DEEP SEA DRILLING PROJECT

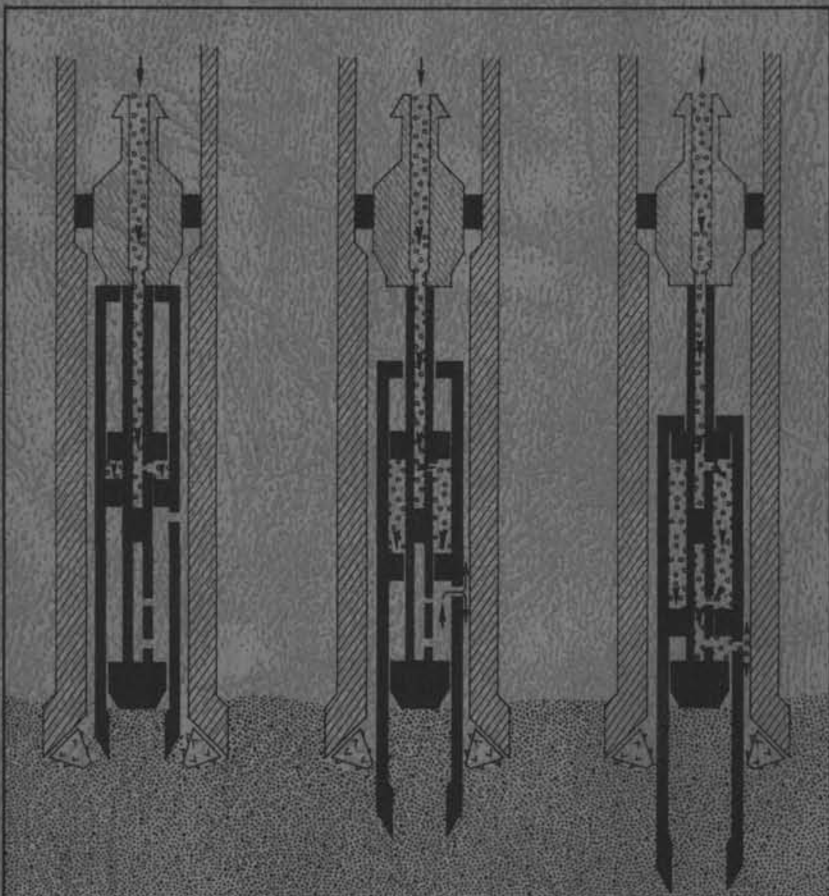
TECHNICAL REPORT NO. 11

OPERATIONS RESUMES - PART VI

PRIME CONTRACTOR

THE REGENTS

UNIVERSITY OF CALIFORIA



SCRIPPS INSTITUTION OF OCEANOGRAPHY

UNIVERSITY OF CALIFORIA, SAN DIEGO

OPERATIONS RESUMES

LEG 55 through LEG 70

Prepared For

NATIONAL SCIENCE FOUNDATION

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DEEP SEA DRILLING PROJECT

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INTRODUCTION

IPOD/DSDP Technical Report Number 11 is the sixth edition of Operations Resumes published since the Project became operational on August 11, 1968.

This book tells about operational and engineering procedures used aboard the D/V GLOMAR CHALLENGER from Leg 55 through Leg 70.

Following procedures established by the previous five technical reports on Operational Resumes, this report which is the second covering International Phase of Ocean Drilling (IPOD) cruises, gives performance achievements, drilling and coring results, drill bit and coring equipment performance and modifications, tests of new procedures and equipment, plus problems encountered and anticipated and the steps taken or proposed for solutions.

ACKNOWLEDGEMENTS

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

To V. Larson, Head of Operations, and S. Serocki, Head of Engineering, and their respective staffs, i.e., B. Robson, G. Foss, R. Knapp, P. Thompson, P. Dempsey, B. Adams, M. Storms, D. Cameron, R. Keefe and Patricia Duley, the Project gratefully acknowledges your dedication, talents and expertise.

In addition R. Olivas, Head of Logistics and his entire staff have also greatly contributed to the operations success by the outstanding support provided for DSDP technical and scientific functions.

IPOD/DSDP extends its most sincere thanks to the persons named for their contributions to a highly successful program.

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Dr. Loren Kroenke, University of Hawaii at Manoa
Dr. Robert Scott, Texas A & M University
Cruise Operations Manager:
Mr. Glen N. Foss, DSDP

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Dr. Donald Hussong, University of Hawaii at Manoa
Dr. Seiya Uyeda, University of Tokyo
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Mr. Robert R. Knapp

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Dr. Brian T. R. Lewis, University of Washington
Cruise Operations Manager:
Mr. Robert R. Knapp, Deep Sea Drilling Project

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Dr. Roland Von Huene, United States Geological Survey
Dr. Jean Aubouin, Universite Pierre et Marie Curie
Cruise Operations Manager:
Mr. Robert R. Knapp, 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. Marcus G. Langseth, Lamont Doherty Geological Observatory
Dr. Joe R. Cann, University of Newcastle upon Tyne
Cruise Operations Manager:
Mr. Glen N. Foss, Deep Sea Drilling Project

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Cruise Co-Chief Scientists:
Dr. Jose Honnorez, University of Miami
Dr. Richard P. Von Herzen, Woods Hole Oceanographic Institution
Cruise Operations Manager:
Mr. Robert R. Knapp, Deep Sea Drilling Project

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
OPERATIONAL RESUME
LEG 55

Leg 55 will be remembered for many and various reasons including a shipyard port call, broken bumper subs, sea lions and scintillating scientific success.

All major scientific objectives for the leg were achieved and in the process the deepest basement penetration in the Pacific Ocean area was drilled, showing up skeptics who said seamounts could not be drilled successfully.

The leg consisted of three phases:

A) Shipyard and drydock port call at Bethlehem Steel Company Shipyard, Terminal Island, Los Angeles, California.

B) Dead ahead steaming from Los Angeles to Honolulu, Hawaii for a crew change port call.

C) Scientific phase to investigate the Emperor Seamount chain.

Leg 55 started June 18, 1977 with the arrival of the GLOMAR CHALLENGER at the Bethlehem Steel Company Shipyard on Terminal Island at Los Angeles, California and terminated some 80.03 days later on September 6, 1977* at Yokohama, Japan. The CHALLENGER travelled 7,862 nautical miles and drilled 11 holes at 4 sites. Water depths were relatively shallow ranging from 1320 meters to 1874 meters and a total of 806.5 meters of coring resulted in 404.47 meters, or 50.15% of recovery.

The 80.03 day voyage consisted of 24.28 days in the shipyard, 0.96 days in port calls at Honolulu and Adak, 36.29 days in cruising and 18.5 days on site.

SHIPYARD AND DRYDOCK PORT CALL

The GLOMAR CHALLENGER arrived at Berth 4-B, Bethlehem Steel Company Shipyard, Terminal Island, Los Angeles at 0706 hours, June 18, 1977. Work began immediately on a long list of repair and inspection items scheduled for the required bi-annual upkeep and drydock period.

The arrival day was a Saturday and the only shipyard work done was the offloading

* Includes crossing the international date line

of the drill pipe while the ship's crew worked to dismantle equipment scheduled for repair and inspection and generally ready the vessel for shipyard work.

The following day, Sunday, a joint GMI-SIO open house was held and little work was accomplished. On Monday, June 20, shipyard work began in earnest. However, lifting the vessel out of the water was delayed approximately two days as the floating drydock was occupied with an emergency repair job on the freighter SAN BENITO. The CHALLENGER finally entered drydock on the morning of Friday, June 24. Initially, seven days were planned for the drydock period; however, the vessel was not refloated until the morning of July 7, 13 days after going dry. The additional drydock days were the result of unrealistic original time estimates, the accomplishment of additional unplanned work and the July 4th holiday. The shipyard did not work on July 4, however, additional night tours were worked on pacing items during June 29 and 30 as well as July 1 and 2.

After entering a wet berth at the shipyard, testing of repaired tanks, final USCG and ABS inspections, reloading of drill pipe, completion of numerous repair items and the loading of stores and equipment took a further 4-1/2 days.

On the afternoon of July 11, the CHALLENGER departed the shipyard and moved to Berth 210, Long Beach Harbor for bunkering (500,000 gallons of marine gas-oil).

At 1440 hours July 12, on completion of bunkering, the vessel departed for sea trials in the San Pedro Channel. These trials were completed early on the morning of July 13 and, after disembarking various sea trial observers to a launch at the Long Beach pilot buoy, the CHALLENGER departed for Honolulu at 1000 hours July 13.

Significant work items accomplished during the upkeep period were as follows:

HULL AND STRUCTURAL

Alternative methods of strengthening the "moon pool" area of the hull had been proposed by GMI dependent on results of a thorough drydock inspection. This inspection found that an effective corrosion control program of painting and cathodic protection had resulted in negligible metal loss from the bottom hull plates. Consequently, it was unnecessary to replace any plating. Strengthening was accomplished by using doubler plates which were fabricated and welded onto the area of the ship's bottom, port and starboard of the moon pool (center well).

In addition, the corners of the moon pool were strengthened by the installation of four 8-foot long stiffeners which were welded into the lowermost corners of the moon pool itself. Two 60-foot long beams were installed longitudinally, one on either side of the moon pool in the double bottom of the ship. These beams penetrate and join the transverse bulkheads forward and aft of the moon pool.

Portions of the stabilizer flume tank bulkheads were cut out to investigate the extent of damage caused by overpressuring on a routine tank test during

Leg 49. The damage was found to be confined to distortion and ruptured welds of the plating. The structural members and braces were intact. Necessary repairs were made and the flume tank bulkhead plates were replaced.

A section of defective exterior hull plating repaired following Leg 47 was replaced on the peak tank (port bow).

A valve fitting was installed in No. 2 bow thruster tunnel to facilitate dewatering by connection to the ship's trim and drain system. This will be helpful when repairs to the thruster gearboxes are made.

During the drydock period, the entire hull below the waterline was sandblasted and given coats of anticorrosive primer and antifouling paint. Underwater anticorrosive zinc anodes were replaced.

ENGINEERING

The major overhaul of No. 12 Caterpillar engine and the replacement of two D. C. generators, Nos. 2 and 6, were the major engineering jobs done. In addition, D.C. generator 9B was overhauled and bearings were replaced in generators Nos. 3, 5 and 9A.

The shell of evaporator No. 2 was replaced, which necessitated the removal of a large section of the evaporator room bulkhead in the 'tween deck hatch area. Various circulating pumps were overhauled or replaced. The D.C. propulsion switchboard was cleaned and its knife switches refurbished. The emergency switchboard was inspected. Thruster overspeed prevention circuits were installed in the propulsion switchboard.

The gearboxes of the stern thrusters were replaced with rebuilt units while propeller seals were replaced on the bow thrusters. In addition, armature shafts in the bow thruster motors, damaged on Leg 51, were replaced. The drive shaft alignment of bow thruster No. 1 was checked and adjusted.

Other engineering repair items included the replacement of the stern windlass motor, replacement of most fuel tank sounding tubes and vents, and the replacement of various deteriorated pipings.

DRILLING EQUIPMENT

The major repair item to drilling equipment was the complete refurbishment of the horizontal pipe racker. This was one of the pacing items during the shipyard period and was completed without major incident. The drawworks and the hydraulic coring winch were completely overhauled. Repairs were made to the drawworks auxiliary brake which had given trouble during Leg 54.

Drill pipe, which had previously been graded as premium class and identified for possible downgrading by Sonoscope (internal magnetic flux leakage tool) inspection, was further investigated using internal optical and ultrasonic means. Those joints confirmed as Grade 2 were reloaded on the CHALLENGER for use in the lower sections of the drill string. Several joints of drill pipe, which had previously been internally zinc coated, were inspected to determine the effectiveness of this type of internal coating. The results of this inspection were such that a recommendation has been made to internally zinc coat all future drill strings.

Magnetic particle inspections were conducted on all load handling equipment and on all rotary shouldered connections. No signs of fatigue cracking were found. The drilling derrick was also inspected resulting in the replacement of two minor members. It was recommended that a number of additional members be maintained (cleaned and regalvanized) during Leg 55 cruising period.

During the yard period, the rotary connections of the drill collars and other bottomhole assembly components were recut from NC 61-82 thread to a 6-5/8-inch API Full Hole thread modified to give a 7-inch thread length. This modification was indicated by a number of joint failures in the bottomhole assembly during spudding operations. The new connection is stronger than the NC 61-82.

LABORATORY AND GFE EQUIPMENT

The major work item involving scientific equipment was the installation of the 2.5/3.5 kHz acoustic profiling system. The system was mounted in the port forward corner of the moon pool area. The 12 kHz transducer used in the precision depth recorder system was replaced with a new unit.

Another installation was the addition of a third Rix high pressure air compressor to meet increased requirements for supply to seismic air guns.

The electric motor units of the downhole re-entry scanning sonar tool were modified by EDO in Salt Lake City and new aluminum pressure cases manufactured at UCSD were delivered to the ship. All electronics equipment was serviced and test instruments were recalibrated.

The CNEXO X-Ray Fluorescence Unit, which had broken down, was repaired.

In order that cores could be described and photographed at the same location, a hydraulically operated scissors table was installed in the core laboratory.

New book shelves and cabinets were installed in the science lounge. This resulted in a vast improvement both in the decor and habitability of the lounge. A second Xerox copying unit was installed to supplement the capabilities of the present unit.

Complete overhauls were carried out on the logging winch and the cementing unit, including maintenance of auxiliary components of both units. A diaphragm type pump was placed aboard the vessel to provide a back-up cement slurry transfer capability for the BJ pump.

Other items delivered to the ship were a storage rack for fishing and other special downhole tools and a cable reel stand designed to facilitate the spooling of sandlines and logging cables.

NAVIGATIONAL, SAFETY AND TRAINING

The 12 kHz transducer for the ship's fathometer was replaced with a new unit. Considerable effort was put into repairing the ship's pit log speed indicator but the job could not be completed during the shipyard period. This work was completed during the voyage to Honolulu and the log was calibrated utilizing the measured mile off Pearl Harbor, Hawaii.

Periodic USCG, ABS and FCC recertifications were obtained.

Several training sessions were conducted for the benefit of both GMI and DSDP personnel. Representatives of Schlumberger Well Services and Vector Cable Company provided instruction in the care and operation of logging cable and in the principles and operation of the logging winch and other associated equipment. McCullough Services personnel provided training in the drill pipe severing system and the free point/back-off equipment carried on board the CHALLENGER. DSDP and Baash-Ross experts discussed proper care and handling of the drill string, the hazards of fatigue failure and the background and special features of the bumper subs used by the Project.

RESUPPLY

Due to the proximity to domestic sources and associated savings in shipping costs, the upkeep period saw major resupply and logistics efforts on all fronts. Stocks of foodstuffs and consumable items were augmented, as well as those of bulk commodities. Heavy and bulky pieces of equipment were loaded to the extent possible to minimize later shipping. Bulk cement and mud tanks were topped off. 500,000 gallons of fuel, approximately 6,000 gallons of lube oil products and 220,000 gallons of fresh water were taken on.

STEAMING SAN PEDRO TO HONOLULU AND HONOLULU PORT CALL

The GLOMAR CHALLENGER departed Los Angeles harbor entrance at 1000 hours, July 13, after successfully completing the post drydocking sea trials. The steaming time to Honolulu was utilized to complete a number of shipboard tasks which remained uncompleted after the shipyard work.

Routine profiling was done with the addition for the first time of a 3.5 kHz acoustic profiling system. This system was operated at 8 kw for three days after which a short developed in the input transformer to the transducer. This caused the system to fail. The transducer housing was removed from the moon pool area while approaching Honolulu harbor and while in harbor the transformer was replaced and the unit reinstalled. The system was successfully tested at dockside. The ship's pit log speed indicator was successfully repaired. The unit was calibrated utilizing the measured mile off Pearl Harbor immediately after the vessel left Honolulu harbor enroute to the first drilling site for Leg 55.

The drilling crew also completed various jobs started during the shipyard period, including changing out the flooring on the rig floor, continued chipping and restoration of derrick girts, the construction of a protective housing over the BJ cementing unit, and general rig cleanup and maintenance.

During the dockside period approximately 55,000 gallons of water were taken on board as well as a load of perishables.

Crew change was scheduled for 0600 hours on Saturday, July 23 and sailing immediately thereafter. However two members of the marine crew did not arrive as scheduled and the departure was delayed until their arrival. Signing of ship's articles was accomplished at noon. The vessel eventually sailed at 1242 hours.

SCIENTIFIC INVESTIGATION OF THE EMPEROR SEAMOUNT CHAIN

The scientific objective of Leg 55 was to drill three holes in seamounts of the Emperor chain in the north central Pacific Ocean. The principal purpose of the drilling was to test the hypothesis that this chain of shield volcanoes, like the Hawaiian chain, was formed as the Pacific plate moved over a melting anomaly in the ocean mantle.

SITE 430 (Holes 430, 430A, 430B)

The first drilling site was situated on the flat topped seamount Ojin located approximately 1650 km southwest of Rat Island.

Only one profile, Lee profile No. 21 (0750), was available for the proposed drilling location and it was thus considered necessary for optimum site positioning to obtain further sections using shipboard seismic systems. Consequently 80 km of profiling was done over the proposed area before a 16.0 kHz ORE beacon was dropped. The first pass was made in a direction 290° true and a second in a direction 230° true.

The ship was then positioned and the drilling assembly made up and run to a depth of 1455 meters. This was the water depth as indicated by the PDR system. The mudline depth as indicated by the drill pipe was 1464 meters at which depth a mudline core was attempted. No recovery was obtained. Continuous coring was continued to a point 14 meters below the mudline. Recovery was very poor in the pebbly mudstones encountered and continued caving of the unconsolidated formations forced an early abandonment of the hole.

The drill string was then pulled 60 meters above the sea floor and the ship was slowly moved 915 meters northeast of the original location. A mudline core was taken at this offset location at a depth of 1485.5 m. Formations proved to be more suitable for spudding and coring commenced. The formation was fairly firm with rotation and water circulation being required in order to obtain penetration. It was considered expedient to bury the bottomhole assembly to a point above the first bumper sub as quickly as possible thus each alternative 9.5 m section was washed down. However, this use of rotation and circulation resulted in poor core recoveries in the sediment section. Basalt was first encountered 62 meters below the mudline which was considerably higher in the section than anticipated. The basalt was fresh and massive and cored smoothly. High core recovery was expected.

However, when Core No. 6 was recovered, it was found that the support sleeve for the plastic core liner had become damaged. This in turn damaged the plastic liner and the upper core catcher. The action of the catcher dogs was interferred with; one dog broke off and lodged between the core the plastic liner. When the liner barrel was retrieved, a section of core dropped out of the barrel. Some of these pieces of core lodged in the core opening of the bit and prevented the inner barrel from seating on subsequent core runs.

While pumping the inner barrel down for Core No. 7, the bit became plugged and it was some while before circulation was once again obtained. Cores Nos. 7, 8 and 9 gave no recovery despite changes in core catchers, the introduction of a plastic sock and varied drilling techniques. Two slugs of mud were circulated; one of 50 barrels and the other 75 barrels.

Pressure fluctuations indicated that the bit was still partially plugged and a center bit was pumped down prior to attempting Core No. 10. This latter core resulted in a small amount of recovery of drilled cuttings. The center bit was pumped down twice before Core No. 11, but it was obvious from pressure indications that the bit was not open and it was decided to cease drilling operations. When the bit was on surface approximately 1.03 meters of core (presumably from Core No. 6) was found jammed into the core opening of the bit.

Before finally abandoning the site, the ship was offset 500 meters in a direction 040° true and an attempt was made to obtain a sea floor sample. The blocked bit obviously prevented this although a minor amount of sand/mud did enter the core barrel and a further minor amount stuck to the face of the bit.

At 0500 hours on 3 August, the 16.0 kHz beacon started to double ping and a 13.5 kHz ORE beacon was dropped to ensure position holding. The formations penetrated in Hole 430A consisted of 66.5 meters of very shallow fossiliferous sediments, algal limestone, calcareous mud and volcaniclastic sandstone and 5.5 meters of highly vesicular to massive basalt. The basalt section contained at least four flow units and the cores obtained were suitable for chemical, paleomagnetic and radiometric age studies and comparisons with Hawaiian and southern Emperor Chains. It was thus considered that the scientific objectives of this site were achieved. Operations on Site 430 were completed with the pulling of the drill string and the ship left the site at 1812 hours on 3 August.

SITE 431 (Holes 431 and 431A)

Site 431 was located some 271 miles north of Site 430 and was on a terrace of an unnamed seamount north of the Nintoku Seamount. Enroute to the site the GLOMAR CHALLENGER followed a course which passed over the Jingu and Nintoku Seamounts to obtain additional seismic records. After some tense moments maneuvering in dense fog through a fleet of fishing vessels, Site 431 was occupied at 1830 hours on 5 August.

A mudline core was taken at 1714 meters and 1.90 meters of unconsolidated gravel sand was recovered. A second mudline core was taken in an attempt to obtain more core of this significant zone, however, recovery was again poor being 1.43 meters.

While taking Core No. 3, the bottomhole assembly broke off at the bottom of the first bumper sub. The drill pipe was pulled to the rig floor and while a new core barrel was being made up, the vessel was offset 500 feet in a direction 230° true.

Hole 431A was then spudded at a depth of 1713.5 meters. While recovering Core No. 2, there were indications that the drill string was bending and it was decided to respud the hole and wash in to such a depth that the first bumper sub was buried before commencing with coring. While washing down without rotation at a depth of 1740 m, the bottomhole assembly once again broke off at a similar point in the string as at Hole 431. The drill string was retrieved and the vessel was moved to an alternative site some 60 miles southwards of Site 431.

SITE 432 (Holes 432 and 432A)

After abandoning Site 431 due to the adverse drilling conditions, the vessel moved south some 96 km to a site on a flat topped seamount (Nintoku) which is situated some 1300 km southwest of Rat Island. The site was occupied at 1100 hours on 7 August and before running in the hole, the bumper subs in the string were inspected and top and bottom tool joints Magnafluxed. A mudline core was taken at 1320 m after which 10 m were again washed down without rotation. At this point the bottomhole assembly broke off in exactly the same manner as at Site 431.

Hole 432A was spudded using a different bottomhole assembly. The first bumper sub was lowered to 27 meters above the bit and a stand of drilling joints was removed from above the drill collars. The hole was spudded using rotation and circulation and no attempt was made to cut core until the first bumper sub was below the mudline. The formation at the mudline was fairly firm and hard sandstone was encountered at 1356 meters at which depth continuous coring was started. A number of layers of hard sandstone, basalt, conglomerate and red clay were intersected before massive basalt was intersected at 1365 meters. This basalt was very hard although drilling was smooth. During a connection at 1394 meters, the bit and core barrel became stuck due to cavings. While working the drill pipe, the lower bumper sub failed at the top service joint, apparently due to a fatigue crack. On recovery of the drill string it was found that the outer barrel of a second bumper sub was belled out immediately above the drive section.

The Co-Chief Scientists requested that the hole be respudded in a effort to obtain core in the section of the hole washed down in Hole 432A. Due to the losses experienced at Holes Nos. 431, 431A and 432, and because only one bumper sub on board was in good working condition, the request could not be granted.

After communicating with DSDP at La Jolla, California and determining that additional bumper subs and core barrel parts could be made available, the vessel departed for Adak in the Aleutian Islands at 0936 hours, 9 August to pick up these parts.

SITE 433

An intermediate port call was made at Adak where four bottom subs for the bumper subs and four core barrel head subs were loaded onto the CHALLENGER. The equipment was immediately available when the ship arrived in Adak resulting in a short three and a quarter hour port call. The vessel then sailed directly to Site 444, which was situated on the Suiko Seamount approximately 1080 km southwest of Rat Island and 200 km north of Site 434. A total time of 7.4 days were lost as a result of the resupply effort.

A 16 kHz beacon was dropped at 1918 hours on Tuesday, August 16, however, profiling beyond the beacon drop indicated a more favorable location and it was decided to offset the hole (2230 feet) 680 m in a direction 205° true from the beacon.

A 13.5 kHz beacon was dropped once the ship was positioned and this second beacon used for stationkeeping purposes. The second beacon was utilized in order to eliminate any positioning error which may have been introduced due to the offset distance.

The drill pipe was measured as it was run to the seafloor and a mudline core was taken at 1874 meters. The hole was then washed to a depth of 1919 m at which point rotation was necessary to obtain penetration. This depth was used to determine the length of 16-inch casing which could be run for the re-entry hole.

HOLE 433A

Hole 433A was spudded at 0442 hours on Wednesday, August 17. Using the same beacon as for Hole 433, a mudline core was again taken at 1874 meters. 163.5 meters of soft to very soft sediments were cored before basalt was intersected at 2037.5 meters. Coring was trouble free with only minor problems associated with retrieving the core barrel which became stuck on a number of occasions. Core No. 10 penetrated only 5.5 meters, however, the core barrel was full, 9.5 meters, when recovered. This and the stuck core barrels were attributed to the extreme softness of the formation.

During the cutting of Core No. 21, the stern thrusters showed excessive amperage and the vessel had to be held on position manually. This proved impossible to do and the drill pipe had to be pulled above the mudline while the problem was resolved. As a result, the hole had to be abandoned.

HOLE 433B

The position holding capability of the ship was recovered when a quantity of fishing net, which had jammed in the stern thrusters, was removed. Station was once again taken over the 13.5 kHz beacon used for holes 433 and 433A, before Hole 433B was spudded.

The hole was drilled from the mudline at 1874 meters to 2012.5 meters at which point continuous coring commenced. A 31.5 meter section of sediments, which had given very poor recovery in Hole 433A, was recored with moderately improved recovery. 26.5 meters of basalt was then cored. The bit then became plugged with pieces of core which had fallen from the inner barrel due to a damaged core catcher, as had happened on Hole 430A. The hole was then abandoned.

Holes 433, 433A, and 433B, although not drilled to their maximum potential depth, did indicate that the site was suitable for a re-entry attempt.

HOLE 433C

A re-entry cone was assembled and keelhauled into place below the moon pool. The 16-inch casing, 39.25 meters in length and bottomhole assembly were then made up and connected to the cone. A9-7/8-inch F94CK bit was run 10 cm up inside the casing shoe and the flow-through lowering tool utilized. The assembly was run to the sea floor without incident.

The casing was jetted in to set at 1914 meters. Weight indications varied from 5,000 lbs. to 15,000 lbs. with a constant mud pressure of 350 psi. The casing/cone were released from the lowering tool one hour after spudding.

The hole was then washed to a depth of 2037 meters and continuous coring commenced. In an attempt to prevent a reoccurence of the type of bit plugging which forced the abandonment of Holes 430A and 433B, a combination slip and dog type core catcher was used. Lack of recovery from Cores Nos. 3 and 4 proved to be a formation change from basalt to an unconsolidated beach sand and not, as was first thought, a core catcher problem. However, the first bit had to be pulled from the hole when it became plugged with pieces of core.

Re-entry for bit run No. 2 was achieved without incident. The cone was first located some 40 feet distant from the scanning tool. Two small maneuvers were made to determine azimuth before the drill pipe was stabbed some 45 minutes after scanning commenced.

Bit run No. 2 started off well and good recoveries were obtained. However, during the cutting of Cores Nos. 16, 17 and 18, the bit continuously became plugged. It became evident that the inner core barrel was not latching effectively and as the problem appeared to be worsening, the bit was pulled out of the hole. Before running back into the hole, the latch sleeve in the outer barrel was replaced.

Rough seas and winds gusting up to 40 knots, as well as false targets on the sea floor, complicated re-entry No. 2. The first attempt to stab the bit hit the cone but apparently bounced outwards into the seafloor. There was evidence that one reflector was damaged during this stab. The cone was eventually entered some 11 hours and 45 minutes after scanning commenced.

Bit run No. 3 drilled smoothly and core recovery was high in the fresh basalts (average 70.9%). Vesicular basalt sections were somewhat crumbly and recovery was not as high in these areas. This bit cored 179 meters of basalt in 53.1 hours before being pulled from the hole. No problems were experienced with bit plugging.

Re-entry for bit run No. 4 took 5 hours, more than 4 hours of which being required to maneuver the ship to within 50 feet of the cone, even though the weather was dead calm. Re-entry was made on the first stab.

Bit run No. 4 again drilled smoothly and gave high core recoveries (average 74%). However, during core run No. 49, the pump pressure built up indicating plugging of the bit. Efforts to clear the bit using a chisel type center bit were only partially successful and when the problem continued while cutting Core No. 50 the bit was pulled out of the hole. When the bit reached surface the cause of the plugging was obvious. A piece of rag had somehow entered the drill pipe, possible from the mud pits, and this had combined with small pieces of core to effectively block the core throat of the bit.

Before abandoning Site 433 a seismic profile was taken across the Suiko Seamount after which the vessel steamed for Yokohama Harbor in Japan.

DRILLING AND CORING ASSEMBLIES

The bottomhole assembly used at Sites 430, 430A, 430B, 431, 431A and 432 consisted of a bit, bit sub (with float valve), core barrel, top sub, head sub (latch), three 8-1/4" drill collars, one Baash-Ross bumper sub, three 8-1/4" drill collars, two bumper subs, two 8-1/4" drill collars, one 7-1/4" drill collar, three drilling (knobby) joints and one 5-1/2" heavy wall drill pipe. One stand (three joints) of premium grade drill pipe were run above the heavy wall joint before using Class 2 drill pipe for the rest of the string.

For Hole 432A, because of the thin soft sediment cover and the immediate past experience of BHA failures, the BHA was modified by positioning the lowermost bumper sub just two drill collars above the core barrel and removing the stand of knobby drilling joints from the string.

On Hole 433C, the original BHA as described above was once again used with no problems being experienced.

Plugging of the bit by pieces of core was a problem on all holes drilled. On Holes 433B and 433C the inner barrel was not latching correctly. More specifically it appeared to become unlatched while drilling the hard basalt. Bit No. 2 was pulled from the hole when excessive time was being used to run a chisel bit in an effort to unplug the bit. It was found that the latch sleeve in the outer barrel had an I.D. of 4-1/8". The standard I.D. is 3-15/16". The larger I.D. sleeve is evidently not suitable when drilling hard basalt. No problems were experienced while drilling sediments. The latch sleeve was changed before bit run No. 3 and no further problems were experienced.

BITS

Ten bits were used to drill the 11 holes that were attempted, four of which were used in the re-entry Hole 433C. All the bits were 9-7/8-inch type F94CK. Only one bit run could be considered as having used the life of the bit. This was bit run No. 3 on Hole 433C which drilled 179 meters of basalt in 53.1 hours. Even this bit could have run some 5 to 10 hours longer but it was pulled as the rotating time was considerably longer than for previous bit runs in basalt. Further, there was a forecast of rough weather and it was considered prudent to attempt re-entry while the seas were still calm.

The other bits were either lost in the hole (4) or pulled "green" when they became plugged.

The basalts penetrated were not abrasive at all and bearing life would be the determining factor for bit life while drilling similar formations.

BUMPER SUB FAILURES

Three similar failures occurred on Holes 431, 431A and 432, when the bottom sub on the lower bumper sub failed due to a bending action.

All failures occurred within 30 meters of the mudline and while there was no rotation of the drill string. The formation at all three holes was relatively firm and circulation was required in order to get any penetration. The subs failed as a result of a reduced section which remained after the pin connections had been recut to 6-5/8" Full Hole with 7" pin during the drydock period.

All three holes had less than the 100 m of sediment cover needed to support a bottomhole assembly and all three failures occurred before the first bumper sub was below the mudline. The circumstances leading to the failures were very similar to those experienced on Hole 309, Leg 32, when a BHA was lost while drilling on the Koko Seamount.

On Hole 432A, a different failure occurred when the upper service break of the lowermost bumper sub failed while working stuck pipe. This failure cannot be related to the previous three.

RE-ENTRIES AND EQUIPMENT

In general, re-entries were achieved without major difficulties. Re-entry No. 2 was complicated by rough seas and high winds. This caused considerable roll and pitch of the ship as well as horizontal excursions. As a result, the drill pipe was swinging excessively as it approached the cone. In addition, there were a number of false targets on the seafloor and three stabs were made at what was later determined to be a false target. For some unknown reason the cone did not show up on the initial long range scan and a false target was mistakenly identified as the cone. When mud resistance was felt by the driller each time a stab was made it was realized something was wrong and a further long range scan was made. On this occasion the cone was readily identified some 170 feet from the ship's position. The ship was positioned over the cone with some difficulty and was not stationary for any length of time. This resulted in one further misstab being made before the re-entry was made some 11-1/2 hours after the commencement of scanning. The EDO scanning tool performed well throughout the operation although it had a tendency to stop rotating. Rotation was easily recovered on such occasions by merely switching the tool off, then on again. When the tool was recovered, it was found that the motor section was not functioning correctly. The problem was attributed to surge of current which occurred when the logging winch operator inadvertently switched off power to the tool and then immediately switched it back on again.

For re-entry No. 3, the same tool was used after having been repaired and it functioned well. During this re-entry, considerable difficulty was experienced in maneuvering the drill pipe over the cone even though initial contact was made at a range of 48 feet. Only small moves were made with the ship but large movements were observed with the scanning tool and it was concluded that bottom currents must have been present. It was also found that the positioning system took a long time to respond or settle down when new offsets were introduced. This re-entry was like the first, done in extremely calm weather although there was some 45° difference in vessel heading.

RE-ENTRY EQUIPMENT

The re-entry sonar system functioned well for the three re-entry attempts made. The only problem, which did not affect the re-entry at all, occurred when the logging winch operator inadvertently switched off the survey switch. When switched back on a current surge through the motor section of the tool resulted in the loss of rotation of the probe. This loss of rotation occurred intermittently during the remainder of the re-entry attempt. Rotation was regained by simply switching off the rotation circuit and then restarting it. The motor section of the tool was repaired before being used successfully during the third re-entry.

The Mohole logging unit performed reliably and well. The only casualty being damage to the spooling arm when the cable head was pulled into the spooling arm sheave. The over-pull was a result of the operator not being used to the new Bendix variable air pressure controller to the clutch. The damage was repaired by the ship's mechanic. The cable head was replaced as a precaution against any damage it may have suffered.

BEACONS

Eight ORE single-life beacons were used during the leg, five of these being 13.5 kHz and the remaining three 16.0 kHz.

One 13.5 kHz was used during sea trials after the shipyard period. A further 13.5 kHz was soaked in preparation for use but would not restart.

The beacons launched on the drilling sites operated well except in one instance on Site 430 when a 16 kHz experienced trouble with a double burst. A 13.5 kHz was then dropped and the positioning system locked into it.

On Site 433 two beacons were dropped. One 16.0 kHz was dropped as the ship approached the proposed drilling site and the other 13.5 kHz was dropped some 2,230 feet from the 16.0 kHz once the final drilling location was determined.

All beacons were sending out strong signals when the various sites were left. There was some considerable speculation that bottom currents were moving the beacons along the seafloor at Sites 431 snd 432. These were the sites where continued bending and breaking of the bumper subs occurred. A larger and heavier anchor was used for the beacons launched at Site 433 and there was no indication or speculation of seafloor beacon movement.

COMMUNICATIONS

Radio communications via radio WWD (Scripps) was maintained without problems throughout the leg mainly on 17105 MHZ, with a few transmissions on 12871.5 MHZ. All equipment performed well.

PERSONNEL

This leg had only a small percentage of time on site. The majority of time was spent cruising or in the shipyard.

The scientific party were a particularly happy group who even when things were going badly at the earlier drill sites managed to maintain their morale and enthusiasm. They were rewarded by achieving all the major scientific objectives set for this particular leg.

The GMI personnel once again performed an outstanding job under trying circumstances. One injury occurred when a chain hoist fell onto a derrickman's left hand causing compound fracture of the middle finger. The patient left the ship at Adak when it was determined that surgery was necessary to reset the finger correctly.

