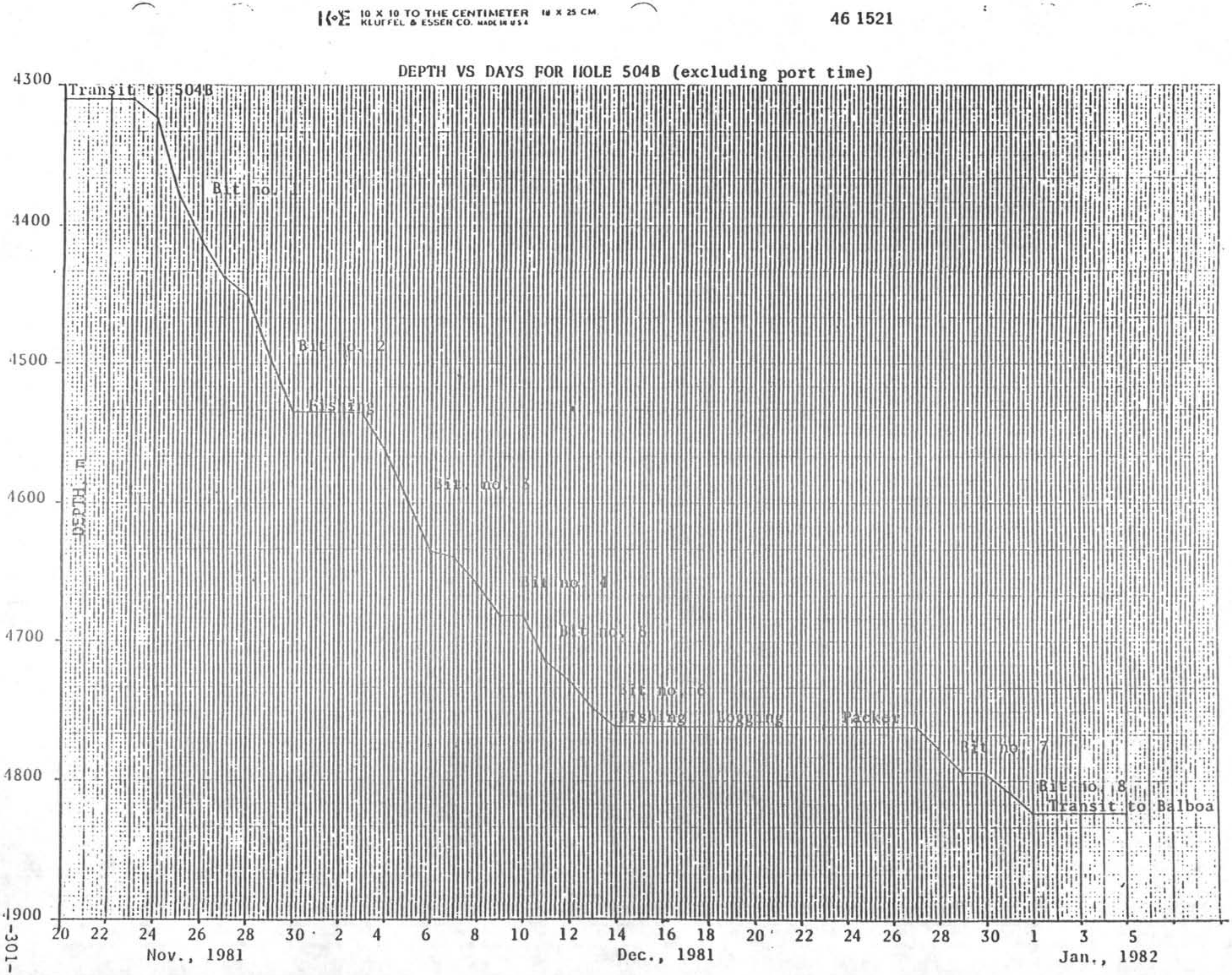
Trip Time	10.24
Coring Time	13.96
Fishing Time	3.86
Downhole Measurements	7.16
Mechanical Downtime	0.57
Re-entry Time	3.84
Other	1.37

Total Distance Traveled (nautical miles)	1079.2
Average Speed (knots)	8.59
Sites & Holes (returned to previous Site 504B)	0
Re-entries	16
Number of Cores Attempted	71
Total Meters Cored	514
Total Meters Recovered	107.88
Per Cent Recovery	20.99
Water Depth	3473.5 m

LEG 83 OPERATING AREA



DEPTH VS DAYS FOR HOLE 504B (excluding port time)



INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
BEACON SUMMARY
LEG 83

SITE NO.	MAKE	FREQ kHz	SERIAL NUMBER	SITE TIME HOURS	REMARKS
504B	ORE	13.5	558	489.2	Still sending weak signal at end of site time.
504B	Benthos	16.0	019	494	Still sending strong signal at end of site time.

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
SITE SUMMARY
LEG 83

HOLE	LATITUDE	LONGITUDE	WATER DEPTH METERS	NUMBER OF CORES	CORES WITH RECOVERY	PERCENT OF CORES WITH RECOVERY	METERS CORES	METERS RECOVERED	PERCENT RECOVERED	METERS DRILLED	TOTAL PENET METERS	AVG. RATE PENET	ROTATING HOURS	BIT NO.
504B	1° 13.63'N	83° 43.81'W	3473.5	15	15	100.0	128.5	33.52	26.01	0.0	128.5	4.08	31.5	1
				12	12	100.0	97.5	27.02	27.71	0.0	97.5	3.08	31.6	2
				14	14	100.0	104.0	19.28	18.54	0.0	104.0	2.52	41.2	3
				9	9	100.0	41.5	5.34	12.87	0.0	41.5	1.58	26.3	4
				6	6	100.0	46.0	5.73	12.46	0.0	46.0	2.19	21.0	5
				4	4	100.0	34.0	8.46	24.88	0.0	34.0	2.12	16.0	6
				5	5	100.0	34.5	5.29	15.33	0.0	34.5	1.21	28.4	7
				6	6	100.0	28.0	3.24	11.57	0.0	28.0	0.96	29.2	8
504B	1° 13.63'N	83° 43.81'W	3473.5	71	71	100.0	514.0	107.88	20.99	0.0	514.0	2.28	225.2	

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
BIT SUMMARY
LEG 83

HOLE	MFG	SIZE	TYPE	SERIAL NUMBER	METERS CORED	METERS DRILLED	METERS TOTAL PENET.	HOURS ON BIT	CONDITION	REMARKS
504B	Smith	9 7/8"	F94CK	AE3379	128.5	0.0	128.5	31.5	B2,T2 In Gauge	Good for rerun
504B	Smith	9 7/8"	F94CK	AE3375	97.5	0.0	97.5	31.63	B2,T2 In Gauge	POOH after twist-off
504B	Smith	9 7/8"	F94CK	AE3466	104.0	0.0	104.0	41.23	B6,T6 I.C. middle for of teeth broken	
504B	Smith	9 7/8"	F94CK	AR2694	41.5	0.0	41.5	26.33	B5, T5 I.C. middle for of teeth broken	2 1/8" core guide
504B	Smith	9 7/8"	F94CK	AE4649	46.0	0.0	46.0	21.00	B, TG I.C. middle for of teeth broken	
504B	Smith	9 7/8"	F94CK	AE3465	34.0	0.0	34.0	16.2	B8 (1 cone locked) T1 in gauge	POOH after twist-off
504B	Smith	9 7/8"	F94CK	AE3398	34.5	0.0	34.5	28.43	B2 in gauge T6 middle row of teeth broken	
504B	Smith	9 7/8	F94CK	AE3376	28.0	0.0	28.0	29.18	B4, T5 in gauge	