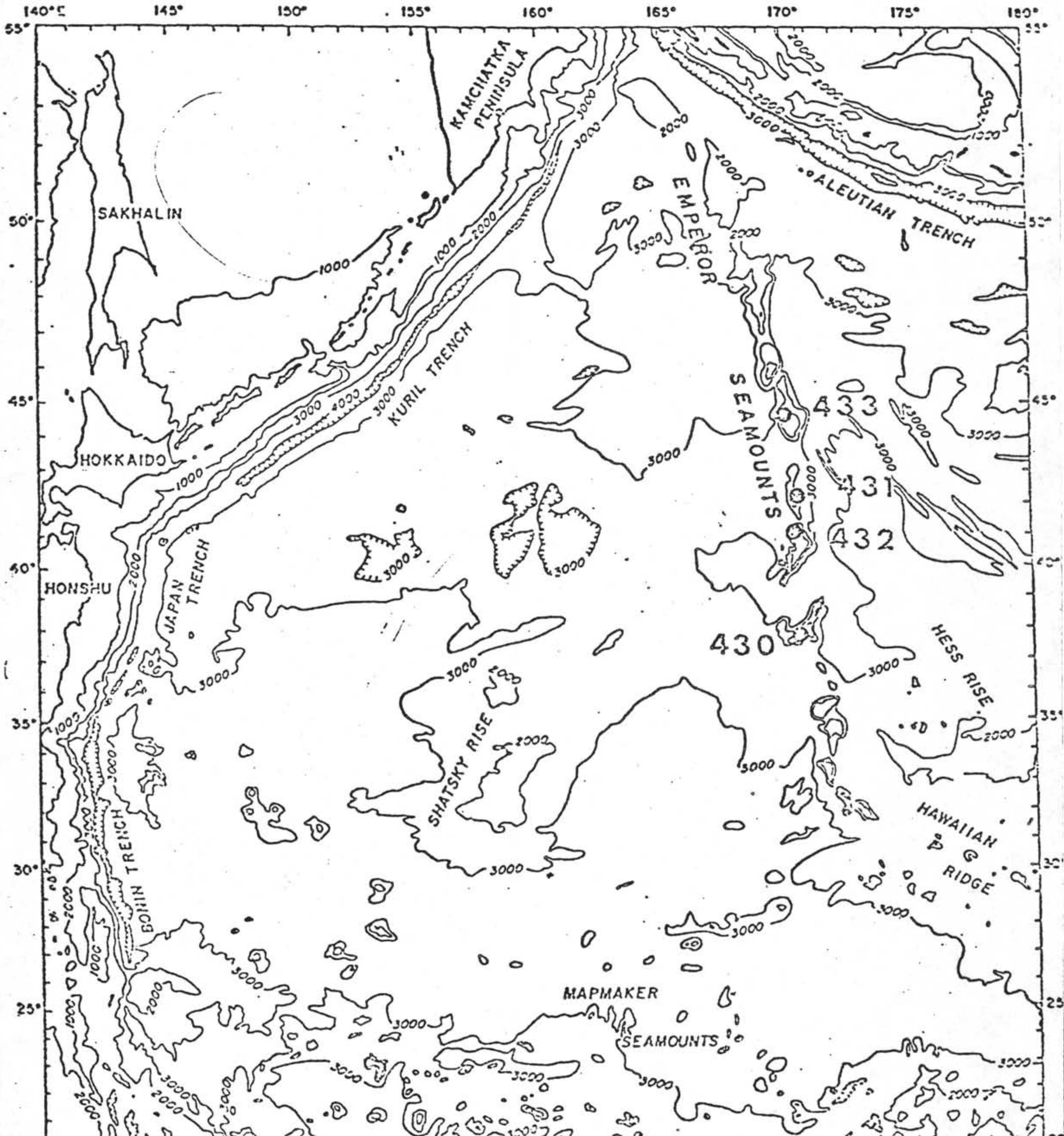
The SIO marine technician crew deserve special mention. Many of the technicians worked the full period of the leg, including the shipyard period, yet they maintained a high morale and performed an excellent service which was greatly appreciated by the Scientific Party in particular.

V.B. Robson

V. B. Robson
Cruise Operations Manager
Deep Sea Drilling Project

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
OPERATIONAL RESUME
LEG 55

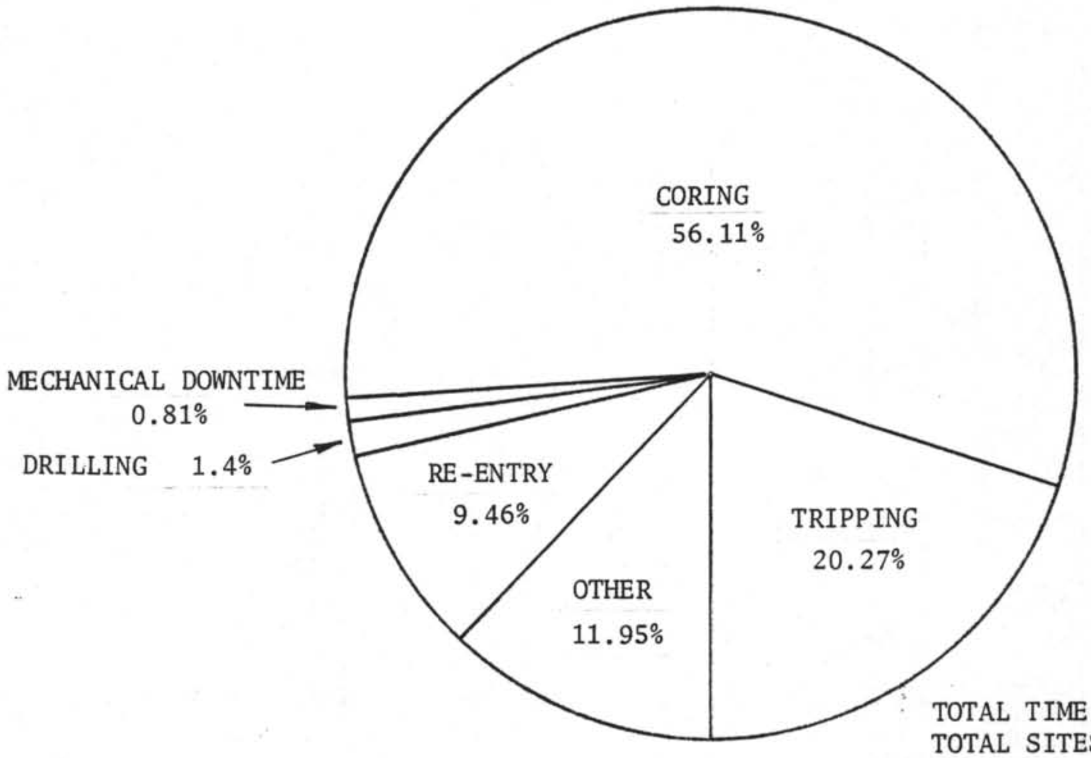
Total Days (June 18, 1977 - September 6, 1977)			80.03
Days in Shipyard			24.28
Days Port Call			0.96
Days Cruising			36.29
Days On Site			18.5
Trip Time (Days)	3.75	20.27%	
Drilling Time	0.26	1.4%	
Coring Time	10.38	56.11%	
Re-entry & Related Time	1.75	9.46%	
Mechanical Downtime	0.15	0.81%	
Other	2.21	11.95%	
Total Distance Covered (Nautical Miles)			7862
Average Speed (Knots)			9.73
Sites Investigated			4
Holes Drilled			11
Number of Cores Attempted			104
Number of Cores With Recovery			96
Total Meters Cored			806.5
Total Meters Recovered			404.5
Percent Recovery			50.2
Total Meters Drilled			424.0
Total Meters Penetrated			1230.5
Percent Penetration Cored			65.5
Maximum Penetration (Meters)			550.5
Maximum Water Depth (Meters)			1874.0
Minimum Water Depth (Meters)			1320.0



KAMCHATKA PENINSULA
SAKHALIN
HOKKAIDO
HONSHU
KURIL TRENCH
JAPAN TRENCH
BONIN TRENCH
EMPEROR SEAMOUNTS
ALEUTIAN TRENCH
SHATSKY RISE
HESS RISE
HAWAIIAN RIDGE
MAPMAKER SEAMOUNTS
433
431
432
430

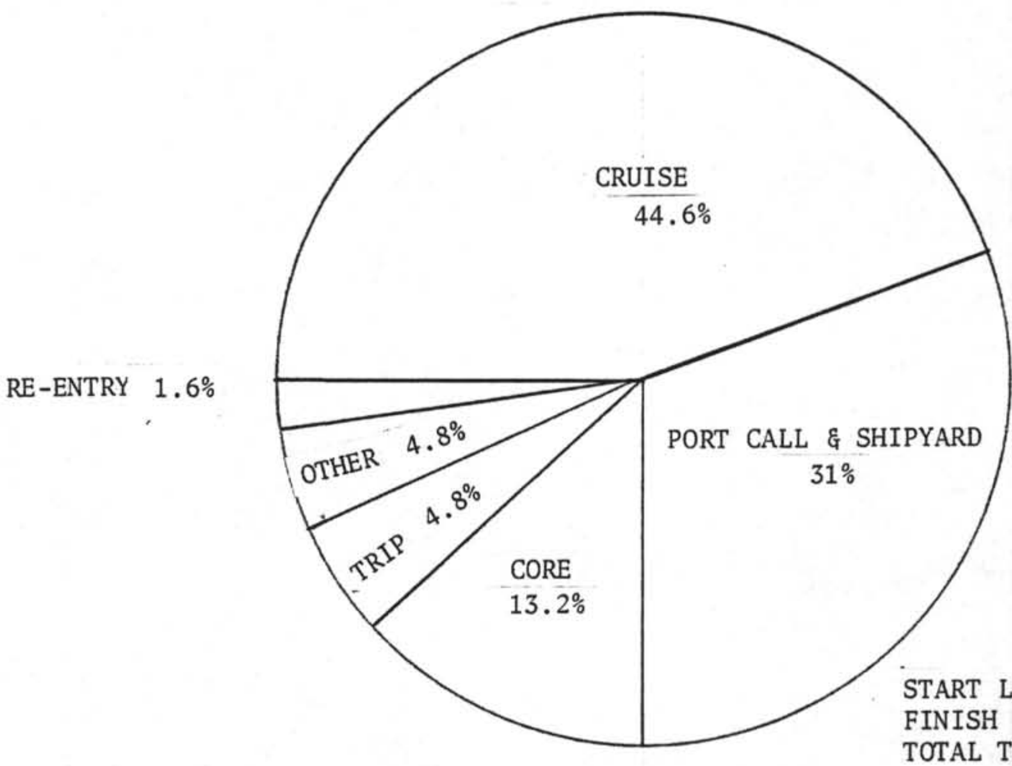
INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
TOTAL TIME DISTRIBUTION
LEG 55

ON-SITE TIME BREAKDOWN



TOTAL TIME ON SITE: 18.5 Days
TOTAL SITES: 4
TOTAL HOLES: 11

TOTAL TIME BREAKDOWN



START LEG: June 18, 1977
FINISH LEG: September 6, 1977
TOTAL TIME: 80.03 Days

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
BEACON SUMMARY
LEG 55

Site No.	Make	Freq. kHz	Serial Number	Site Time Hours	Remarks
Sea Trials	ORE	13.5	361		Single life. Soaked OK but did not restart. Not dropped.
Sea Trials	ORE	13.5	364		Single life. OK when abandoned.
430	ORE	16.0	381	433	Single life. Trouble with double burst. Offset 2990 ft.
	ORE	13.5	401	13	Single life. OK when site abandoned.
431	ORE	16.0	377	30	Single life. OK when site abandoned.
432	ORE	13.5	407	35	Single life. OK when site abandoned.
433	ORE	16.0	378	335	Single life. Offset 2230 ft. OK when site abandoned.
	ORE	13.5	412	330	Single life. Dropped at drilling position. OK when site abandoned.

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
BIT SUMMARY
LEG 55

Hole	Mfg.	Size	Type	Serial Number	Meters Cored	Meters Drilled	Total Meters Penet.	Hours On Bit	Condition	Remarks
430,A,B	Smith	9-7/8"	F94CK	944FE	102.5	32.5	135.0	15.21	T1, B2, IN, SE	Hole 430, 14 m; 430A, 118 m; 430B, 3 m. Bit plugged.
431	Smith	9-7/8"	F94CK	191FF	19.0	- -	19.0	0.33	Not Recovered	BHA lost while washing. No rotation.
431A	Smith	9-7/8"	F94CK	123FF	17.0	9.5	26.5	0.37	Not Recovered	BHA lost while washing. No rotation.
432	Smith	9-7/8"	F94CK	102FJ	5.5	9.5	15.0	0.16	Not Recovered	BHA lost while washing. No rotation.
432A	Smith.	9-7/8	F94CK	084FF	38.0	36.0	74.0	7.60	Not Recovered	BHA lost working stuck drill pipe.
433,A,B	Smith	9-7/8"	F94CK	086FF	237.0	173.5	410.5	12.2	T1, B1, IN, SE	3 holes. Bit plugged.
433C #1	Smith	9-7/8"	F94CK	208FE	39.5	163.0	202.5	12.37	T1, B1, IN, SE	Bit plugged.
#2	Smith	9-7/8"	F94CK	932FE	59.0	- -	59.0	14.98	T4, B1, IN, TB	Pulled to change defective latch sleeve.
#3	Smith	9-7/8"	F94CK	196FF	179.0	- -	179.0	53.10	T1, B3, IN, SE	
#4	Smith	9-7/8"	F94CK	197FF	110.0	- -	110.0	29.48	T1, B2, IN, SE	Bit plugged.
			TOTALS		806.5	424.0	1230.5	145.8		

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
SITE SUMMARY
LEG 55

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/Hr	Time On Hole Hrs.	Time On Site Hrs.
430	37° 59.26'N	170° 36.56'E	1464	3	2	66.7	14.0	7.90	56.4	- -	14.0		11.4	- -
430A	37° 59.29'N	170° 35.86'E	1486	11	8	72.7	85.5	16.83	19.7	32.5	118.0		27.7	- -
430B	37° 59.52'N	170° 36.12'E	1492	1	1	100.0	3.0	0.10	3.3	- -	3.0		6.6	45.8
431	42° 25.44'N	170° 32.68'E	1714.5	2	2	100.0	19.0	3.33	17.5	- -	19.0		12.9	- -
431A	42° 25.39'N	170° 32.60'E	1713.5	2	2	100.0	17.0	4.35	25.6	9.5	26.5		16.6	29.9
432	41° 20.03'N	170° 22.74'E	1320	1	1	100.0	5.5	3.00	54.5	9.5	15.0		5.0	- -
432A	41° 20.03'N	170° 22.74'E	1320	5	5	100.0	38.0	15.92	41.9	36.0	74.0		29.3	34.7
433	44° 46.60'N	170° 01.26'E	1874	1	1	100.0	5.0	5.0	100.0	45.0	50.0		6.0	- -
433A	44° 46.60'N	170° 01.26'E	1874	21	21	100.0	174.0	88.67	50.9	- -	174.0		27.25	- -
433B	44° 46.60'N	170° 01.26'E	1874	7	5	71.4	58.0	9.22	15.9	128.5	186.5		14.53	- -
433C	44° 46.63'N	170° 01.23'E	1874	50	48	96.0	387.5	250.15	64.6	163.0	550.5		258.33	333.6
		TOTALS		104	96	92.3	806.5	404.47	50.15	424.0	1230.5			444.0

DEEP SEA DRILLING PROJECT
TIME DISTRIBUTION
LEG - 55

Date	Site No.	Cruise	Trips	Drill	Core	Stuck Pipe	W.O.W.	Position Ship	Mech. Repair	Port Time	Re-Entry	Other	Total Time	Remarks
6/18 to 7/10/77										544.9			544.9	Shipyard
7/11/77		1.0								23.0			24.0	1611-1714 U/W Fuel Pier
7/12/77		2.3								14.7		7.0*	24.0	*Sea Trials
7/13/77		16.0										8.0*	24.00	*Sea Trials 10-hr Standby
7/14-21		195.0											195.0	U/W to Honolulu
7/22/77		17.0								7.0			24.0	Crew Change Port Call
7/23/77		11.2								12.8			24.0	Honolulu
7/24-31		171.0											171.0	U/W to Site 430
8/1/77	430	18.5	4.0					1.50					24.0	Site 430
8/2/77	430 430A		0.25	0.75	20.75			1.75	0.50				24.0	Lost #2 & #9 Generator
8/3/77	430A 430B	5.75	4.50	0	9.75			1.00	1.00			2.0*	24.0	*Pump Center Bit Clear Plugged Bit
8/4/77		24.0											24.0	
8/5/77	431	16.30	3.75		1.75			2.20					24.0	Site 431
8/6/77	431A		10.25	1.0	4.25				0.50			8.0	24.0	Pick Up New BHA
8/7/77	432	9.50	9.75	0.25	0.75			1.25				2.50	24.0	Pick Up New BHA
8/8/77	432A		5.5	1.75	9.0							7.75	24.0	Deviation-Pick Up New BHA
8/9/77		14.4										9.60	24.0	Depart for Adak
8/10-15		139.75								3.25			143.0	432-Adak-433
8/16/77	433	19.3	3.0					2.7					25.0	
8/17/77	433A		2.5	0.5	20.25							0.75	24.0	

DEEP SEA DRILLING PROJECT
TIME DISTRIBUTION
LEG - 55

Date	Site No.	Cruise	Trips	Drill	Core	Stuck Pipe	W.O.W.	Position Ship	Mech. Repair	Port Time	Re-Entry	Other	Total Time	Remarks
8/18/77	433B				14.75							9.25	24.0	Fish Net in Stern Thruster
8/19/77	433C		9.75		4.75							9.5	24.0	Rig Up & Run Re-entry Cone
8/20/77	433C			2.0	18.75				0.5			2.75	24.0	16" Casing
8/21/77	434C		10.5		9.25						4.25		24.0	Re-entry #1
8/22/77	433C				24.0								24.0	
8/23/77	433C		9.0								15.0		24.0	Re-entry #2
8/24/77	433C		1.75		20.25						2.0		24.0	
8/25/77	433C				24.0								24.0	
8/26/77	433C				24.0								24.0	
8/27/77	433C		9.25		4.5						8.25	2.0	24.0	Re-entry #3
8/28/77	433C				24.0								24.0	
8/29/77	433C	1.25	6.25		14.5				1.0			1.0	24.0	Dev. Survey U/W Yokohama
8/30-9/6/77		167.8										13.2	181.0	U/W Yokohama
TOTALS		830.05	90.0	6.25	249.25			10.4	3.5	605.65	29.5	83.3	1907.9	

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
OPERATIONAL RESUME
LEG 56

Leg 56 started on September 6, 1977 in Yokohama, Japan and ended 34.05 days later, October 10, 1977 in Tokyo, Japan. This leg was the first of two legs which planned to make an east-west transect of the Japan Trench. This leg planned to drill three or four single bit sites and the next leg will drill not only single bit holes, but a re-entry site as well. Some of the scientific objectives were achieved. However, hole problems and adverse weather conditions caused the abandonment of some sites before successful results could be obtained. One of these was the failure to reach crustal material at Site 436 before the approach of tropical storm "Gilda", with winds forecasted at 60 knots.

The CHALLENGER traveled 1165.2 nautical miles and attempted to drill seven holes at four sites. Water depths varied from a deep 6000.5 meters to a relatively shallow depth of 3413 meters. The hole depths ranged from 134.0 meters to 637.5 meters. This variation in depth was due both to rapidly developing poor weather conditions and hole problems. The hole problems included the termination of drilling because of high angle buildup (20^{o}) and also the necessity to shoot off 189.43 meters of drill pipe and the bottomhole assembly of 145.93 meters when the drill string stuck and could not be worked free. A total of 1322.5 meters of coring was attempted with 496.78 meters recovered for a recovery percentage of 37.5%.

Time distribution for the leg was 4.2 days in port, 6.15 days cruising and 23.7 days on site. The on site time breakdown consisted of 4.7 days tripping, 0.9 days drilling, 11.9 days coring, 1.2 days with stuck pipe, 2.7 days waiting on weather, 0.3 days positioning the ship, 0.4 days of mechanical downtime, and 1.6 days for miscellaneous items.

DRILLING AND CORING ASSEMBLIES

The more or less standard bottomhole assembly was used on this leg. This consisted of a bit, bit sub, core barrel, top sub, latch sub, three 8-1/4" drill collars, one 5-foot bumper sub, three 8-1/4" drill collars, two 5-foot bumper subs, two 8-1/4" drill collars, one crossover sub, one 7-1/4" drill collar, three 5-1/2" F.H. heavy drilling joints and one 5-1/2" heavy wall drill pipe. The only variation from this assembly was at Site 434 when a bit release setup was added just above the bit when word was received from the Project that downhole logging tools might be available on this leg. However, this did not happen and the bit release setup was removed for the balance of the leg.

BITS

Only three bits were used during this leg to drill the seven holes that were attempted. These were all F94CK, 9-7/8" and had a total rotating time of 66.5 hours. Two of the bits are in good enough condition to be used as reruns and the third was left in the hole when it was necessary to shoot off the bottom of the drill string in Hole 434B. Most of the drilling was in soft sediment with only two cores containing chert and no crustal material in any of the cores. This accounts for the good condition of the recovered bits.

BEACONS AND POSITIONING

Five beacons were used on this leg; two 13.5 kHz single life, two 16.0 kHz single life and one 16.0 kHz double life. All were manufactured by ORE. They all performed well with the exception of the 13.5 kHz dropped at Site 436. This beacon gave a low signal that required an input gain on the hydrophone amplifier of 8.0 to obtain a minimal signal. Normal input gain for the existing conditions would have been approximately 2.0. Therefore, a new 16.0 kHz beacon was dropped to perform the positioning requirements.

At Site 434 positioning on the 16 kHz double life beacon was initially erratic but within prescribed limits. It was believed that the problem was due, in part, to a strong varying current in the area. Also, the thrusters would not go over 400 rpm regardless of the limits. This problem was resolved and when the ship returned to this site to drill Hole 434B, positioning proved to be much more stable though still obviously affected by the currents. The beacon worked well throughout both stays on this location for over 321 hours on-site time.

HEAVY COMPENSATOR

This piece of equipment was used at Holes 434, 434B, and 435A. While in the string at Hole 434B and cutting Core #13, the electric and hydraulic lines became entangled with the Bowen power sub and one of the electric lines was broken and the other badly damaged. Attempts were made to make the necessary repairs but there was not sufficient replacement material available. Therefore, the compensator was left out of the string for the balance of the leg. Plans were made to replace the necessary parts at the port call in Tokyo.

COMMUNICATIONS

All communication for the DSDP Project was handled via WWD Radio Station in La Jolla, California, with the exception of one commercial and a half dozen messages sent through the Navy circuit. Contact with WWD was good during the hours of 6:00 to 10:00 a.m. ship's time. These four hours would normally be enough time for exchange of messages and, if not, traffic was handled the following day.

Few commercial radio telephone calls were made for the crew members and many amateur phone patches were made with the amateur radio station aboard the ship. Total traffic was light with an approximate group count of 15,000.

PERSONNEL

Due to the fact that this leg was only about half as long as a normal leg, not as many scientific objectives could be achieved. However, all of the scientists displayed a great deal of enthusiasm even though all the goals were not achieved.

As always, the GMI and SIO people did their utmost to make the leg as successful as possible. Hole conditions and weather made the drilling crew's job quite difficult but they did a superior job considering these problems.

SITE 434 (Holes 434, 434A, 434B)

Leg 56 was the first of two legs to take part in making a transect perpendicular to the Japan Trench. The program for this leg was to drill three and possibly four single bit holes in this area and Site 434 was the first of these sites. It was located approximately 400 miles northeast of Yokohama, Japan.

A presite survey was made across the trench before a 16.0 kHz double life beacon was dropped. The ship was positioned over the beacon and the drill string was made up. The bottomhole assembly contained a bit release set up in anticipation of possibly running downhole logging tools. The balance of the bottomhole assembly and drill string was a standard set up. A mudline core was taken and established bottom at 6000.5 meters. The hole was then continuously cored to a subbottom depth of 301.0 meters where a deviation survey was taken to determine if the hole angle could be contributing to the badly broken condition of the samples recovered in the core liners. This survey indicated that the hole was inclined 20° so the drill string was pulled above the mudline and the ship was moved to drill Hole 434A.

One pore water sample was attempted following Core #3, but was unsuccessful due to a leak in the pressure case.

The heave compensator was installed following Core #18 and was used until the hole was abandoned and had a 1/2 stroke of 1/2 foot and one to two thousand pounds of variation.

HOLE 434A

After moving the ship approximately 50 feet, the drill string was lowered and a mudline core was cut establishing bottom at 5998.5 meters. After cutting the mudline core, the hole was to be washed to 6273.0 meters before coring would be started. However, after drilling to 6149.5 meters, the drill string started to build up torque so it was decided to pull the center bit and cut a core and take a deviation survey at the same time. When the single shot picture was recovered, the survey was found to be unreliable, probable a result of the poor sea conditions. This caused three dots to be punched instead of the normal two. A center bit was dropped with plans to drill to 6273.0 meters. However, the hole was drilled to 6183.5 m when the decision was made to pull the drill string due to the approaching tropical storm "Emma". After the drill string was recovered, the ship began profiling toward Site 435 while the weather made drilling impossible.

HOLE 434B

After completing drilling at Site 435, the ship returned to Site 434 and Hole 434B was spudded at 0430 on September 23, 1977. A mudline core was taken which placed the bottom at 5996.0 meters. The hole was then drilled using a center bit to 6291.5 meters or 295.5 meters subbottom. Continuous coring began at this depth and continued to the total depth of 6633.5 meters or 637.5 meters subbottom.

The heave compensator was picked up following the recovery of Core #6 and remained in the string until Core #12. While cutting Core #13, the electric and hydraulic lines of the heave compensator became tangled with the Bowen sub and broke one of the electric cables and damaged the other. The heave compensator was then set back to see if repairs could be made and the unit put back in the string.

While retrieving Core #18, it was noticed that an area on the sandline appeared to be unbraiding and also had lost the line tar. This problem was at a depth of about 20,000 feet, so it was decided to change core recovery to the drawworks sandline. This was done and used until the hole was abandoned.

After cutting Core #37, it was decided to abandon this site and move to J-10. After recovery of this core it was discovered that the bit was plugged and shortly after this the pipe started sticking. It was possible to lay down 10-1/3 stands before the pipe could no longer be moved. The Bowen unit was hooked up so that pumping and attempted rotation could be possible, however, rotation was never achieved.

Attempted recovery of the drill string began at 2000 hours on September 28 and release of the string was accomplished at 2400 on September 29. During this time, over 200 barrels of mud was spotted. It was planned to run a magnetector and attempt to locate the free point to shoot off the pipe. However, this was not possible because all the necessary parts could not be located. In place of this a collar locator attached to sinker bars was run to determine if the new Schlumberger cable and the collar locator tool were working. This proved to be a satisfactory operation and a severing charge was then attached to the assembly and run in to 6009 meters and detonated. The drill string was severed successfully and then recovered and the ship departed for the next location.

The only other mechanical problem was the necessity for changing the Kelly hose which broke after cutting Core #25.

Generally, penetration rates were slow and recovery was less than usually enjoyed, but most of the scientific objectives were accomplished.

SITE 435

After leaving Site 434 due to the weather conditions, the ship profiled while moving toward Site 435. At 1717 hours on September 18, a 26 kHz single life beacon was dropped for Site 435 which was approximately 14 miles westerly from Site 434.

The drill string was made up and the hole was spudded at 0400 on September 19.

A mudline core established bottom at 3413 meters. The hole was then continuously cored to a depth of 3563.5 meters. Weather conditions had deteriorated during this time and it was decided to pull the drill string and wait on the weather. After the drill pipe had been pulled for three hours, the pipe racker skate broke down and it required two hours to repair. When repairs were complete, the weather was so bad the balance of the drill string could not be recovered safely so the pipe remained hanging while the ship waited for the weather to improve. After waiting for 24 hours, the weather improved enough for the pipe to be run back to drill Hole 435A.

HOLE 435A

Following the bad weather, the pipe was run back and Hole 435A was spudded at 0450 hours on September 21 and established bottom at 3414.0 meters with a mudline core. The hole was then washed and drilled to a subbottom depth of 149.5 meters, where continuous coring began again.

The hole was cored to a subbottom depth of 244.5 meters when the weather conditions again began to deteriorate. Winds built to 40-50 miles per hour and seas began to build. The heave compensator was set back and the drill string was held in the elevators while the ship's ability to maintain position was assessed. After an hour, it was decided that the drill string should be pulled to protect it from breaking off. While the drill string was slowly being pulled, a decision was made to leave this site and return to the Site 434 area when the drill string was safely aboard.

SITE 436

After making up a new bottomhole assembly at Hole 434B, the ship departed for Site 436. While profiling to the new site, which was located about 70 miles easterly, the drilling line was changed out. This was done because a defect was noted and there was not enough cable left on the old spool to slip the line far enough to avoid this defective area.

A 13.5 kHz single life beacon was dropped at 1454 hours on October 1 and positioning was begun. However, a 16.0 kHz single life beacon was dropped at 1528 hours because of the poor operation of the first beacon.

The ship was positioning in automatic at 1647 hours and the drill string was made up. Bottom was established at 5248 meters with a mudline core. The PDR had indicated bottom to be at 5250 meters.

Continuous coring began with pore water samples taken following Cores 7, 10, 15, 20, 25, 30, and 35. This sampling was discontinued when it was felt that the rocks were too hard for the sampler to operate properly.

Coring was discontinued after Core #42 was recovered due to a very rapid storm buildup. Site 436 was officially abandoned when the bit cleared the mudline at 0730 hours, October 5, 1977. At this time the winds were gusting 55 to 60 mph and the seas were building. It was too dangerous to attempt recovery of the drill string, but the pipe was kept moving and a stand was laid down about every hour while the ship was positioned in an attempt to stay close to the beacon.

SITE 437

The storm which caused the sudden abandonment of Site 436 had developed so quickly that it was only possible to clear the mudline with the drill string. After this, while waiting for the weather to improve, about one stand an hour was pulled and laid down. While this was happening, the ship was also drifting because it could not be kept in position over the beacon. By the time the weather had improved enough to begin drilling, the ship had drifted about 4.7 miles easterly. To move back to the original location would require that the total drill string be recovered and then move the ship. Instead of this, permission was received from the Project to drop another beacon and drill to the depth reached at Site 436 before coring had to be started.

A beacon was then dropped and the pipe was run back to attempt a mudline core and then drill ahead. The PDR indicated a water depth of 5227 m and a mudline core was taken to verify this depth. However, no material was recovered and it was decided to drill ahead to the old Site 436 T. D. of 397.5 meters.

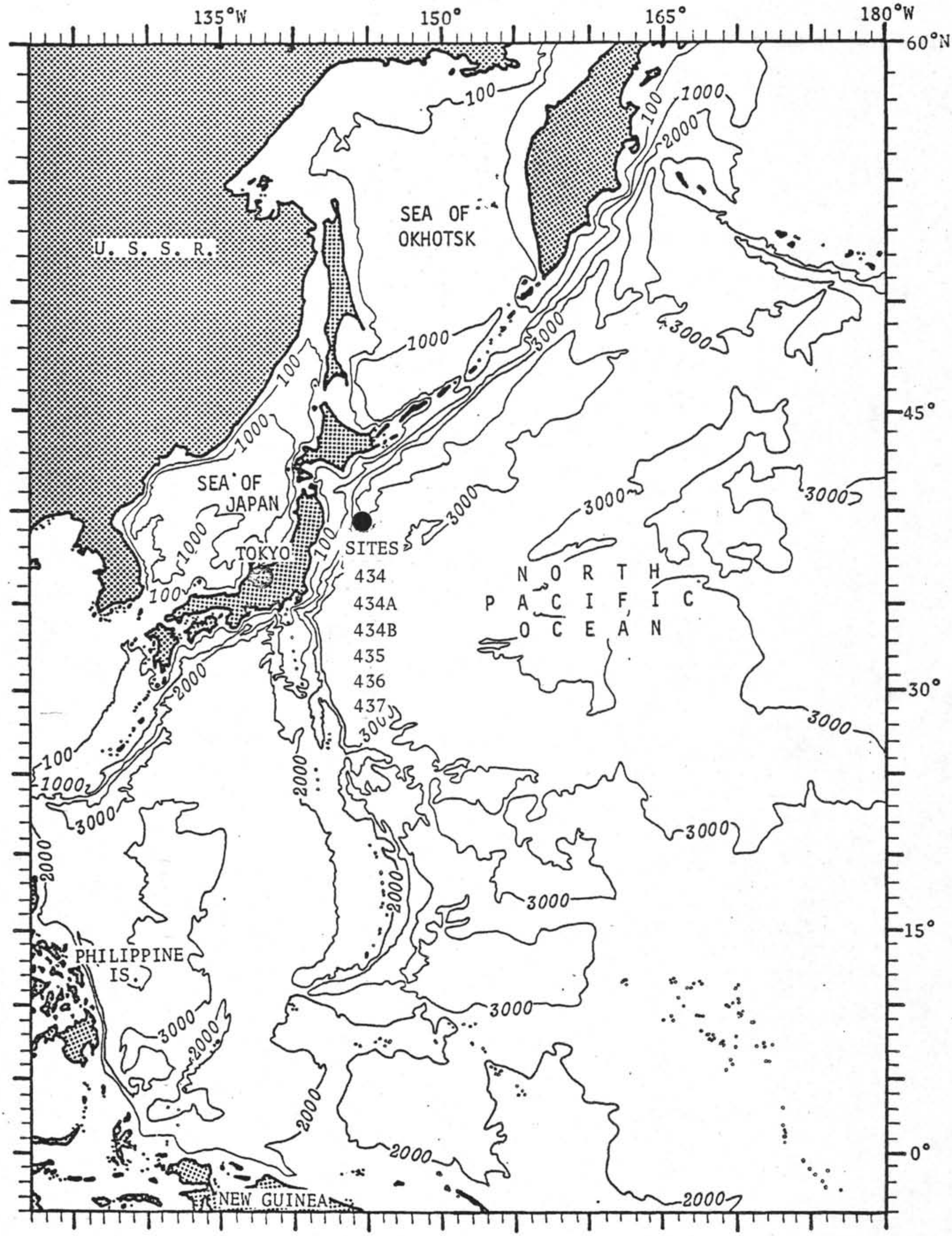
The hole was drilled to 134.0 meters subbottom when the decision was made to leave this site and return to Tokyo due to the approaching tropical stirm "Gilda", which had winds of 60 knots. The drill string was pulled and the site was abandoned at 2030 on October 7, 1977.