DEEP SEA DRILLING PROJECT
LOGGING SUMMARY
LEG 83

HOLE	TOTAL DEPTH (M)	WATER DEPTH (M)	OPEN ENDED PIPE AT (M)	FLUID IN HOLE	BIT SIZE	TOTAL TIME FOR LOGGING (HOURS)	RUN NO.	LOGS RECORDED	FROM (M)	TO (M)	OBSERVATIONS
504B	4309.5	473.5	3523 to 3667.5	seawtr	9 7/8	4.0	1	temp & bore-hole sample	3523.5	3667.5	Good run and 50 ML sample.
	4309.5	473.5	3667.5-3924.5	seawtr	9 7/8	2.5	2	temp & bore-hole sample	3667.5	3924.5	Good run and 125 ML sample.
	4309.5	473.5	3952.5	seawtr	9 7/8	5.3	3	large volume sample	3952.5		10 gal sample
	4309.5	473.5	3952.5 4124.0	seawtr	9 7/8	3.0	4	temp & bore-hole sample	3952.5	4124.0	Good temp data and no sample
	4309.5	473.5	4124.0 4209.5	seawtr	9 7/8	3.5	5	temp & bore-hole sample	4124.0	4209.5	No temp data & 150 mls steaming water
	4309.5	473.5	4266.5	seawtr	9 7/8	6.4	6	large volume sample	4266.5		10 gal sample
	4761.0	3473.5	3746.5	seawtr	9 7/8	6.7	7	temperature	3473.5		Good run.
	4761.0	3473.5	3746.5	seawtr	9 7/8	3.7	8	televiewer			Tool shorted out during test.
	4761.0	3473.5	3746.5	seawtr	9 7/8	6.3	9	dual laterlog			Faulty electronics cartridge.
	4761.0	3473.5	3746.5	seawtr	9 7/8	7.0	10	dual induction	3750.5	4761.0	Good log. CR-SP-NID-FID-SLL
	4761.0	3473.5	3746.5	seawtr	9 7/8	17.0	11	televiewer	3750.5	4761.0	Good quality pictures except for bottom 200 M.
	4761.0	3473.5	3746.5	seawtr	9 7/8	9.5	12	long spaced sonic	3750.5	4761.0	Obtained P-wate calibration. Tool failed during P-wave digitization.
											Tool stuck in bottomhole assembly.
	4761.0	3473.5	3746.5	seawtr	9 7/8	6.3	13	temperature	3473.5	4761.0	Good run.
	4761.0	3473.5	3746.5	seawtr	9 7/8	6.7	14	FOL-CNL-GR	3750.5	4761.0	Good run.
	4761.0	3473.5	3746.5	seawtr	9 7/8	6.7	15	sampler	4452.0		650 ML sample. Light tool hung up conx. down
	4761.0	3473.5	3746.5	seawtr	9 7/8	10.3	16	temperature	3473.5	4761.0	Good run.
	4761.0	3473.5	3746.5	seawtr	9 7/8	10.4	17	long spaced sonic	3750.5	4761.0	Good run. Obtained P-wave digitization S-wave run caliper.
	4761.0	3473.5	3746.5	seawtr	9 7/8	10.5	18	large scale resistivity	3750.5	4761.0	Good run.
	4761.0	3473.5	3746.5	seawtr	9 7/8	5.2	19	sampler	4747.0		650 ml sample.
	4761.0	3473.5	3746.5	seawtr	9 7/8	9.8	20	televiewer	4558.0	4758.0	recorded 200 m

DEEP SEA DRILLING PROJECT
TIME DISTRIBUTION
LEG - 83

Date	Site No.	Cruise	Trips	Drill	Core	Stuck Pipe	FISHING	DOWNHOLE MEAS.	Mech. Repair	Port Time	Re-Entry	Other	Total Time	Remarks
11/14/81 11/22/81										119.7			119.7	Balboa Harbor Panama
11/14/81 11/22/81		62.6										7.7	70.3	Balboa to Site 504
11/22/81 01/02/82	504B		245.8		334.7		92.6	171.9	13.6		92.2	32.4	983.2	
01/02/82 01/05/82		65.3										8.6*	73.9	*at anchor

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INTERNATIONAL PHASE OF OCEAN DRILLING

DEEP SEA DRILLING PROJECT

OPERATIONS RESUME

LEG 84

The 84th scientific voyage of the Deep Sea Drilling Project returned to the Mid-America Trench area and concentrated its investigation in the region previously drilled on Leg 67. Difficult drilling conditions prevailed, as in previous investigations of active plate margins.

Despite major delays and the loss of a drill string, eleven holes were drilled at six sites, with five holes bottomed in igneous/metamorphic rocks. Major scientific achievements included determination of the nature of basement rocks and the study and collection of hydrocarbon gases and gas hydrates. Unexpected successes were core recovery and well logs from a massive gas hydrate zone about four meters thick.

The voyage commenced on January 5, 1982, at Balboa, Panama and terminated at Los Angeles, California on March 3, 1982. An interim stop was made at Manzanillo, Mexico to disembark scientific personnel. Total length of the leg was 57.1 days; of which 33.5 days were spent on site, 5.9 days in port, and 17.7 days in transit. Political delays accounted for 4.4 days, with 1.5 days spent making up new drill string and 0.2 day on mechanical breakdown.

Balboa Port Call

Leg 84 began with the first mooring line at 1554 hours, January 5, 1982 at Berth 8, Balboa Harbor, Panama. The scheduled workload for the port call was fairly heavy, with major items including: overhaul of number six engine, rear seal replacement on number eleven engine, overhaul of the anchor windlass, replacement of the drawworks brake drums, overhaul of one Bowen power sub and magnetic inspection of the drill string. In addition, the French X-ray laboratory van was offloaded, and 233,000 gallons of fuel and 3500 sacks of drilling mud materials were loaded. The usual on-and offgoing freight shipments and produce were handled. The vessel shifted to nearby Berth 7 for fueling on the morning of January 10.

Balboa to Site 565

The *GLOMAR CHALLENGER* left her berth at 1042 hours, January 11, and proceeded to an area outside the traffic lanes where the vessel's thrusters and dynamic positioning system were given a brief check. The course to the initial operating area lay northwestward along the Central American coast. With excellent weather and a following current, the vessel averaged about 9.8 knots for the transit. After a 3 1/2 hour profiling survey of the landward slope of the Middle America Trench, a positioning beacon was dropped about 25 miles off Costa Rica's Nicoya Peninsula at 1732 hours, January 13.

Site 565

The vessel was positioned over the beacon in the normal manner and the pipe trip was begun. As the bottom hole assembly (BHA) was being made up, the vessel received instructions to halt drilling operations until final authorization had been received from the Costa Rican government.

A 15 hour delay ensued before permission was received to proceed with operations. Part of this time was used to conduct a detailed survey of the site area with the 3.5 kHz precision depth recorder (PDR) using the positioning beacon for navigational reference. The pipe trip began at 1030 hours, January 14. Six hours later a patrol vessel came alongside the *CHALLENGER* to transfer two Costa Rican observers onto the drillship while two Scripps personnel disembarked for the duration of Site 565 operations. The pipe trip was not interrupted.

Hole 565 was spudded at 0330 hours, January 15 with a punch core to 3121.5 meters. Based on the PDR depth of 3109 meters and the recovery of a completely full inner core barrel, water depth was estimated at 3111 meters. Rotary coring proceeded with excellent core recovery through green mud grading with depth to mudstone. Combination temperature/water sampler probe runs were made at 48.5, 96.0, 143.5, and 200.5 meters BSF. Hole conditions began to deteriorate slowly but steadily from about 250 meters below seafloor (BSF). Penetration rate declined while drill string torque increased. This was interpreted as a "heaving formation" condition. Good recovery continued to about 30 meters from total depth, but the sediment was noted to be fractured with depth. Hole cleaning problems began about 280 meters BSF, and a losing battle of mud flushes and "working" pipe was fought with tight hole and fill to a total depth of 328 meters, when the bit could not be worked back to bottom following core number 34. Back pressure of up to 250 psi was noted in the drill pipe during this time and was attributed to formation overpressure. Problems were further compounded when the Bowen power sub hydraulic system failed and the pipe could not be rotated for nearly two hours. Sticking tendencies were overcome when rotation was regained, however.

Hydrocarbon gas samples were collected from core liners from about 20 meters to total depth and were analyzed immediately. Icy substances were noted in cores from below 300 meters and material from core number 33 was positively identified as gas hydrate. The hole was abandoned by plugging from about 250 meters to 50 meters with cement.

The bit was then pulled clear of the seafloor and a drill string instrumentation test run was made before the pipe was recovered. The string was then pulled and the vessel departed at 0508 hours, January 19.

Site 565 to Site 566

Before the *GLOMAR CHALLENGER* could head for Guatemalan waters and the next drill site, it was necessary to disembark the two Costa Rican observers. The Costa Rican patrol boat had been delayed in its departure from Puntarenas and the *CHALLENGER* therefore headed for that port in an effort to expedite the transfer. The rendezvous and personnel transfer took place a few miles off Cabo Blanco, Costa Rica, and the drillship set course for the Guatemala transect operating area after a delay of about 12 hours.

On January 20, as the vessel approached the operating area, word was received from DSDP Headquarters that no authorization had been secured for any investigations with Guatemalan claimed waters. It was therefore necessary to retrieve the towed geophysical gear just a few miles from the operating area. About 20 hours were then spent waiting in the vicinity of the proposed site for notification to proceed with operations. Late on January 21, it was learned that authorization still had not been granted, and instructions were received to proceed to a contingency site approximately 350 miles to the south.