Robert R. Knapp

Robert R. Knapp
Cruise Operations Manager
Deep Sea Drilling Project

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
OPERATIONS RESUME
LEG 56

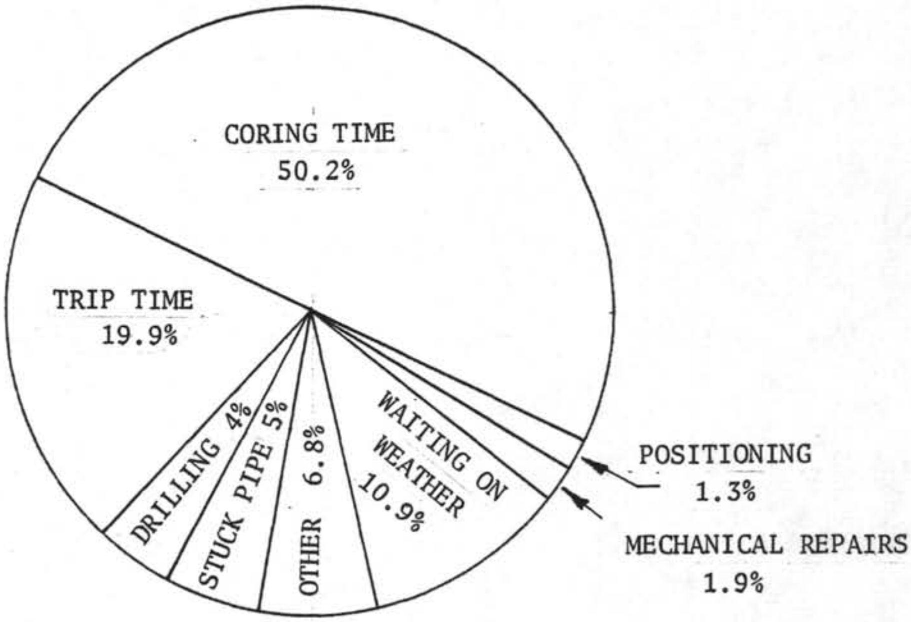
Total Days (September 6, 1977 - October 10, 1977)		34.05
Total Days In Port		4.2
Total Days Cruising Including Site Survey		6.15
Total Days On Site		23.7
Trip Time	4.7	
Drilling Time	0.9	
Coring Time	11.9	
Stuck Pipe	1.2	
Waiting On Weather	2.7	
Position Ship	0.3	
Mechanical Repair	0.4	
Other	1.6	
Total Distance Traveled Including Survey (Nautical Miles)		1165.2
Average Speed		8.01
Number of Sites		4
Number of Holes Drilled (Attempted)		7
Number of Cores Attempted		142
Number of Cores With Recovery		135
Percentage of Cores With Recovery		95.0
Total Meters Cored		1322.5
Total Meters Recovered		496.78
Percent Recovery		37.5
Total Meters Drilled		736.0
Total Meters of Penetration		2050.0
Percentage of Penetration Cored		64.5
Maximum Penetration (Meters)		637.5
Minimum Penetration (Meters)		134.0
Maximum Water Depth (Meters)		6000.5
Minimum Water Depth (Meters)		3413.0



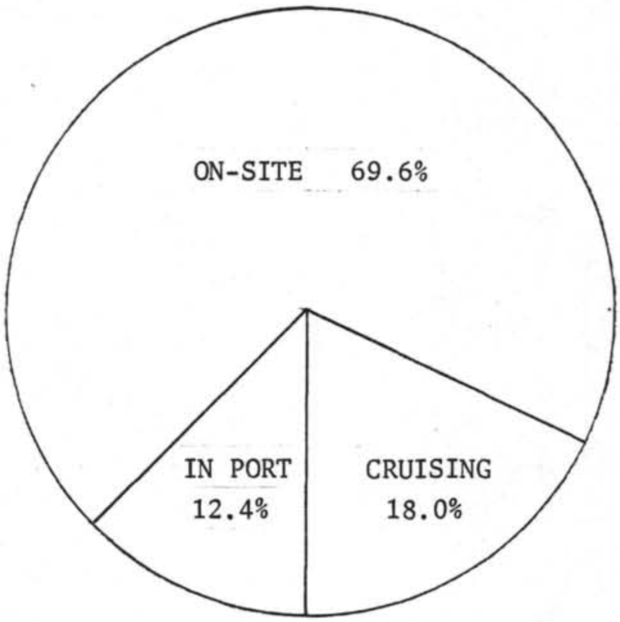
LEG 56
PROPOSED SITES

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT LEG 56

ON-SITE TIME BREAKDOWN



TOTAL TIME DISTRIBUTION
LEG 56



INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
BEACON SUMMARY
LEG 56

Site No.	Make	Freq. kHz	Serial Number	Site Time Hours	Remarks
434, A, B	ORE	16.0 D.L.	382	321.3	
435, A	ORE	16.0 S.L.	380	67.1	
436	ORE	13.5 S.L.	445	- -	Poor signal after drop. Dropped 16.0 to replace.
436, A	ORE	16.0 S.L.	346	86.8	
437	ORE	13.5 S.L.	410	13.1	

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
BIT SUMMARY
LEG 56

Hole	Mfg.	Size	Type	Serial Number	Meters Cored	Meters Drilled	Total Penet. Meters	Hours On Bit	Condition	Remarks
434, A	Smith	9 7/8"	F94CK	125FF	319.0	185.0	514.0	17.4	T1-B1-I-SE	
435, A	Smith	9 7/8"	F94CK	125FF	252.5	142.5	395.0	4.6	T1-B1-I-SE	Rerun from Site 434.
TOTAL					571.5	327.5	909.0	22.0		
434, B	Smith	9 7/8"	F94CK	200FF	343.0	294.5	637.5	39.4	Unknown	Drill string shot off.
436	Smith	9 7/8"	F94CK	193FF	397.5	- - -	397.5	4.5		
437	Smith	9 7/8"	F94CK	193FF	10.5	123.5	134.0	.6	T1-B1-I-SE	Rerun from Site 436.
TOTAL SITES 436 & 437					408.0	123.5	531.5	5.1		

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
SITE SUMMARY
LEG 56

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
434	39° 44.76'N	144° 06.12'E	6000.6	33	33	100.0	301.0	55.3	18.4	- -	301.0	20.9	107.0	
434A	39° 44.76'N	144° 06.12'E	5998.5	2	2	100.0	18.0	14.0	77.7	175.5	185.0	61.6	29.2	
434B	39° 44.87'N	144° 06.8'E	5996.0	37	32	86.4	343.0	64.05	18.6	294.5	637.5	16.1	196.2	332.4
435	39° 44.09'N	143° 47.53'E	3413.0	16	15	93.8	150.5	78.42	52.1	- - -	150.5	62.7	53.2	
435A	39° 44.10'N	143° 47.59'E	3414.0	11	11	100.0	102.0	45.21	44.3	142.5	244.5	111.1	35.6	88.8
436	39° 55.96'N	145° 33.47'E	5248.0	42	42	100.0	397.5	239.8	60.3	- - -	397.5	88.3	118.7	118.7
437	39° 53.83'N	145° 39.98'E	5227.0	1	0	0	10.5	0	0	123.5	134.0	223.3	30.9	30.9

DEEP SEA DRILLING PROJECT
TIME DISTRIBUTION
LEG - 56

Date	Site No.	Cruise	Trips	Drill	Core	Stuck Pipe	W.O.W.	Position Ship	Mech. Repair	Port Time	Re-Entry	Other	Total Time	Remarks
9.6.77		.	.	.	.	.	.	.	.	13.0	.	.	13.0	
9.7.77		.	..	.	.	.	.	.	.	24.0	.	.	24.0	
9.8.77		.	.	.	.	.	.	.	.	24.0	.	.	24.0	
9.9.77		.	.	.	.	.	.	.	.	24.0	.	.	24.0	
9.10.77		.	.	.	.	.	.	.	.	16.0	.	.	16.0	
TOTAL		.	.	.	.	.	.	.	.	101.0	.	.	101.1	.
9.10.77		8.0	.	.	.	.	.	.	.	.	.	.	8.0	
9.11.77		24.0	.	.	.	.	.	.	.	.	.	.	24.0	.
9.12.77		18.0	.	.	.	.	.	.	.	.	.	.	18.0	
TOTAL		50.0	.	.	.	.	.	.	.	.	.	.	50.0	
9.12.77	434	.	4.9	.	.	.	.	1.1	.	.	.	.	6.0	
9.13.77		.	12.7	.	9.5	.	.	.	.	.	.	1.8	24.0	
9.14.77		.	.	.	24.0	.	.	.	.	.	.	.	24.0	
9.15.77		.	.	.	21.0	.	.	.	.	.	.	3.0	24.0	INSTALL H.C.
9.16.77		.	.	.	24.0	.	.	.	.	.	.	.	24.0	
9.17.77		.	2.7	.	2.3	.	.	.	.	.	.	.	5.0	
TOTAL		.	20.3	.	80.8	.		1.1	.	.	.	4.8	107.0	
9.17.74	434A	.	7.3	3.7	5.6	.	.	1.4	.	.	.	1.0	19.0	
9.18.77		.	7.7	.	.	.	2.5	.	.	.	.	.	10.2	
TOTAL		.	15.0	3.7	5.6	.	2.5	1.4	.	.	.	1.0	29.2	

DEEP SEA DRILLING PROJECT
TIME DISTRIBUTION
LEG - 56

Date	Site No.	Cruise	Trips	Drill	Core	Stuck Pipe	W.O.W.	Position Ship	Mech. Repair	Port Time	Re-Entry	Other	Total Time	Remarks
9.18.77		7.1	.	.	.	.	.	.	.	.	.	.	7.1	
TOTAL		7.1	.	.	.	.	.	.	.	.	.	.	7.1	
9.18.77	435	.	5.5	.	.	.	.	1.2	.	.	.	.	6.7	
9.19.77		.	4.7	.	19.3	.	.	.	.	.	.	.	24.0	
9.20.77		.	3.0	.	.	.	17.5	.	2.0	.	.	.	22.5	
TOTAL		.	13.2	.	19.3	.	17.5	1.2	2.0	.	.	.	53.2	
9.20.77	435-A	.	1.5	.	.	.	.	.	.	.	.	.	1.5	
9.21.77		.	4.8	2.0	13.0	.	.	.	.7	.	.	3.5	24.0	PORE WATER
9.22.77		.	8.1	.	1.0	.	1.0	.	.	.	.	.	10.1	
TOTAL		.	14.4	2.0	14.0	.	1.0	.	.7	.	.	3.5	35.6	
9.22.77		3.0	.	.	.	.	.	.	.	.	.	.	3.0	
TOTAL		3.0	.	.	.	.	.	.	.	.	.	.	3.0	
9.22.77	434-B	.	6.2	.	.	.	.	1.8	.	.	.	2.9	10.9	
9.23.77		.	4.5	15.5	3.0	.	.	.	.	.	.	1.0	24.0	
9.24.77		.	.	.	21.7		.	.	.	.	.	2.3	24.0	
9.25.77		.	.	.	18.5		.	.	.	.	.	5.5	24.0	
9.26.77		.	.	.	22.3	.	.	.	1.7	.	.	.	24.0	
9.27.77		.	.	.	20.0	.	.	.	4.0	.	.	.	24.0	
9.28.77		.	1.4	.	18.1	4.5	.	.	.	.	.	.	24.0	
9.29.77		.	.	.	.	24.0	.	.	.	.	.	.	24.0	

DEEP SEA DRILLING PROJECT
TIME DISTRIBUTION
LEG - 56

Date	Site No.	Cruise	Trips	Drill	Core	Stuck Pipe	W.O.W.	Position Ship	Mech. Repair	Port Time	Re-Entry	Other	Total Time	Remarks
9.30.77	434-B	.	10.7	.	.	.	.	.	1.3	.	.	5.3	17.3	
TOTAL		.	22.8	15.5	103.6	28.5	.	1.8	7.0	.	.	17.0	196.2	
9.30.77		6.7	.	.	.	.	.	.	.	.	.	.	6.7	
10.1.77		14.9	.	.	.	.	.	.	.	.	.	.	14.9	
TOTAL		21.6	.	.	.	.	.	.	.	.	.	.	21.6	
10.1.77	436	.	6.3	.	.	.	.	1.8	1.0	.	.	.	9.1	.
10.2.77		.	2.7	.	16.9	.	.	.	.	.	.	4.4	24.0	PORE WATER SAMPLES
10.3.77		.	.	.	19.3	.	.	.	.	.	.	4.7	24.0	"
10.4.77		.	.	.	20.7	.	.	.	.	.	.	3.3	24.0	"
10.5.77		.	2.5	.	5.0	.	16.5	.	.	.	.	.	24.0	
10.6.77		.	.	.	.	.	13.6	.	.	.	.	.	13.6	
TOTAL		.	11.5	.	61.9	.	30.1	1.8	1.0	.	.	12.4	118.7	
10.6.77	437	.	7.5	1.6	1.3	.	.	.	.	.	.	.	10.4	
10.7.77		.	8.9	.	.	.	11.3	.	.	.	.	.3	20.5	
TOTAL		.	16.4	1.6	1.3	.	11.3	.	.	.	.	.3	30.9	
10.7.77		3.5	.	.	.	.	.	.	.	.	.	.	3.5	.
10.8.77		24.0	.	.	.	.	.	.	.	.	.	.	24.0	
10.9.77		24.0	.	.	.	.	.	.	.	.	.	.	24.0	
10.10.77		12.2	.	.	.	.	.	.	.	.	.	.	12.2	
. .		63.7	.	.	.	.	.	.	.	.	.	.	63.7	

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
OPERATIONAL RESUME
LEG 57

Leg 57 of the Deep Sea Drilling Project was the culmination of a two voyage expedition concentrating on drilling a transect of the Japan Trench. The geological and geophysical data compiled on this expedition will be a significant contribution to the understanding of the nature and history of the active continental margin represented by the Japan Trench arc system.

The Leg 57 coring program was successful in achieving several deep sediment penetrations, including one that reached and sampled the acoustic basement. In addition, an important body of *in situ* geophysical information was amassed through a very effective well logging program.

The voyage commenced on October 10, 1977 at Tokyo, Japan and ended at Yokohama, Japan on December 4, 1977. A brief port call was also made at Hakodate, Japan to disembark an injured crewman.

Total length of the cruise was 55.1 days, of which 41.3 days were spent on site, 6.4 days underway and 7.4 days in port. 4.5 days of operating time were lost to weather delay and 2.4 days to adverse hole conditions. Mechanical repair accounted for only 0.6 days.

TOKYO PORT CALL

Leg 57 began with the first mooring line over at Berth L, Harumi Pier in Tokyo Harbor at 1212 hours on October 10, 1977. The port call was routine in terms of maintenance, repair and resupply activities.

The GLOMAR CHALLENGER's port call coincided with a visit to Tokyo by the Director of the National Science Foundation. The vessel was visited by the Director and several other distinguished persons in the field of marine science and higher education representing both the United States and Japan. "Open house" activities on October 13 and 14 hosted more than 1200 visitors to the ship.

In addition to normal ship's and commissary supplies, 400,100 gallons of fuel, 2,200 gallons of lube oil and 38,200 gallons of fresh water were taken on.

On the rig floor, the power sub/swivel assembly was replaced by the alternate unit carried on board and the heave compensator hose bundle was replaced. Periodic inspections and nondestructive testing were carried out.

HOLE 438 - DEEP SEA TERRACE

The GLOMAR CHALLENGER departed her berth at Tokyo at 1424 on October 16. Forty four hours were required to steam the 428 miles to the location of Site 438, about 130 km east of Hachinohe, Northern Honshu. Before the positioning beacon was dropped, about five additional hours were spent in presite geophysical profiling. Site 438 operations officially began at 1906 hours on October 18.

An offset was introduced at the positioning console to station the ship 200 feet south of the beacon. This measure was taken to avoid disturbing the sediments in the area to be occupied by the re-entry cone.

Two mudline punch cores were taken to ascertain water depth. Before further penetration could be made, the passage of a cold front resulted in winds that shifted abruptly and gusted to 45 mph. The vessel was blown about 250 feet off station and a delay of about 45 minutes ensued while the dynamic position system stabilized.

As soon as respudding was possible, a wash-in test was conducted to determine the eventual re-entry cone casing point. The bit could be jetted only 18 meters before penetration stopped in apparent stiff clay.

Continuous coring then commenced and good progress was being made when a rotary helper was injured in a rig floor accident. His injuries were considered by the ship's surgeon to be sufficiently serious to warrant evacuation to a hospital. Therefore, after only 12 cores (109.5 m) the hole was abandoned and the drill string was pulled.

HAKODATE PORT CALL

The emergency run to Hakodate on the Island of Hokkaido was made in just over 17 hours.

The vessel waited at anchor in the outer harbor while the injured man was taken ashore. Hospital x-rays and examination revealed that his pelvis was fractured and that repatriation to the United States would be required.

Due to the inadvisability of attempting to operate for an extended period with a short drilling crew, it was necessary to wait at Hakodate until a replacement arrived from the United States. Fortunately timely action had been taken by GMI to locate a replacement and arrange transportation. Their representative, Mr. Alford, arrived in Hakodate shortly after the vessel and expedited arrangements. for both crewmen.

The CHALLENGER departed Hakodate after 30 hours in port and, aided by a fortuitous current eddy, made the return trip to Site 438 in 13 hours. Total lost time due to the mishap is estimated at 75 hours.

HOLE 438A

Deviations from course and speed on the approach to the beacon cost only a few minutes time and provided additional geophysical data. Detailed analysis of all available profiles prompted science to request that the deep exploratory hole be drilled about one kilometer east of the original hole to stay clear of faults inferred from the profile.

The beacon's signal was acquired without difficulty for the ship's positioning system and the maximum programmable offset of 2990 feet east was entered into the computer.

After the pipe trip a mudline punch core was again obtained to determine water depth. The interval from the seafloor to 106.5 meters was then drilled with only four cores taken to cover a section of low recovery in Hole 438. An in situ pore water sample was taken at 59 m below seafloor (BSF).

Continuous coring then recommenced and continued to a total depth of 2446 meters, 878 meters below seafloor.

Eight additional in situ pore water sample runs were made at 47.5 m intervals with the last sample collected at 448.5 m BSF. The sampler probe was found to be slightly bent following the run and sampling was discontinued due to the degree of compaction of sediment.

A "wiper" trip was made by pulling the drill collars to seafloor depth, then running the bit back to just short of total depth. The shifting tool was then attached to an inner core barrel and run to the bit on the sandline. The bit and associated terminal equipment were released automatically as the core barrel was retrieved and dropped to the bottom of the hole. The hole was further conditioned by flushing with bentonite gel.

The logging sheaves were rigged and a full suite of downhole geophysical logs was run. Four separate tool configurations were run with the following logs recorded: borehole compensated sonic/gamma ray, compensated formation density/ compensated neutron porosity/gamma ray, dual laterolog/ gamma ray and high resolution thermometer. Additional thermal data were acquired by attaching maximum reading thermometers to each of the logging tools. (For more detail on logging, see Appendix I to this report).

After the completion of logging operations, the open-ended pipe was lowered to near total depth and the hole was filled with weighted barite mud.

HOLE 438B

Geophysical data indicated that a better location for the re-entry hole lay about 340 meters east of 438A. The existing beacon could not be used for positioning on the new hole as the maximum east offset had already been entered. The system's position error display and computer printout were used, however, to offset the ship the approximate required distance. This provided more positive control than either dead reckoning or any of the ship's navigational gear. A new beacon of the alternate frequency was launched when the proper error signal had been generated.

Because of the distance moved and because the pipe was retrieved from Hole 438A without a bit, it was necessary to make a round trip for determination of water depth and casing point. While the drill string was being lowered, satellite navigation fixes showed the new position to be too far east and an 800 foot west offset was entered in the positioning system. Soft sediment thickness was found to be greater at the new location and the bit was jetted in to 41 meters BSF. Water depth was determined to be 1578 meters by punch core and weight indicator.

As soon as the pipe had been retrieved, assembly of the re-entry cone was completed and the cone was keelhauled and hung off beneath the moonpool. The 16-inch casing string was then made up and hung off below the rig floor. Some concern was generated at this point due to a current estimated at 2-1/2 to 3 knots that set the casing strongly back against the guide horn. When the drill collars had been run down through the casing, however, the drag angle was greatly reduced and no problem was encountered in latching the assembly into the cone.

The pipe trip to the seafloor was slow due to the "floating" tendency of the re-entry cone. The casing was spudded and jetted down smoothly in about 45 minutes to a point where progress stopped. At this point the mud skirt was at 1574.5 meters - 1.5 meters above the precision depth recorder (PDR) reading and 3.5 meters above the depth indicated by punch core. When no progress was made after several minutes of pumping, the drill string was raised and 30,000 pounds overpull was required to lift the cone, indicating possible "suction" of the mud skirt in sediment. Although the primary and reflected pulses of the expendable pinger attached to the mudskirt were coincident on the PDR record, no attenuation or interruption of signal was noted. It was generally agreed that the cone was in place and the shifting tool was run on the sandline, releasing cone and casing from the drill string. When free rotation and loss of weight had been noted, drilling commenced. The bit encountered resistance as it left the casing shoe and it was necessary to "drill through" something hard at this point. This led to speculation that the cone had, indeed, been released one or two meters high with the casing shoe resting on a glacial boulder.

As the upper stratigraphic section had been continuously cored in Holes 438 and 438A, the re-entry hole was drilled to 862 m BSF with only three widely spaced spot cores for paleontological and hole deviation checks.

Continuous coring commenced 48 hours after arrival on the Hole 438B location. Operations commenced smoothly except that nearly from the beginning, the cores recovered were locally reduced in diameter. The effect was obviously mechanical with spiral "machined" grooves evident. Similar effects had resulted on occasion in the past from contact with the core catcher when an inner core barrel had begun turning together with the outer barrel. In this case, however, the core was damaged in both inner barrels and no reason for their rotation could be determined. It was obvious that some core was being destroyed and recovery was adversely affected. The problem abated somewhat with depth as more indurated sediments were encountered.

On Core 23, after 1039 meters of penetration but only a little over 22 rotating hours, the bit locked. When retrieved, the bit was found to be in poor condition. One cone had broken circumferentially at the third row of inserts and the inner (pointed) half of the cone had been lost in the hole. All the bearings had failed and the bit was somewhat battered from drilling on junk. It was also about 1/4 inch out of gauge. This mode of bit failure had not been observed previously by any shipboard personnel and a defective cone is suspected. It has been concluded that the condition of the bit was responsible for abnormal cores through an interval of about 170-meters.

Due to the severe out-of-gauge condition of the 10-1/8 inch bit, a 9-7/8 inch bit was selected to be run next to avoid reaming the hole. Stabilizers were not incorporated into the BHA due to the fractured nature of the rock being penetrated and the likelihood of unstable hole conditions.

When the pipe had been tripped to just above the re-entry cone, the logging sheaves were rigged for re-entry. The sonar tool was run down to the bit and preliminary operational checks inside pipe were satisfactory.

On commencement of scanning, the re-entry cone was quickly acquired at a range of only 30 feet. The video presentation was found to be weak and no amount of tuning could produce normal contrast. The signal was considered adequate, however, to approach and stab the cone and standard re-entry maneuvers were initiated. Although the drill string was repeatedly brought to a range of 15-20 feet from the cone, it refused to swing directly over it. After 100 minutes of sonar scanning and maneuvering the ship, power regulation to the tool was lost and it was necessary to retrieve it.

While the tool was being pulled, the surface console was replaced with its alternate unit to eliminate a possible source of trouble. A standby downhole tool was attached to the cable and immediately lowered for a second re-entry attempt.

This tool functioned normally and the drill pipe obligingly moved over the cone to permit a stab only seven minutes after scanning recommenced.

After the sonar tool had been retrieved and the re-entry verified by running two stands of pipe, the sheaves were rigged down and the trip to total depth began. No obstructions were encountered until the bit reached a depth of 985 m BSF. At this point the heave compensator and power sub/swivel assembly were picked up for washing to bottom. The first obstruction proved to be only a bridge, but solid fill was encountered at 1021 m. The bottom 17-meters of hole were found to be quite tight and three hours were required to ream to total depth. Some sticking tendencies were noted. At first, these effects were thought to be the result of the previous bit's extreme under-gauge condition. A 1.5 m core was cut to regain the "Kelly down" position before the inner barrel was recovered. Because of the difficulty in reaching bottom, a single was laid down before the barrel was retrieved. When the new barrel was in place, it was found that hole conditions were worse than before. Two hours of effort failed to regain bottom and produced only increasing torquing, sticking and back pressure. One hundred barrels of gel mud and 10 barrels of cross-linked guar gum were ineffective in clearing the hole. About 5-1/2 hours of working pipe and setting back singles followed. As the pipe continued to stick, it was decided to set back the heave compensator and power sub and pull back into casing or far enough to clear the annulus. When the pipe had been pulled to about 700 m BSF, vertical drag creased. The power sub was picked up and the string rotated freely. The bit was washed down without incident to the same point, 17 meters off bottom, where tight hole was again encountered. During the next three hours, bottom was reached three or four times, but each time the pipe was pulled back to check the hole, the hole would "close in" again. Batches of gel mud were again ineffective for hole cleaning.

At this point, it was decided that further attempts at coring in this location were futile and that persistence would only endanger the drill string. As there was about 1020 meters of apparently good hole, a pipe trip was started to remove the bit and log the hole before abandoning. The trip out of the hole proceeded smoothly with only occasional minor drag until, without warning, the pipe stuck with the bit at 414 m BSF. The string could be moved vertically only about ten feet and could not be rotated. There was no bumper sub action, indicating that the point or interval of sticking was above the bumper subs. The Chiksan circulating head was rigged and, surprisingly, circulation was broken with normal pump pressure. With rising optimism, the power sub was rigged and gel mud was pumped around. Although "circulation" remained normal, the pipe would not rotate and absolutely no progress had been made after seven hours of pulling, "working" pipe and pumping mud batches.

The power sub was set back, the inner barrel retrieved and the logging sheaves were rigged to run a severing charge. The charge was made up and lowered on the logging line and the string was parted in the lowermost drill pipe joint (5-1/2 inch) without incident. After one stand of pipe had been pulled, the hole was plugged with 50 barrels of cement and the remainder of the drill string was recovered.

SITE 439 - DEEP SEA TERRACE

The unstable hole conditions encountered below 1000 meters at Site 438 held little promise for deeper penetration at that location. Study of seismic profiles indicated that the sediment section above the target seismic reflector was about 300 meters thinner at a location about five kilometers to the east and that the portion of the section absent appeared to be the fractured interval that caused. the hole problems in Hole 438B. Hole 438B had bottomed very near the intersection of two major faults while the easterly site was situated well inside a relatively undisturbed structural block. The easterly site was the originally proposed drilling location, but had been rejected by the Safety Panels on the grounds that it was structurally high and the hydrocarbon reservoir potential of the sediments was unknown. The sediment section overlying the target reflector had been cored at Site 438 and no significant hydrocarbon accumulations or reservoir rock had been encountered. The Chief Scientists therefore requested approval of DSDP Management to make another attempt at the originally proposed site (J-12). The radio request was approved before the drill string was on deck and the vessel got underway for the new site with no lost time.

Transit and presite survey consumed about 3-3/4 hours and the beacon was dropped at Site 439 at 2031 hours on November 2. Drill collars had to be removed from the hold and a new bottomhole assembly made up before drilling could commence.

After the initial pipe trip and spud, drilling commenced. The previously cored section (to 850 meters) was again washed down with only four spot cores. Continuous coring continued through a claystone and siltstone section and into sandstone. Although some of the siltstone was poorly consolidated, no hole trouble developed.

At just over 1100 meters BSF, a conglomerate horizon was encountered that included large rounded igneous boulders, hard fractured siltstone and some soft clay. The unit was poorly consolidated overall and was found to be about 40 meters thick.

Some torquing and sticking began in the lower half of the unit and fifty barrel batches of gel mud were pumped with each core to keep the hole clean.

Underlying the conglomerate was a very hard, intensely fractured silicified siltstone. This was considered by the shipboard scientists to represent the target seismic reflector and a concerted effort was made to obtain a representative interval of core samples. Torquing and sticking tendencies became pronounced, however, and core recovery and penetration rate fell drastically. It was felt that the very hard boulders of the overlying conglomerate had severely damaged the cutting structure of the long insert F93CK core bit. After about 13 meters penetration into the acoustic basement unit, coring operations were abandoned.

A short trip was made to just below the seafloor and back down the hole. The power sub was rigged after a bridge was encountered at 1093 meters. This was knocked out and solid fill and tight hole conditions were hit at 1114 meters (just below the top of the conglomerate zone). After about a half hour of fighting severe torquing to reopen the lower part of the hole with no progress, it was decided that further attempts would be counterproductive and that chances of logging the interval were virtually nil.

The inner core barrel was retrieved and a wireline run was made to release the bit. The hole was flushed with 50 barrels of mud followed by 20 barrels of cross-linked guar gum followed by 50 barrels of mud. The open-ended pipe was then pulled to 122 m BSF and the logging sheaves were rigged.

The first log to be run was the borehole compensated sonic log with caliper and gamma ray curves. The caliper tool had not been run on Hole 438A due to the fact that the caliper supplied was too large to pass through the outer core barrel latch sleeve. In the meantime, the caliper had been modified to reduce its diameter as much as possible while a latch sleeve was especially bored out to allow the caliper's passage. The 439 log quality was expected to benefit greatly from the centralization provided by the caliper arms. The BHC tool was made up and run down the drill pipe without difficulty but the tool stopped abruptly at 77 meters above the end of the pipe. A quick check of BHA dimensions confirmed that that the tool was stopping at the uppermost bumper sub. Several attempts failed to work the tool past this point and it was pulled for removal of the caliper section. (It was subsequently discovered, after the string had been pulled, that the bumper sub I.D. was a full 1/4 inch under specification).

The sonic/gamma ray tool was subsequently lowered through the drill pipe and BHA only to stop at the end of the pipe. A check of the sonic signal and raising/lowering of the string revealed that the tool had not emerged from the pipe. "Working" the tool was again unsuccessful and it was retrieved.

The circulating head was attached to the top of the drill pipe and the mud pump run at top speed for several minutes. Normal circulating pressure indicated that the obstruction had been cleared immediately or that circulation was through the holes in the side of the bit release top connector. The latter apparently was the case as the sonic tool again failed to clear the end of the pipe on the next attempt.

An inner core barrel was then fitted with a core breaker center bit for an attempt at clearing the obstruction. The power sub was picked up and the barrel was lowered on the sandline with the pump running 30 strokes per minute. No definitive decrease was ever noted on the sandline weight indicator to show contact of the barrel with the obstruction. The core barrel was run a considerable distance into open hole and retrieved with no impediment.

While the sandline trip was in progress, the logging cable was being cut back and reheaded. The armor of the last 70 meters of cable had been damaged slightly in the original rigging up when the cable became fouled in a guard on top of the travelling block.

Open hole was finally encountered on the sonic tool's fourth attempt. The tool reached a total depth of 1101 m BSF and a successful log was run. The log of the lower 250 meters was of very poor quality, however, apparently due to lack of centralization in a hole that deviated ten degrees from vertical.

At this point it was reasoned that a possible explanation of the caliper's failure to pass the top bumper subs was flexing of the BHA at the bumper subs. This was considered plausible since they were only about 40 meters before the seafloor and any lateral force, such as that induced by positioning error, could have caused flexure in a washed out hole. Due to the importance of a good sonic log, two more stands of drill pipe were run into the hole, the caliper was reinstalled and another attempt was made. Again, the tool stopped solidly at the depth of the top bumper sub. The sonic tool was retrieved and the FDC-CNP-GR tool was picked up.

The remaining three logs were obtained without incident except that a hole obstruction was encountered thqt did not permit passage of the tools below about 955 m BSF. This was unfortunate because the lower part of the hole was of the greatest scientific interest.

HOLE 440 - INNER TRENCH SLOPE

In an attempt to penetrate and sample the sediments of the active continental margin's accretionary wedge, a move was made into the deeper water of the Japan Trench. Site 440 was situated about 100 km southeast of Site 439 on a narrow feature known as the mid-slope terrace. The positioning beacon was launched at the new location after about six hours of presite geophysical surveying at 1100 hours on November 9.

As the vessel attempted to take station over the beacon, it became apparent that the beacon's performance was unsatisfactory and would not be consistently acceptable to the positioning system. A backup beacon of the alternate frequency was therefore readied and dropped as a replacement.

As re-entry at this site was considered a definite possibility, Hole 440 was to serve as an exploratory hole. This included the recovery of a mudline punch core to determine water depth and a jetting test for casing point determination. The PDR water depth of 4522 meters was refined to 4517 following the recovery of a 6.5 meter core from a total depth of 4523.5 m. The bit was then jetted without rotation to a depth of 19 meters BSF where it met firm resistance. A second attempt was made in case an isolated boulder had been struck. This time the bit would not pass 11.5 meters.

Continuous coring then began. A successful in situ pore water sample was taken following the seventh core.

While the next core was being retrieved, the positioning system began to "lose" the beacon signal due to a low signal-to-noise ratio. The frequent acoustic loss made stationkeeping unreliable and, since the BHA was not yet fully supported laterally by sediments, the bit was quickly pulled above the seafloor.

In review, the loss of acoustics appears to have been the result of coincident circumstances including a combination of wind and current vectors that forced the ship onto an unfavorable heading. This caused the aerated thruster wash to pass under the hydrophones. The signal was apparently attenuated further by an irregular thermocline, scattering or other adverse sea conditions.

HOLE 440A

After about 4-1/2 hours, acoustic conditions improved and stable automatic positioning was regained.

Before actual drilling commenced, an in situ pore water sample was collected successfully from only three meters below seafloor. This was accomplished while monitoring ship's position closely and using the heave compensator to maintain a steady 5000 pounds on the bit.

The interval cored in Hole 440 was drilled and continuous coring recommenced. A pore water sample was taken at 130 meters BSF.

After only seven cores, at a depth of 139.5 meters BSF, it was again necessary to pull the bit above the mudline. High winds and swell caused vessel motion to exceed safe operating limits and 19 hours of downtime accrued before conditions moderated to permit further operations.

HOLE 440B

After the respud on the morning of November 14, the bit was washed down to the total depth of Hole 440A before continuous coring began.

Two additional in situ water samples were collected before a portion of the sampler probe was pulled off and left in the hole at 235 meters BSF. Fortunately, the heavy steel parts were recovered in the subsequent core.

Continuous coring operations were sustained for four more days with relatively good core recovery. A gale warning on November 17 forced cessation of coring operations at 795 meters BSF. The drill string was pulled to leave only 200 meters of pipe in the hole while weather developments were monitored. This provided the option of reduced trip time to the surface or pulling clear of the mudline should conditions warrant without prematurely forfeiting the hole. The power sub was picked up to provide circulating and rotating capabilities.

After the wind and seas had abated, the power sub was set back and the string was run back into the hole. A bridge was struck at 678 meters. The heave compensator and power sub were deployed and the bit was washed in to total depth through fill. Total weather delay was 28 hours.

At this point it had been decided that the unexpectedly thick Neogene sediment section had greatly reduced chances of penetrating imbricate wedge sediments at this site. Two cores were taken after the hole was cleaned to total depth. As recovery was quite low in both, a third and final core was planned to obtain a representative core and confirm that hole conditions had returned to normal.

No pressure kick was observed to indicate seating of the core barrel after sufficient pump down time. Cuttings or dropped core in the bit sub assembly were suspected of obstructing the barrel's passage.

A wireline trip with the overshot assembly was made to retrieve the core barrel in preparation for attempts to clear the obstruction. The sandline weight indicator showed setdown at approximately the correct depth. On attempting to pull up, the sandline would not come free. It was assumed that the core barrel was wedged into the bit with cuttings or core fragments. When the barrel could not be worked free, the next step was to shear the release pin in the overshot and retrieve the overshot assembly. Considerable effort was required to finally free the sandline for retrieval. (This was attributed to the limited amount of overpull allowed in deep water due to heavy line weight). When the line was recovered, the entire sinker bar/overshot assembly was missing. The line appeared to have been cut by a dull edge and the lower few meters were kinked in a manner suggesting that the line had been slacked in open hole. It was concluded that the bit had been released unintentionally as the previous core barrel was pulled and that the bit, bit sub assembly, inner core barrel and overshot/sinker bar assembly were all at the bottom of the hole.

This accident was, at least, well-timed and there was now no need to make a wireline run with the shifting tool to release the bit. The hole was flushed with an additional 100 barrels of gel mud to condition it for logging and the drill string was pulled to leave only the BHA below the seafloor.

The combined effects of wind, swell and current produced vessel motion near the operational limits during logging operations and logging was adversely affected. The sonic log tool is very long and somewhat weak in its slotted mid-section. It was severely stressed when the ship rolled as it was being picked up. The logging engineer was concerned about possible damage, but the tool functioned normally inside the drill pipe on the down trip. The tool became quite noisy once it reached open hole, however, and was found to be hypersensitive to the heave of the ship. The sonic curve recorded was unusable, but good gamma ray and (for the first time) caliper logs were obtained.

The formation density/neutron porosity log was run next with reasonable success. The vessel's heave, however, caused cyclic variation in the recorded values and a generally untidy log.

The backup sonic log tool was assembled next and a second attempt was made to secure a usable sonic log. This tool was of a slightly different model and the gamma ray and caliper curves could not be recorded without some adaptation. To save time the GR cartridge was left off and the caliper was employed for centralization only. An excellent sonic curve was recorded and a very satisfactory log resulted from a composite of the two runs.

The final logging run was made with the high resolution thermometer. This lightweight tool came to rest on an obstruction and only about 500 meters of hole was logged. The earlier logs had bottomed 50-60 meters off the total drilled depth of 814 meters below seafloor.

No electrical resistivity log was run due to the monolithologic character of the section penetrated. The information to be gained was felt to be too limited to warrant the expenditure of operating time.

When the tool was recovered, about 400 meters of line above the cable head was found to be kinked and twisted. This was attributed to excess slacking of the cable after the logging tool had touched bottom. (The fluctuation of the tension device caused by vessel motion made detection of setdown nearly impossible except by observation of the log traces). About 1-1/2 hours were spent in cutting and reheading the cable.

The open ended drill pipe was run back into the hole to 5081 meters and the hole was filled to the seafloor with 200 barrels of barite mud.

HOLE 441 - LOWER INNER TRENCH SLOPE

In a final attempt to find a site where accretionary wedge material could be cored, a move was made to a location about 11 kilometers east of Site 440. Although the water was over 1100 meters deeper than at Site 440, a thinner overburden section was anticipated that would permit penetration of accretionary material with a single bit in the remaining time.

Because of the very deep water, it was necessary to remove the previously shortened sandline from the coring reel and to transfer a new line from the drawworks sand-reel. This was done underway with no lost time. The electric wireline installed on the logging unit was also too short to log an anticipated deep penetration. Anomalously calm weather the first day on site permitted the crew to replace the logging line with a new full length cable stored in the ship's hold.

During the move from Site 440 to Site 441, unfortunate coincidental failure of both seismic profiling hydrophone streamers and of the 3.5 kHz echo sounder system forced reliance on dead reckoning and bottom contour methods to pinpoint the drilling location. Poor sound transmission conditions and a very irregular sea-floor made bottom contours difficult to ascertain on the 12 kHz PDR. At 1442 hours on November 20, a positioning beacon was dropped mostly on the basis of dead reckoning.

After taking station over the beacon and receiving satellite navigation fixes, it was found that the anticipated current set had not occurred and that the beacon was about two kilometers too far to the south. The maximum north positioning offset (2990 feet) was introduced and, after a "very good" satellite fix had been received, the vessel was moved by dead reckoning to the desired position. An alternate frequency beacon was launched at 1954 hours and normal site operations commenced.

Determination of water depth required over five hours, in which three "water cores" were pulled before spud-in took place. The PDR trace showed 15 discreet reflections. Concern for the BHA dictated that the shallowest (though not the strongest) be treated as the seafloor. The final drill pipe measurement of 5665 meters agreed most closely with the fourth reflector down. The seafloor was found to be extremely firm clay and considerable care was required in punching the first two cores.

Coring and washing operations then proceeded smoothly to a subbottom depth of 273 meters with a total of nine cores recovered.

Coring operations were terminated due to the approach of a weather front expected to produce gale force winds. The bit was pulled to 4500 meters water depth to clear the nearby trench slope should the vessel be blown off station. A later forecast indicated that complete retrieval of the string would not be necessary. Fifteen hours of weather downtime resulted.

HOLE 441A

Following passage of the weather front, the pipe was lowered to put the bit in spud position. Unstable wind and current conditions caused difficulty in positioning the ship and a two hour delay resulted. On attempting to spud, bottom was felt at 5654 meters, 12 meters higher than previously. No positioning changes had been made except for the heading of the vessel. The bit was pulled clear of bottom and a few minutes wait ensued to allow any pipe swing to stabilize. On attempting to spud, the bit was found to be completely plugged. A wireline trip was made, a new core barrel was pumped down, and normal circulation was regained. At this time the passage of a cold front with shifting and freshening wind resulted in another heading change and 1-1/2 hours of repositioning. Spud-in was accomplished after six hours of effort at a new depth of 5656 meters. This depth agreed with the third PDR trace — quite a strong one.

The hole was drilled and spot cored to a depth of 510 meters BSF. Some cuttings fill was noted after retrieving cores, but no sticking or torquing occurred. On attempting to retrieve Core No. 7, the overshot would not engage the core barrel pulling neck, although two wireline runs were made. The bit was found to be plugged and circulation impossible. The core barrel annulus had apparently filled with cuttings up to and over the inner barrel latch.

Six single joints were pulled and pumping again attempted without success. The hole was given up for lost and the heave compensator and power sub were set back. Four wet stands were pulled and then a dry one, indicating flow through the bit. The circulating head was installed and normal pump pressure was regained.

The bit was run back to near total depth and the power sub picked up. (The heave compensator was left out due to uncertain weather conditions). A new core barrel was pumped down, accompanied by a 100 barrel mud flush to clean the hole and operations recommenced.

Very low core recovery was realized on subsequent cores, consisting mostly of material resembling cuttings and a few hard lumps. Partially plugged bit situations resulted after Cores 8 and 10. Core Barrel No. 12 was stuck in place and two wireline runs were required to retrieve it.

It was decided that, due to unstable hole conditions and an unfavorable weather forecast, the current hole should be sacrificed for a set of logs rather than risk loss of everything gained thus far by continued drilling attempts.

In an effort to save time, the practice of making a wiper trip to condition the hole was foregone in favor of filling the hole with fresh water mud. To guard against backflow and plugging during the bit release operation, the mud was emplaced before the shifting tool run. Three hundred barrels of gel mud were pumped to fill the hole and overdisplaced with an additional 100 barrels to flush out cuttings.