The ship had traveled about 220 miles toward the alternate site on the following day when it was learned that the Guatemalan drilling program had finally been approved in full. An immediate U-turn was made, and the vessel headed back for the site, which was located about 60 miles off the Guatemalan coast. Headwinds and opposing currents were encountered, and the positioning beacon was not dropped until 2200 hours, January 23. An additional 1 1/2 hours were spent in profiling before the seismic gear was retrieved and the vessel was positioned over the beacon.

Hole 566 - San Jose Canyon

A special core bit and BHA were assembled to permit deployment of either the Variable Length Hydraulic Piston Corer (VLHPC) or the Extended Core Barrel (XCB) coring system. A 12 kHz pinger was attached to the drill pipe 498 meters above the bit to aid in water depth determination, since the irregular bathymetry of the area was expected to produce misleading side echos on the PDR. The PDR reading was 3745 meters and, when the bit had been run to 3710 meters, the pinger indicated a water depth of 3769 meters. The power sub was then picked up and pipe was added to position the bit at 3767 meters for the first 9.5 meter piston core attempt. No core was recovered on this or on the following 9.5 meter attempt. The third HPC was "shot" from 3785.6 meters at 1620 hours, January 24. Drill pipe pressure failed to bleed off after actuation of the corer, indicating that it had not stroked to its full 9.5 meter length. The corer was recovered with about four meters of very stiff sediment. Subsequent lowering of the bit showed weight loss indication 4.5 meters below the previous depth and water depth was established at 3786 meters. The number of shear pins in the piston corer was then increased from two to the maximum of three. The attempt for core number two also produced an incomplete stroke indication. Considerable resistance was noted when the core barrel was pulled from the sediment. Six meters of core were recovered, and it was found that part of the quick connect mechanism had been deformed nearly to failure by the pullout tension.

With the sediment determined to be too hard for piston coring, the VLHPC system was rigged down and the Extended Core Barrel System was deployed. Three mudstone cores were then taken with the XCB system. The system seemed to function normally except that collapse or failure of the plastic core liner prevented core from entering beyond the point of failure in each instance. Altered serpentinite/peridotite "basement" was encountered at this point. Core recovery dropped sharply and, as the rubbly igneous rock became fresher and harder, considerable damage to the XCB cutting shoes was noted. Coring was terminated at 55.8 meters BSF due to low rates of penetration and core recovery.

Hole 566A

The bit was then pulled clear of the seafloor and the vessel was offset about one kilometer to the southwest. Hole 566A was to be a step toward determining the areal extent of the igneous rock body encountered in Hole 566. The weight indicator registered contact with a firm sea bottom at 3865 meters (as compared with 3836 by PDR reading and 3858 by pinger). Rotation and strong pump circulation were required to penetrate the stiff sediment, which became even harder after two meters of penetration. At about six meters BSF, drilling parameters indicated hard "basement" rock had been encountered, and 20 minutes were required to make one additional meter. Lack of lateral support for the BHA precluded the application of sufficient bit weight to penetrate such hard material and drilling efforts were terminated. The inner core barrel was retrieved and 12 cm of serpentinized peridotite pebbles were recovered from the core catcher.

Hole 566B

The core bit was pulled well clear of the seafloor in anticipation of an offset move upslope. Offsets were then entered into the positioning system to station the vessel about one kilometer northeast of the beacon. PDR depth was 3661 meters and pinger depth was 3677 meters. Hole 566B was spudded at 2030 hours, January 25, when the seafloor was "felt" by the weight indicator at 3674 meters. The hole was "washed down" to 49 meters BSF with the XCB in place. The wash barrel was then recovered in preparation for continuous coring. NO core was recovered. Damage to the inner barrel latch mechanism indicated that the XCB was no longer being driven by the latch sleeve and that the latch sleeve was probably damaged also. There was little prospect of completing the objectives of the site with the XCB system, and a round trip of the drill string was therefore made to convert to a conventional BHA for standard rotary coring.

Hole 566C

Hole 566C was spudded at the same location at 2032 hours, January 26. The wash barrel was recovered after 50 meters had been drilled and a core was attempted to determine the age of the sediment being penetrated. The inner barrel was recovered empty, and three successive cores recovered a total of only one meter of sandy mud. It was inferred that the sandy nature of the material was responsible for the low recovery rate. The bit was then washed ahead to 109 meters BSF, where hard drilling was encountered. Three consecutive cores were taken in this "basement" formation of serpentinized peridotite. Core recovery in this interval averaged about 1 1/2 meters, and gas rich in heavier hydrocarbon components was collected from the core liners. The bit was found to be completely plugged following each of these cores and was cleared with greater difficulty each time. The gas analysis and the plugging tendencies prompted the decision to terminate coring operations and to log the hole before the opportunity was lost. Total depth of the hole was 136.6 meters.

A shifting tool, attached to an inner core barrel, was pumped into place at the bit and the hole was flushed with drilling mud. A wireline trip was then made to retrieve the barrel and shift the bit release mechanism. The hole was filled with weighted barite/bentonite mud and the open-ended pipe was pulled to 46 meters BSF for logging. Logging equipment was then rigged and the sonic-caliper-gamma ray sonde was lowered into the hole. The logging tool was stopped by a bridge in the hole at about 66 meters BSF. When attempts to break through the obstruction failed, the drill string was raised in the derrick and both conventional sonic and wave form logs were recorded over an open hole interval of about 50 meters. The logging tool was then recovered and one stand of drill pipe was added to the string to knock out the bridge in the hole. The combination induction-sonic logging sonde was then assembled and run down the pipe. It was hoped that the very long and heavy tool would find its way past minor bridges and reach the basement interval. Unfortunately the tool did not get past the end of the pipe, as the mechanical bit release top connector had apparently become plugged with sediment. The logging tool was recovered but, although circulation was then regained after pressuring the pipe to about 800 psi, no more time remained for logging operations. The upper portion of the hole was refilled with heavy mud and the drill string was recovered. Routine inspection of the BHA revealed definite indications that inner barrel latch fingers had been forced past the latch sleeve, allowing the barrels to be unseated and pushed up inside the outer core barrel. This helped to explain the low recovery and plugged bits at Hole 566C.

Hole 567 - Base of Continental Slope

The move into deeper water to the next drill site consumed just 1 3/4 hours, and a positioning beacon was dropped at 0034 hours, January 30. The site was to be a redrill of Site 494 which had been cored on Leg 67. Sat Nav fixes received during the pipe trip were used to refine the site position, and the vessel was offset about 870 meters to the southwest prior to spud-in. A seafloor punch core at Site 494 had established a water depth of 5529 meters. The PDR depth for Site 567 was 5510 meters, but no weight indicator deflection was noted until 5542 meters. As the interface sediments were known to be soft, the Site 494 depth was used. (Gamma-ray logs later indicated 5525 meters.)

As the upper section had been cored on Leg 67, the hole was drilled without coring to 176 meters BSF before the "wash" inner barrel was recovered. This inner barrel was filled with sediment and the coring system seemed to be in good order. The following core (No. 1) was recovered with only 10 cm of sediment jammed in the core catcher. Core 2 was then attempted and the barrel was found to be stuck at the bit. Three wireline trips succeeded only in shearing overshot pins. It then became apparent that a round trip would be necessary to correct the situation. A fourth wireline attempt was made after 40 stands of pipe had been pulled. The reduced weight of a shorter sandline made it possible to pull harder on the core barrel. The barrel remained firmly stuck, however, and the attempt was unsuccessful. On completion of the pipe trip, it was necessary to disassemble the outer core barrel assembly completely to dislodge the core catcher sub from the throat of the bit, which was found to be too small in diameter. Only cuttings were recovered from the inner barrel.

Hole 567A

The vessel was offset an additional 100 meters to the north-northeast to match the coordinates of Site 494 as closely possible. The bit was replaced, the long pipe trip was repeated and Hole 567A was spudded at 1015 hours, January 31. The bit was "washed" ahead to 195.5 meters BSF, and continuous coring then commenced. A rather monotonous fractured mudstone section was cored to about 319 meters BSF where soft, altered serpentinite was encountered. The serpentinite was apparently interbedded with hard intervals of basaltic and gabbroic material, as evidence by pebbles recovered in the cores and by drilling parameters. Core recovery was disappointingly low through the lithified section of Hole 567A.

Hole conditions deteriorated after Core 22 (203 meters BSF), with apparent annular packing during core retrieval periods and resultant torquing and difficulty working the bit back to total depth. This situation persisted but, rather surprisingly, did not worsen for two more days of operations. Then, during drilling operations at about 498 meters, the annulus apparently packed off and pump pressure suddenly increased to about 1300 psi with accompanying torque on the drill string. The pump was shut off and restarted, and normal circulation was reestablished. A 30 barrel mud flush was then started down the pipe as drilling continued, in an attempt to clean the hole prior to retrieval of the core barrel. About 45 minutes later, as the mud began to move up the annulus, pump pressure again increased abruptly and the pipe became firmly stuck. At this point the formation had apparently "broken down" as free circulation was established at pressures somewhat above normal. The pipe remained stuck and a shut-in pressure of 500-550 psi was maintained on the pipe when the pump was shut down. The pipe was freed after about two hours of effort, and the pipe pressure dropped to zero.

Three joints of pipe were set back and the core barrel was retrieved. Attempts to clean the hole to total depth for logging were unsuccessful, and the bit was released 29 meters off bottom. The pipe was still sticking, and six more singles were set back before the heave compensator and power sub could be rigged down. The open-ended pipe was then pulled to 95 meters BSF for logging operations.

The logging sheaves were rigged and the combination dual induction-sonic caliper-gamma ray log sonde was deployed. The logging tool was stopped by an obstruction in the hole at about 270 meters BSF. As the bridge was quite solid and the more important portion of the hole lay below it, the decision was made to complete the logging program in the upper interval before cleaning out the hole. The induction-sonic and waveform logs were recorded, and a second run to the same depth produced formation density and neutron logs without incident.

The pipe was then powered to a point just above the bridge in the hole and the power sub was picked up. The pipe was washed to 396 meters BSF where a solid bridge or fill was encountered. The hole was pumped full of weighted mud and the pipe was pulled back to 279 meters BSF, just below the obstruction that thwarted earlier logging attempts.

The induction-sonic tool was run down the pipe for a second log run. As the tool approached the bottom of the pipe, abnormal indications were noted on the weight indicator. The tool seemed to be "dragging" in the pipe when moved in either direction, and it stopped just short of the end of the pipe. When repeated attempts failed to get the tool into open hole, it was speculated that one of the caliper/centralizer bow springs might have broken (as on Leg 83). The sonde was then retrieved for inspection, and the dragging effect was noted to cease at about the 4000 meter depth. The tool was pulled from the pipe and was found to be in excellent condition. A circulating head was attached to the pipe, and circulation was broken after the pipe had been pressured to about 550 psi. On the next attempt, the tool moved freely to the end of the pipe, but again refused to pass into open hole. When the heavy tool again failed to break through, it was apparent that a solid clay plug had formed in the lower few inches of the bit release top connector. A weighted junk inner core barrel was then assembled for an attempt to clear the plug as the logging tool was again pulled up the pipe.

When the tool had reached the 3300 meter level, a violent shudder was felt throughout the vessel. The traveling block lurched upward in the derrick and the logging line parted at the lower sheave. The weight indicator confirmed that nearly the entire 5800 meter drill string had been lost. The logging sheaves were then rigged down and the crown and traveling blocks were checked. The six remaining stands of drill pipe were recovered and it was discovered that the lowermost joint had parted in the tube section about seven meters below the tool joint. The failure resulted in the loss of 579 joints of drill pipe, the BHA, the logging sonde, and about 3300 meters of logging cable.

The abbreviated pipe trip consumed only minutes, and the vessel was under way for Site 568 at 1247 hours, February 7.

Site 568 - Middle Continental Slope

The vessel then proceeded toward the coast to the next site, which was located about 50 miles off the Guatemalan shore. The acoustic beacon was launched at 1602 hours, February 7. The slow process of assembling a new drill string then began. By the time new drill collars and pipe had been removed from the hold and made up, about one day had been added to normal trip time. Hole 568 was finally spudded at 2150 hours, February 8, in 2030 meters of water. This was 11 meters deeper than the PDR reading.

The primary scientific objectives of the site were focused on geochemistry and the occurrence of natural gas hydrates. Therefore the continuous rotary coring at Hole 568 was interspersed with six instrumented in situ probe runs and four pressure core barrel (PCB) runs.

Lithology changed with depth from soft mud to hard, fractured mudstone. Good core recovery was achieved, although it was disappointingly low on the PCB runs. A considerable quantity of gas hydrate was recovered from about 407 meters BSF and samples were preserved for further study. Coring operations were stopped at 418 meters BSF for hydrocarbon safety considerations. The methane-ethane ratio was decreasing at a rapid rate with depth and the lower boundary of the hydrate-stable zone had been calculated to lie at 460 meters.

The bit was then released, and the hole was filled with weighted mud before the pipe was pulled to logging depth. The sonic-caliper-gamma ray tool was run and a good sonic log was recorded, although the associated caliper did not function electrically. Wave forms were logged on a second pass with the same tool. The hole was found to be in excellent condition, and it remained so for the formation density - neutron porosity log which was run next. Both tools found the bottom of the hole just a few meters short of the driller's total depth, indicating very little fill.

The logging equipment was then rigged down, the pipe was recovered, and the vessel was prepared for sea. Departure from Site 568 was at 1616 hours, February 12.

Hole 569

The nine-mile move back in the direction of Site 567 took about 1-1/2 hours to the first crossing of the proposed site. An additional two hours were then spent in ascertaining the position before the beacon was dropped.

As the intended drill string length exceeded that of the new pipe remaining on board, it was necessary to pick up 27 joints of used pipe from the casing rack and to add it to the lower portion of the string. Hole 569 was spudded at 0852 hours, February 13, in 2799.7 meters of water.

The new familiar section of green mud, grading with depth to fractured mudstone was cored without problems to about 255 meters below seafloor (BSF).

An unstable section of hole then produced about 12 meters of hole fill following Core 27. A mud flush and attempts to work the bit back to total depth for the next core failed to clear the hole and apparent annular packing ensued. The pipe did not become stuck, but it could not be moved downward without torquing and stalling. A shut-in drill pipe pressure of 250 psi was noted when the pump was shut down. The pressure rebuilt immediately after being bled off at the standpipe. Further drilling appeared impossible, but as the basement objective was believed to be only a few tens of meters deeper, another attempt was considered to be warranted. The hole was filled with weighted mud and abandoned.

Hole 569A

The drill string was pulled clear of the sea floor and the vessel was offset about 930 meters to the west-southwest. Sat Nav fixes received during the drilling of Hole 569 placed the new position very near the originally-intended geographic coordinates.

Hole 569A was spudded at 0445 hours, February 15, with the first sediment "felt" at 2814 meters. The hole was then drilled to 246 meters BSF before the inner barrel was pulled and continuous coring began. No hole problems were experienced until the fifth core was being cut. This may have been due to the unstable zone being located at greater depth than in the previous hole or to the reduced time the borehole was exposed to circulation. Torquing and increased pump pressure were then noted, with 175 to 200 psi back pressure observed at times. The formation apparently did not break down, however, and annular circulation was maintained. A critical forty meter interval was penetrated, during which frequent mud flushes were pumped and inner barrels were retrieved on alternate joints. The severe torquing eased somewhat on Core 9, and the hole seemed to stabilize, although sporadic torquing persisted.

Basement rocks, consisting of metamorphosed dolerite and gabbro, finally were encountered in Core 10 at about 358 meters BSF. One additional short core was taken to confirm the basement findings. The first significant vertical sticking occurred on pulling up from total depth following the final core, and it was necessary to pull three tight singles before the pipe came free. The hole was then filled with barite mud and the pipe was recovered, with the bit arriving on deck at 0030 hours, February 17.

Site 570 - Upper Continental Slope

The final drill site of Leg 84 was located about 45 miles northwest of Site 569. The beacon was dropped at 0705 hours, after 1 1/4 hours of preliminary surveying. An initial positioning offset of 460 meters to the north-northeast was entered before the pipe trip began. Spud-in occurred at 1412 hours in a relatively shallow 1718.2 meters of water.

A thick section of green mud was again present, and coring proceeded uneventfully to about 200 meters. A small amount of gas hydrate was found in Core 21. This was not totally unexpected, as the temperature/pressure environment was favorable for hydrate occurrence. The gas analysis was comparable with that of gas samples from the preceding cores and followed the "maturity gradient" that had been established by the apparently biogenic gas of the upper sediment column. More hydrate was found in Core 25. Analysis of this gas showed a sharp drop in methane-ethane ratio and a radical increase in heavier gases from the previous core. Almost simultaneously, Core 27 arrived on deck containing over one meter of massive hydrates. The hydrates were associated with highly fractured dolomite, and the analysis confirmed the more mature signature of the sample from Core 26.