The shifting tool was then run in on a core barrel with the sandline and the bit release sleeve was shifted. When the inner barrel was lowered to verify open ended pipe, however, it apparently came to rest in the lower support bearing indicating the bit was still in place. The string was raised several feet with corresponding elevation of the stop point.

The shifting tool was retrieved and an inner core barrel assembly was made up using worn components that had been taken out of service. The barrel was pumped down the pipe at full pump speed to knock off the bit. No difference in pump pressure was noted when the barrel reached the end of the pipe. A wireline run with overshot and sinker bars was made and no setdown was noted at bit depth, indicating that there were now no obstructions to logging tools. Unfortunately, all the mud had been displaced from the hole as the core barrel was pumped down.

The drill string was retrieved until only the BHA remained in the hole and the logging sheaves were rigged.

The formation density log had been determined to be of the most scientific importance in this instance and this tool was the first to be assembled and run. The anticipated inclement weather arrived sooner than expected and conditions were already deteriorating as the logging tool was being run into the hole. A further delay was experienced for inspection and adjustment of the winch brakes when they failed to hold the weight of line and tool (over 6000 pounds).

A very successful and valuable log was obtained, but it was necessary to abandon plans for further logging and for plugging the hole due to rapidly worsening weather. By the time the log had been completed and the tool retrieved, it was apparent that the drill string had to be pulled as quickly as possible for the safety of the crew and the drill pipe.

After the pipe had been pulled to 2500 meters to clear the adjacent trench slope, the vessel was headed into the easterly gale and allowed to drift. This reduced vessel motion and allowed the pipe trip to be completed in greater safety.

Nearly 36 hours were required before the gale and its resulting swell were sufficiently spent to permit the resumption of operations.

HOLE 441B

On the morning of November 29, with less than four days of site time remaining, the pipe trip began for a final attempt to reach the imbricate wedge.

Drift measurements in Hole 441A had indicated that the irregular bottom had caused the pipe to spud in at an angle. A 300-foot north offset was now introduced in the hope of spudding 441B under better conditions. Weight indication on spudding showed a new water depth of 5650 meters.

Drilling proceeded to the depth of Hole 441A with only four spot cores taken. Upon reaching the old depth, the old problems reappeared immediately. The core barrel used for washing down to 668 meters BSF was found to be stuck and had to be worked free. After 19 additional meters penetration, the next core barrel was stuck and required two wireline trips to retrieve. Meanwhile sticking and annular packing-off tendencies were noted. After pumping down a new barrel, an attempt was made to flush the hole with mud followed by cross linked guar gum. In the few seconds required to switch pumps, the bit plugged and further circulation was impossible.

A wireline run was begun in an effort to retrieve the core barrel and regain normal circulation. An unusual vibration in the sandline quickly caught the driller's attention. On investigation it was found that one of the sandline sheaves in the derrick crown had been worn completely through from the inside by the line. As severe damage to the line was imminent, the run could not be completed.

Five stands of pipe were pulled to clear the unstable part of the hole. The drill string was rotated throughout the operation as the travelling block was raised to just below the crown to serve as a work platform for replacement of the sheave assembly. Replacement of the sheaves, along with cutting off about 100 meters of worn line and reattaching the sinker bar, consumed about 5-1/2 hours.

On the new attempt to retrieve the core barrel, the pulling neck could not be engaged. The overshot was finally latched on after about one half hour of "working" the sinker bar and link jars. The barrel was then discovered to be stuck. After another hour of working the line to free the barrel, the release pin was sheared. Plans at that time called for replacement of the pin and one last attempt to recover the inner barrel so that logging could be accomplished.

As the sandline reached the surface, the operator inadvertently pulled the sinker bars and line wiper up into the travelling block where it jammed. The line then parted at the crown and the sinker bar/overshot assembly fell back down the pipe.

At this time still another gale warning was received and only about 55 hours of site time remained. The odds against successfully releasing the bit, logging and making a 12-hour trip seemed rather overwhelming.

The power sub was set back and a long, wet pipe trip began without delay. When the BHA had been recovered, it was found that the outer core barrel and the two lower drill collars were filled with sand and very fine drill cuttings of a "quicksand" consistency. After the outer barrel had been disassembled, it was necessary to chain down the inner barrel and pull it free of the outer barrel with the travelling block. In addition, the core bit was found to have one cone missing.

SITE 441 TO YOKOHAMA

Weather conditions were again deteriorating as the CHALLENGER departed for port at 1345 hours on December 2. By late evening a northwesterly whole gale was blowing with winds in excess of 50 knots. The resultant beam seas caused the vessel to roll to 20 degrees. In addition to the normal problems of gear adrift and minor breakage, some green water was taken through the main deck hatch into the core van hold and through openings in the laboratory house bulkhead into the chemistry lab. This caused additional cleanup work and soaked some freshly re-packed boxes of logging equipment.

The wind and seas abated during the following day as the vessel and the storm proceeded in opposite directions.

The transit to Yokohama Harbor consumed a total of 47.7 hours with an average speed of 9.1 knots. Leg 57 ended at 1324 hours on December 4 with the first mooring line at Berth D4, Honmoku Pier, Yokohama.

DRILLING & CORING EQUIPMENT

The standard DSDP bottomhole assembly, with only minor variations, was utilized for all operations. This consisted of a core bit, bit release assembly (with flapper valve and inner core barrel support bearing), outer core barrel assembly (modified 8-1/4" drill collar), three 8-1/4" drill collars, one 5' stroke Baash-Ross bumper sub, three 8-1/4" drill collars, two 5' stroke bumper subs, three 8-1/4" drill collars, one joint 5-1/2 inch range three drill pipe. The BHA used at Site 438 and lost in Hole 438B utilized a 7-1/4" drill collar as the top collar. Three "drilling joints", consisting of turned down drill collars with seven inch diameter hubs each six feet, were incorporated above the 7-1/4 inch collar. At the time of loss, a standard bit sub was in use instead of the bit release assembly.

At Site 441, the straightest possible hole was desired for core dip angle measurements and for a good quality sonic log. 9-7/8 inch stabilizers were incorporated into the BHA at about 10 and 19 meters above the bit to reduce hole angle. Deviation surveys in Hole 441A indicated that the stabilization was effective. The stabilizers did not appear to contribute to hole problems.

A modified latch sleeve was installed in the outer core barrel on all holes subsequent to Site 438. The standard 3-15/16 inch inside diameter sleeve was bored out to 4-1/31 inch I.D. to provide for passage of the modified caliper log tool. No problems arose from the employment of the oversize sleeve. The core recovery and bit plugging problems at Hole 441A were similar to the symptoms of unlatched inner barrels and it was feared that the modified sleeve was allowing inner barrels to "pop loose". The rig welder built up a latch finger to provide a greater shoulder area, but no improvement resulted. Experience in Hole 441B and review of Leg 56 operations at nearby Site 434 provided evidence that the difficulties resulted from the nature of the material being drilled.

Failure of the caliper logging tool to pass through a bumper sub at Site 439 resulted in the discovery that several of the bumper subs on board were undergauged on the inside diameter at the very top. Inside calipers showed the inside diameter of the offending sub to be 3-7/8 inch instead of the specified 4-1/8 inches. Three additional bumper subs were picked up before one was found that would pass a four inch "rabbit". Arrangements were made to have the undergauged subs bored out in Yokohama.

The bit release assembly was employed on all holes except 438B. Four bits were released for logging with one release occurring accidentally as a core barrel was retrieved. Another bit refused to drop off when the sleeve was shifted. Both of these problems have occurred on earlier voyages and should be eliminated by the employment of a new hydraulically-actuated bit release now in the prototype stage.

BITS

All the core bits utilized were Smith Type 93 long-insert (soft formation) bits. There was variety in configuration, however, as two of the bits were of the old three-cone style and diameters were 10-1/8, 10 and 9-7/8 inches. Four bits were released in the hole for logging, one was lost when a stuck BHA was severed and two were retrieved. Both of the bits recovered had failed prematurely and had lost all or part of a cone. The cause and exact nature of these failures are presently unknown and will be investigated further. All the other bits performed well and were thought to be in good condition when disengaged. Extraordinarily high penetration rates were enjoyed and no long bit runs were logged. The only "hard" drilling was encountered in Hole 439 in an igneous boulder conglomerate. The bit was not recovered, but low penetration rate in the underlying shale was believed due to cutting structure damage.

WIRELINE RETRIEVAL SYSTEM

Although nearly 300 wireline trips were made in the course of drilling operations, sandline problems were nil. The only exception was a buildup of protective line tar in the pipe which interfered with the action of the overshot and resulted in one extra wireline run early in Site 441 operations. This effect can be expected whenever a significant length of new sandline is run down the pipe.

Overshot release pins were sheared deliberately on two or three occasions due to stuck inner core barrels and once for no obvious reason.

The failure of the sandline sheave wheel on the final day of operations was the result of extreme wear caused by the steel line pulling to one side during its travel into and out of the hole. A bent or misaligned sheave hanger bracket was the suspected cause and the entire assembly has been replaced.

HEAVE COMPENSATOR

The motion compensator system was employed routinely and without significant operational problems for most of the cruise. It was taken out of operation for the final days on site due to extremely unstable prevailing weather conditions.

On one occasion it was necessary to lock the compensator cylinder for a few cores when the cylinder developed a tendency to stroke open without warning. The problem was traced to a sticky air relay valve associated with the anti-slingshot valve. The valve was freed up with no interruption of coring operations.

On two occasions, the system was tested in the active mode of operation. No difference in hook load variation was noted from that of the passive mode.

RE-ENTRY HARDWARE

One re-entry cone was emplaced, supported by a 400-meter string of 16-inch conductor casing. No undue difficulty was encountered in assembling and deploying the cone/casing subsystem. While the casing string was suspended from the moon pool framework, a strong current forced it back against the guide horn at a considerable angle. It was feared that this would hamper attempts to latch into the re-entry cone, but a successful latch-in occurred on initial contact.

It is believed, in retrospect, that the cone was released with the mud skirt about two meters above the seafloor and that no settling occurred prior to the re-entry. One successful re-entry was made and there was no indication of damage to cone or casing.

RE-ENTRY ELECTRONICS

Following the initial weak video presentation on the first re-entry attempt and eventual failure of the downhole electronics, both the sonar tool and the bridge console were replaced. No problems were encountered on the second attempt.

Troubleshooting revealed a broken lead and a shorted transistor in the electronics of the downhole tool. The stepping motor was also found to have a shorted winding.

The bridge console, which had not been used previously for an actual re-entry, was found to have been received from the vendor without the latest modification to the video circuitry.

SPECIAL TOOLS

The explosive drill pipe severing system was utilized on one occasion to release the stuck BHA in Hole 438B. The operation proceeded according to plan and was handled by the GMI Electronics Technician. Valuable assistance and advice was provided by the logging engineer.

The Eastman single-shot drift indicator was utilized on numerous occasions to monitor hole deviation. The instrumentation displayed a high degree of reliability despite vessel motion, the shock of seating core barrels and the stresses imparted by coring and retrieval operations.

The in situ pore water sampler was employed with considerable success. A total of 14 sampling runs were made. All were successful in retrieving interstitial water samples, although some samples were of less than optimum volume.

The final run on Hole 440B resulted in the loss (and eventual recovery) of the sampler probe tip and filter block assembly. The failure of the threaded stud securing these components has occurred previously and is believed related to the extreme pressure differentials that occur during sampling at deep water sites. The unit presently in use has been field-modified by the installation of a much stronger stud.

The sampler probe itself was slightly bent on the final sampling run in Hole 438A. This is thought to be the result of attempting to penetrate compacted sediment with a probe designed for fairly soft material. A shorter probe, smaller in diameter and possibly tapered, would extend the sampling range into semi-indurated sediments.

LOGGING WINCH

The Project's Mohole logging unit received extensive use and performed admirably. A total of 20 runs were made into the hole and about one hour of lost time accrued due to minor winch unit problems. Most of this time was spent in checking and adjusting the winch brake after it failed to hold on the deep logging run at Hole 441A. The problem was attributed to wet brake shoes from the heavy rainfall occurring at the time. It was found that the brakes would hold with slightly modified operating procedures.

CEMENTING UNIT

The BJ cementing unit was utilized on several occasions to plug holes and to mix high-viscosity hole cleaning material. Only minor mechanical problems occurred.

Weather doors were installed on the front of the unit to protect the engine and radiator.

BEACONS

A total of seven ORE acoustic positioning beacons were employed. Two of these were double-life models.

The performance of one 16 kHz single life beacon was unacceptable for positioning purposes. The signal strength was extremely unstable and the pulse repetition frequency did not remain within acceptable limits for the system.

The pulse envelope of this beacon was somewhat "ragged" as was that of the 13.5 kHz beacon dropped to replace it. This condition, along with fairly low signal strength, improved after one or two days and is attributed to temporary adverse sound transmission conditions in the sea.

DYNAMIC POSITIONING SYSTEM

The vessel's positioning system performed almost flawlessly within its design capabilities through extended periods of difficult wind and current conditions.

The one significant exception was the failure of a vertical reference gyro on October 30.

During the coring of Hole 440B, it was noted that a positioning excursion of about 100 feet in the X axis would occur each time a core was cut. Stable positioning would be regained as soon as the wireline trip started. The phenomenon is not understood, but it is speculated that the hole may have been drilled very close to the beacon and that pump circulation during the coring operation may have influenced the acoustic signal.

ENGINEERING

Power generating and propulsion equipment was utilized to the maximum extent for prolonged intervals due to unusually heavy positioning demands and a full drilling load. The equipment performed reliably and no operating time was lost due to mechanical failure of marine machinery.

The main bearing of No. 7 D.C. generator was found to be noisy and it was necessary to change it at sea. The job was completed in about 24-hours during a period of weather downtime and operations were not affected by the repair. Upon removal the bearing race was found to be rather severely scored.

5.6 hours of operating time were lost when stern thruster No. 1 apparently became fouled with fish net or other floating debris. Weather conditions precluded sending a diver to clear the thruster. The maximum stern thruster RPM was limited to 400 to reduce the electrical overload caused by the fouling. The thruster apparently cleared itself after operating in this mode for about a day.

NAVIGATION

The satellite navigation system functioned dependably as the primary means of fixing the ship's position. As in the past, the only real shortcoming of the system was the unwillingness of the satellites to pass over when they were most needed.

The recently installed Omega navigation system was tested on-site and found to be accurate within about four miles. To date, the system has not proven to be a viable backup for satellite navigation on site approaches and surveying, but efforts are being made to improve its performance.

Loran A lines of position were useful in some situations, such as on site approaches. Fixes were not possible as only one line was received in the operating area.

The ship's pitometer log is still not operational in that the speed readings are consistently much too high.

HYDROCARBONS

Monitoring of hydrocarbons at all sites was conducted in accordance with the JOIDES Manual on Pollution Prevention and Safety. Natural gas was present in virtually every core recovered, but there was no indication of significant accumulation. With the possible exception of a sand at Site 439, all the sediment cored was quite impermeable. Chromatographic analysis indicated that the gas present was low-temperature biogenic and had not migrated from a hydrocarbon deposit of significant maturity.

No traces of liquid hydrocarbons or petroliferous residue were encountered.

Much of the shallower sediment contained a considerable amount of hydrogen sulfide. The strong odor resulted in unpleasant laboratory working conditions and the need for extra ventilation.

WEATHER AND CURRENTS

Due to the lateness of the season and the latitude of the operating area, a considerable amount of rough weather and lost operating time had been anticipated for Leg 57. For most of the voyage, weather conditions were much better than the seasonal norm with cyclonic depressions tracking to the north of the area and their associated fronts having a tendency to dissipate before reaching the CHALLENGER. At times the proximity of Honshu provided a sheltering effect and reduced fetch when strong westerly winds were experienced.

During the final two weeks, however, conditions returned to normal and operations could proceed only during the lulls. The water depth contributed to the uncertainty of the situation in that the time required to pull pipe was roughly equal to the periodicity of the weather patterns. In some cases, weather analyses broadcast six hours apart bore very little resemblance. Trip time from the seafloor was 12 hours.

Current was a major factor in the vessel's ability to hold station satisfactorily. All the drilling sites were located in the Kuroshio/Oyashio current system and currents came generally from the south to west southwest at velocities from 0 to nearly 3 knots. The direction and velocity were found to be subject to considerable change in a short period of time. A typical operating condition on Leg 57 involved a brisk northwesterly wind with current from the south and swell from the east. Keeping station under these conditions while holding vessel motion within operating limits was a real challenge.

The on-board weather man's summary is included as Appendix II to this report.

COMMUNICATIONS

Daily contact was maintained with Radio WWD on 17 MHZ and there were no material delays in the handling of traffic either to or from San Diego.

A large number of radio telephone calls were made via amateur radio.

A few commercial radio telephone calls on official business were made via KMI (Oakland). In particular, those dealing with operational problems and in the case of one accident were handled in this manner.

Volume of traffic was reasonable low. All equipment worked well and no major repairs to radio or radar were required.

PERSONNEL

Leg 57 was relatively long with a very high proportion of the time spent on-site. Consequently the work load was consistently heavy for nearly everyone on both the shipboard and scientific staffs. Despite the prevailing unpleasant weather (the wind chill factor reached $0^{o}F$ on one occasion) and sometimes awkward working conditions, spirits remained high. The continuing scientific and technical successes contributed greatly to morale.

The broken pelvis sustained by a rotary helper the first day on site was the only incapacitating injury to occur. The man is reported to be recovering satisfactorily and is expected to return for Leg 59.

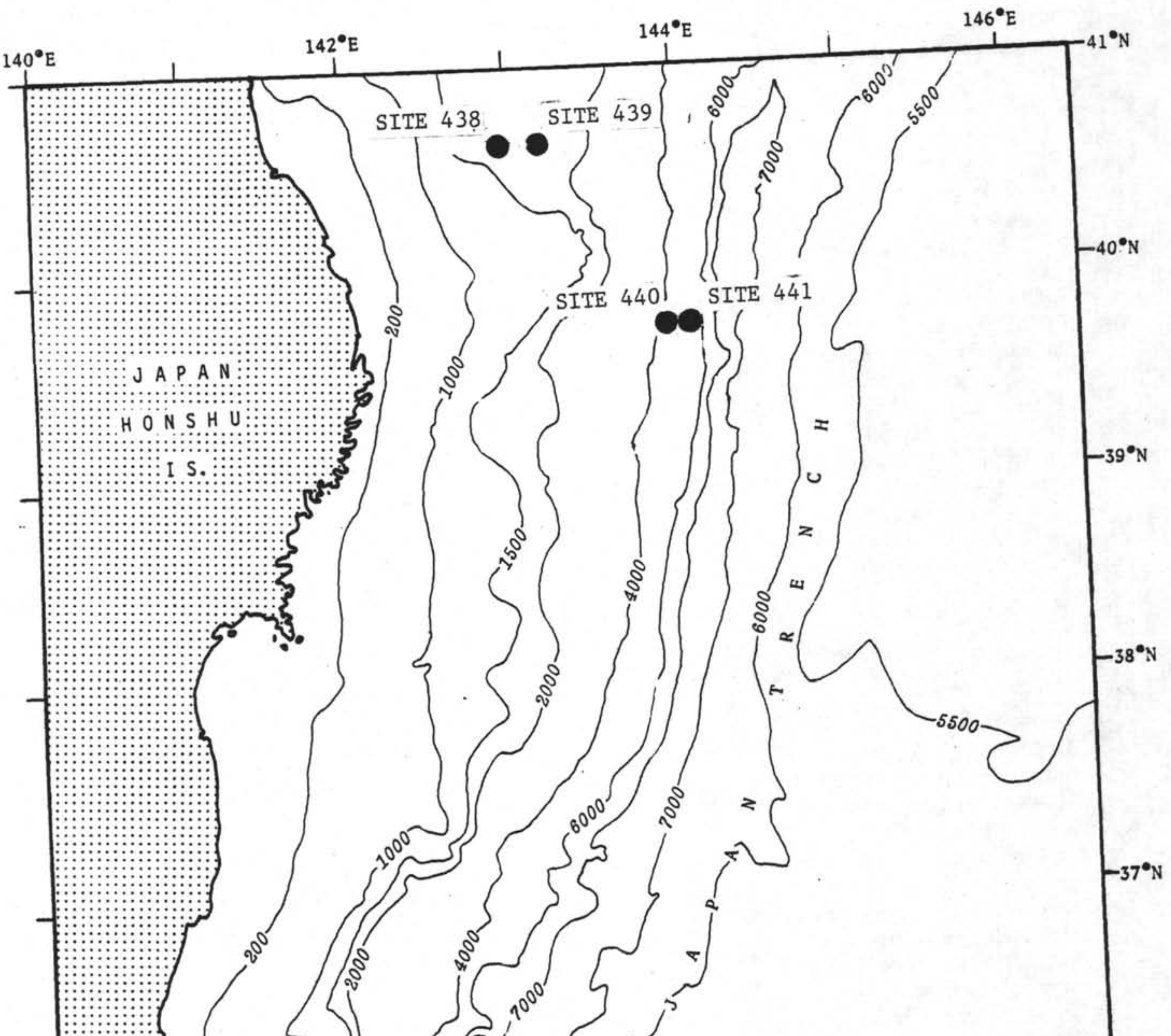
A messman sustained second degree burns on the wrist while attempting to pour hot water as the ship was rolling in rough water.

Illnesses were mostly limited to colds and upper respiratory ailments.

Both the GMI crew and the international scientific staff performed with a high degree of competence and cooperation.

Glen N. Foss

Glen N. Foss
Cruise Operations Manager
Deep Sea Drilling Project



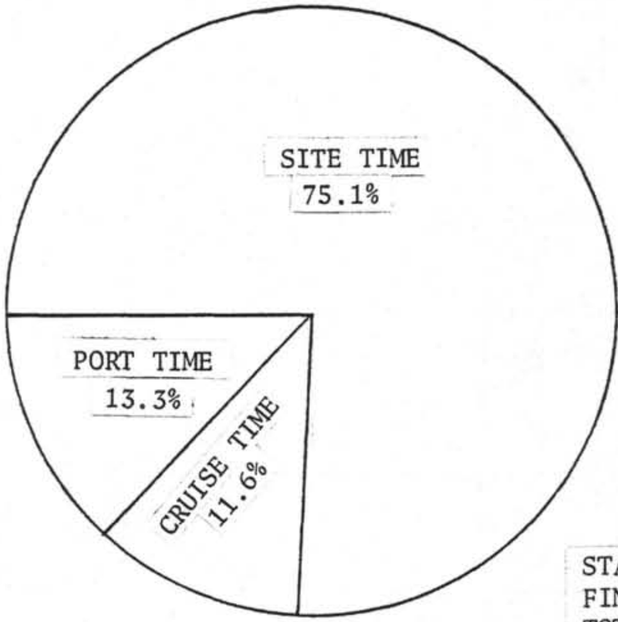
LEG 57 OPERATING AREA

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
OPERATIONAL RESUME
LEG 57

Total Days (October 10, 1977-December 4, 1977)		55.05
Total Days In Port		7.35
Total Days Cruising		6.37
Total Days On Site		41.33
Trip Time	4.8	
Drilling Time	3.2	
Coring Time	16.9	
Logging & Related Operations	4.4	
Re-entry & Related Operations	1.1	
In Situ Water Sampling	0.7	
Positioning Ship	0.7	
Mechanical Repair	0.6	
Hole Trouble & Stuck Pipe	2.4	
Wait On Weather	4.5	
Other	2.0	

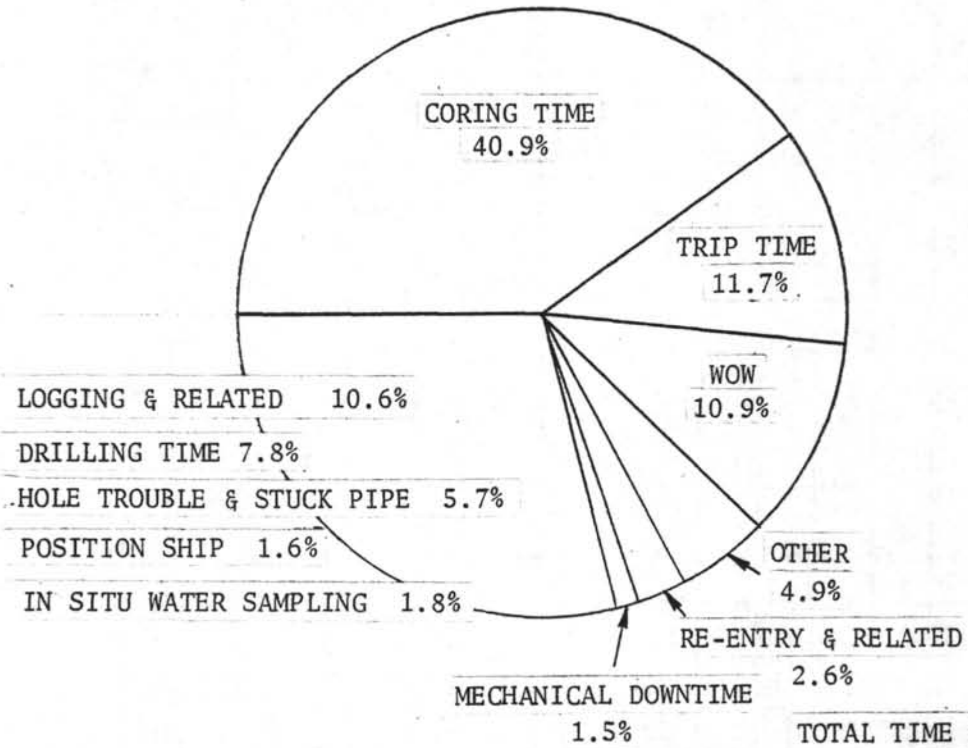
Total Distance Traveled (Nautical Miles)	1302
Average Speed (Knots)	9.1
Sites Investigated	4
Holes Drilled	10
Number of Cores Attempted	273
Number of Cores With Recovery	262
Percent of Cores With Recovery	96.0
Total Meters Cored	2523.9
Total Meters Recovered	1423.7
Percent Recovery	56.4
Total Meters Drilled	3308.8
Total Meters Penetration	5832.7
Percent Penetration Cored	43.3
Maximum Penetration (Meters)	1157.5
Minimum Penetration (Meters)	73.0
Maximum Water Depth (Meters)	5665.0
Minimum Water Depth (Meters)	1557.5

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
TOTAL TIME DISTRIBUTION
LEG 57



START LEG: October 10, 1977
FINISH LEG: December 4, 1977
TOTAL TIME: 55.05 Days

ON-SITE TIME DISTRIBUTION
LEG 57



TOTAL TIME ON SITE: 41.33 Days
TOTAL SITES: 4
TOTAL HOLES 10

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
10/10/77 10/18/77		52.7								146.2			198.9	Tokyo to Site 438
10/18/77 10/19/77	438		7.5		11.4		0.7	1.5			1.4		22.5	
10/19/77 10/11/77		30.5								30.3			60.8	Site 438 to Hakodate to
10/22/77 10/22/77	438A		9.4	1.8	73.6			1.1				41.2	127.1	Hole 438A
10/27/77		1.4											1.4	438A to 438B
10/27/77 11/02/77	438B		27.7	9.0	41.2	31.9		1.5	5.6		23.5	5.5	145.9	
11/02/77		3.7											3.7	438B to 439
11/02/77 11/08/77	439		9.5	14.0	65.7	0.9		1.3	0.8			51.6	143.8	
11/08/77 11/09/77		14.7											14.7	439 to 440
11/09/77 11/10/77	440		9.2		13.0		3.9	3.6	0.5		1.0	2.5	33.7	
11/10/77 11/12/77	440A			1.0	10.3		19.0					3.2	33.5	
11/12/77 11/20/77	440B		9.1	1.9	122.5	2.1	26.4					36.4	198.4	
11/20/77		2.1											2.1	440B to 441
11/20/77 11/23/77	441		10.5	4.1	14.9		16.1	6.8				7.1	59.5	
11/23/77 11/29/77	441A		12.6	18.9	42.9	14.5	42.2		1.0			19.2	151.3	
11/29/77 12/02/77	441B		21.0	26.2	9.9	7.4			6.8			4.9	76.2	
12/02/77 12/04/77		47.7											47.7	441 to Yokohama
		152.8	116.5	76.9	405.4	56.8	108.3	15.8	14.7	176.5	25.9	171.6*	1321.2	TOTALS

*Includes 105.9 hrs logging and related and 17.1 hrs in situ water sampling

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
SITE SUMMARY
LEG 57

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
438	40° 37.75'N	143° 13.90'E	1557.5	12	10	83.3	109.5	81.9	74.8	- -	109.5	32.9	22.5	
438A	40° 37.79'N	143° 14.58'E	1568.0	86	85	98.8	809.5	554.8	68.5	68.5	878.0	75.7	127.1	
438B	40° 37.80'N	143° 14.80'E	1574.5	24	23	95.8	214.4	97.3	45.4	824.8	1039.2	46.5	145.9	
			TOTALS	122	118	96.7	1133.4	734.0	64.8	893.3	2026.7	54.4		295.5
439	40° 37.61'N	143° 18.63'E	1666.0	39	39	100.0	342.0	163.1	47.7	815.5	1157.5	33.7	143.8	143.8
440	39° 44.13'N	143° 55.74'E	4517.0	8	8	100.0	73.0	50.4	69.0	- - -	73.0	30.4	33.7	
440A	39° 44.13'N	143° 55.74'E	4517.0	7	6	85.7	66.5	33.5	50.4	73.0	139.5	99.6	33.5	
440B	39° 44.13'N	143° 55.74'E	4517.0	71	71	100.0	674.5	403.9	59.9	139.5	814.0	35.9	198.4	
			TOTALS	86	85	98.8	814.0	487.8	59.9	212.5	1026.5	38.7		265.6
441	39° 45.05'N	144° 94:59'E	5665.0	9	8	88.9	79.0	16.6	21.0	194.0	273.0	78.0	59.5	
441A	39° 45.05'N	144° 04.59'E	5656.0	15	10	66.7	138.5	16.7	12.1	523.5	662.0	32.9	151.3	
441B	39° 45.08'N	144° 04.60'E	5650.0	2	2	100.0	17.0	5.5	32.4	670.0	687.0	30.4	76.2	
			TOTALS	26	20	76.9	234.5	38.8	16.5	1387.5	1622.0	35.1		287.0
			TOTALS	273	262	96.0	2523.9	1423.7	56.4	3308.8	5832.7	40.4		991.9

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
BIT SUMMARY
LEG 57

Hole	Mfg.	Size	Type	Serial Number	Meters Cored	Meters Drilled	Meters Total Penet.	Hours On Bit	Condition	Remarks
438	Smith	10-1/8"	F93C	KN303	109.5		109.5	3.3	TO, BO-I	3-Cone
438A	Smith	10-1/8"	F93C	KN303	809.5	68.5	878.0	11.6	Unknown	Still coring OK when released at T.D.
					919.0	68.5	987.5	14.9		
438B	Smith	10-1/8"	F93C	KN308M	214.4	824.8	1039.2	22.4	T3BT,B8LC,0 ¼	Cone broke circumferentially then drilld drilled on junk.
438B	Smith	9-7/8"	F93CK	642KR	1.5		1.5	6	Unknown	Hole trouble-couldn't get back to T.D. Lost when stuck pipe severed.
439	Smith	10"	F93CK	963EL	342.0	815.5	1157.5	34.3	Unknown	Slow penetration after drilling igneous boulders. Released at 1112 m BSF.
440	Smith	10"	F93CK	821EL	73.0		73.0	2.4		Pulled above mudline-WOW-Respudded.
440A	Smith	10"	F93CK	821EL	66.5	73.0	139.5	1.4		Pulled above mudline-WOW-Respudded.
440B	Smith	10"	F93CK	821EL	674.5	139.5	814.0	22.7		Accidentally released at 801 m BSF.
					814.0	212.5	1026.5	26.5	Unknown	
441	Smith	10"	F93CK	961EL	79.0	194.0	273.0	3.5	Unknown	Pulled above mudline-WOW-Respudded.
441A	Smith	10"	F93CK	961EL	138.5	523.5	662.0	20.1	Unknown	Released at T.D. for logging.
					217.5	717.5	935.0	23.6		
441B	Smith	9-7/8"	F93CK	645KR	17.0	670.0	687.0	22.6	T1BT-B8LC-I	One cone gone, one locked, two loose.

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
BEACON SUMMARY
LEG 57

Site No.	Make	Freq. kHz	Serial Number	Site Time Hours	
438	ORE	13.5	402	83.8*	Double Life. *Includes trip to Hakodate and return.
438A	ORE	13.5	402	127.1	Drilled on 2990' offset.
				210.9	Strong for duration.
438B	ORE	16.0	417	145.9	Stayed very strong. No problem.
439	ORE	13.5	441	143.8	Single life. Brief problem of double pulsing.
440	ORE	16.0	426	2.3	Single life. Unstable gain, variable PRF, poor pulse envelope.
440	ORE	13.5	442	32.0	Low S/N ratio early. Loss of acoustics. Somewhat
440A	ORE	13.5	442	33.5	ragged envelope but no problems after second day.
440B	ORE	13.5	442	198.4	
				263.9	
441	ORE	16.0	424	5.2	Single life. Looked good but dropped in wrong place. Used to reposition
441	ORE	13.5	400	54.3	Single life
441A	ORE	13.5	400	151.3	Strong for duration. No problems.
441B	ORE	13.5	400	76.2	
				281.8	

APPENDIX I

SCHLUMBERGER LOGGING - DSDP Leg 57

The logging was done with the on-board MOHOLE unit and 2 different 7P46 logging cables. The logging unit is adequately modified for our operations, with the cables there was a problem: the first cable (22.000') had no magnetic marks, so our depth control relied on the spooler measurement and drillers depth, which we matched; the second cable (28,000') had marks, but were 27 m off drillers DP depth @ 5,600 m. So again we matched the drillers depth.
Logging was done through drillpipes of about 4" ID, in holes averaging 12", with deviation up to 10°, drilled and filled with sea water. During the end of leg 57 with its rough weather and ship heave, the absence of a Wave Motion Compensator made the logging tool jump up and down in the hole all the time (drillpipe end indication appeared 3 times within 3 meters of 441 A FDC-GR log), affecting log quality, resolution and depth control.

ACCOUSTIC LOGGING - SONIC-GAMMA RAY

As we can't put rubber stand-offs on the tool, we need it well centralized for a good signal. The maximum was achieved with an in-line centralizer CME-J on top and a modified VCD-D on the bottom (see drawings). Modification: Rubber off springs H129201, Bushings B 10975 out and sliding collar H 130777 filed down as far as possible. We still could pass only through specially opened bit release sleeve. A smaller diamater of the VCD/MCD can be achieved by bringing the Dowel Pin H 102537 in the sliding collar more towards the center. This must be done in advance.

It was difficult to trigger the right waves E_2 as compressional and mud waves arrived at about the same time near the sea floor.

Log Quality: Good results despite some noise and skippings.

RADIOACTIVE LOGGING (FDC-CNL-GR)

Tool arrangement: SGT-E, CNT-A, PGT-H with 12" excentralizer spring at the bottom.
Hole deviation helps the quality of the logs, ships heave introduces error, sometimes periodic.
Improvements needed: PGT: Stronger and larger bottom excentralizer, opening to 16", with stiffer spring. The sliding pin holding the spring was found stuck with cuttings twice; design needs improving.
CNT: some kind of excentralizer spring needed, possibly a modified CME-J with only 1 aligned spring.

Log quality: FDC: good results
CNT: all logging in shale sections, so no LS porosity derived
GR: always good

APPENDIX I

RESISTIVITY LOGGING (DLT-GR)

Tool arrangement: SGT-E, DLT-B
There were no centralizers available to run the tool centered, as standard; considering length and weight of tool, it is doubtful whether there ever will be strong enough throuhg drillpipe centralizers. This did not affect our logs, as the resistivities were very low, so the drill fluid effect was negligible. But it has to be considered when logging high resistivity formations.
Alternative is Induction type tool (IRT-K, DIT-B) which does not need centralization, but is not so goog for high R_t over R_m contrast.

Log quality: Good, no contrasts in the logged sections

TEMPERATURE LOGGING (HRT)

Tool arrangement: 2 steel weights 1 11/16", HTT-B
Additional weight is desirable (high density weights or weights with bigger diameter) to better judge the tool movement in the open and deep hole. Small steel stand-offs might help the tool to descend further in uneven hole without scratching the wall and plugging the measyring wire.

Log Quality: Good.

Dieter Bartsch

Dieter Bartsch
Schlumberger Engineer

Encl.: 2

APPENDIX II

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL WEATHER SERVICE

Overseas Operations Division
8060 - 13th St.
Silver Spring, Md. 20910
December 4, 1977

Dr. M. N. A. Peterson
DSDP, A-031
Univ. of Calif. at San Diego
La Jolla, Calif. 92093

Dr. Peterson,

Summary of Leg 57 follows:

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ATS-1... 12

FAX Weather Maps copied:

Tokyo, Japan....................................408
Khabarovsk, USSR................................ 50

Despite excellent radio-facsimile weather map coverage from one of the very best meteorological services and the use of the real-time satellite coverage of NOAA-5, the last two weeks of this leg were among the most difficult of the past seven years for the weatherman.

The down-time due to weather is shown by the operational report, but I would like to point out that an 18 hr. gale and subsequent swell, followed some five days later by another, resulted in only 17 hours of working time below the depth we were when we commenced pulling pipe for the first storm. How much time would have been lost on the second is unknown as the hole and leg were terminated due to operational problems one hour before it wouldhave been necessary to pull pipe due to anticipated severe weather. This storm developed into a whole gale of considerable severity.

Apart from this last two week period weather was reasonable good.