A coring hiatus of about three hours then ensued for further analysis, discussions and phone calls to determine if further penetration would be safe and advisable. It was eventually decided that the scientific value of the site warranted deepening the hole if no additional indications of petroleum accumulation were noted and if penetration did not exceed 440 meters (100 meters above the calculated base of the hydrate-stable zone). Subsequent cores encountered more semi-consolidated mud. Hydrates were found dispersed in cracks in the sediment, but no more major accumulations were cored. Methane-ethane ratios began to climb back toward the values noted above the hydrate deposit. Conditions were fairly normal as the bit entered a series of Eocene limestones, sandstones and conglomerate at about 330 meters BSF. Core recovery was low in this interval and gas analyses were inconclusive due to poor sampling conditions. At about 374 meters BSF, a "basement" lithology of serpentinite and serpentinized periodotite was encountered. This material was cored to a total depth of 402 meters BSF. Considerable outgassing from the basement cores was noted. Analysis showed disproportionately high quantities of ethane and propane and quantities of heavier gases similar to the samples from the massive hydrate deposit. Methane-ethane ratios of less than 100 were measured.

The hole was then flushed with polymer mud, the bit was released and the hole was filled with weighted mud. The open ended pipe was pulled to logging position and the wireline sheaves were rigged.

The site provided the unique opportunity to log both massive gas hydrates and the anomalous serpentinite basement. Therefore the entire available suite of Schlumberger logs was run. Hole conditions were excellent, and good logs were recorded on each run from about six meters off total depth. Nearly six hours were lost to logging equipment problems, and it was necessary to use backup tools for the sonic, neutron and temperature logs.

An additional hole at the site had been planned to test the lateral extent of the hydrate body and the nature of the basement contact. However it became apparent that insufficient time remained for adequate coring, and it was decided that the ship's time could best be used by departing for port one day early. The final pipe trip culminated in a magnaflux inspection of the bottom hole assembly and the power sub/swivel assembly. Following the inspection, the vessel was secured for sea and was under way at 1432 hours, February 21.

Site 570 to Manzanillo

Following a 45-minute profile across the drill site, course was set for Manzanillo, Mexico, the originally scheduled terminating point for Leg 84. Loss of the drill string and logistical difficulties had forced a continuation of the voyage to Los Angeles, California. Nevertheless an interim stop had been scheduled at Manzanillo to disembark the scientific staff.

The *CHALLENGER* made about nine knots for the first few hours with smooth seas and a following current. The next morning, however, the wind began to rise as the vessel crossed the notoriously windy Gulf of Tehuantepec. The "Tehuantepecer" produced headwinds of up to 40 knots and slowed progress to about 6 1/2 knots for nearly a day. Good steaming conditions returned when the vessel had passed the gulf area and the *CHALLENGER* arrived at Manzanillo almost on schedule. The anchor was let go in Manzanillo Harbor at 1430 hours, February 25, 1982.

Manzanillo to Los Angeles

After disembarking all the scientific staff and all but four of the Scripps personnel (Cruise Operations Manager, Logistics Officer, Electronics Technician and Logging Engineer) and taking on fresh food, the vessel weighed anchor to depart Manzanillo at 1723 hours, February 25 after a very smooth three hour stopover.

Departure from Manzanillo was uneventful and the vessel was making 9.5 knots when excitation voltage to a port shaft motor was lost at 2117 hours. The vessel proceeded northward at 4.5 knots, operating on the starboard shaft only for six hours while the engine room crew sought to correct the problem. At 0215 hours, February 26, repairs were effected and the ship was again under way at full speed on both shafts.

A scheduled stop was made for one hour off Point Loma at 0600 hours on March 3 to swing the ship for Radio Direction Finder calibration. The vessel then proceeded directly to Los Angeles Harbor where Leg 84 came officially to an end at 1539 hours with the first line over at Berth 241-C of the Southwest Marine Shipyard.

Drilling and Coring Equipment

Problems with the drill string itself held the spotlight on Leg 84. Two pipe failures in the lower part of the string had occurred during coring operations on Leg 83. A subsequent investigation had indicated that hydrogen embrittlement was the probable cause of the failures, since they had occurred in a hole drilled in a geothermally active area in which hydrogran sulfide was known to be present. A magnetic inspection of the pipe had been conducted at Balboa, and a total of 120 joints of older pipe had been designated for removal from the string. This was accomplished during the early part of Leg 84 and, after the second site had been drilled, 440 joints of used pipe remained in the string--all in the lower part. This, along with 139 joints of new pipe, was lost on the very next site when a joint of new pipe failed 171 meters beneath the rig floor. The break appeared to have been caused by a fatigue crack which propagated from an external flaw of unknown origin and which had grown to involve one fourth of the pipe's circumference.

A second problem with the new drill pipe had been noted early in the process of removing the pipe from the hold and adding it to the string. A recent modification to the hydraulic piston corer had increased its maximum diameter to four inches. Therefore a four inch "rabbit" was constructed and was dropped through each joint of new pipe as it was made up. It was soon found that the rabbit was too large to pass the tool joint/tube transition area of a majority of the joints. It was then necessary to reduce the diameter of the HPC top cap sub to 3.94 inches. One of the modified subs was then used as a rabbit, and 24 out of 416 joints of new pipe on board were found to be too tight for even this diameter. Almost all the restrictions were found to be at the box end and appeared to have developed when the tool joints were welded to the tube. The restrictions obviously had not been bored out to conform to dimensional specifications.

Aluminum Drill Pipe

Operational evaluation of a 44 joint test string of aluminum drill pipe continued on Leg 84. The test string was deployed at all sites except 567 and caused no operational problems. The pipe appeared to be in good condition at the end of the leg.

The standard DSDP bottom hole assembly was used at Sites 565, 568, 569, and 570. This consisted of bit, bit release (bit sub at Hole 565), outer core barrel assembly, three 8 1/4" drill collars, one Baash-Ross five foot-stroke bumper sub, three 8 1/4" drill collars, two bumper subs, two 8 1/4" drill collars, crossover sub and one 7 1/4" drill collar. Four stands of new drill pipe was positioned directly above the BHA to provide strength in the transition. An extra drill collar was placed above the outer core barrel for Hole 566C to provide additional weight in anticipation of basement drilling. When a drift angle in excess of 10 degrees was measured in that hole, a stabilizer was placed above the extra collar for Site 567. Holes 566, 566A, and 566B, were cored with a special BHA that had been improvised to implement switching from oriented hydraulic piston coring to extended core barrel operations without a round trip for BHA modification. The extra drill collar was also used in this BHA, but primarily as an extension to the outer core barrel. A top sub/head sub combination was needed for each coring system, as well as spacer subs to compensate for the extra length of the XCB. A twelve foot gammaloy drill collar was positioned above this elongated core barrel assembly to provide for magnetic HPC core orientation.

Mechanical bit releases were used at all sites except 565 and were actuated to release bits on four occasions. The mechanism operated flawlessly in each case, with no excessive overpull or difficulty in separation.

Premature release has been a problem with the mechanical release in the past, especially when hole cleaning conditions were poor. It did not occur on Leg 84, however. Another unfortunate feature of the mechanical bit release is the tendency of the bore of the top connector to become plugged with clay following release of the bit. This plug prevented logging the lower portions of Holes 566C and 567A. At Hole 570, the plug had to be dislodged by "spudding" the logging tool.

A faulty core barrel latch sleeve was blamed for low core recovery and a series of plugged bits at Hole 566C. The steel in the sleeve was found to be much softer than required by material specifications. The upward pressure of the harder inner barrel latch fingers had deformed the latch sleeve and permitted the inner barrels to be pushed up inside the outer barrel and out of their position at the bit.

A malfunction in the hydraulic plant for the Bowen power sub resulted in the loss of this system for the final day of operations at Site 565. When initial troubleshooting efforts were unsuccessful, the power sub was cross-connected with the sandreel hydraulic system and only two hours of operating time were lost. The problem proved extremely difficult to isolate, but it was eventually traced to a faulty check valve within one of the pumps.

A defective directional valve in the heave compensator control valve complex caused control solenoids to burn out repeatedly. The valve was replaced, but then a malfunctioning filter check valve prevented proper operation until it was located and replaced. The compensator was out of service for about four days, but only about 3/4 hour of rig time was lost.

Core Bits

Several types of bits were used during Leg 84, including both 9 5/8" and 9 7/8" F94CP (pressure core barrel), standard 9 7/8" F94CK and F93CK bits and a special 11 1/4" XCB/HPC bit. A dimensional problem in the throat of the 9 7/8" F94CP bit caused a core barrel to become stuck in the bit and resulted in the loss of Hole 567. Subsequent dimensional checks of bits revealed considerable variability in diameters of both upper and lower core guides. This may be related to empirical observations that some individual bits have produced consistently better core recovery than others in a variety of comparable lithologies.

Special Tools

Leg 84 marked the initial deployment of the extended core barrel (XCB) system. The system was used in Holes 566, 566A, and 566B, which provided an opportunity to core both soft and hard formations. Initial results were encouraging, with core recovery apparently limited only by collapsed and broken plastic core liners. The liner failures, however, proved to be inherent in the system and occurred on every XCB run. Low core recovery and damaged cutter shoes occurred in the pebbly serpentinite basement of

Holes 566 and 566A. The final extended core barrel penetration was a 50-meter "washdown" in Hole 566N. There was no core recovered and the rate of penetration was only about half that of a standard bit in subsequent Hole 566C. Inspection of the latch mechanism showed wear and deformation that indicated that the barrels had not been driven (as designed) and may not have been latched into place. It was not clear how long the latch/driving mechanism had been malfunctioning. Field solutions to the above problems were contrived, but there were no further opportunities to deploy the system.

The pressure core barrel was deployed four times in Hole 568, where hydrocarbon geochemistry was a primary concern. The upper core chamber was recovered pressurized in all cases, but in one instance there was no core above the ball valve, indicating that it might have closed prematurely. Recovery on the other three runs was considerably less than the trend of standard inner barrels in that hole.

The hydraulic piston coring system was utilized only once--on Hole 566--where the sediment was found to be too stiff. Two cores were attempted and the corer failed on both attempts to stroke completely. Pullout forces on the second attempt resulted in partial failure of the quck-connect mechanism. A bottom hole assembly was assembled that accommodated both the XCB and HPC systems so that operations could be switched from one mode to the other without tripping the pipe. Some spacing problems need to be resolved, as miscellaneous subs are required for proper core barrel spacing and the already-lengthy HPC assembly must be lengthened an additional 1.5 meters due to the length of the XCB.

The instrumented core barrel, which began as a temperature probe, now produces measurements of in situ temperature and pressure and collects an in situ pore water sample. An attached instrumentalso measures hole angle on the same wireline run. The pressure measuring instrumentation was developed by DSDP shipboard personnel and was impressively successful on Leg 84.

Logging

A total of 17 logging runs were made in the four holes surveyed. The logs were nearly all of excellent quality and were an extremely valuable adjunct to the scientific research. This is especially true for areas of low recovery and for the massive gas hydrate occurrence, which was beautifully documented with a full suite of logs. Equipment problems were negligible until the final site, when the sonic, neutron and temperature log tools all failed on or shortly after deployment. The backup tools all functioned properly and produced the critically important logs of this unique hole. The combination long-spaced sonic-dual induction/caliper/gamma ray sonde lost in the drill pipe failure was a heavy casualty. Loss of the induction sonde meant that a separate wireline trip had to be made with the laterolog on subsequent holes to obtain a resistivity log. Both of the MCD caliper tools which had been modified for our drill string were part of the lost sonde. A new backup MCD had been loaded at the beginning of the voyage and then required extensive modification to reduce its diameter. During the process, the caliper potentiometer was irreparably damaged and the caliper tool could be used only as a centralizer at Site 570.

Beacons

All six acoustic beacons that were dropped on Leg 84 produced signals that were acceptable for positioning. The signal strength of one beacon dropped considerably when the beacon reached the sea floor. The water was fairly shallow, however, and the signal was sufficiently strong for positioning. Four of the beacons were of the new self-contained configuration. A fifth new style beacon flooded as it was "soak" tested due to an improperly installed vacuum port plug. The magnetic switch arrangement on these beacons may be a source of problems. One beacon was returned for inspection after it "switched itself off" shortly after activation. Another unit self-actuated following a period of rough seas. The box was opened and the magnet was found in the bottom. The magnet was replaced to turn off the beacon.

Dynamic Positioning

The vessel's positioning system performed well and reliably for the duration of the voyage. A control console relay failed and was replaced during on-site operations with no interruption in coring. Minor problems with the backup pulse and hydrophone selection circuits were resolved during the cruise and did not affect on-site positioning.

Difficulty was experienced in lowering and raising two of the positioning hydrophones. They have been freed up but the problem is apparently related to marine growth and frequent "exercising" of the hydrophones is required to prevent recurrence of the problem.

Engineering

No significant problems were experienced with the ship's power generating and propulsion equipment until the final transit leg from Manzanillo to Los Angeles had begun. Failure of a circuit card in a static exciter then resulted in the loss of the port shaft for propulsion until the fault could be found and rectified. This caused the loss of about 3 1/4 hours of transit time due to reduced speed.

A suspected leak in fuel tank N7F was reported by Leg 83 GMI personnel. The tank was emptied, cleaned, tested and inspected during Leg 84, but no leak or other fault was found.

Weather and Currents

Weather conditions on Leg 84 were nearly flawless, with warm sunny days and relatively calm seas. Rain fell briefly only on the final day on site. The only rough sea conditions occurred on the crossing of the Gulf of

Tehuantepec. Currents estimated to approach two knots were encountered on the two sites closest to the Guatemalan coast. They were apparently surface currents, as they had little effect on the drill string. Due to the prevailing light and variable wind conditions, current was often the dominant force to be stemmed by the positioning system. The benign positioning conditions permitted one or more engines to be taken off line much of the time, with considerable savings in fuel consumption resulting.

Personnel

Shipboard morale suffered at times during the voyage due to delays and resultant cruise extensions. Nevertheless, highly professional efforts on the part of the GMI crew, the technician staff and the scientists combined to salvage important scientific results from an expedition that suffered more than its share of misfortune.

Arrangements had been made at one time during the cruise to repatriate to the U.S. a derrickman who had sustained an eye injury. A foreign body was removed from the eye before the personnel transfer could be made, however, and the patient recovered in time for the transfer to be cancelled. A rotary helper suffered a badly bruised leg in a rig floor accident and, only days later, a crushed finger. He was disembarked in Manzanillo along with the scientific and technical personnel so that the finger could be treated in the United States.

Glen N. Foss

Glen N. Foss
Cruise Operations Manager

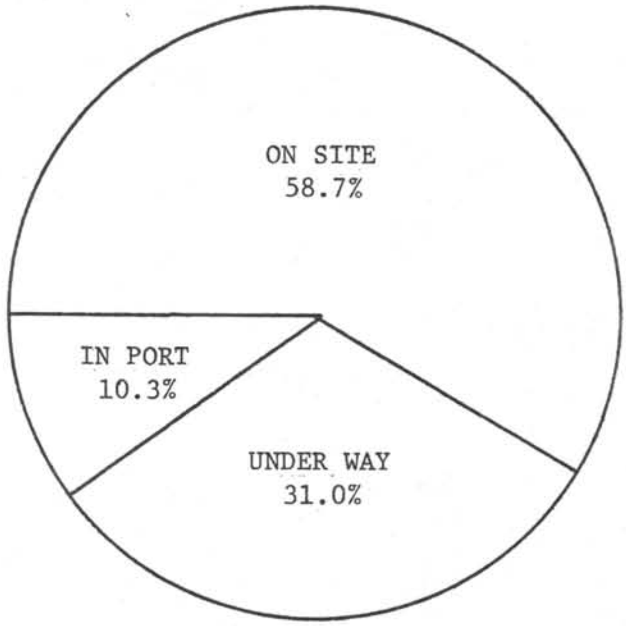
INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
OPERATIONS RESUME
LEG 84

Total Days (January 5, 1982-March 3, 1982)	57.12
Total Days in Port	5.91
Total Days Under Way Including Site Survey	17.68
Total Days on Site	33.53

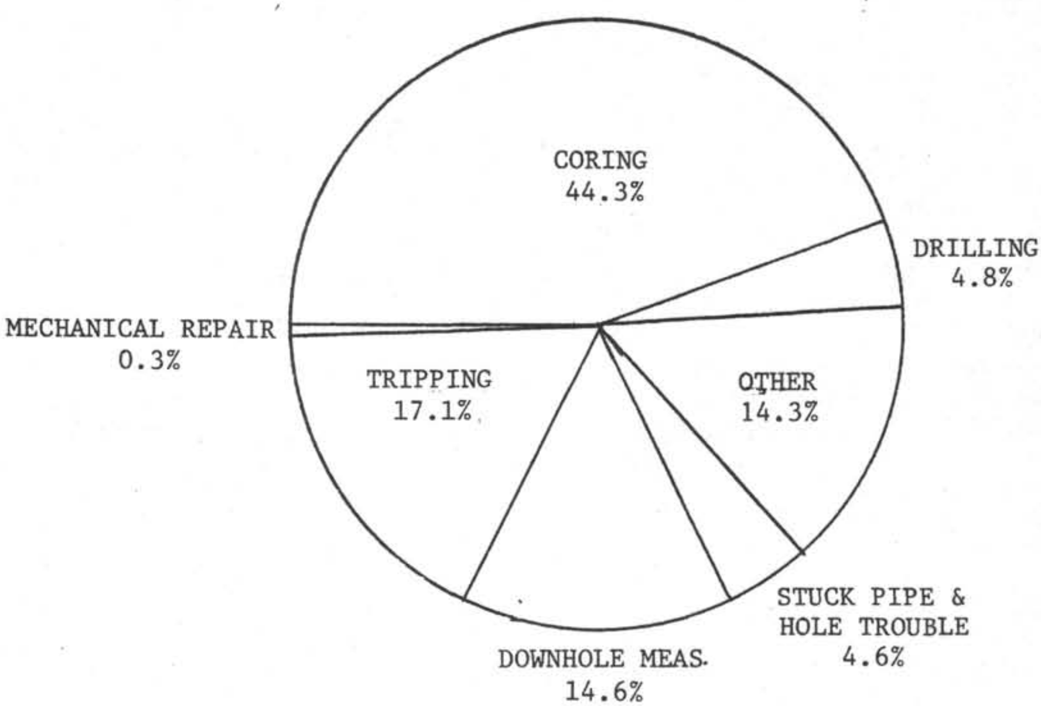
Trip Time	5.7
Drilling Time	1.6
Coring Time	14.9
Downhole Measurement	4.9
Stuck Pipe	1.5
Mechanical Downtime	0.1
Other	4.8