Sincerely,
Melvin L. Fields
Melvin L. Fields

cc: OOD, Silver Spring
Mr. McLerran NSF
file

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
OPERATIONAL RESUME
LEG 58

Leg 58 began with the first mooring line ashore, at 1324 hours, on December 4, 1977, on Hommoko Pier D-4 in Yokohama, Japan. It ended 56.8 days later on January 30, 1978 in Naha, Okinawa. The proposed drilling program was formulated to investigate the active ocean margins in the northern part of the Philippine Sea. Sites were located in the central portion of the Skikoku Basin and then farther west in the Daito Ridge and Basin Province.

Most of the science objectives were achieved, however, hole problems and weather conditions caused the abandonment of some sites before all of the desired information could be obtained. One of these disappointments was the early abandoning of the re-entry site, No. 442, which was due to the unstable nature of the rocks encountered.

The GLOMAR CHALLENGER traveled 1771 nauticial miles and attempted to drill nine holes at five sites. Water depths varied from 3382 meters to 4980 meters. The hole depths ranged from shallow 67 meters penetration, used to determine the proper casing length for the re-entry hole, to a 892.0 meters penetration at Site 445. A total of 2971.5 meters of coring was attempted with 1591.82 meters being recovered, for a very creditable overall recovery rate of 53.5%.

Time distribution for the leg was 7.04 days in port, 8.96 days cruising and 40.8 days on-site. The on-site time breakdown consisted of 8.84 days tripping the drill string, 0.87 days drilling, 25.13 days coring, 3.08 days waiting on weather, .54 days positioning the ship, .26 days of mechanical downtime, .55 days for re-entry and 1.57 days for miscellaneous work.

PORT CALL

The port call at Yokohama, at the beginning of the leg, was a little longer than usual due to several major repair jobs. Beside the usual taking on of supplies, of food and spare parts, sixteen 8-1/4" drill collars, one 7-1/4" drill collar, four bumper subs, 16 joints of 16" casing and about 4300 sacks of mud material (bentonite and barite) were loaded. In addition, 200,035 gallons of diesel fuel were pumped aboard.

While these supplies were being stowed, the drill pipe was "Sonoscope" inspected by Tuboscope. The pad eyes in the derrick crown were magnafluxed and a major improvement was made to the racker arm for the heave compensator. A diver was sent down into the thruster tunnels to check the gear boxes and he found a ball of nylon rope on the forward starboard thruster which he removed. All work was finally completed and the ship departed for Site 442 at 1430 hours on December 11, 1977.

DRILLING AND CORING ASSEMBLIES

Two different bottomhole assemblies were used on this leg. A more or less standard assembly was used on Holes 442, 443, 444, 444A, 445, 446 and 446A. This consisted of the bit, bit sub, 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" and one 7-1/4" drill collars and one joint of 5-1/2" drill pipe for a total length of 114.52 meters. On Hole 442B, when the casing and cone were to be washed in, the configuration was changed to a bit, bit sub, core barrel, top sub, head sub, six 8-1/4" drill collars, crossover sub, running tool, two 5' bumper subs, two 8-1/4" and one 7-1/4" drill collar and one joint 5-1/2" drill pipe for a total length of 115.88 meters. For re-entry at Hole 442B, the assembly was the same less the running tool and crossover sub.

BITS

Five 9-7/8" F94CK core bits were used to drill the nine holes attempted on this leg. Two of the bits performed very well; one accumulated 50.26 rotating hours and the other 71.8 hours. Both bits drilled a combination of sedimentary and igneous rocks. The bit, with 50 hours, could have undoubtedly drilled deeper but it had to be pulled when the weather changed and the site had to be abandoned.

The other long life bit drilled a total of 1049 meters before it was pulled.

BEACONS AND POSITIONING

Five beacons were used on this leg, one 16 kHz double life, one 13.5 kHz single life and three 16 kHz single life. All performed well and contributed to the positioning which was good. Offsets were used on the last two sites to compensate for an out of level gyro, but this did not cause any problems as far as keeping the ship on station. There were a few times when the ship made excursions up to 400' due to rapid changes in wind direction and speed was well as the currents. In no case did these changes interrupt drilling for more than an hour or so.

RE-ENTRY

Only two re-entries were made because the site chosen for re-entry had to be abandoned sooner than anticipated due to very poor hole conditions. The two re-entries required 48 minutes and two hours and 22 minutes respectively for maneuvering and actual stabbing. On the first attempt all equipment operated well with the exception that the new shipboard display console presented a weak although readable signal. Troubleshooting after re-entry discovered the fault and it was corrected before the next attempt. On the second attempt, the 8° transducer failed when tested at 4000 meters while running in to re-enter. As a result, the 45° transducer was used.

After the tool was recovered, an oil leak was noticed on the motor housing shaft. Indications are that the transducer wires were poorly potted during recent modifications. All five motor units are being returned to the vendor for testing and modification.

COMMUNICATIONS

Most communications for the leg were handled direct via WWD Radio Station in La Jolla, California. A few messages, however, were sent via the Navy's secondary circuit which was a big assist.

A communication window from the ship was established from 0630 to 1000 hours local time which corresponded to La Jolla's 1330 to 1600 hours on the day before. This caused somewhat of a slow down in the response time for question and answer traffic.

Only one commercial radio telephone call was made. It was direct to Japan. In addition, one radio telephone call was made via Station WWD direct to DSDP. As usual, personal phone patches were made by the scientific staff and crew by use of amateur radio stations. Compared with other legs, total overall traffic was light. No communication equipment problems developed during the voyage.

SITE 442 - HOLES 442, 442A, 442B

The first site to be investigated on Leg 58 was the re-entry site located approximately 435 miles southwest of Yokohama.

The ship arrived at the proposed location and a 16.0 kHz double life beacon was dropped at 2116 hours on December 12. At 2306 hours, the ship was in an automatic positioning mode with a 200-foot offset to avoid disturbing the sediments in the exact area where the re-entry cone would be located. The work of running the drill string commenced.

Before the first pilot hole was drilled, all of the Grade 2 drill pipe located in the drill pipe racker was removed and replaced with new pipe in accordance with the new Project policy of using only PREMIUM grade pipe. This was a long job as the new pipe had to be brought out of storage from the tween deck and the Grade 2 pipe had to laid down and then placed in storage in the tween deck. The re-entry site pilot hole was finally spudded at 2130 hours on December 17, 1977.

HOLE 442

A mudline core was taken and used to establish the mudline at 4649.0 meters based on the amount of sedimentary material recovered in the core barrel. The drill string was then washed to 4715.5 meters without rotation which determined that

66.5 meters of 16" casing could be jetted-in with the re-entry cone. The drill string was then pulled above the mudline so that a pilot hole could be cored through this interval to provide additional geological information as to the acceptability of the area for re-entry.

HOLE 442A

This pilot hole was spudded at 0250 hours, December 18 and a mudline core from 4649.5 to 4659.0 meters was attempted. No recovery was obtained, however, a slight loss of weight was noticed on the weight indicator at approximately 4644.0 meters. Later it appeared that the ocean floor was actually at 4644 m when the re-entry cone could not be jetted-in deeper. The hole was then continuously cored to a subbottom depth of 313.5 meters with basaltic material topped at 287 meters subbottom. Based on this coring, it was concluded that it would be a satisfactory site for a re-entry cone. Pulling the drill string at 1500 hours on December 20. During the drilling operation, one and one half hours were lost due to an oil leak in the Bowen sub.

HOLE 442B

Hole 442A ended at 2300 hours on December 20 when the bit reached the derrick floor and assembly of the re-entry equipment began. The cone was keelhauled. 65.46 meters of 16-inch casing was made up and attached to the bottomhole assembly and then in turn attached to the cone. Following this, the cone was lowered to the bottom. The casing was spudded at 2310 on the 21st of December, or less than 24-hours from the time 442A was ended. The cone and casing were then washed in to 4711.0 meters (top of 16" 4645 m) in about 3-1/2 hours. The cone could be washed no deeper indicating that the mud skirt was resting on the bottom. At 0345 hours, the shifting tool was run and the drill string released from the casing. The drill string was then drilled in to 4912 meters (266.5 m subbottom) where continuous coring began. Coring continued until a subbottom depth of 401.0 meters was reached when torque increased and core recovery decreased and it was felt that the bit was worn out.

The bit was changed and the pipe was run back for re-entry No. 1. When the re-entry tool first began scanning, the target was observed at a distance of 80 feet.

A successful re-entry was achieved after 48 minutes of maneuvering the ship. The bit was then run to bottom and coring began after spending about one hour and 15 minutes cleaning out the hole from 5030.0-5034.5 meters. Four cores were cut and recovered when the weather deteriorated and it was considered advisable to pull above the basalt contact and wait for the weather to improve. After waiting for 16 hours, the weather became worse and it was necessary to pull the pipe out of the hole and above the top of the cone. This was done and a stand an hour was then pulled for 16 hours. Weather then began improving and the pipe was lowered so that a second re-entry could be attempted. The re-entry tool was run in and two hours and 22 minutes were required to make the re-entry.

The drill string was then run in the hole to a point about 40 meters from bottom where fill was encountered. One and one half hours were required to clean out the fill and reach bottom. During this time, considerable torquing was experienced. One core of 9.5 meters was cut, however, only 0.72 meters was recovered. After retrieving the core and pumping down a new core barrel, fill was again encountered. While trying to clean out, torque increased to such an extent that the pipe could not be rotated. After repeated attempts, it was finally necessary to abandon this hole because of the potential damage to, or loss of, the drill string.

SITE 443

After abandoning Hole 442B, the ship steamed approximately 75 miles in an easterly direction before dropping a 13.5 kHz single life beacon at 1000 hours on December 28 for Site 443.

The drill string was made up and the hole was spudded at 2200 on December 28. A mudline core established bottom at 4386.0 meters. The hole was then continuously cored to 4431.0 when coring was stopped for 45 minutes while the ship was repositioned due to weather changes. Coring resumed again and continued to a total depth of 4967.5 m or a subbottom penetration of 581.5 meters. Deteriorating weather conditions at this time made it necessary to discontinue drilling. When the last inner core barrel was retrieved a rabbit was dropped to assure that no cores had been dropped in the string. After several hours of pulling pipe, the roll of the ship became excessive and it was necessary to "wait on weather" for seven hours, pulling one stand of drill pipe an hour. Then weather conditions improved enough that the balance of the string could be pulled using a great deal of care. The bit was recovered at 0018 hours on January 4 and the site was abandoned.

During the drilling, 460 meters of sediments and 221.5 meters of basaltic rock were cored. The recovery of the sediments was only 48% and was probably attributable not only to the presence of ash beds, but to ash within the clays as well. Basalt recovery was good, averaging 67%. This was probably due to the homogeneous nature of the rock and the recementing of fractures. This rock type also allowed for a bit run of over 50 rotating hours of which 45.5 hours were in the crustal material.

HOLE 444

This site was located about 50 miles south of Site 443. After steaming for 9.5 hours, a 16 kHz single-life beacon was dropped at 1012 hours on January 4, 1978. The drill string was assembled and run to bottom where a mudline core was cut and established bottom at 4852.0 meters. This hole ended after only ten cores had been recovered due to deteriorating weather conditions, which required that the drill string be pulled above the mudline.

HOLE 444A

The weather conditions deteriorated so quickly that the drill string could not be brought aboard without possible injury to the drilling crew or damage to the equipment. Therefore, one stand was pulled and laid down carefully every hour. This continued for 21 hours at which time the weather improved again and the pipe was run back to bottom and operations were again resumed.

A mudline core was not taken because the ship's positioning system indiated that 444A was within 20 feet of the original hole. The bit was washed from 4852.0 m to 4934.0 m where continuous coring began. This beginning depth allowed a duplication of the last core from Hole 444 and a chance for geological comparison.

The top of igneous rock was located at 5082 m and continued to 5105.0 m, where sediments were again recovered. This sedimentary material was cored to approximately 5130.0 m where basaltic rock was again cored. Coring continued to a depth of 5162.0 m or 310.0 m subbottom when it became necessary to abandon this hole because of an approaching storm front. This was at 0130 hours, January 9, 1978.

SITE 445

After the abandonment of Hole 444A due to an approaching storm, the ship departed for the next site which was located about 304 miles southwest and should have been reached in about 41 hours. However, due to the same storm, the ship's speed was reduced and over 61 hours were needed to cover the distance. At 1600 hours on January 11, 1978, a 16 kHz single-life beacon was dropped for Site 445.

After the drill string was made up and run, a mudline core established bottom at 3382.0 m. The hole was then continuously cored to a total bottom penetration of 892.0 m. In the process, 95 cores recovered 619.52 meters for a 69.4% recovery factor. No troubles were encountered and the hole could have been taken deeper, except that as at Hole 444A, the approach of adverse weather conditions forced abandonment of the site at 1530 hours on January 17, 1978.

SITE 446

After abandoning Site 445, the ship steamed southwesterly for about 50 miles and a 16 kHz single-life beacon was dropped at 2354 hours on January 18, 1978. A sonobuoy was dropped at the same time and about two hours and 45 minutes were spent in profiling before the ship returned to the beacon and began positioning. The automatic positioning mode was achieved at 0336 hours on January 18, 1978 and the drill string was made up and run.

One water core was recovered before a mudline core established bottom at 4980.0 m. The hole was then continuously cored to 5399.5 m. At this point an inner barrel, dropped to cut Core #46, would not seat properly as indicated by the pressure gauge on the driller's console. Apparently the bit was plugged with a core fragment and a center bit was used to remove the problem.

When a new inner barrel was dropped and cleanout work was in progress, the weather slowly began changing for the worse. At 1925 hours, it was necessary to pull the drill string above the mudline and wait for improved weather conditions. At 2100 hours, January 21, 1978, the bit was above the mudline and Hole 446 was officially abandoned.

PERSONNEL

The Scientific party was an enthusiatic group and were very understanding, in general, when the particular objective could not be reached either because of weather or hole conditions. Most of their goals were reached along with some new data for additional thought and work.

As usual, GMI and Scripps people did an outstanding job. This was a trying job because of the large volume of material cored and recovered, but all work was accomplished. All in all, it was quite a successful leg.

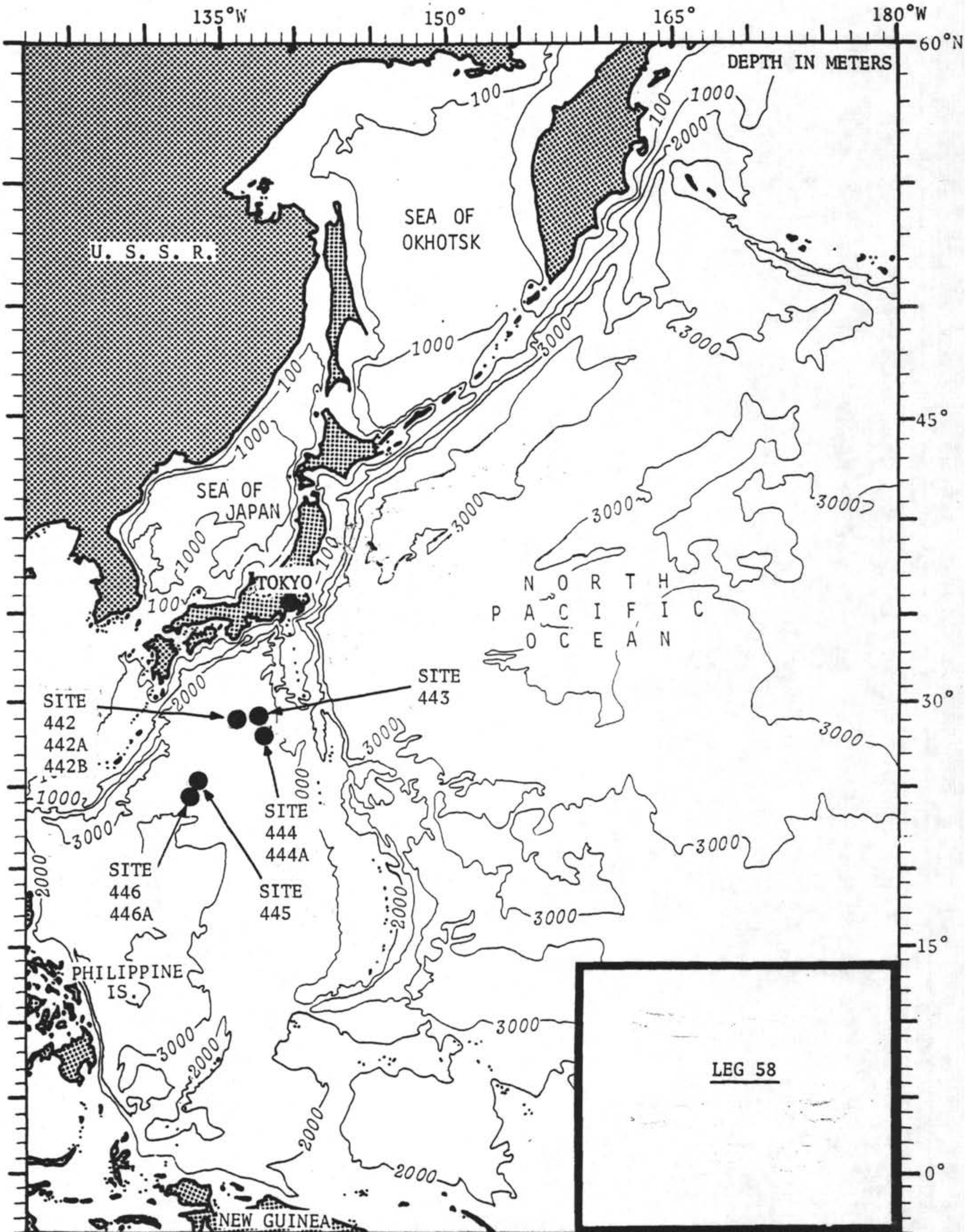
R. R. Knapp
Cruise Operations Manager
Deep Sea Drilling Project

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
OPERATIONAL RESUME
LEG 58

Total Days (December 4, 1977 - January 30, 1978)	56.8
Total Days In Port	7.04
Total Days Cruising Including Site Survey	9.0
Total Days On Site	40.76

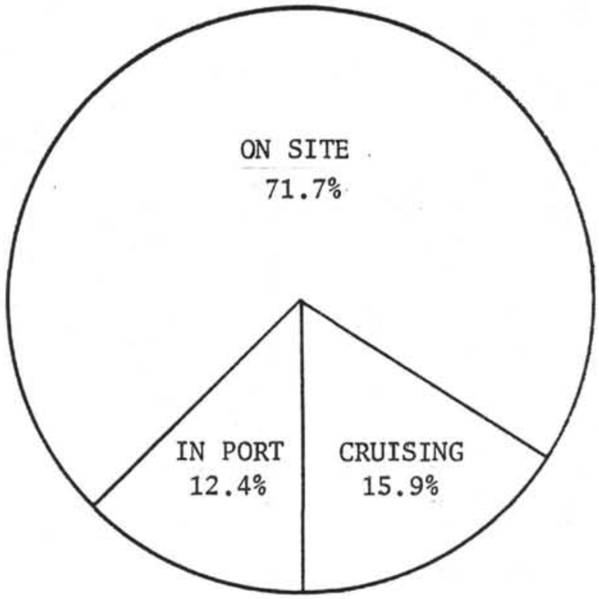
Trip Time	8.84
Drilling Time	.86
Coring Time	25.12
Waiting On Weather	3.05
Position Ship	.54
Mechanical Repair	.25
Re-entry	.55
Other	1.55

Total Distance Traveled (Nautical Miles) Including Survey	1771
Average Speed (Knots)	7.25
Number of Sites	5
Number of Holes Drilled	9
Number of Cores Attempted	324
Number of Cores With Recovery	322
Percentage of Cores With Recovery	99.3
Total Meters Cored	2971.5
Total Meters Recovered	1591.82
Percentage Recovery	53.5
Total Meters Drilled	721.5
Total Meters of Penetration	3759.5
Percent of Penetration Cored	79.0
Maximum Penetration (Meters)	892.0
Minimum Penetration (Meters)	67.0
Maximum Water Depth (Meters)	4980.0
Minimum Water Depth (Meters)	3382.0

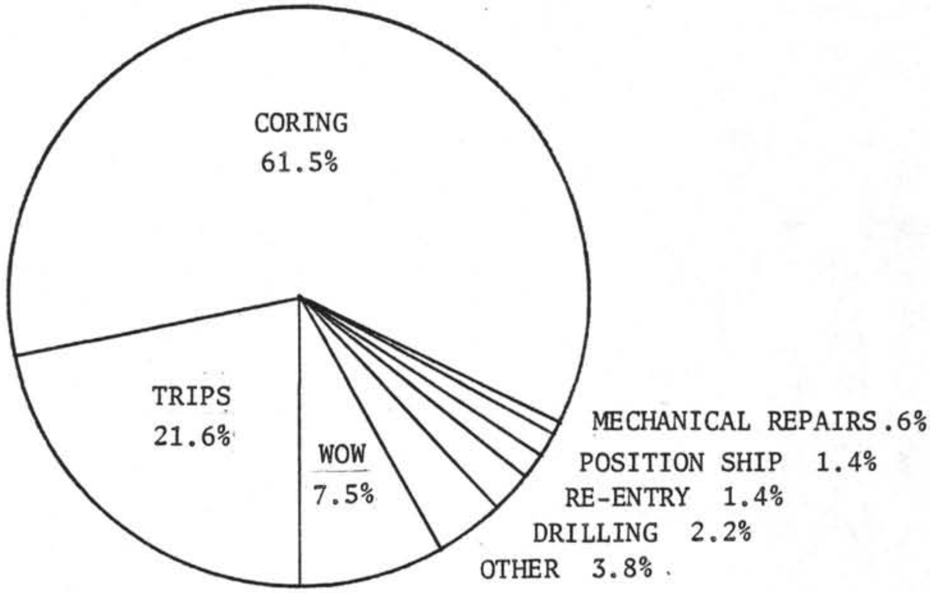

135°W
150°
165°
180°W
60°N
45°
30°
15°
0°
DEPTH IN METERS
U. S. S. R.
SEA OF OKHOTSK
SEA OF JAPAN
TOKYO
NORTH PACIFIC OCEAN
SITE 442 442A 442B
SITE 443
SITE 444 444A
SITE 445
SITE 446 446A
PHILIPPINE IS.
NEW GUINEA
100
1000
2000
3000
LEG 58

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT

TOTAL TIME DISTRIBUTION
LEG 58



ON SITE TIME BREAKDOWN
LEG 58



INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
BEACON SUMMARY
LEG 58

SITE NO.		MAKE	FREQ. kHz	SERIAL NUMBER	SITE TIME HOURS		
442		ORE	16.0 (D.L.)	414	100.0		
442A		ORE	16.0 (D.L.)	414	70.2		
442B		ORE	16.0 (D.L.)	414	166.5		
	TOTAL				336.7	=	14.02 days
443		ORE	13.5 (S.L.)	444	158.3	=	6.59 days
444		ORE	16.0 (S.L.)	423	26.3		
444A		ORE	16.0 (S.L.)	423	86.2		
	TOTAL				112.5	=	4.6 days
445		ORE	16.0 (S.L.)	428	143.5	=	5.9 days
446		ORE	16.0 (S.L.)	425	93.1		
446A		ORE	16.0 (S.L.)	425	136.9		
	TOTAL				230.0	=	9.6 days

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
BIT SUMMARY
LEG 58

HOLE	MFG.	SIZE	TYPE	SERIAL NUMBER	METERS CORED	METERS DRILLED	METERS TOTAL PENET.	HOURS ON BIT	CONDITION	REMARKS
442	Smith	9 7/8"	F94CK	158FF	0.5	66.5	67.0	1.01	T1-B1-EI	Will rerun on Hole 442B.
442A	Smith	9 7/8"	F94CK	158FF	313.5	- -	313.5	6.68	T1-B1-EI	Will rerun on Hole 442B.
442B	Smith	9 7/8"	F94CK	158FF	142.5	201.0	343.5	14.95	T1-B1-EI	
	TOTAL				456.5	267.5	724.0	22.64		
442B	Smith	9 7/8"	F94CK	049FF	45.0	- -	45.0	2.96		Will rerun on Site 443.
443	Smith	9 7/8"	F94CK	049FF	581.5	- -	581.5	47.3	T1-B8-SF-0 1/8"	
	TOTAL				626.5	- -	626.5	50.26		
444	Smith	9 7/8"	F94CK	126FF	91.5	- -	91.5	0.7		
444A	Smith	9 7/8"	F94CK	126FF	228.0	82.0	310.0	14.7	T1-B1-SE/0 1/16"	
	TOTAL				319.5	82.0	401.5	15.38		
445	Smith	9 7/8"	F94CK	933FE	892.0	- -	892.0	29.2	T1-B1-SEI	
	TOTAL				892.0	- -	892.0	29.2		
446	Smith	9 7/8"	F94CK	190FF	420.5	- -	420.5	15.1		
446A	Smith	9 7/8"	F94CK	190FF	256.5	372.0	628.5	56.7	T1-B8-SF 0 1/4"	
	TOTAL				677.0	372.0	1049.0	71.8		

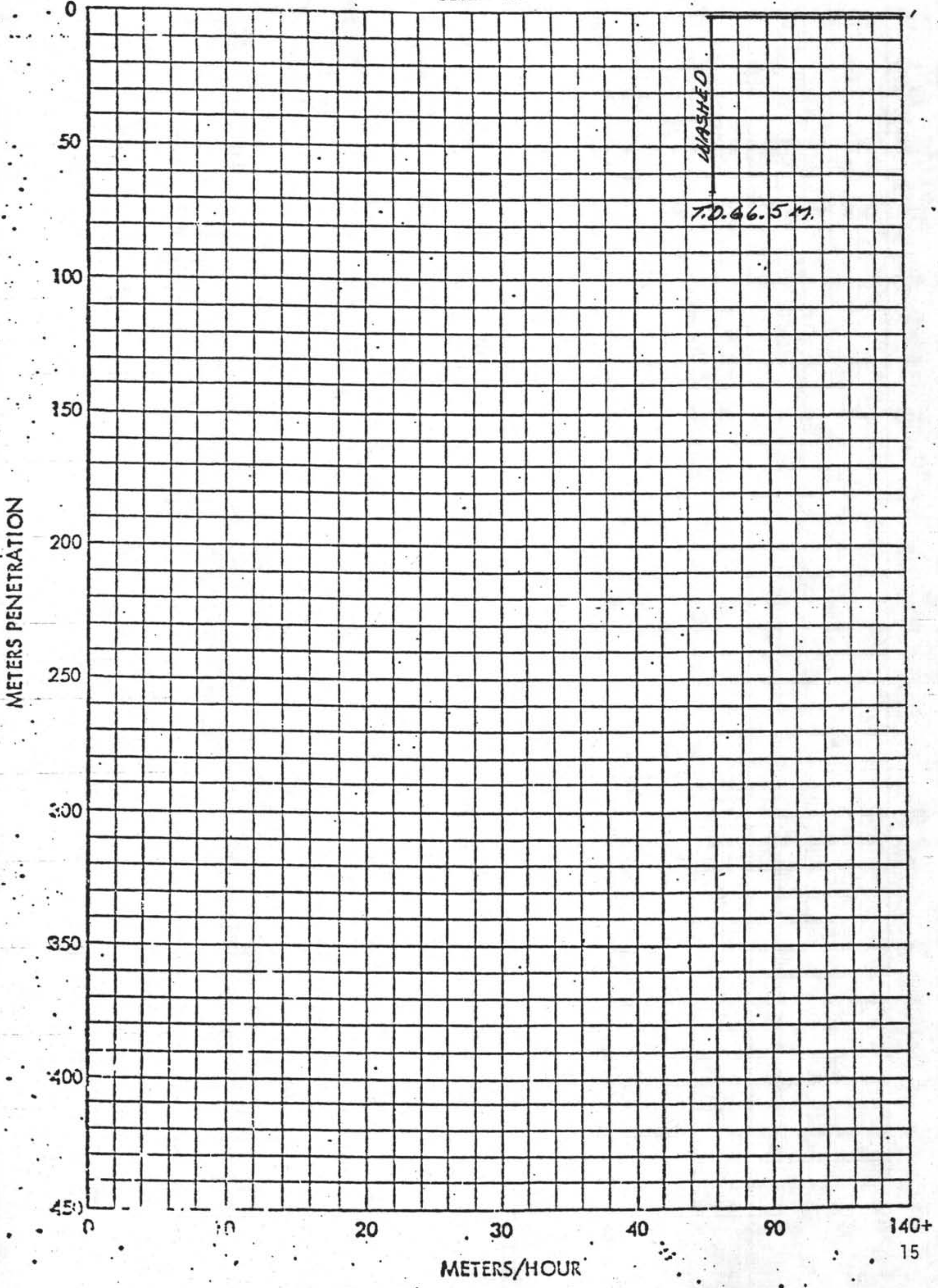
INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
SITE SUMMARY
LEG 58

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/HR	TIME ON HOLE HRS.	TIME ON SITE
442	28° 59.00'N	136° 03.43'E	4649.0	1	1	100.0	0.5	0.10	20.0	66.5	67.0	70.0	100.0	
442A	28° 59.00'N	136° 03.43'E	4649.5	34	33	97.0	313.5	154.26	49.2	- -	313.5	46.9	70.2	
442B	28° 59.04'N	136° 03.43'E	4644.5	20	20	100.0	187.5	50.99	27.2	201.0	455.0	25.4	166.5	336.7
443	29° 19.65'N	137° 26.43'E	4386.0	64	64	100.0	581.5	304.05	52.2	- - -	581.5	12.2	158.3	158.3
444	28° 38.25'N	137° 41.03'E	4852.0	10	10	100.0	91.5	41.49	45.3	- - -	91.5	130.7	26.3	
444A	28° 38.25'N	137° 41.03'E	4852.0	27	27	100.0	228.0	107.20	47.0	82.0	310.0	21.5	86.2	112.5
445	25° 31.36'N	133° 12.49'E	3382.0	94	94	100.0	892.0	619.52	69.4	- - -	892.0	30.5	143.5	143.5
446	24° 42.04'N	132° 46.49'E	4980.0	46	45	97.8	420.5	197.10	46.8	- - -	420.5	28.0	93.1	
446A	24° 42.04'N	132° 46.49'E	4980.0	28	28	100.0	256.5	117.09	45.6	372.0	628.5	11.0	136.9	230.0
			TOTAL	324	322	99.3	2971.5	1591.82	53.5	721.5	3759.5		981.0	981.0

DEEP SEA DRILLING PROJECT
TIME DISTRIBUTION
LEG – 58

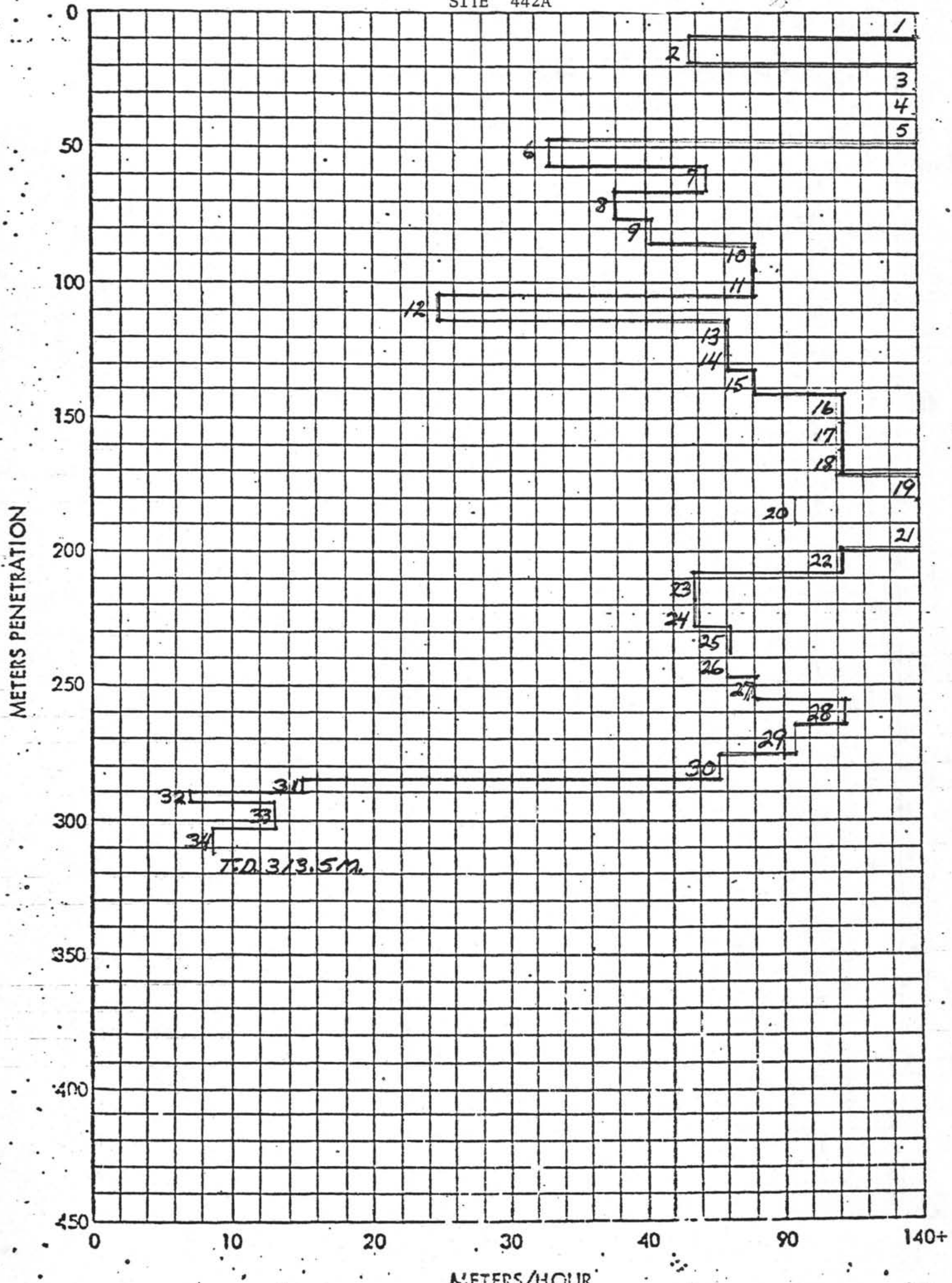
Date	Site No.	Cruise	Trips	Drill	Core	Stuck Pipe	W.O.W.	Position Ship	Mech. Repair	Port Time	Re-Entry	Other	Total Time	Remarks
12/4-11										169.1			169.1	
12/11-13		54.8											54.8	
12/13-18	442		81.5	2.5	1.3			1.8	1.0			11.9	100.0	
12/18-20	442A		8.5		58.2				3.5				70.2	
12/20-27	442B		46.4	8.7	47.9		32.5		1.7		13.3	16.0	166.2	
12/27-28		12.0											12.0	
12/28 01/4			19.0		128.6		7.0	3.7					158.3	
01/4		9.9											9.9	
01/4-5	444		10.5		14.0			1.5				.3	11.5	
01/5-9	444A		11.0	1.0	52.7		21.0					.5	86.2	
01/9-11		61.0										.3	61.3	
01/11-17	445		13.1		124.7			2.4				2.8	143.0	
01/17		8.4										.5	8.9	
01/17-21	446		9.6		79.8			3.6				.1	93.1	
01/21-27	446A		13.0	8.7	95.8		13.5					5.9	136.9	
01/27-30		67.1											67.1	

SITE 442



METERS PENETRATION
0
50
100
150
200
250
300
350
400
450
METERS/HOUR
0
10
20
30
40
90
140+
WASHED
T.D. 66.5 M.

SITE 442A



METERS PENETRATION
0
50
100
150
200
250
300
350
400
450
METERS/HOUR
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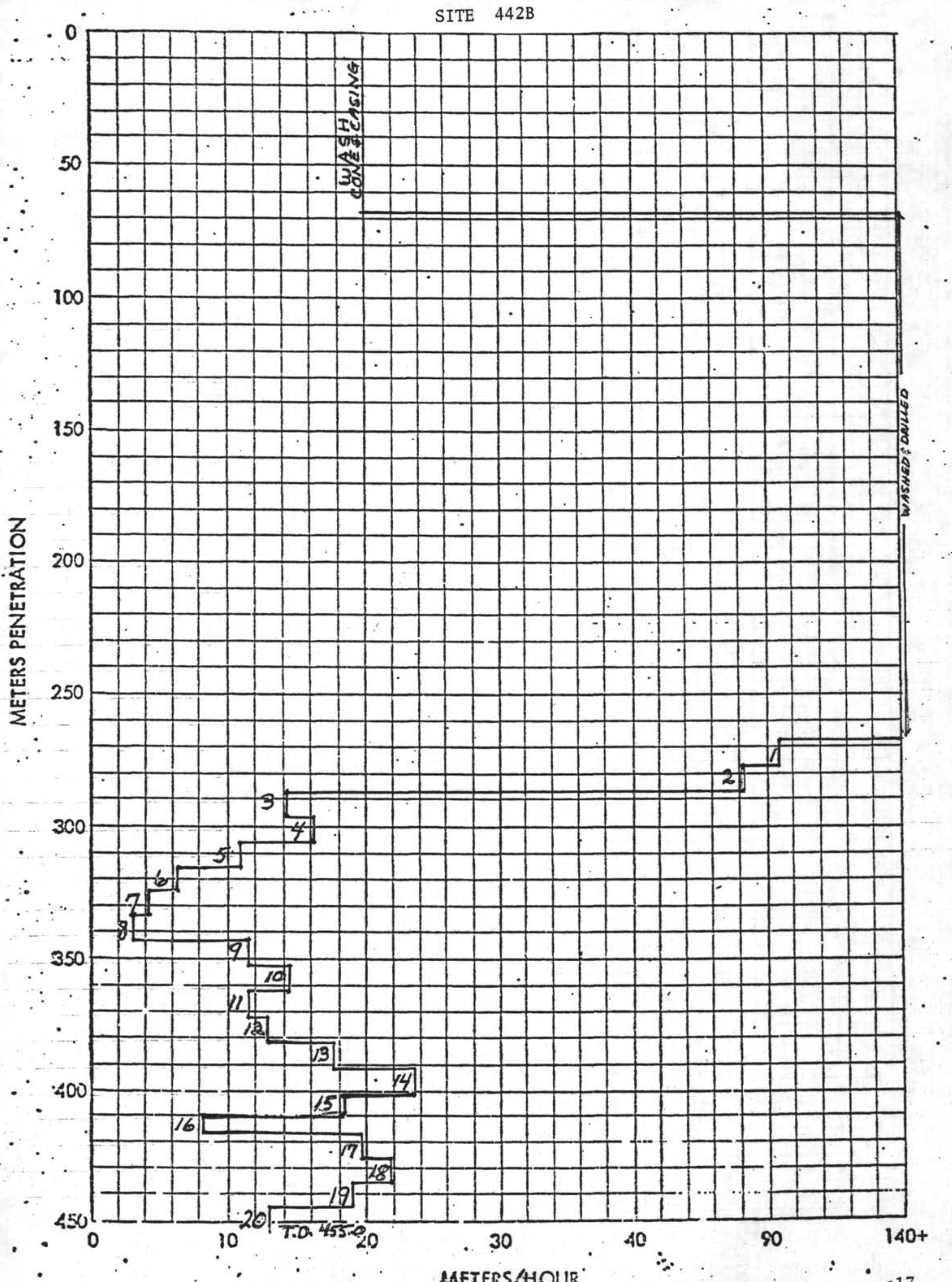
10
20
30
40
90
140+
T.D. 313.5M.