Total Distance Traveled Including Survey (nautical miles)	3759.5
Average Speed (knots)	8.9
Number of Sites	6
Number of Holes Drilled	11
Number of Cores Attempted	206
Number of Cores with Recovery	200
Total Meters Cored	1907.0
Total Meters Recovered	1043.6
Percent Recovery	54.7
Total Meters Drilled	801.4
Total Meters of Penetration	2708.4
Percent of Penetration Cored	70.4
Maximum Penetration (meters)	501.0
Minimum Penetration (meters)	7.0
Maximum Water Depth (meters)	5529.0
Minimum Water Depth (meters)	1718.2

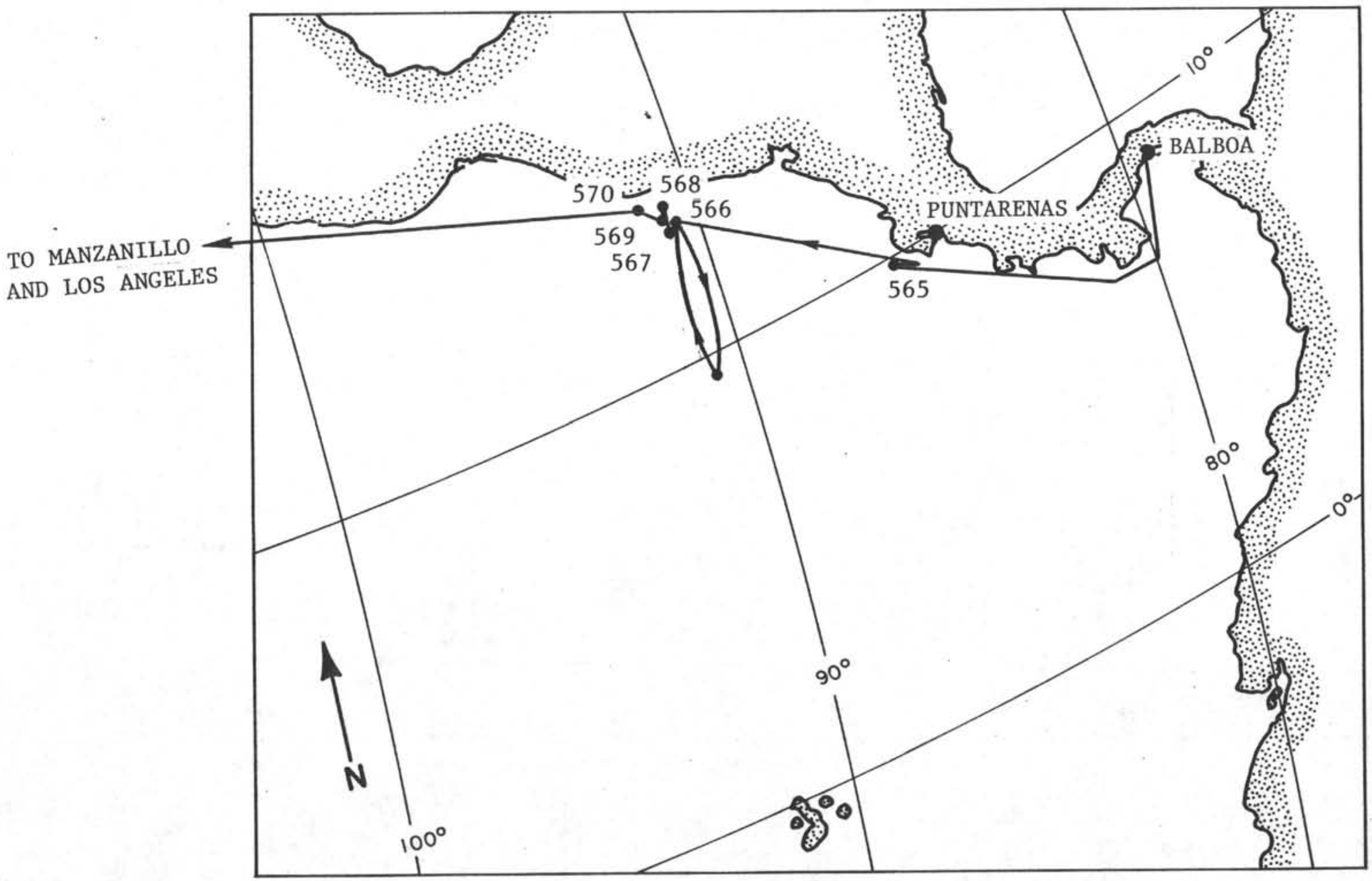
TOTAL TIME DISTRIBUTION
LEG 84



ON SITE TIME BREAKDOWN



LEG 84 OPERATING AREA



INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
SITE SUMMARY
LEG 84

Hole	Latitude	Longitude	Water Depth Meters	Number of Cores	Cores with Recovery	Percent of Cores With Recovery	Meters Cored	Meters Recovered	Percent Recovered	Meters Drilled	Total Penet Meters	Avg. Rate Penet	Time on Hole	Time on Site
565	09° 43.7'N	86° 05.4'W	3111	34	34	100.0	328.3	287.3	87.5	0.0	328.3	16.5		131.6
566	12° 48.3'N	90° 41.8'W	3786	9	9	100.0	55.8	21.5	38.5	0.0	55.8		39.0	
566A	12° 47.9 N	90° 42.0'W	3865	1	1	100.0	7.0	0.1	1.7	0.0	7.0	12.4	4.2	
566B	12° 48.8'N	90° 41.5'W	3674	0	0		0.0	0.0		49.0	49.0	12.0	17.1	
566C	12° 48.8'N	90° 41.5'W	3675	7	5	71.4	65.8	5.8	8.8	70.8	136.6	16.2	60.0	
	TOTALS			17	15	88.2	128.6	27.4	21.3	119.8	248.4			120.3
567	12° 43.0'N	90° 56.0'W	5529	2	2	100.2	19.4	0.6	3.0	176.1	195.5	67.4	44.4	
567A	12° 43.0'N	90° 55.9'W	5529	29	28	96.6	263.4	103.7	39.4	237.6	501.0	9.4	183.8	
	TOTALS			31	30	96.8	282.8	104.3	36.9	413.7	696.5			228.2
568	13° 04.3'N	90° 48.0'W	2031	44	43	97.7	417.7	308.4	73.8	0	417.7	44.8		120.3
569	12° 56.3'N	90° 50.4'W	2799.7	27	27	100.0	250.7	134.8	53.8	0	250.7	37.6	53.8	
569A	12° 56.2'N	90° 50.8'W.	2814.0	11	10	90.9	100.0	16.3	16.3	264.9	364.9	21.4	47.2	
	TOTALS			38	37	97.4	350.7	151.1	43.1	264.9	615.6	28.0		101.0
570	13° 17.1'N	91° 23.6'W	1718.2	42	41	97.6	398.9	165.1	41.4	3.0	401.9	27.3		103.4
	GRAND TOTALS			206	200	97.1	1907.0	1043.6	54.7	801.4	2708.4			804.8

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
BIT SUMMARY
LEG 84

Hole	Mfg.	Size	Type	Serial Number	Meters Cored	Meters Drilled	Meters Total Penet.	Hours on Bit	Condition	Remarks
565	MSDS	9 5/8	F94CP	PCB-1	328.3	0	328.3	19.9	TO-BISE-I	Like new--good for rerun.
566	MSDS	11 1/4	XCB/HPC	RB-36	55.8	0	55.8	6.1	Unknown	Respud without round trip.
566A	MSDS	11 1/4	XCB/HPC	RB-36	7.0	0	7.0	0.6	Unknown	Hard FM at 5meters.
566B	MSDS	11 1/4	XCB/HPC	RB-36	0	49.0	49.0	4.1	TO-BISE-I	Bit OK--Problems with XCB System.
			TOTALS		62.8	49.0	111.8	10.8		
566C	Smith	9 7/8	F94CK	812-RV	65.8	70.8	136.6	8.4	Unknown	Released for logging.
567	Smith	9 7/8	F94CP	AP7671	19.4	176.1	195.5	2.9	New	Core catcher sub of inner barrel jammed in undersized core guide--forced round trip.
567A	Smith	9 7/8	F94CP	AN7408	263.4	237.6	501.0	53.3	Unknown	Released for logging.
568	MSDS	9 5/8	F94CP	PCB-1	417.7	0	417.7	29.2	Unknown	19.9 hours previously released for logging.
569	MSDS	9 7/8	F93CK	S-17	250.7	0	250.7	6.7	Unknown	Respud without round trip.
569A	MSDS	9 7/8	F93CK	S-17	100.0	264.9	364.9	17.0	TO-BISE-0 1/8	
570	MSDS	9 7/8	F93CK	S-17	398.9	3.0	401.9	14.7	Unknown	Run on both sites--released for logging at 570.
			TOTALS		749.6	267.9	1017.5	38.4		

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
BEACON SUMMARY
LEG 84

SITE NO.	MAKE	FREQ. kHz	SERIAL NUMBER		SITE TIME HOURS	REMARKS
565	ORE	16.0 kHz	537		131.6	Double life - strong throughout
566	ORE	13.5 kHz	114		39.0	Single life - strong throughout
566A	ORE	13.5 kHz	114		4.2	
566B	ORE	13.5 kHz	114		17.1	
566C	ORE	13.5 kHz	114		60.0	
				Total	120.3	Good beacon
567	ORE	16.0 kHz	538		44.4	Double life
567A	ORE	16.0 kHz	538		183.8	Strong throughout
				Total	228.2	Good beacon
567	ORE	16.0 kHz	104			Single life; flooded on soak; string fouled in vacuum port plug
568	ORE	13.5 kHz	115		120.3	Signal strength weaker than normal--otherwise OK.
569	ORE	16.0 kHz	105		101.0	Good beacon
570	ORE	13.5	113		103.4	Good beacon

DEEP SEA DRILLING PROJECT
LOGGING SUMMARY
LEG 84

HOLE	TOTAL DEPTH (M)	WATER DEPTH (M)	OPEN ENDED PIPE AT (M)	FLUID IN HOLE	BIT SIZE	TOTAL TIME FOR LOGGING (HOURS)	RUN NO.	LOGS RECORDED	FROM (M)	TO (M)	OBSERVATIONS
565	3439.3	3111.0									No logs requested.
566	3841.8	3786.0									Insufficient penetration.
566A	3872.0	3865.0									Insufficient penetration.
566B	3723.0	3674.0									Insufficient penetration.
566C	3811.6	3675.0	3692.5	mud	9 7/8	4.0	1	DDBHC-CAL-GR	3741.0	3692.5	Stopped by bridge in hole.
566C	3811.6	3675.0	3692.5	mud	9 7/8	1.0	2	SWF	3741.0	3692.5	Washed out hole--just read mud.
566C	3811.6	3675.0	3749.5	mud	9 7/8	4.5	1	DIT-DDBHC CAL-GR			Could not get past plugged MBR-release bit, fill hole, rig sheaves, etc.
						6.1					
					TOTAL	15.6					
567	5724.5	5529.0									No logs requested.
567A	6030.0	5529.0	5595.5	sea water	9 7/8	5.5	1	DIT-DDBHC CAL-GR	5800.0	5595.5	Tool stopped by bridge at 5801 meters
567A	6030.0	5529.0	5595.5	sea water	9 7/8	2.0	2	SWF	5800.0	5595.5	Tool stopped by bridge at 5801 meters
567A	6030.0	5529.0	5595.5	sea water	9 7/8	6.8	1	FGT-CNT-GR	5791.0	5595.5	Tool stopped by briget at 5789 meters
567A	6030.0	5529.0	5808.0	mud	9 7/8	6.6	3	DIT-DDBHC CAL-GR			Could not get out end of pipe.
567A	6030.0	5529.0	5808.0	mud	9 7/8	3.9	4	DIT-DDBHC CAL-GR			Could not get out-lost drill string, logging sonde & 3300 meters cable.
						10.1					Release bit, rig sheaves, cleanout trip condition hole.
					TOTAL	34.9					
568	2448.7	2031.0	2117.0	mud	9 5/8	4.0	1	DDBHC-GR	2444.0	2117.0	No caliper--electrical problem. Recorded GR to mudline.
568	2448.7	2031.0	2117.0	mud	9 5/8	1.7	2	SWF	2444.0	2117.0	
568	2448.7	2031.0	2117.0	mud	9 5/8	4.3	1	FGT-CNT-GR	2444.0	2117.0	
						2.0					Release bit, rig sheaves, etc.
						12.0					

DEEP SEA DRILLING PROJECT

LOGGING SUMMARY

LEG 84

HOLE	TOTAL DEPTH (M)	WATER DEPTH (M)	OPEN ENDED PIPE AT (M)	FLUID IN HOLE	BIT SIZE	TOTAL TIME FOR LOGGING (HOURS)	RUN NO.	LOGS RECORDED	FROM (M)	TO (M)	OBSERVATIONS
569	3050.4	2799.7									No logs requested.
569A	3178.9	2814.0									No logs requested.
570	2120.1	1718.2	1761.0	mud	9 7/8	4.0	1	BHC-GR	2113.0	1761.0	Caliper & long spaced sonic tools not working;recorded GR to seafloor.
570	2120.1	1718.2	1761.0	mud	9 7/8	1.5	2	SWF	2113.0	1761.0	
570	2120.1	1718.2	1761.0	mud	9 7/8	4.0	1	FDC-GR-(CAL)	2113.0	1761.0	Neutron tool did not work.
570	2120.1	1718.2	1761.0	mud	9 7/8	4.3	1	CNT-GR	2113.0	1761.0	Backup neutron tool.
570	2120.1	1718.2	1761.0	mud	9 7/8	3.8	1	DLL-GR	2113.0	1761.0	
570	2120.1	1718.2	1790.0	mud	9 7/8	3.5	1	HRT	1717.0	2113.0	Equilibrated slowly at TD--thermistor mudded up?
						6.5					Release bit, rig sheaves, work on logging tools
					TOTAL	27.6					

DEEP SEA DRILLING PROJECT
TIME DISTRIBUTION
LEG – 84

Date	Site No.	Cruise	Trips	Drill	Core	Stuck Pipe	W.O.W.	Position Ship	Mech. Repair	Port Time	Re-Entry	Other	Total Time	Remarks
1/05/82 1/13/82		55.5								138.8		0.3	194.6	Balboa to Site 565
1/13/82 1/19/82	565		17.4		57.9	15.8		9.0	1.9			29.6	131.6	565
1/19/82 1/21/82		112.4										0.5	112.9	565 to 566
1/23/82 1/25/82	566		10.0		19.5							9.5	39.0	566
1/25/82	566A		1.7		1.5							1.0	4.2	566A
1/25/82 1/26/82	566B		8.9	4.7	0.8							2.7	17.1	566B
1/26/82 1/28/82	566C		17.3	3.4	16.0	4.0		16.4				2.9	60.0	566C
1/28/82 1/29/82		2.3											2.3	566 to 567
1/29/82 1/30/82	567		22.5	4.1	4.9	0.4						12.5	44.4	567
1/30/82 2/07/82	567A		13.6	17.6	97.8	10.7		34.9				9.2	183.8	567A
2/07/82		3.2											3.2	567 to 568
2/07/82 2/12/82	568		12.6		51.3			28.4	0.7			27.3	120.3	568
2/12/82		3.5											3.5	568 to 569
2/12/82 2/15/82	569		9.8		36.0	1.5		0.3				6.2	53.8	569
2/15/82 2/17/82	569A		10.3	8.8	21.5	2.7		0.6				3.3	47.2	569A
2/17/82		6.3											6.3	569 to 570
2/17/82 2/21/82	570		13.5		49.9	1.9		27.6				10.5	103.4	570
2/21/82 3/ 82		236.1							3.3	2.9		0.9	243.2	570 to Los Angeles
TOTALS		419.3	137.6	38.6	357.1	37.0		117.2	5.9	141.7		116.4	1370.8	