SITE 442B
METERS PENETRATION
METERS/HOUR
WASH CONE & CASING
WASHED & DRILLED
T.D. 455.0
0
50
100
150
200
250
300
350
400
450
0
10
20
30
40
90
140+
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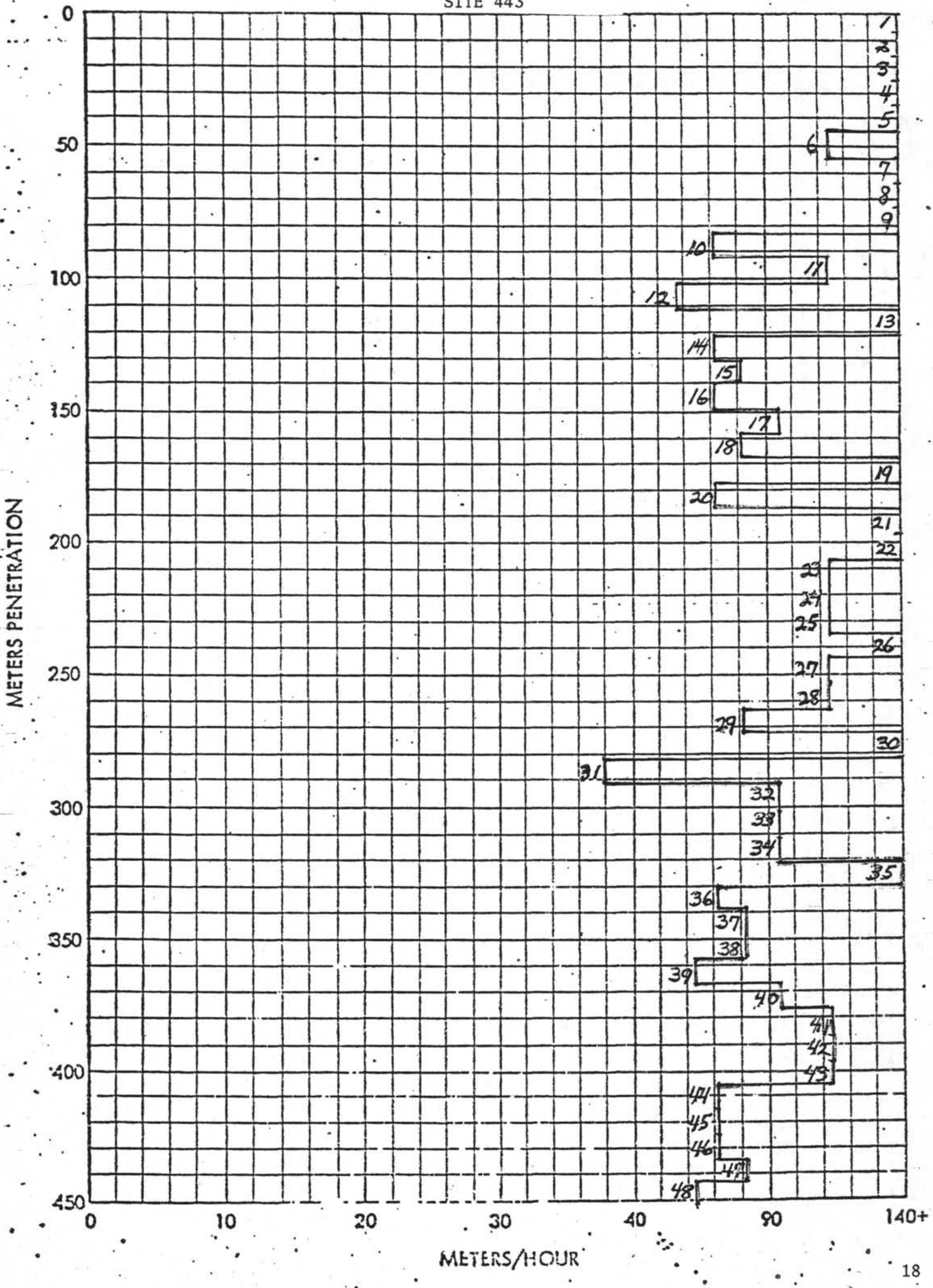
METERS PENETRATION
0
50
100
150
200
250
300
350
400
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METERS/HOUR
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140+
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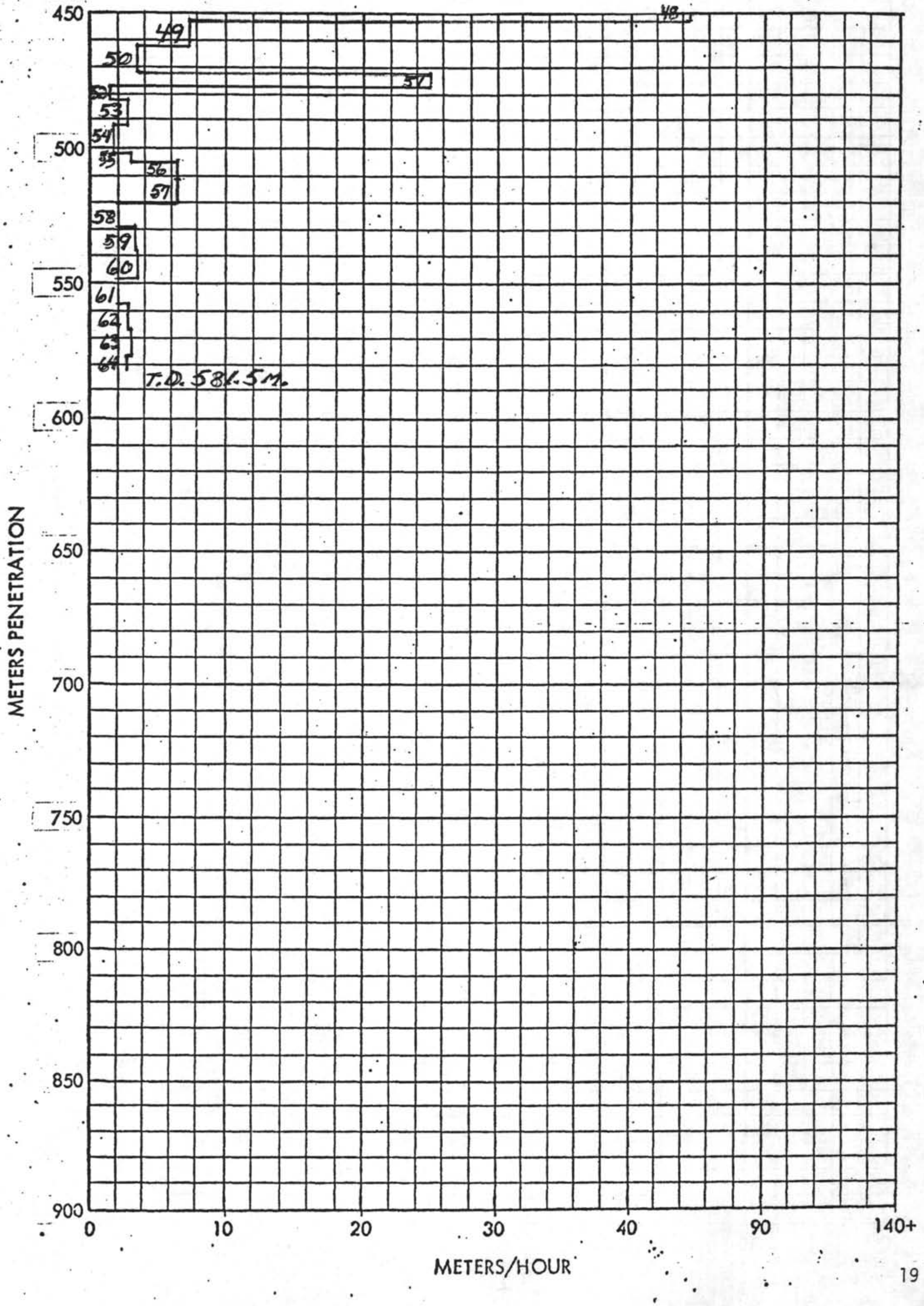

METERS PENETRATION
450
500
550
600
650
700
750
800
850
900
0
10
20
30
40
90
140+
METERS/HOUR
48
49
50
51
52
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54
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56
57
58
59
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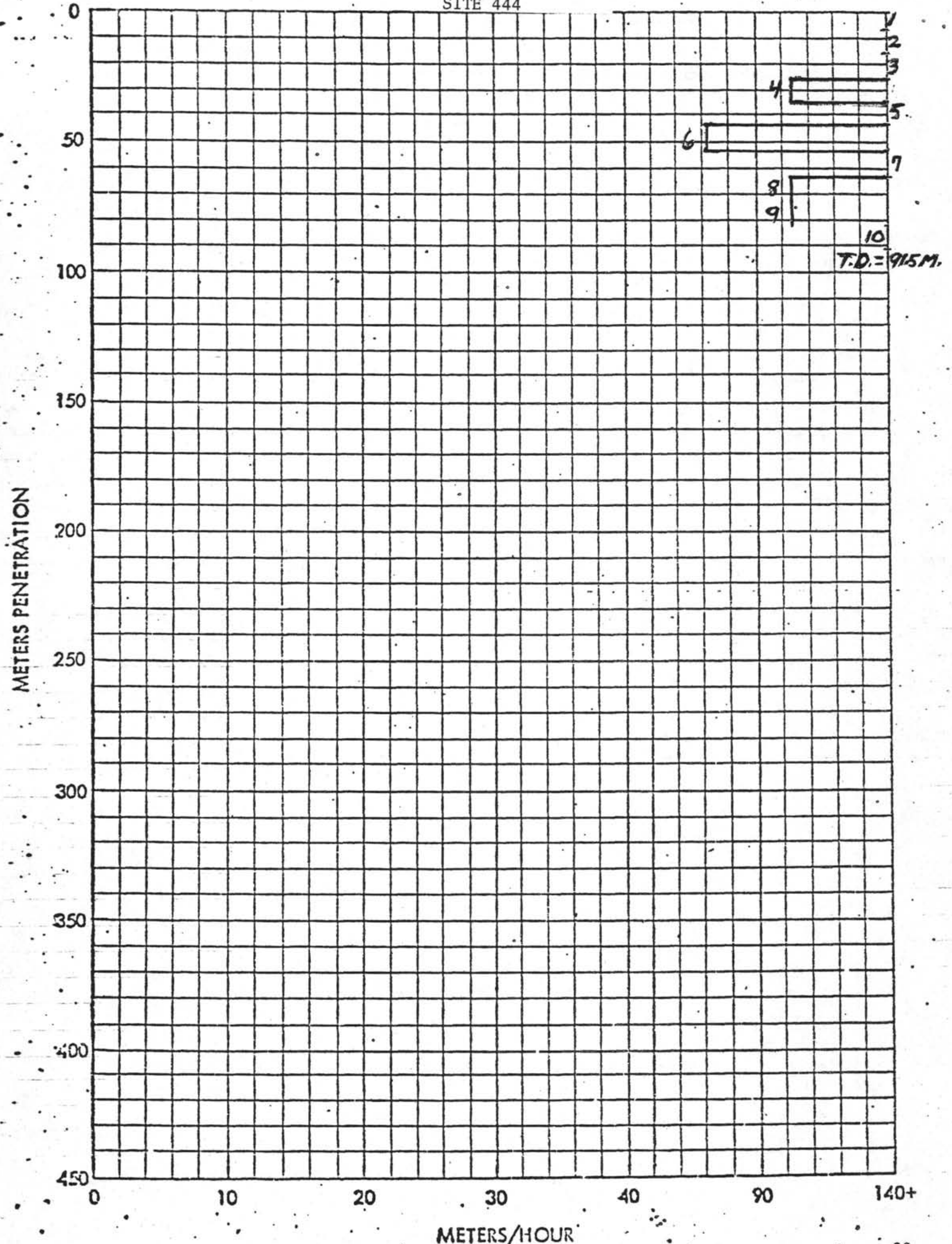
61
62
63
64
T.D. 581.5 M.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200
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450
METERS PENETRATION
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140+
METERS/HOUR
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8
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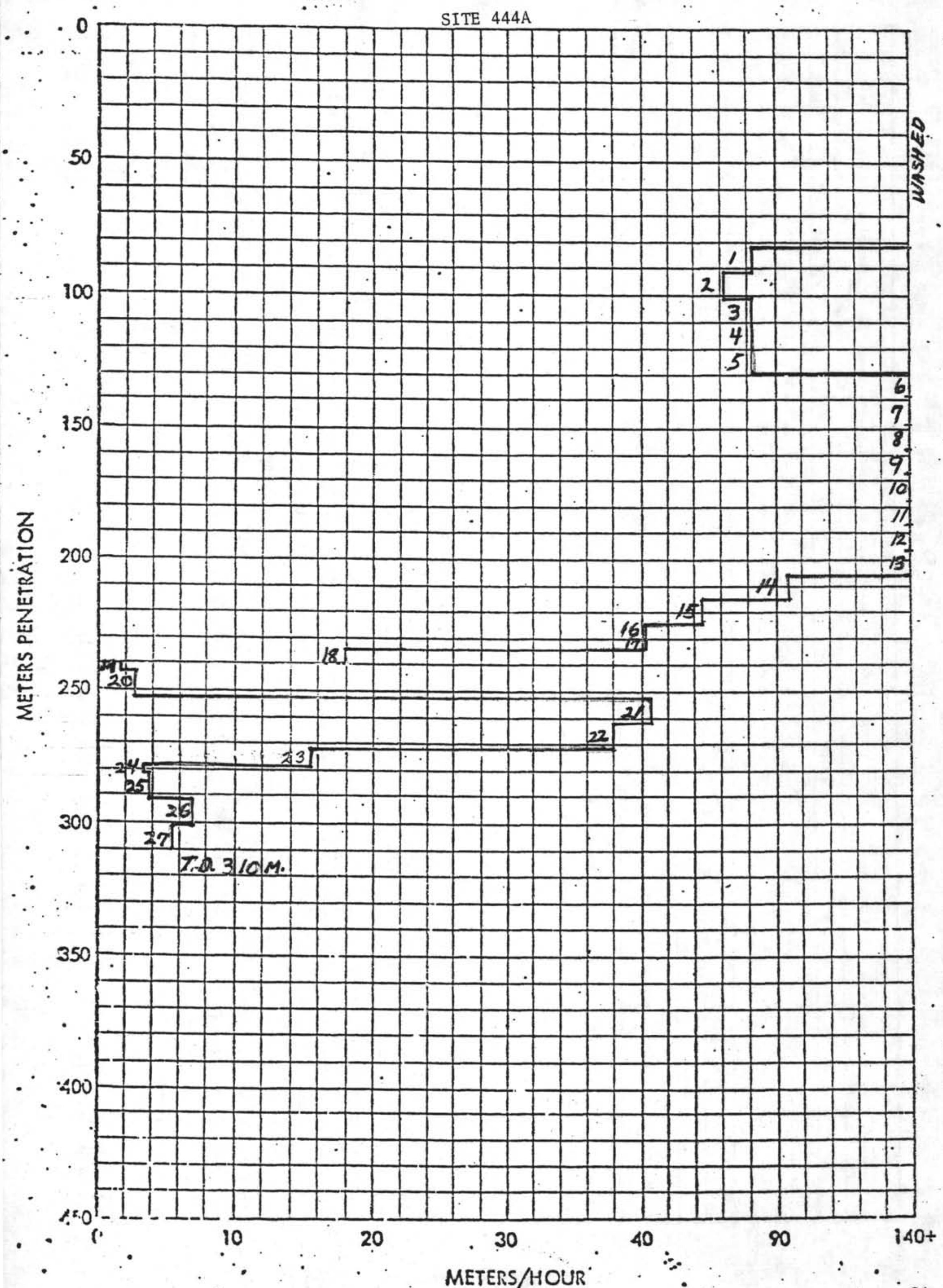
T.D.=91.5M.

SITE 444A



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100
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200
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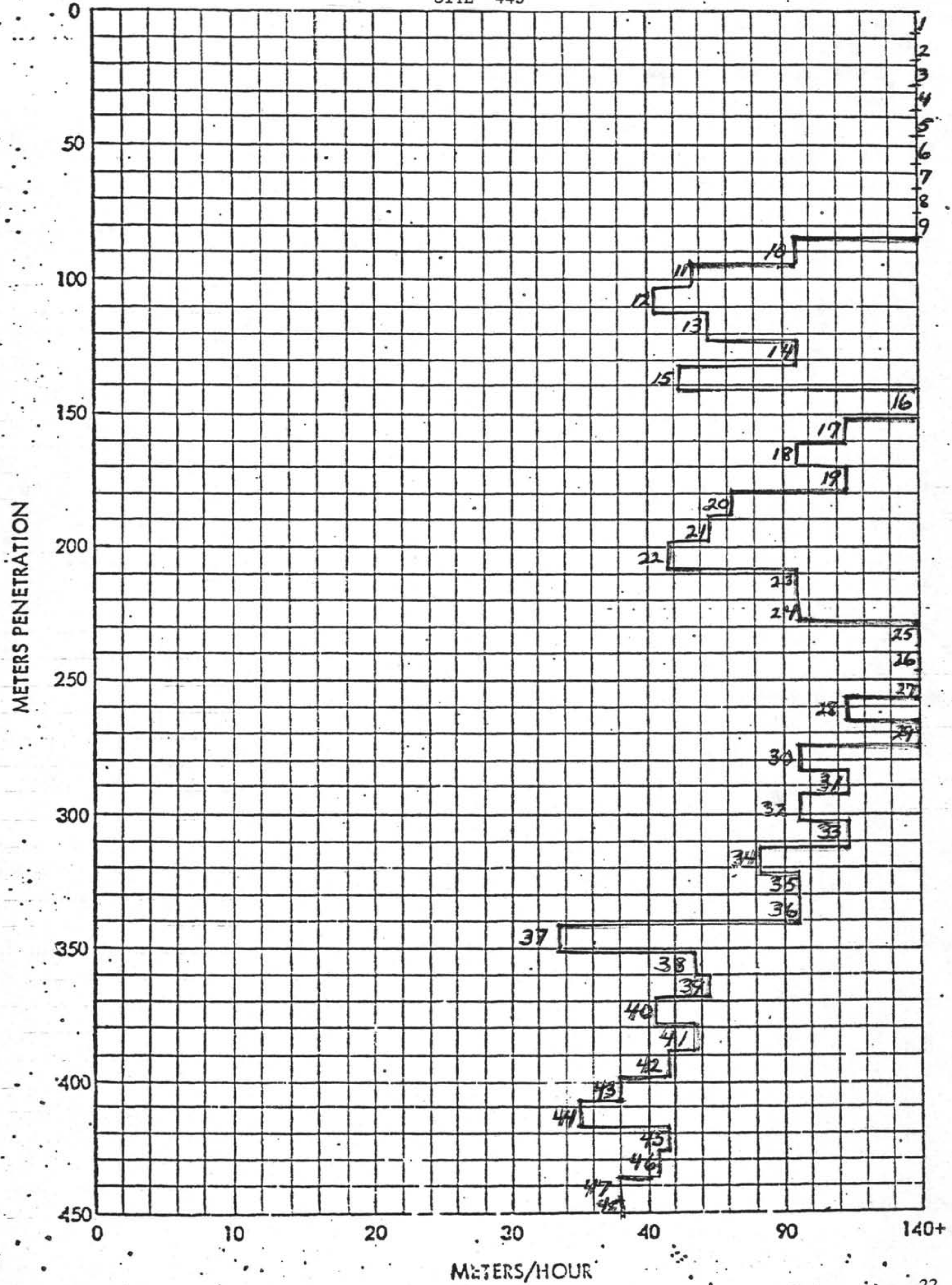
400
450
METERS/HOUR
0
10
20
30
40
90
140+
WASHED
T.D. 310 M.

SITE 445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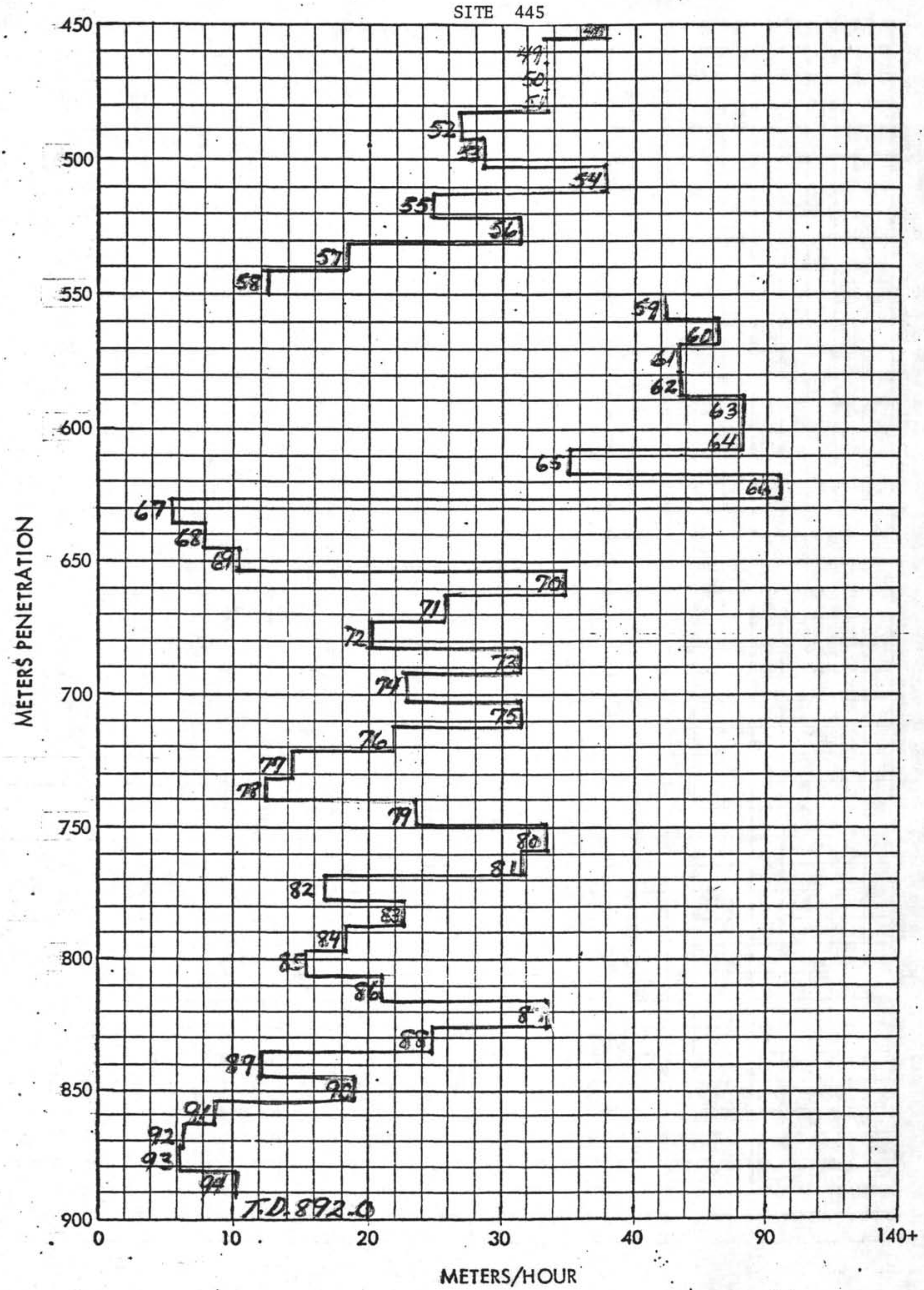
SITE 445



450
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750
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850
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METERS PENETRATION
0
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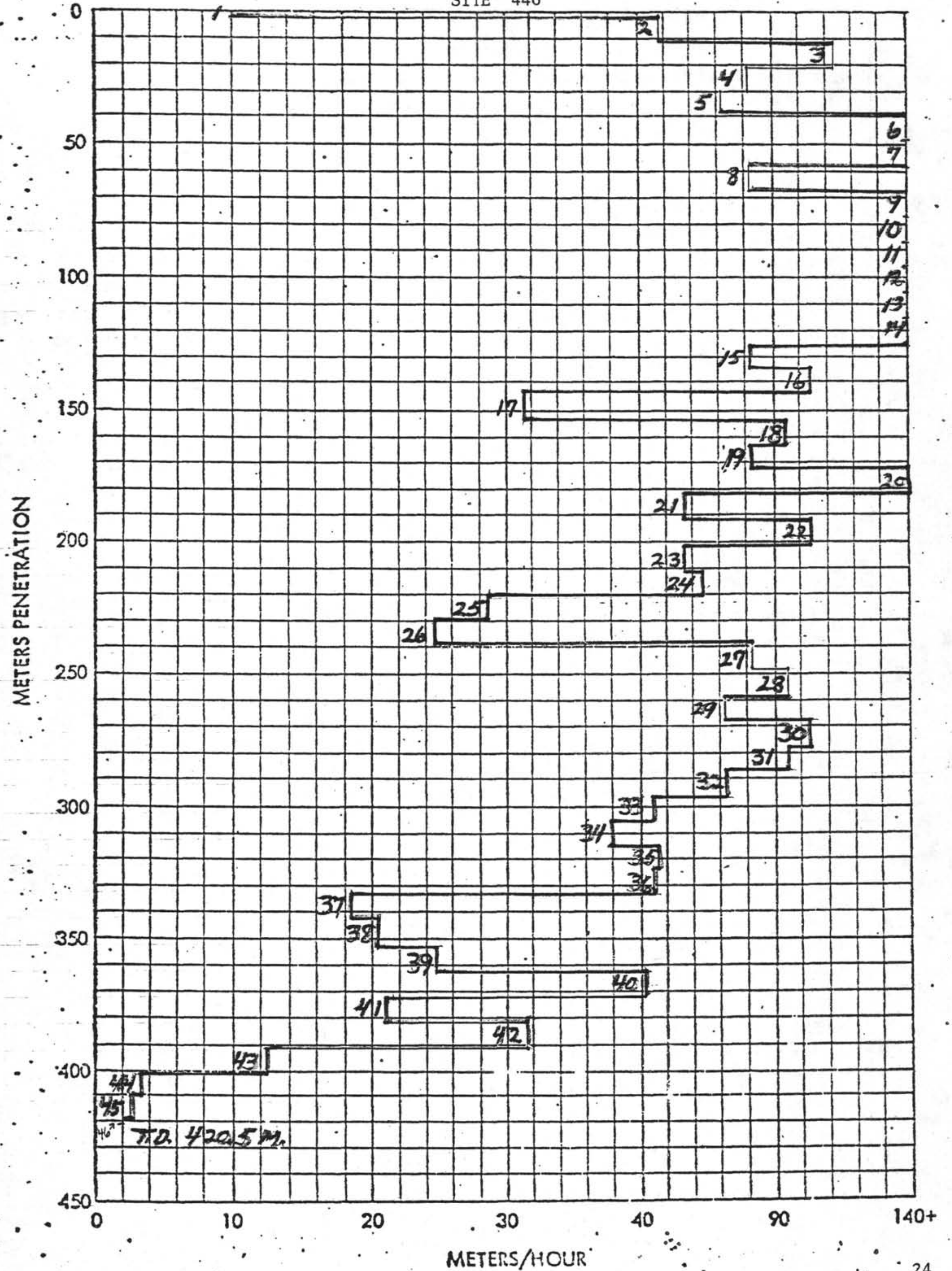
20
30
40
90
140+
METERS/HOUR
T.D. 892.0

SITE 446



METERS PENETRATION
METERS/HOUR
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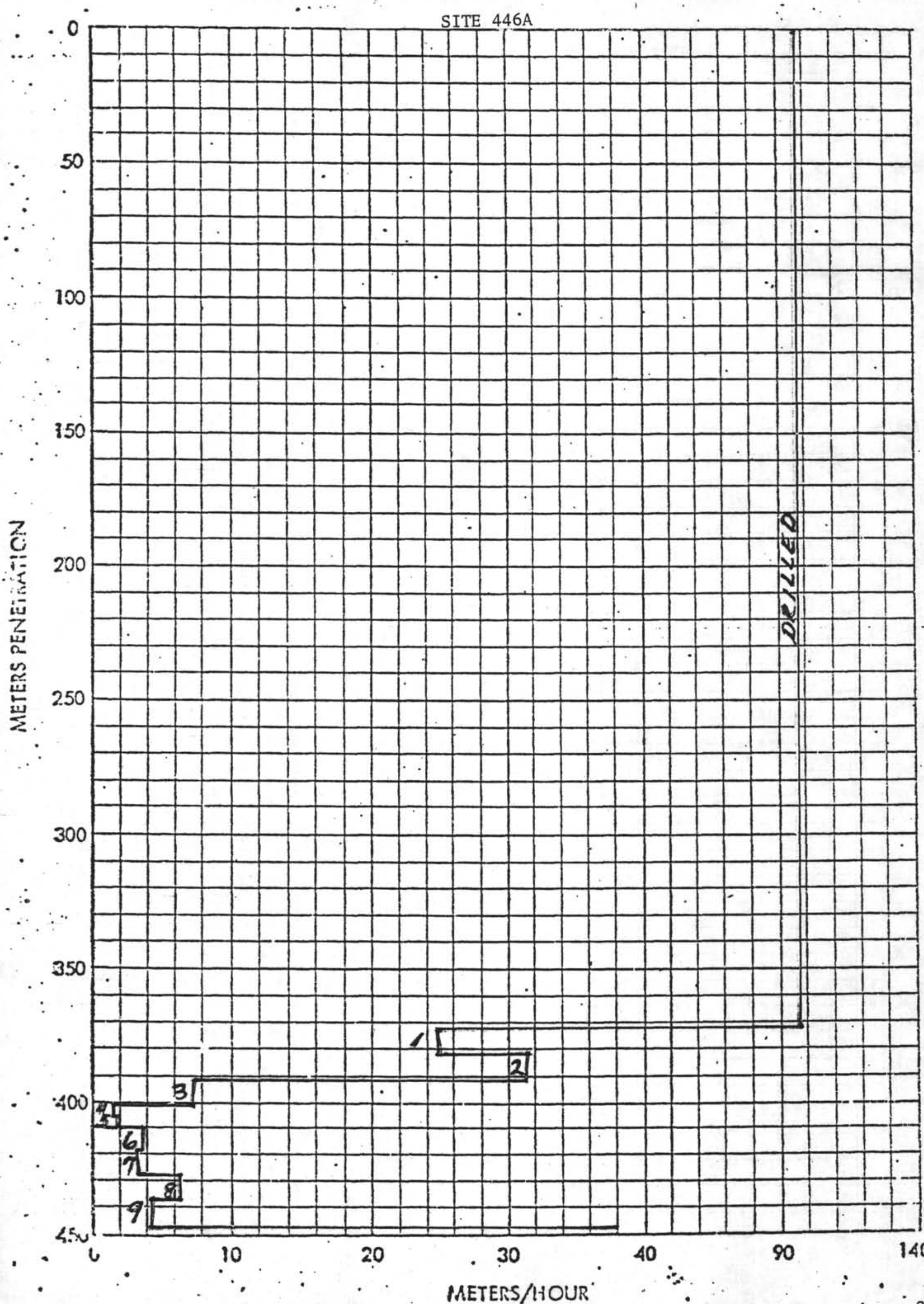
140+
T.D. 420.5 M.



SITE 446A
METERS PENETRATION
0
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METERS/HOUR
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90
140
DRILLED
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3
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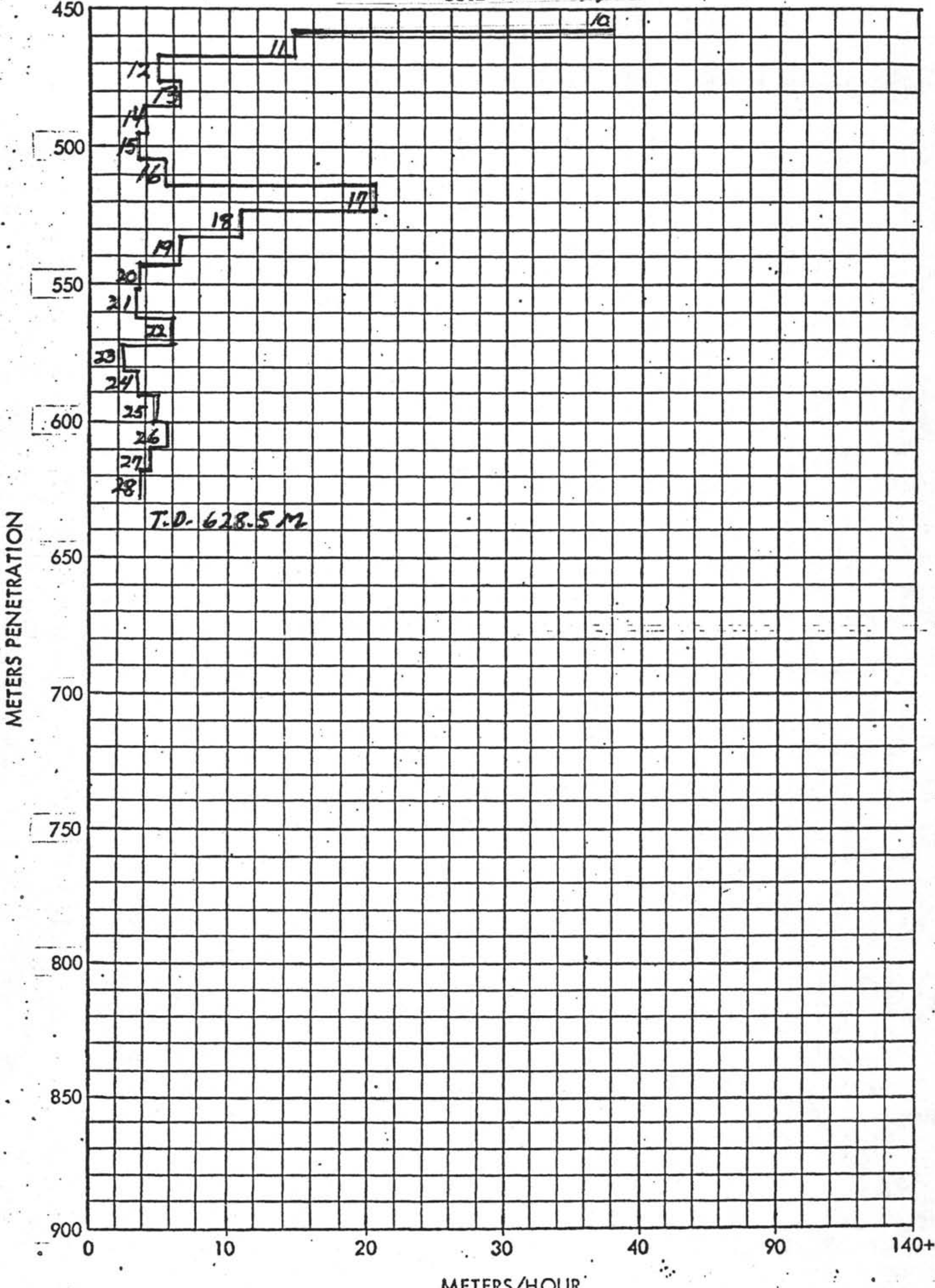
450
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METERS PENETRATION
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METERS/HOUR
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T.D. 628.5 M

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
OPERATIONAL RESUME
LEG 59

Leg 59, of the Deep Sea Drilling Project, was the first voyage of the Project devoted primarily to the investigation of island arcs and inter-arc basins. Scientific objectives of the voyage required the penetration of considerable sections of volcanogenic sediments and basalt. Five drill sites were investigated along a west-east transect of the South Philippine Sea from the Philippine Basin to the West Mariana Ridge. The nature of the volcanic material penetrated was relatively new to the GLOMAR CHALLENGER. Some unexpected problems and successes were experienced and the Project's general knowledge of deep ocean drilling was enriched. Most of the scientific objectives were achieved and the leg was a definite technical success. Some serious mechanical failures occurred but their timing was such that impact on scientific objectives was minimal.

The voyage commenced on January 30, 1978 in Naha, Okinawa, Japan and terminated at Apra Harbor, Guam on March 15, 1978. Although the cruise was a full two weeks shorter than the "standard" DSDP leg, 322 cores were attempted. This compares favorably with the record of 354 cores on a much longer Leg 38. Hole 448A produced a record penetration of 623 meters into volcanic sections below the first basalt flow. In addition, mineralization, as evidenced by native copper, was found in the material recovered from two sites.

Total length of the voyage was 43.9 days, of which 31.4 days were spent on-site, 8.4 days underway and 4.0 days in port. 1.6 days were lost to mechanical breakdowns.

NAHA PORT CALL

The GLOMAR CHALLENGER'S visit to Okinawa was devoted primarily to crew change and routine resupply activities.

Work items included replacement of derrick guide rail supports, repair and strengthening of the upper drill pipe guide horn clamp and overhaul of the engine room main seawater circulating pump. Contents of the port casing rack were offloaded onto the dock to facilitate cleaning and preservation of the rack area and then reloaded.

Fresh water, lube oil, commissary and other expendable supplies were replenished. The backup swivel and power sub assemblies were returned to the vessel following refurbishment.

NAHA TO SITE 447

At Naha, the last line was cast off at 0818 on February 3 and the CHALLENGER departed on a southeastward course into the Philippine Sea. Good weather prevailed during the cruise to the first drilling site and an average speed of 8.1 knots was realized over the 600 miles despite 5.3 hours spent dead in the water due to a main propulsion motor bearing failure.

SITE 447 - PHILIPPINE BASIN

The positioning beacon was dropped at Site 447 (SP-8a) at 0948 on February 6. The drill site was located about 290 miles southwest of Okino Tori Shima Atoll (Parece Vela), 600 miles southeast of Okinawa and 600 miles east of Luzon. Then an additional 1.7 hours was spent profiling beyond the drop point and in returning to the beacon. This was required to ascertain that the correct site had been selected.

The drill string was run to the seafloor and Hole 447 was spudded at 0145 February 7 in 6031 meters of water with a mudline punch core. Although several meters of penetration had been registered by the rig weight indicator, the inner core barrel was recovered with the core catcher jammed with about a quart of small manganese nodules. As only a handful of sediment was obtained, a second punch core was felt to be warranted.

Because the same interval was to be sampled twice, the respud was designated Hole 447A. The new hole was continuously cored to a depth of 296.5 meters below seafloor (BSF). Basalt was encountered at 113 meters BSF and was continuous to total depth.

Hole conditions in 447A were generally quite good and routine 25 barrel mud flushes were employed on alternate cores in the basalt section to keep the hole clean. On one occasion, despite this measure, an accumulation of fine cuttings in the hole filled the inner core barrel, plugged the bit, and nearly stuck the pipe. A fractured and highly altered basalt zone was being penetrated at a relatively rapid rate at the time. It appeared that inadequate hole cleaning could have resulted from fluid loss into the fractures. The situation was resolved after a "short-trip" of nine joints of pipe, cleaning 20-25 meters of fill to total depth and slugging the hole with 100 barrels of drilling mud.

A plugged bit was experienced on one other occasion when an inner core barrel was dropped and could not be pumped down. Normal circulation, however, was regained during retrieval of the barrel. As a piece of dropped basalt core was suspected to temporarily blocking the bit, a core barrel with a chisel core breaker was pumped down and retrieved to ensure the removal of any obstruction.

Gradual reduction of core diameter over the final cores indicated progressive failure of the bit cone bearings. Then excessive torque developed while cutting the 37th core and further operations were precluded. The drill string was pulled and all four roller cones were found to be missing from the bit.

HOLE 448 - PALAU/KYUSHU RIDGE

Site 448 was located about 120 miles southeast of Site 447. The vessel arrived in the area about 0100 on February 13 and commenced presite surveying. The drill site lay in a relatively small sediment pond and precise coordination with seismic profiles of an earlier site survey was essential. Unfortunately the critical seismic line of the earlier survey was misplotted some distance to the west and the CHALLENGER was obliged to spend about five additional profiling hours to locate the drill site.

After the beacon drop and positioning of the ship, the drill string was run to just above the seafloor. The water depth by precision depth recorder was 3493 meters and the core barrel was retrieved after the bit had been lowered to 3498.5 meters. No sediment was recovered, so another 9.5 meter joint of pipe was added and the procedure repeated. Rig weight indication and the position of the core recovered indicated a water depth of about 3503 meters.

About 175 meters of calcareous ooze was cored, which gave way to a sequence of volcanic ash and tuff beds. The first basalt flow was encountered at about 345 meters BSF. The basalt tended to be highly vesicular and the flows alternated with volcanic breccia and ash beds to total depth. Most of the volcanic-derived material, including the basalts, cored poorly and a low recovery rate prevailed. The tendency of the material to disintegrate, however, resulted in a relatively rapid rate of penetration.

On several occasions, empty inner core barrels failed to produce a sufficient pump pressure increase upon arrival at the bit. This indicates an obstruction, probably a core fragment, which prevents the barrel from seating properly and becoming latched down. Bit depluggers were repeatedly employed successfully to dislodge the obstructions.

Although core recovery was low, some core consistently entered the core barrel before the core catcher or liner jammed. On the 62st core, 3.9 meters of good basalt were recovered. Following this, no core was recovered in four attempts over a 28.5 meter interval. Penetration rate and all drilling parameters were normal, except that torque was abnormally low. Two runs with the bit deplugger were followed by unsuccessful core attempts.

It was concluded that some component of the bit or downhole coring equipment was malfunctioning and the hole was terminated due to the inability to recover core. When the drill string had been retrieved. the bit was found to be in excellent condition and no fault was found with the remainer of the coring system.

HOLE 448A

Following the bit change, the drill string was again lowered with the goal of significant additional penetration. This was considered feasible in sight of the fact that the previous bit had penetrated 245 meters of igneous section and was in very good condition after 23.3 rotating hours.

The trip was delayed 2 1/4 hours by mechanical problems with the pipe racker skate air control valving and the second hole at Site 448 was spudded at 1815 hours on February 18. A mudline punch core was recovered. The hole was then drilled ahead with spot cores taken to cover cored intervals with poor recovery on Hole 448. Continuous coring commenced at 4030.5 meters, 57 meters above the total depth of Hole 448. During this period, a total of 18.5 operating hours were lost due to successive failures of both of the ship's Bowen power sub units.

Except for three extra wireline runs occasioned by failure of overshots to engage, no additional operational problems were encountered in continuous coring to a total depth of 914 meters BSF.

Although core diameter and reduced penetration rate indicated progressive bit failure, core recovery was still good when scheduling considerations forced termination of drilling operations.

SITE 449 - WESTERN PARECE VELA BASIN

The next site to be investigated lay about 130 miles to the northeast of Site 448 and 160 miles south southeast of Parece Vela. Headwinds held the average speed to 8.1 knots and the transit was made in 16 hours.

About 3 1/2 hours were spent on presite profiling due to difficulty in locating a sediment pond of sufficient thickness. A locality with marginal sediment thickness was finally located and a beacon was launched. As the ship continued along its track preparatory to retrieving seismic gear, an appreciable sediment thickening trend was noted and a second beacon of alternate frequency was dropped about two miles from the first.

The drill string was then run the the seafloor at the second site. The hole was spudded in 4727.5 meters of water at 1500 hours on February 28. 110 meters of soft pelagic sediments were cored before basalt was encountered. The basalt was found to be badly weathered and rubbly, producing low core recovery and difficult hole conditions.

Torquing and sticking tendencies, plugged bits and up to ten meters of fill began to accompany each core retrieval and pipe connection. Finally, operations were discontinued because of the potential hazard to the drill string and poor prospects for improved conditions.

The drill string was retrieved and the vessel was underway for Site 450 less than 48 hours after beacon drop.

SITE 450 - EASTERN PARECE VELA BASIN

The second Parece Vela Basin site was located about 240 miles due east of Site 449 and 210 miles west of Pagan Island in the Marianas. The freshest winds of the entire cruise were experienced during the transit and average speed was held to 7.2 knots. Some difficulty in navigation was experienced when the site was approached as all navigational instrumentation was temporarily out of commission and the weather was too cloudy for celestial fixes. The LORAN C and satellite navigation units were both restored to service when the ship entered the immediate area of the site. However, no useable satellites were scheduled for several hours and the final approach was made on the basis of LORAN and bathymetry.

The vessel passed over the drill site, reversed course and dropped the beacon on the second pass. A delay of about 1/2 hour was experienced during the retrieval of seismic gear. The handling cable for the 110 cubic inch air gun was found to be severed near its attachment point at the gun and required special handling.

Penetration of the entire sediment section through to basement in the allotted time was dependent upon positioning the ship over the apex of a basement pinnacle visible on the CHALLENGER seismic profile. Therefore, after the ship had taken station over the beacon, it was displaced 900 feet to the east southeast. This matched the PDR depth with that under the seismic array when it passed over the point of minimum sediment cover.

Initial positioning conditions were difficult and about 3 1/2 additional hours were required before the vessel could hold a heading that would reduce roll to a safe level for handling of the drill string. An unexpectedly strong current from the south interacted with 20 knot northeast trade wind and three sets of swells. The initial pipe trip was further delayed three quarters of an hour by difficulties with the pipe racker skate control valve. Hole 450 was then spudded at 0555 hours, March 4, in 4720 meters of water.

Early concern for the bottomhole assembly was generated when very hard streaks of silicified ash were encountered between 18 and 25 meters BSF. The strata were thin, however, and "broke through" rather quickly with rotation.

Coring operations proceeded very smoothly for the remainder of the hole, except for extremely low core recovery through about 60 meters of poorly consolidated ash and tuff beds. No hole problems were experienced.

Core No. 36 was ended after two to three meters of hard drilling. On the attempt to retrieve the inner core barrel, it was found to be stuck in place and the safety release pin on the overshot sheared. At about the same time, one of the main motor bearings of the auxiliary hydraulic unit was discovered to be running rough and hot. Further operation without repair was not possible, as running the bearing to complete failure easily could have damaged the motor shaft and ended drilling capabilities for the cruise. The hydraulic unit powers both the sand-line winch and the power sub. As the bearing replacement would require much more time than could be budgeted to Site 450, there was no choice but to retrieve the drill string and proceed to the next site while repairs were in progress.

The inner barrel was retrieved (no longer stuck) when the outer core barrel reached the rig floor. The core recovered consisted of 2.1 meters of basalt and an equal amount of overlying sediment. Thus, most of the scientific objectives had been attained. Had the breakdown not occurred, however, one or two more cores would have been taken to answer important questions about the basalt occurrence.

SITE 451 - WEST MARIANA RIDGE

The final drill site was situated about 130 miles due east of Site 450. An average speed of 8.1 knots was realized and a brief presite survey was initiated at 1130 hours, March 7, 17 1/2 hours after departing Site 450. The positioning beacon was dropped at 1326 and normal site operations began.

An attempt to retrieve a mudline punch core was made when the core bit had been lowered to 2081.5 meters. Although no weight indication of contact with the seafloor had been noted, this depth was 11.5 meters below the PDR depth. No sediment was recovered. The procedure was repeated with an additional joint of pipe to 2091 meters. On this attempt, 4.2 meters of sediment was recovered and the water depth was established at 2086 meters from the rig floor.

Rather firm volcaniclastic material was encountered at only 38 meters BSF and again there was concern for the BHA as the lower bumper subs were just reaching the seafloor. After a few careful meters, however, somewhat softer material was encountered and the BHA was buried without incident.

Very low core recovery persisted from about 55 to 475 meters BSF in unconsolidated to semi-indurated tuff and ash beds. Numerous variations in technique and coring equipment produced no improvement. Finally increased compaction and induration with depth appeared to augment recovery naturally.

Minor hole problems were experienced at 537 meters and at 641 meters. Both seemed to be the result of excessive cuttings accumulations in the hole. The hole had been kept clean by regular mud flushes in the course of drilling and it was felt that, in these instances, there were "avalanches" of cuttings from the seafloor around the hole or from washouts in the upper part of the hole.

The second cuttings influx occurred during attempts to clear a plugged bit. The altered volcaniclastic material being penetrated had demonstrated a tendency to accumulate in a waxy clay-like mass in core catchers and this repeated jamming had adversely affected core recovery. A similar build-up apparently occurred in the throat and jets of the core bit. The bit deplugger was run and the throat was opened, as indicated by mud pump pressure. The next core barrel apparently failed to seat, however, and even more severe plugging resulted from a three-meter core attempt. Several more wireline runs were required to clear the bit completely and a total delay of 7-1/2 hours resulted.

Normal operations continued until the final operating day of the leg. At a depth of 925.6 meters BSF, core barrel #101 stuck at the bit and three wireline runs (two sheared release pins) were required to retrieve it. A very small lump of altered basalt was found imbedded in the clay-like material jamming the core catcher.

The penetration rate was much lower on the subsequent core and it was decided that the core would be retrieved after four meters were cut to maximize basalt recovery. During the cutting of the core, however, the mud pump pressure increased dramatically, indicating bit plugging.

Core recovery was a disappointing 40 cm, some of which was altered basalt. The amount was insufficient to determine whether the basalt was a large clast or part of a flow.

A last minute attempt was then made to clear the bit and cut one additional core. Pump pressure indicated the bit to be almost completely plugged and the deplugger did not open the throat when it landed at the bit. When the overshot was lowered and engaged the deplugger barrel, several attempts were made to "spud" through the obstruction using the wireline jars, but the deplugger became stuck without reducing the pumping pressure. Attempts to dislodge the deplugger resulted in a sheared release pin.

Operating time had run out and prospects were dim for any additional core. The drill string was retrieved and drilling operations for Leg 59 were concluded.

Upon retrieval, the throat of the bit was found to be solidly packed with pulverized clay and rock for its entire length. The ends of all four cones on the bit had been broken or worn off flush with the ends of the cone bearing shafts. Only the second row of inserts on two of the cones remained to "trim" the outside diameter of the core.

After the drilling equipment had been secured for sea, the vessel got underway for post-site surveying at 1940 hours, March 13. Following departure to the west to stream gear, the site was crossed on an easterly profile. The profile was continued 21 miles to the east and then a southerly course was set for Guam.

SITE 451 to GUAM

Excellent weather prevailed for the cruise to Guam although an opposing current from the south was encountered. The final 290 miles of the voyage was concluded in 35.8 hours. Leg 59 was officially concluded at 0830 hours on March 15, 1978 with the first mooring line over at the Dillingham Shipyard Pier, Apra Harbor, Guam.

DRILLING & CORING EQUIPMENT

The bottomhole assembly employed was of the standard DSDP configuration. This consisted of a core bit, bit sub (with float valve and inner core barrel support bearing), outer core barrel assembly (modified 8 1/4" x 4 1/8" drill collar), three 8 1/4" drill collars, one 5' stroke Baash-Ross bumper sub, three 8 1/4" drill collars, two 5' stroke bumper subs, two 8 1/4 drill collars, one 7 1/4 drill collar, one joint 5 1/2" range three drill pipe. This assembly was used at all sites, except that a second bumper sub was added at the lower location subsequent to the second drill site as a result of the loss of the heave compensator.

By far the most serious problem encountered with drilling equipment was the failure of both Bowen power subs, resulting in 28 1/2 hours of lost time. Both were bearing failures, although different bearings were involved. Both manifested themselves by locking the power sub mechanism without warning. On later disassembly of the unit, the first lockup was discovered to have been caused by excessive wear of the upper auxiliary shaft bearing. The inner race of the upper main stem bearing was also found to be loose and rotating on the stem. Although it had not yet affected operation, it had damaged the stem considerably. On disassembly of the recently rebuilt replacement power sub, the upper main stem bearing was found to have failed as the result of inadequate lubrication. The wrong model oil pump had been installed at the rebuilding facility and the pump shaft was incompatible with its drive fitting. The linkage failed soon after the power sub was put into use and the pump ceased to supply oil to all the upper bearings. The lockup occurred after less than six drilling hours.

Shortly after the main stem bearing replacement had been completed and drilling operations had resumed, a "whistling" sound was noted coming from the power sub. A check revealed that the oil pump (transferred from the other power sub) had failed and that the upper bearings were again running dry. This time the pump failure was found to be the result of compressive end loading of the pump shaft. The method of mounting the pump to the body of the newer model power sub had been changed and the pump shaft was now slightly too long. A rebuilt pump, with proper adaptation, was installed along with an audible oil pressure alarm system.

Air control valves on the pipe racker skate and drawworks throttle were troublesome. Though not a serious problem, they caused nearly three hours of lost rig time.

Inner core barrel equipment caused no problems of consequence, but two close calls occurred. On Hole 448A, while drilling ahead through volcanic breccias and basalt flows, the latch finger shoulder was sheared off and the barrel unseated. This was not unexpected and drilling was stopped as soon as the pump pressure drop was noted. The subsequent core barrel did not seat, however, and it was necessary to pump down a core barrel with a deplugger to clear the throat of the bit. On Site 450, an inner core barrel broke in half at the joint between the two 15-foot sections. The barrel had just been redressed following retrieval of a core and was being laid down on the catwalk ramp. It had been in service for a considerable length of time and the break appeared to be a fatigue failure.

A Baker float valve spring was found to be broken upon retrieval from Hole 447. The valve seal ring broke up and a section was recovered in a core soon after Hole 448A was spudded. The float valve failed to close about half the time while Hole 451 was bring cored, contributing to bit plugging problems. The valve was in good condition when recovered.

CORE BITS

All bits utilized were 9 7/8" Smith F94CK tungsten carbide insert bits. Three bits were run to varying degrees of failure and three were retrieved in relatively good condition. One of the latter is suitable for rerun.

Bits that penetrated long sections of volcanogenic sediments showed the effects of drilling the highly abrasive material. On review, it appears that cone shell abrasion causes the less deeply set inserts near the cone tips to become dislodged. Continued coring results in progressive wearing away of the tips of the cones until they become truncated flush with the ends of the cone bearing shafts. This results in inadequate trimming of core diameter and leads to plugged bits, core catcher jamming and low core recovery. Problems in the lower portions of Holes 448 and 451 are attributed to this wear pattern.

HEAVE COMPENSATOR

The drill string motion compensator was utilized only on initial Site 447. The compensator operated normally, except that a slight hydraulic fluid leak developed around the rings of the compensator piston. The volume of the leak was initially small, but the fluid sprayed from the overflow vent each time the cylinder was closed. The wind carried the fluid (which is toxic, irritating and chemically active) onto the deck house and weather decks. Several personnel slipped and fell on the slickened decks. It became necessary to lock the compensator out of operation for the safety of personnel, topside equipment and paint. However, at times, a vessel heading could be taken that allowed the spray to blow over the side and the compensator was again used. Despite this, the amount of leakage increased steadily and it was finally necessary to secure the unit for the remainder of the voyage.

With the compensator alternately in and out of operation with the vagaries of the wind, it became evident that motion compensation had a significant effect on penetration rate. While generalization should be avoided, there is evidence that the penetration rate was improved by about five minutes per meter at Site 447, where hard basalt was being drilled in very deep water.

DYNAMIC POSITIONING SYSTEM

The ship's positioning system functioned well and dependable for the duration of the leg. On very infrequent occasions, it was necessary to reinitialize the system to overcome an apparent "memory lock" after a heading change or sudden change in weather conditions. At no time did positioning problems or excessive "excursions" pose a hazard to the drill string.

BEACONS

A total of six positioning beacons were launched on Leg 59. Due to an inventory surplus of 13.5 kHz double-life beacons, five of these units were used. One beacon was dropped out of position and was not monitored. The five beacons used for on-site positioning functioned normally and no operational problems were experienced.

ENGINEERING

Only hours after the vessel's departure from Naha, the engineers noted that the pinion end bearing of No. 6 propulsion motor was running hot and failure was imminent. The ship spent a total of about five hours dead in the water for decoupling the motor from the reduction gear unit and for recoupling again after the bearing replacement. In addition, 24 hours were spent steaming at reduced speed on five rather than six propulsion motors.

A fresh water circulating pump was replaced on No. 3 engine during the transit between Sites 448 and 449. As no other engine can be assigned to propulsion motor No. 3, it was again necessary to cruise on five motors for 5 1/2 hours.

On March 4, during Site 450 operations, metal fragments were found in the crankcase of No. 1 ship's service air compressor. Investigation indicated failure of the front end bearing. It was necessary to take the compressor out of service for overhaul and bearing replacement, putting the heavy drilling operations air demand on No. 2 compressor. No time was lost.

While the air compressor was out of service, the end bearing (port side) of the 750 h.p. auxiliary hydraulic unit motor was discovered to be running rough and hot. As further running of the motor would risk damage to the motor shaft, immediate bearing replacement was required. No breakdown time was accrued due to this failure, but it forced the slightly premature termination of drilling operations at Site 450. The major repair effort was undertaken by drilling department personnel with the aid of the engineers and was completed during the transit to Site 451.

NAVIGATIONAL EQUIPMENT

Satellite navigation continued to be the primary means of fixing the vessel's position both under way and while on site. The usual inconvenience of waiting for a satellite to pass in the proper orbit during site approaches was increased by the fact that the operating satellites tended to be "bunched". Three or four satellite transmissions would be received in a short time period (sometimes mutually interfering) and then several hours would elapse before another fix was obtained. In addition, the SAT NAV computer dumped its program on two or three occasions (including the transit to Site 450) and considerable time was lost in troubleshooting and reloading the program. These problems were resolved.

The ship's LORAN receiver was repaired and adjusted during the cruise by the Radio Officer. The vessel was operating in an area of good LORAN C coverage and a considerable number of useful bearings were obtained during the latter portion of the leg. Both of the ship's radar sets failed early in the cruise but each was repaired expeditiously by the Radio Officer.

Some troubleshooting was attempted on the Omega navigation and on the pitometer log. Both systems, however, remained ineffective for the duration of the cruise.

COMMUNICATIONS

Radio propagation conditions were generally poor to fair on the high frequencies (8 to 22 MHZ). This resulted in poor to unreliable message transmission from the ship to Scripps Radio Station WWD. As a result, most outgoing traffic was routed through naval Radio Station NPN in Guam. Incoming traffic, however, could usually be received directly from WWD on 17105 MHZ.

Several commercial phone calls were attempted through Radio Station KMI San Francisco, but only a few were completed satisfactorily due to the unfavorable conditions. Numerous personal phone calls were placed via amateur ham band links in Honolulu and Seattle. This was, ironically, the most reliable means of radio communication available, but federal regulations prohibited any business or official conversations.

WEATHER AND CURRENTS

Weather conditions encountered on Leg 59 could be described as nearly ideal. The prevailing northeast trade winds provided the dynamic positioning system with a relatively constant force to stabilize against. On only one or two occasions did the sea state increase to levels where vessel motion became an operational factor. On two other occasions, north to northwesterly swells were experience which produced operationally marginal ship rolls. On these occasions, the trade winds were too strong to permit the ship to head into the swell.

Currents were very light in the western portion of the operating area and did not become significant to operations until Site 450 was occupied. On the final two sites, a current from the south with a velocity of up to one knot complicated positioning somewhat and slowed progress on the transit into Guam.

PERSONNEL

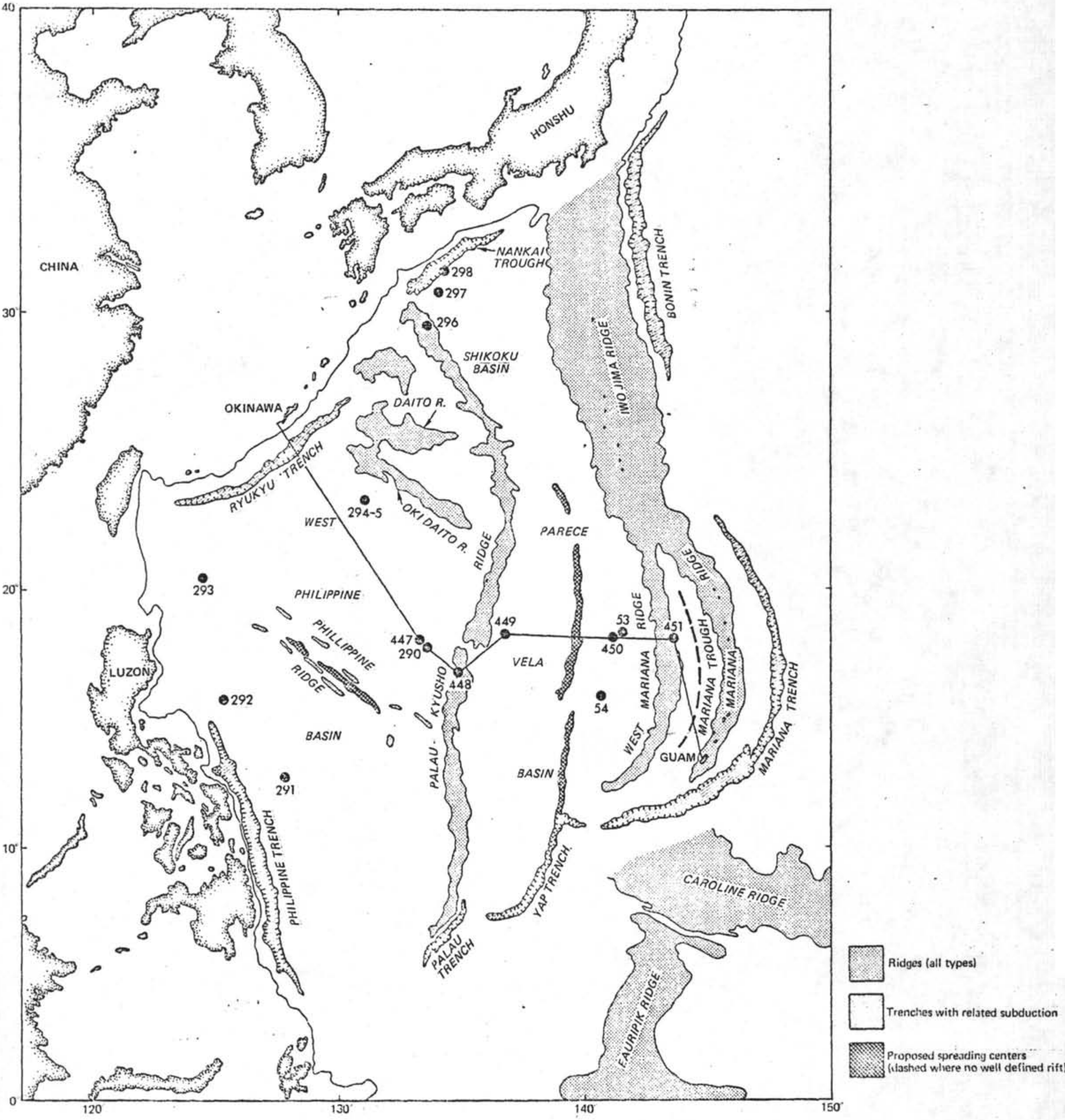
The pace of operations and the good weather combined to keep shipboard morale high and provided little opportunity for boredom. The GMI crew turned in their usual fine professional effort. The drilling and engine room crews deserve particular credit for their efficient efforts in handling major repairs with minimal loss of operating time or scientific objectives. The multinational scientific staff worked harmoniously and handled a very large volume of work under severe time limitations.

One seaman suffered a back injury which resulted in about two days off work. Other than this, no serious injuries or illnesses occurred.

Glen N. Foss
Cruise Operations Manager
Deep Sea Drilling Project

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
OPERATIONAL RESUME
LEG 59

Total Days (January 30, 1978-March 15, 1978)		43.94
Total Days In Port		3.97
Total Days Under Way		8.36
Transit	7.2	
Survey	1.0	
Mechanical Down Time	0.2	
Total Days On Site		31.38
Trip Time (Days)	3.7	
Drilling Time	0.8	
Coring Time	22.6	
Mechanical Downtime	1.3	
Position Ship	0.5	
Hole Trouble & Stuck Pipe	0.2	
Other	2.3	
Total Distance Covered (Nautical Miles)		1643.5
Average Speed (Knots)		8.0
Sites Investigated		5
Holes Drilled		7
Number of Cores Attempted		322
Number of Cores With Recovery		306
Percentage of Cores With Recovery		95.0
Total Meters Cored		2798.5
Total Meters Recovered		1162.1
Percentage Recovery		41.5
Total Meters Drilled		427.5
Total Meters of Penetration		3226.0
Percent of Penetration Cored		86.7
Maximum Penetration (Meters)		930.5
Minumum Penetration (Meters)		9.0
Maximum Water Depth (Meters)		6031.0
Minimum Water Depth (Meters)		2086.0

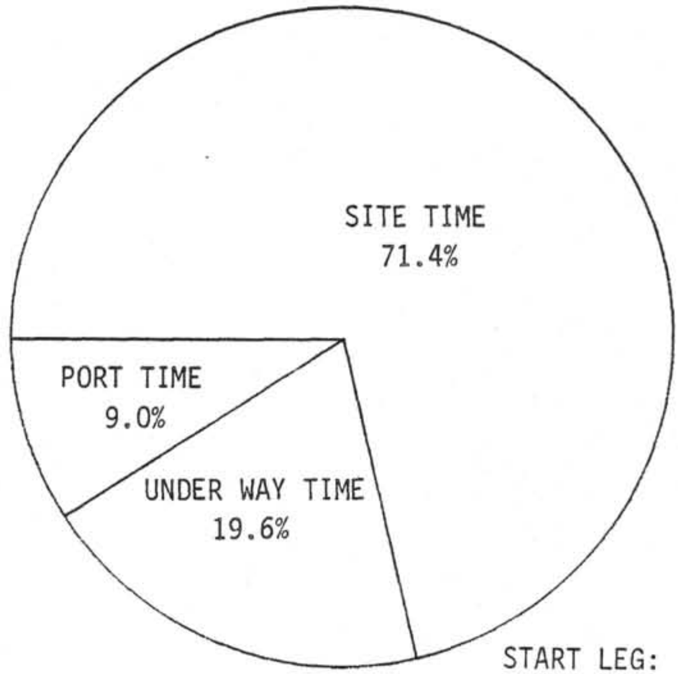


LEG 59 - OPERATING AREA

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT

TOTAL TIME DISTRIBUTION

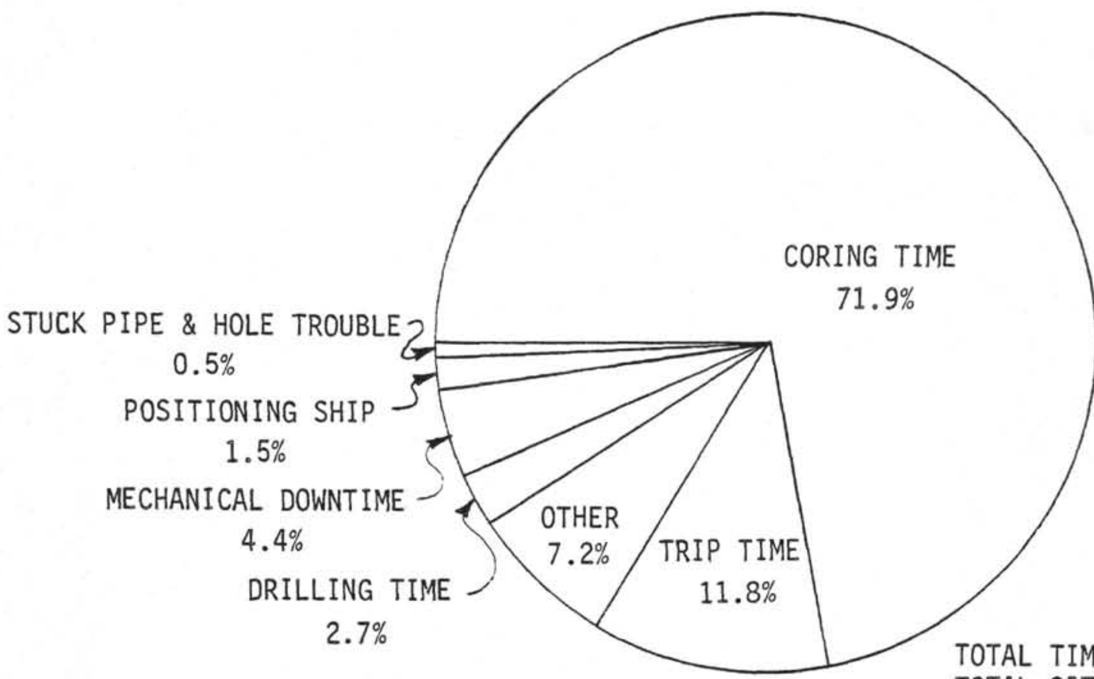
LEG 59



START LEG: January 30, 1978
FINISH LEG: March 15, 1978
TOTAL TIME: 43.94 Days

ON-SITE TIME DISTRIBUTION

LEG 59



TOTAL TIME ON SITE: 31.38 Days
TOTAL SITES: 5
TOTAL HOLES: 7

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
BEACON SUMMARY
LEG 59

SITE	MAKE	FREQ. kHz	SERIAL NUMBER	SITE TIME HOURS	REMARKS
447	ORE	13.5	404	17.8	Double life.
447A	ORE	13.5	404	127.5	Strong for duration.
			Total	145.3	
448	ORE	13.5	366	120.8	Double life.
448A	ORE	13.5	366	216.0	Very good; weakened normally with time.
			Total	336.8	
449	ORE	13.5	403	- - -	Double life; dropped out of position.
449	ORE	16.0	384	46.5	Double life; strong throughout.
450	ORE	13.5	406	74.1	Double life; no problems.
451	ORE	13.5	431	150.3	Double life; strong throughout.

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
BIT SUMMARY
LEG 59

HOLE	MFG.	SIZE	TYPE	SERIAL NUMBER	METERS CORED	METERS DRILLED	METERS TOTAL PENET.	HOURS ON BIT	CONDITION	REMARKS
447	Smith	9 7/8	F94CK	210FE	9.0	- -	9.0	- -		
447A	Smith	9 7/8	F94CK	210FE	296.5		305.5	43.0	B8LC-0 3/16	39.9 hrs & 180 M in basalt - all cones gone.
448	Smith	9 7/8	F94CK	942FE	584.5	- -	584.5	23.3	T1-B1SE-I	17 3/4 hrs & 245 M in basalt, volcanic breccia & tuff; spear points gone.
448A	Smith	9 7/8	F94CK	088FF	705.0	209.0	914.0	78.4	T1-B7SF-0 1/16	95.8 hrs & 623 M in basalt, volcanic breccia & tuff; 3 loose cones.
449	Smith	9 7/8	F94CK	087FF	151.5	- -	151.5	6.3	T0-B4-I	2 cones handy; one semi-locked.
450	Smith	9 7/8	F94CK	156FF	340.0	- -	340.0	6.6	T0-B1-I	Good for rerun.
451	Smith	9 7/8	F94CK	050FF	930.5	- -	930.5	40.1	T4-B1SE-I	Apexes of all cones gone. Drilled no solid basalt

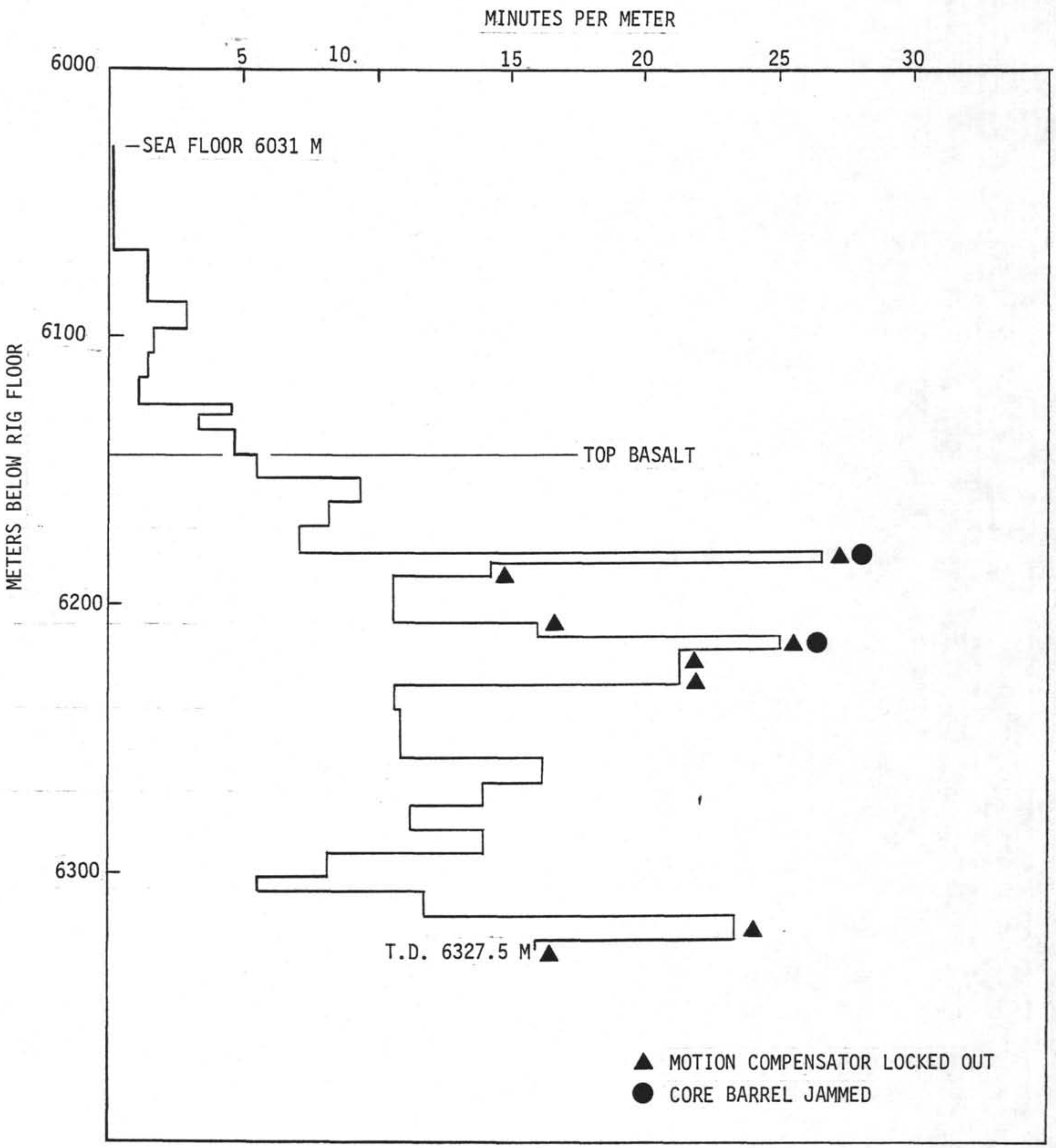
INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
SITE SUMMARY
LEG 59

HOLE	LATITUDE	LONGITUDE	WATER DEPTH METERS	NUMBER OF CORES	NO. OF CORES WITH RECOVERY	PERCENT OF CORES WITH RECOVERY	METERS CORED	METERS RECOVERED	PERCENT RECOVERED	METERS DRILLED	TOTAL PENET METERS	AVG. RATE PENET M/HR	TIME ON HOLE HR	TIME ON SITE
447	18° 00.88'N	133° 17.37'E	6031.0	1	1	100.0	9.0	0.4	4.4	- -	9.0	- -	17.8	- -
447A	18° 00.88'N	133° 17.37'E	6031.0	37	36	97.3	296.5	155.0	52.3	- -	296.5	7.1	127.5	145.3
448	16° 20.46'N	134° 52.45'E	3503.0	65	57	87.7	584.5	235.3	40.3		584.5	25.1	120.8	- -
448A	16° 20.46'N	134° 52.45'E	3503.0	63	63	100.0	486.5	214.6	44.1	427.5	914.0	11.7	216.0	336.8
449	18° 01.84'N	136° 32.19'E	4727.5	18	18	100.0	151.5	93.4	61.7	- -	151.5	24.0	46.5	46.5
450	18° 00.02'N	140° 47.34'E	4720	36	35	97.2	340.0	183.3	53.9	- -	340.0	51.3	74.1	74.1
451	18° 00.88'N	143° 16.57'E	2086	102	96	94.1	930.5	280.1	30.1	- -	930.5	23.2	150.3	150.3
			TOTALS	322	306	95.0	2798.5	1162.1	41.5	427.5	3226.0	16.3	- -	753.00

DEEP SEA DRILLING PROJECT
TIME DISTRIBUTION
LEG - 59

Date	Site No.	Cruise	Trips	Drill	Core	Stuck Pipe	W.O.W.	Position Ship	Mech. Repair	Port Time	Re-Entry	Other	Total Time	Remarks
1/30/78 2/3/78										95.3			95.3	In port Naha, Guam
2/3-6		68.2							5.3				73.5	Naha to Site 447
2/6-7	447		12.4		1.9			1.8				1.7	17.8	Site 447
2/7-12	447A		11.5		106.3	1.0						8.7	127.5	Site 447A
2/12-13		19.6											19.6	447 to 448
2/13-18	448		11.9		92.4			1.6				14.9	120.8	Site 448
2/18-27	448A		14.3	20.5	140.2	0.2		0.6	30.9			9.3	216.0	Site 448A
2/27-28		21.9							0.3				22.2	448 to 449
2/28/78-3/2/78	449		14.3		28.2	1.1		1.3	1.0			0.6	46.5	Site 449
3/2-3		35.6											35.6	449 to 450
3/3-6	450		14.5		51.2	0.4		4.8	1.2			2.0	74.1	Site 450
3/6-7		19.5											19.5	450 to 451
3/7-13	451		9.5		121.2	1.3		1.1				17.2	150.3	Site 451
3/13-15		35.8											35.8	451 to Guam
TOTALS		200.6	88.4	20.5	541.4	4.0		11.2	38.7	95.3		54.4	1054.5	

HOLE 447A DRILL TIME



INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
OPERATIONAL RESUME
LEG 60

Leg 60 was involved in the drilling of the eastern portion of an east-west transect of the South Philippine Sea, Marianas Arc, begun on Leg 59 and was concerned. with the most recently active portion of this area.

Most of the scientific objectives of the leg were achieved and a major technical accomplishment was the successful recovery of cored material while operating in a record setting water depth of 7044 meters. The leg was also successful in recovering cored material using the longest drill string used to date and in successfully operating in the deepest water ever attempted by the CHALLENGER.

The leg began on March 15, 1978 at Apra, Guam and ended at the same location on May 15, 1978. A brief port call was made at Janapal Harbor on the Island of Saipan to disembark an injured crewman, a scientist and also take on supplies, particularly some drilling equipment needed to complete the objectives of the leg.

During Leg 60, the GLOMAR CHALLENGER traveled 2445 nautical miles and attempted to drill 17 holes at 10 sites. These holes ranged from a very short 3.5 meters, at Site 452, when the inner core barrel unscrewed and the string had to be pulled to 691.5 meters at Hole 459B. Water depths ranged from 2647.0 meters to the record setting 7044 meters at Hole 461A. A total of 2716 meters of coring was attempted with 832.99 meters (30.6%) being recovered.

Time distribution for the leg was 7.11 days in port, 12.08 days cruising and 41.96 days on site. The on-site time consisted of 11.13 days tripping, .09 days drilling, 22.08 days coring, .67 days waiting on weather, 1.52 days positioning the ship, .08 days of mechanical downtime, and 6.39 days for miscellaneous work, such as running the downhole logging equipment and the Institute of Oceanographic Sciences resistivity experiment.

PORT CALL

The port call at Apra, Guam lasted for six days and involved considerable work. While the normal onloading of supplies was being accomplished, the active drill pipe was Sonoscoped (magnetic flux leakage inspection) and previously found suspect joints were optically (Borescoped) and ultrasonicly inspected for final grading.

A new weather antenna was installed on the foundation of the previous antenna. A new logging van (workshop) for storing and working on downhole logging tools was installed on the main deck forward under the pipe rack. Logging tools and necessary surface recorders were then loaded.

Calculations had shown a need to use new drill pipe at the top end of the drill string on the deep water investigation planned for the leg, therefore, Grade Two drill pipe, stored in the tween deck area, was offloaded on the dock so the 101 joints of new pipe could be brought out and placed in service. The Grade Two pipe was then put back. While this was being done, both Bowen power subs were disassembled and reworked with new parts installed where necessary. The heave compensator was also disassembled and no scoring was found in the bore of the heave compensator cylinder. New rings and packing were installed and the hoses were replaced.

The ship was shifted to a fuel dock on March 28 and took on 228,685 gallons of fuel. When all the work was finally completed on March 21, the ship departed for Site 452. The last line was off the dock at 1812 hours.

DRILLING AND CORING ASSEMBLIES

Two different bottomhole assemblies were used on this leg. The more or less standard assembly was used on Holes 452, 452A, 453, and 455. This consisted of the bit, bit release sub, top connector, one 8-1/4" drill collar, top conversion 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, crossover sub, one 7-1/4" drill collar, and one joint of 5-1/2" drill pipe. A variation of this was necessary after losing two top connectors for the bit disconnect set up. At Holes 457, 458, 461, and 461A, no bit disconnect set up was used and a regular bit sub was used in its place. On Holes 457, 458, 459, 459A, 459B, 460, 460A and 461A, another change was made in the top stand of collars. The last remaining 7-1/4" drill collar was lost at Site 456 when it became necessary to shoot off the bottomhole assembly. An 8-1/4" drill collar was then substituted for the 7-1/4" drill collar in the holes remaining.

Still another assembly was used on Holes 454, 454A, 456, 456A. It consisted of bit, bit disconnect sub, top connector, core barrel, top sub, head sub, three 8-1/4" drill collars, one 5' bumper sub, two 8- 1/4" drill coloars, crossover sub, one 7-1/4" drill collar, one 5-1/2" R-3 joint of drill pipe.

The bit release sub was run to provide an opportunity for downhole logging.

BITS

Two F94CK bits were used on the first three holes drilled. The first of these was lost when part of the bottomhole assembly was found broken off after 28 meters of penetration. The second was released after the bit had apparently worn out so that the hole could then be logged.

The remaining 14 holes were drilled using F93CK bits. This change was made to assure that there would be enough F94CK bits onboard to drill a planned major reentry hole on Leg 61. A hoped for shipment of new bits could not be expedited for Leg 61. The two bits recovered were in good shape after 23.5 and 8.18 hours respectively.

BEACONS AND POSITIONING

Ten beacons were used on this leg, three 16.0 kHz double life, two 16.0 kHz single life, four 13.5 kHz double life and one 13.5 kHz single life. All performed well. Dynamic positioning was very good. On the last two sites, where the water depths were 6454, 7039 and 7044 meters respectively, the gains were increased. This was required to maintain a signal level that was acceptable and was accomplished with no trouble. Weather created no positioning problems on this leg.

COMMUNICATIONS

Due to poor propagation conditions in the high frequencies, during the working hours of WWD, most of the traffic to and from the project base was handled via the Navy's secondary circuit. That is, the GLOMAR CHALLENGER sent traffic direct to a Navy station, usually at Guam, with an occasional message to the Navy station in northwest Australia, which in turn placed the traffic into their secondary circuit and sent it to the Long Beach Coast Guard Station, which in turn sent the message to WWD via teletype and then WWD would distribute the traffic. Incoming traffic came from the Navy station at Guam on their automatic sending system and was copied on the GLOMAR CHALLENGER. The method is slow and an occasional message would go astray but by the serial number system it could be recovered. The Navy secondary circuit is greatly appreciated and has been a great system for the Project. Especially with the limited hours of operation of WWD. Radio propagation conditions were very good during the night hours when Radio Station WWD was closed and if the need really arose, traffic could be conducted directly. Conditions expect to improve soon and again we will be in direct contact with WWD which is the best method for the Project.

No commercial radio-telephone calls were made from the GLOMAR CHALLENGER to the United States, however, two calls were made to Australia. Several personal messages were sent via the U. S. Coast Stations with good contacts during their night hours. Many personal radio-telephone calls were made via the amateur radio station aboard the ship with very satisfying results from a helpful amateur station in Honolulu, Hawaii.

ELECTRIC WIRELINE LOGGING

Downhole logging was conducted again on this leg with tools and operations personnel supplied by a new vendor to us, Gearhart-Owens Wireline Service. Logging was attempted at three sites and was successful on two of these.

The drill string was assembled with a bit release set up on all sites with the exception of 457, 458 and 461. When both of the bit releases had been lost, an additional unit was picked up in a short port stop in Saipan and the logging capability was then restored. The disconnect assembly was not run at Site 461 due to the deep water (7000 m) and the uncertainty of the amount of sediment that had been deposited.

Site 453 was the first logging attempt. After the bit was released, the pipe developed some sticking tendencies so a circulating head was installed and the pipe was washed down three joints. While washing, the drill string showed a weight loss of 35,000 pounds (approximately BHA weight).

When the first logging tool was made up and run, it stopped short of the bottom of the pipe and required a 600 lb overpull to start it moving up again. It was then lowered carefully and stopped again. It was suspected that the drill pipe had become bent so further logging was discontinued. When the pipe was recovered, a bent joint of pipe was found three joints above the BHA.

After Hole 454A had been drilled as deep as possible (the pipe had begun sticking), the bit was pulled above the bad part of the hole and the bit released. The drill string was pulled to 3911 meters, the logging sheaves were rigged, and the Induction-Gamma Ray, Compensated Density, Deep Laterolog, B.H.C. Sonic and Differential temperature logs were run through the interval 3911.5-3977.0 meters. This required about 24 hours and was followed by a resistivity experiment which took another nine hours.

The next hole logged was 459A and here the same logs were run through the interval 4239.2-4621.4 meters. Logging was available for the other holes on the leg but could not be run because of poor hole conditions.

All of the Gearhart-Owen (GO) equipment worked well with the exception of one sonic tool. In general, the tools and the people operating them were excellent.

SITE 452 - HOLES 452, 452A

The first site to be investigated on Leg 60 was located approximately 350 miles northeast of Guam. A 13.5 kHz double-life beacon was dropped at 1358 hours on April 23 at the proposed location and at 1546 hours, the ship was positioning in the automatic mode with a 1000 foot southerly offset from the beacon. This offset was used to obtain the b-st geologic results as interpreted from the geophysical data available. The running of the drill string 3as then commenced.

The PDR (Precision Depth Recorder) indicated a bottom depth of 5868 meters. However, while running in, the seafloor was encountered at 5838 meters. The Bowen sub was picked up and a mudline core was cut but when the overshot was lowered, the core barrel could not be retrieved and the shear pin was sheared. This was replaced on the next trip and the core barrel was recovered but required a pull of about 13,000 pounds.

The next core barrel was dropped and it appeared to seat properly with onoy a slight variation in what the proper pressure should have been. Core No. 2 was recovered after some difficulty but no pins were sheared. Core No. 3 also showed only a slight variation in the expected pressure build up when the barrel landed. However, the core barrel could not be recovered after cutting the core and after two pins were sheared, it was decided to pull the drill string.

When the string was recovered, the bit, bit release sub, top connector, outer core barrel and two 8 1/4" drill collars were missing. The inner core barrel was protruding from the next drill collar where it was wedged in the bent pin of the collar. Apparently this was the same place the core barrel had landed and Cores No. 1 and No. 2 were taken.

This loss was apparently due to an error in pipe measurement and when the pipe ran into bottom, it broke off. With careful measurements on the next hole, the location of bottom agreed with the PDR readings.

HOLE 452A

A new bottomhole assembly was made up and the drill string run again. This time the pipe was measured before it was run and a mudline core indicated bottom to be at 5872.5 m which confirmed the PDR measurement. Continuous coring then began but after four cores had been cut to a depth of 37 meters, chert was encountered. Core No. 5 required 30 minutes to cut and when the barrel was dropped to cut Core No. 6, 50 minutes of rotating time were required to reach the total depth of Core No. 5. Torquing had increased greatly and as only about one third of the BHA was buried, it was necessary to abandon the hole to protect the drill string and the one remaining top connector for the bit release system. This latter piece of equipment was vital to the planned logging program scheduled for Leg 60 and had to be preserved if possible. The drill string was pulled and the site abandoned and 0415 hours on March 27, 1978.

SITE 453

After abandoning Hole 452A, the ship steamed westerly approximately 225 miles before dropping a 16.0 kHz double-life beacon at 1318 hours on March 27 for Site 453.

The drill string was made up and run to bottom. The mudline core established bottom at 4703 meters which was the same depth as recorded by the PDR. The hole was continuously cored to a total penetration depth of 605.0 m subbottom. Relatively soft rocks consisting of ashes and ashy mudstone were cored to about 455 meters where hard, dense gabbro and breccia was encountered. This continued to total depth. After reaching total depth, 150 barrels of mud was circulated to clean the cuttings out of the hole. A shifting tool was then run and the bit released which made it possible to carry out a logging program.

While the pipe was being pulled up hole some torquing and sticking developed. A circulating head was installed and the pipe was washed down three joints. While this was being done, the bit took about 35,000 pounds of weight.

When the first log reached a depth of 4677.5 meters, it stopped and required about 600 pounds of overpull to move it. The tool was then lowered carefully and again it stopped at 4677.5 meters. It was concluded that the drill pipe must be bent so the tool was pulled. The drill string was also recovered. When it was first picked up, the hanging weight was 325,000 pounds or about 50,000 pounds lighter than it should have been, but the weight increased to 450,000 pounds before it could be moved and reverted to its normal weight of 375,000 pounds. When the third joint above the BHA was pulled to the derrick floor, it was found to be bent and this had caused the logging tool to stop. The balance of the string was in good condition but the site was abandoned at 0942 on April 4.

SITE 454

Site 454 was located approximately 50 miles east of Site 453. After steaming about 10 hours, a 16 kHz double-life beacon was dropped at 1940 hours on April 4, 1978.

The drill string was made up and the hole was spudded at 0720 hours on the fifth of April. The mudline was found to be at 3828.5 meters and then three more cores were cut and recovered. A heat flow experiment was conducted and followed by one more core. At this point, due to rapidly changing sea conditions, it was decided to stop drilling, pull out of the hole and wait for the weather to improve. Therefore, Hole 454 was abandoned at 1636 hours, April 4, 1978 when the pipe was pulled above the mudline.

HOLE 454A

Excessive rolling of the ship, up to 13° while tripping out the drill pipe from Hole 454, required that only one stand per hour be pulled. This procedure to protect the drill string was necessary for a 16-hour period before routine tripping could be resumed.

Hole 454A was spudded at 1218 hours on April 6. After the first core, three joints of pipe were washed in and then the hole was continuously cored to total depth. Igneous rock was encountered after approximately 63 meters of sediments had been penetrated. This condition had been anticipated from the seismic records and a short bottomhole assembly (82.99 meters) had been used instead of the normal 120 meter assembly.

After cutting Core No. 14 and before starting into retrieving the core, the drill string stuck and could not be rotated. The heave compensator was closed and locked. Then the pipe was worked for about ten minutes when it came free and would rotate. After retrieving the core, a 30 barrel mud pill was spotted and this seemed to aid in working the drill string back to bottom. Core No. 15 required 48 minutes to cut and some torquing developed. After Core No. 16, 42 minutes were spent working with the torquing and sticking drill pipe before it was free enough to run in after the core. Before starting to cut Core No. 17, 30 barrels of mud were again spotted but nine meters of fill were found when starting back to bottom. It required 50 minutes to clean back to bottom and when the pipe reached there, it became stuck and required pulls as high as 540,000 pounds to finally free it. At this point in time it was necessary to abandon further attempts to drill deeper and an attempt was made to log as much of the hole as possible.

Pipe was pulled to 3968.5 meters which was above the unstable portion of the hole and a heat flow test was conducted. After this experiment, the shifting tool was rigged and the bit released and the pipe then was pulled to 3911.5 meters for the logging program.

After the logging sheaves were rigged, the following logs were run through the interval 3911.5-3977.0 m; Induction-Gamma Ray, Compensated Density Log, Deep

Laterolog, B. H. C. Sonic Log and Differential Temperature Log. This required about 24-hours to complete. A resistivity experiment was then conducted which took about nine more hours. Following this the drill string was pulled and the site was abandoned at 2310 hours on April 9, 1978.

SITE 455

After steaming in an easterly direction for about 12 hours, a 13.5 kHz double life beacon was dropped at 1230 hours on April 10 and work began. The drill string was made up and run to bottom where a mudline was established by coring at 3478.0 meters and then continuous coring was begun. After ten cores were cut and recovered and while waiting for the heat flow tool to be assembled, the pipe became stuck. While attempting to work free, it was learned that the heat flow equipment was not operating properly and the test would be deferred. The drill pipe was finally worked free after pulling more than 50,000 pounds over hanging weight several times. The apparent reason for the sticking was the loose volcanic sand material which was topped in Core No. 3 and continued to be recovered as the hole was drilled deeper. While cutting Core No. 11, the torquing and sticking continued and as it was too hazardous to work with, the hole was abandoned at 1930 hours on April 11, 1978.

SITE 456

Following the early abandonment of Site 455, the ship traveled about 11 miles westerly and dropped a 16.0 kHz single-life beacon on April 12, 1978.

The bit was made up and run and a bottom depth of 3600.5 meters was established with a mudline core. Then three more cores were cut and recovered and then a combination heat flow and pore water sampler was run. The hole was then continuously cored to a subbottom depth of 161.5 meters where the pipe began torquing. A 30 barrel slug of mud was then spotted before running back to cut the next core. When the pipe was run back after this, bottom was found to be 4.5 meters high. The pipe was worked through this fill but during the coring from 161.5 m to 169.0 m, torquing and sticking again returned which required a pull of over 400,000 pounds to loosen the string. The pipe was pulled to 159 m subbottom and another 30 barrels of mud was circulated. When starting back, the pipe started taking weight just below 159 m and after 45 minutes of rotating the pipe, was only 166 meters deep and had been torquing and sticking all through this operation. Because of this hazardous condition, it was necessary to abandon the hole and offset the ship from the beacon, hopefully to find a better location. The drill string was pulled above the mudline at 2115 hours on April 13 and the hole was officially abandoned.

HOLE 456A

After clearing the mudline at Hole 456, the ship was offset 700 feet easterly and Hole 456A was spudded and established a seafloor depth of 3601.0 meters with a mudline core on April 14.

Following the mudline core, two singles were washed in and then two cores were recovered. A heat flow was then taken, two more singles cored, and then heat flow No. 2 was taken at 66.5 m subbottom. The hole was then cored to a depth of 133 meters. After Core No. 12 had been recovered, the pipe showed indications of fill so it was decided not to run a third heat flow and 30 barrels of mud were spotted before continuing to core. After the mud had been circulated, fill was encountered five meters above the depth reached in Core No. 12 and 15 minutes were required to work back to bottom. Core No. 13 was cut and recovered with no additional problems. However, while coring Core No. 14, the pipe stuck and required a pull of 410,000 pounds to free it. After Core No. 14 was cut (69 minutes rotating time) and recovered, the bit tagged bottom six meters high. After taking 15 minutes to clean to bottom, coring began but torquing and sticking was encountered immediately. After coring seven meters in 72 minutes with repeated stopping and starting, it was decided to discontinue coring, pull up to a free point, drop the bit and log the hole. The bit was pulled up to what appeared to be safe spot above the fill and the core barrel was retrieved. The shifting tool was lowered and the bit released at 3740.5 meters.

The shifting tool was recovered and when the drill string was picked up, it was found to be stuck. Sixty barrels of mud was spotted and attempts began to try and free the pipe. Two hours were spent and no progress was made so a 20 barrel batch of guar gum was mixed and pumped down but to no avail. During all this time the bumper sub was not working (only one because of the short 83 meters of BHA). After working over five hours with pulls as high as 580,000 pounds, it was necessary to shoot the pipe off.

A shot was made up and run to 3643 meters (identified by tool joint at 3638 m) and firing was attempted, however, nothing happened. When the charge was recovered, it showed that the cap had fired but the prima cord had not ignited. A second attempt had the same results. It was felt that possibly a leak was developing in the cap prima cord connection so on the third attempt, it was taped and scotch-coated and the charge exploded severing the 5" drill pipe in the first joint above the 5 1/2" heavy wall. The drill string was recovered with no other problems and the site was abandoned at 0030 on April 16, 1978.

SITE 457

Site 457 was located 37 miles east of Site 456 but 12 hours were spent profiling before a decision as to its final location was made. There was concern among the scientific staff as to whether the type of rock that would be encountered here would be drillable. A 13.5 double-life beacon was dropped at 1400 hours on April 16 and the drill string was made up. The PDR indicated a water depth of 2640 meters and a core was taken to a depth of 2641.5 and recovered only water. A single was added and encountered resistance at 2647.0 m and required 11 minutes of rotation to cut four meters. However, when the core barrel was recovered, it was empty. Core No. 2 recovered about four meters of loose, coarse black volcanic sand, as did Cores No. 3 through No. 7. However, while cutting Core No. 7, the pipe began torquing and sticking requiring as much as a 360,000 pound pull to free it. Because of the thick section of sand already penetrated and not knowing its total thickness combined with the increased hazard to the drill string, it was decided to leave this location. The drill string was then pulled and the site abandoned at 1530 hours on April 17, 1978.

SITE 458

Although Site 458 was located only 64 miles east of Site 457, about ten hours were spent profiling to locate an area with enough sediment to spud-in safely as far as the equipment was concerned. A 13.5 double-life beacon was dropped at 0148 hours on April 18 and work commenced.

The drill string was made up and the site was spudded at 0921 hours on the 18th. Two hundred and sixty-six meters of sediments were cored before igneous rock was encountered. While this section was being cored, two heat flow measurements were taken at 76.0 and 142.5 meters subbottom.

After recovery of Core 38, the bit became plugged but was cleared after working on it for about 20 minutes. Before starting to cut Core 39, 40 barrels of mud were circulated to help cure the bit plugging condition. Mud was spotted again before cutting Core 48. However, the drill pipe became stuck after Core 49 had been recovered in spite of the mud flush. At first the pipe could not be rotated or circulated and pulls up to 425,000 pounds would not move it. After working about one half hour, the pipe was moved without an overpull but circulation could not be regained. It was decided then to pull the pipe to a logging depth (BHA below the mudline), recover the core barrel and see if circulation could be regained. The first attempt to retrieve the inner barrel was unsuccessful, however, the inner barrel was recovered on the next attempt and circulation was again achieved.

An attempt was made to run logs through the bit by dropping a modified inner barrel to hold the float valve open. After the pipe was positioned with the bit at 3579.5 meters, the temperature log was run. When the tool reached 3566 m or the top of the inner barrel it stopped and after repeated attempts to get past this point with no success, the tool was pulled. The Gamma-Neutron was made up and encountered the same obstacle. It too was pulled and it was decided that logging was not possible and the drill string was then pulled. The site was then officially abandoned at 0900 hours, April 22, 1978.

SITE 495 - HOLE 459, 495A, 459B

After completing Site 458, the next site was located 21 miles due east. However, this move was delayed because it was necessary to go to Saipan to pick up needed parts. A vessel that had been chartered to bring these parts to the CHALLENGER developed engine problems and could not arrive soon enough to allow continuation of the logging program.

The ship returned from Saipan and at 0604 hours on April 25, a 13.5 kHz single life beacon was dropped for Site 59. The drill string was made up and run and a mudline core taken. Just as this core was being pulled from the pipe at the derrick floor, the barrel came unscrewed and dropped the bottom part of the core barrel and the core liner back to the bottom of the drill string. Two attempts were made to fish these parts out, but both failed. It was thus necessary to pull the drill string so coring could continue. The bit was on the derrick floor at 0030 hours on April 26 and Hole 459 ended.

HOLE 459A

Make up of the bottomhole assembly was begun as soon as the inner core barrel parts were recovered and the drill string was rerun. As this site was a potential re-entry location, this hole was used to determine how much casing could be attached and washed in with a re-entry cone. The hole was spudded at 0726 hours on April 26 and required 73 minutes to wash the pipe to a subbottom depth of 67 meters. This was considered the casing depth because the sediments had firmed up sufficiently near the bottom of the hole. The pipe was then pulled clear of the mudline at 0933 hours and was ready to drill Hole 459B.

HOLE 459B

After offsetting the ship 50 feet east another mudline core was taken when the hole was spudded at 1100 hours on April 26 which established bottom at 4125.5 meters. The hole was then continuously cored to a subbottom depth of 691.5 meters. During the coring operation four heat flow measurements were taken at 64.5, 121.0, 197.5 and 330.5 meters.

After Core 72 had been cut and before it could be retrieved, the drill string began sticking. The overshot was recovered and work began on trying to free the pipe. After about an hour the pipe was free enough to allow the recovery of the core barrel. After the core barrel had been recovered, the pipe again began torquing so it was decided to discontinue drilling and log the hole before conditions became worse.

The string was pulled to a free point above the sticking area (4788.5 m) and the shifting tool was run and the bit dropped at 0753 hours on May 2. The drill string was then pulled to 4244.0 meters and preparations for logging were started. Initially, five log runs were made involving the following tools: Gamma-Density, Gamma-Sonic/Caliper, Gamma-Neutron Guard (Laterolog), Gamma Induction, Temperature. A resistivity experiment was conducted while the Gamma-Sonic tool was repaired. A moderately successful Gamma-Sonic log was later obtained.

After the logging program had been completed (approximately 39 hours), the string was pulled and the site was abandoned at 0930 hours on May 4, 1978.

SITE 460

Site 460 was located only 21 miles southeast of Site 459, however, ten hours were spent profiling before a 16.0 kHz beacon was dropped at 1935 hours on May 4, 1978. The sediment pond of the site was rather small and located in deep water, 6400 + meters, on the west side of the Mariana Trench.

The drill string was made up and run making sure that the upper section of the drill string consisted of new pipe. On may 5, 1978, the hole was spudded in the deepest water ever drilled by the CHALLENGER. The mudline was established at 6461.5 meters with a mudline core. Coring then continued with penetration rates quite slow for the type of material recovered. Core No. 6 recovered 1.9 meters of what appeared to be mainly cuttings ranging from coarse grained one half inch fragments to fine grained. Therefore, before Core No. 7 was cut, the hole was circulated with 20 barrels of mud in the hope that this material could be cleaned out. Recovery was poor for Cores Nos. 7, 8, and 9 and each took more than 40 minutes to cut. When starting Core No. 10, about six meters of fill was encountered and required 24 minutes to clean out. After cleaning to bottom, the pipe was rotated for 109 minutes with no apparent penetration. It was decided to stop drilling, pull above the mudline, and move the ship to a more favorable location. After pulling the pipe above the mudline, the overshot was lowered to recover the core barrel, however, no contact was made at the depth that the inner barrel should have been. When the overshot was recovered and the pump turned on, the pressure indicated that the inner barrel was gone.

The drill string was pulled and when it was recovered, the bit release sub and bit were missing. The tool had shifted in some unknown manner and the bit had been released. On examination of the top connector, it was noted that the sleeve retainer had been worn down about a one half inch. This indicated that the pipe had been rotated quite a while after the release had taken place. The bottomhole assembly came to the derrick floor at 2400 hours on May 6, 1978 and Hole 460 was ended.

HOLE 460A

After the drill string was recovered from Hole 460, new offsets of 950 feet south and 400 feet west of the beacon were put into the positioning program. A new bit release assembly was attached to the bottomhole assembly and the drill string was run to bottom. Hole 460A was spudded at 1549 hours on May 7, 1978.

The core recovery was very much like that encountered in 460. The drill rate continued to be slow and recovery was poor, averaging about 30%. After Core No. 10, 30 barrels of mud were pumped into the hole to clean out the fill. After 94 minutes only six meters had been cut on Core No. 11 when suddenly the drill string would not rotate. Pulls up to 525,000 were made before the string could be rotated and pulled above the tight spot. Because of the poor recovery, deep water and poor hole conditions, it was decided that drilling should stop so the pipe was pulled and Hole 460A was abandoned at 1300 hours on May 9, 1978.

SITE 461

The proposed location of this site was about eight miles northeast of Site 460. However, it required eight hours of profiling until a satisfactory location could be chosen. A 16.0 kHz single-life beacon was dropped at 2100 hours on May 9, 1978 and Site 461 began.

The PDR indicated a record water depth for the CHALLENGER of 7044 meters. When the drill string was made up and run, a mudline core showed a water depth of 7039 meters. The first core was only 1.5 meters long and required 18 minutes of drilling. The next core was 9.5 meters and also required 18 minutes of rotation and some pump. The third core which bottomed at 20.5 meters, needed 65 minutes to cut. With the drilling time so long plus the extremely deep water, it was decided that this location should be abandoned and an attempt made to find amore suitable location in the near vicinity. It was hoped that a thicker, easily drilled sediment section could be found which would protect the drilling assembly and achieve the scientific objectives. The bit was pulled above the mudline at 0100 hours on May 11, 1978 and Site 461 was abandoned.

HOLE 461A

The profile records were reviewed and a new location, with offsets of 800 feet south and 600 feet east of the beacon, was selected. The drill pipe was run back and a mudline core attempt was spudded at 0313 hours on May 11. A six meter core established bottom at 7044 meters which was the same calculated by using the PDR data. A second core was drilled to 15 meters and required 46 minutes and recovered 1.29 meters of pebbly to coarse grained igneous material. When the third core was attempted, fill was encountered at six meters and after 20 minutes, the bit had only reached nine meters in trying to clean out the hole to 15 meters for the new core.

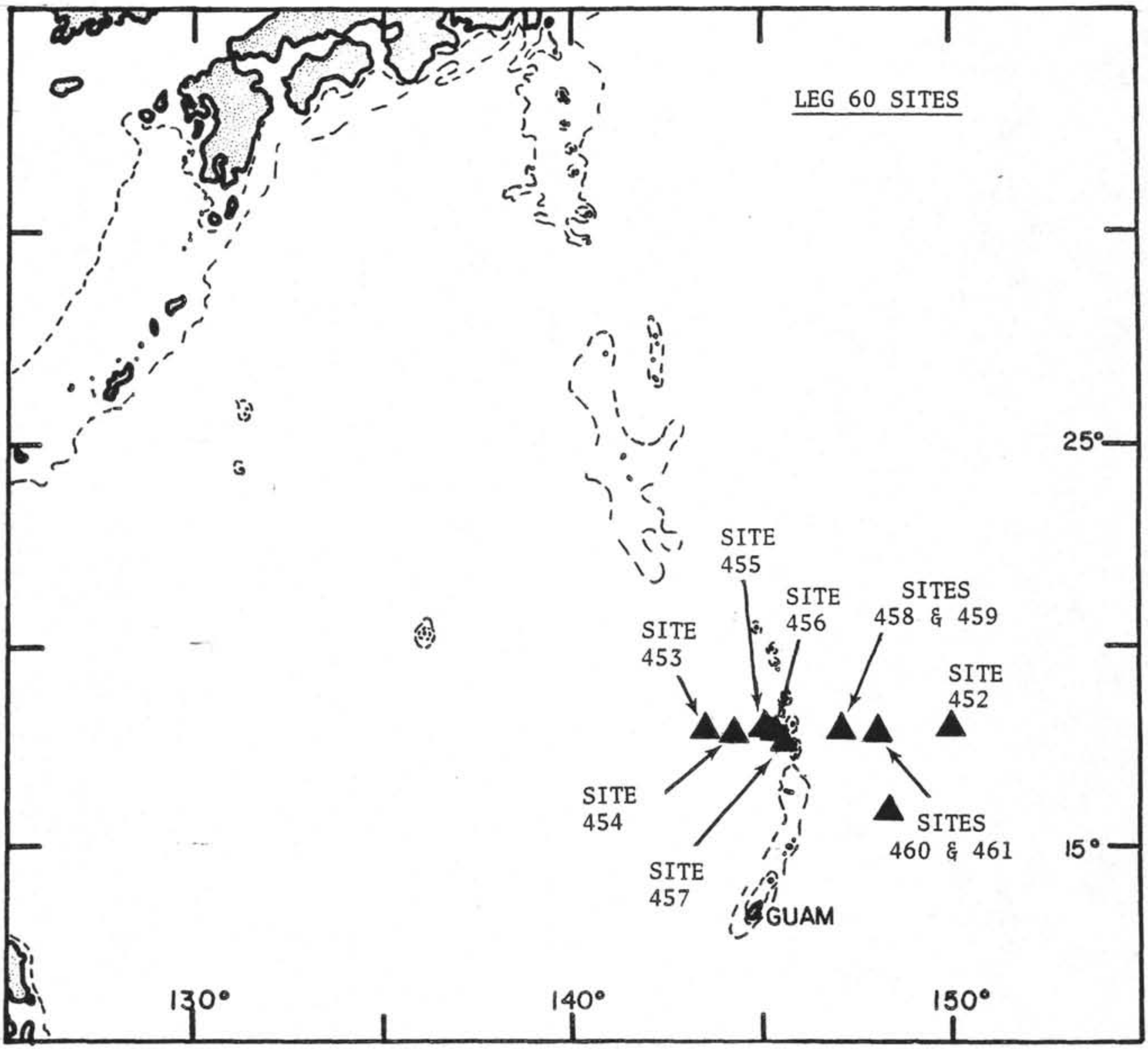
Since no increase in drillability had been achieved and no immediate protection was available for the drilling assembly, it was decided that this hole also be abandoned. At 0836 hours, the mudline was cleared and the drill string was pulled. The hole was abandoned at 2136 hours on May 11, 1978 when the bit reached the derrick floor. The GLOMAR CHALLENGER then headed for Guam.

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

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
OPERATIONAL RESUME
LEG 60

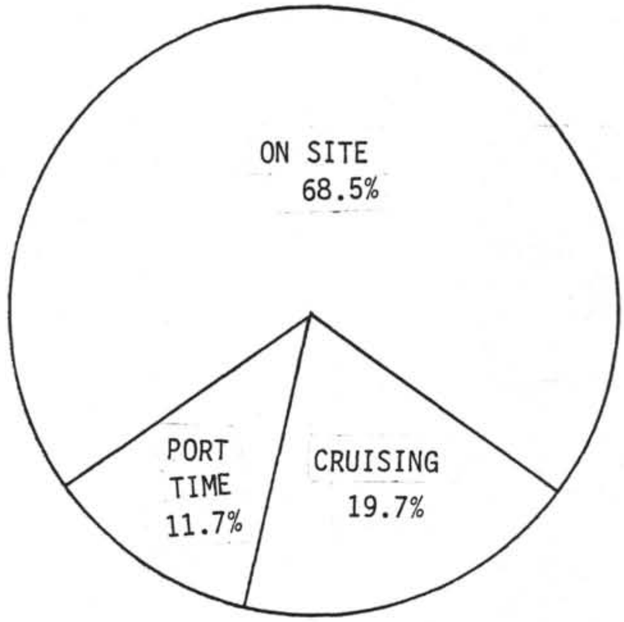
Total Days (March 15, 1978 - May 15, 1978)		61.15
Total Days In Port		7.11
Total Days Cruising Including Site Survey		12.08
Total Days On Site		41.96
Trip Time	11.13	
Drilling Time	.09	
Coring Time	22.08	
Waiting On Weather	.67	
Position Ship	1.52	
Mechanical Repair	.08	
Other (Include Logging)	6.39	

Total Distance Traveled (Nautical Miles) Including Survey	2445
Average Speed (Knots)	8.76
Number of Sites	10
Nunber of Holes Drilled	17
Number of Cores Attempted	293
Number of Core With Recovery	280
Percentage of Cores With Recovery	95.5
Total Meters Cored	2716.0
Total Meters Recovered	832.99
Percentage Recovery	30.6
Total Meters Drilled	115.0
Total Meters of Penetration	2831.0
Percent of Penetration Cored	95.9
Maximum Penetration (Meters)	691.5
Minimum Penetration (Meters)	3.5
Maximum Water Depth (Meters)	7044.0
Minimum Water Depth (Meters)	2647.0

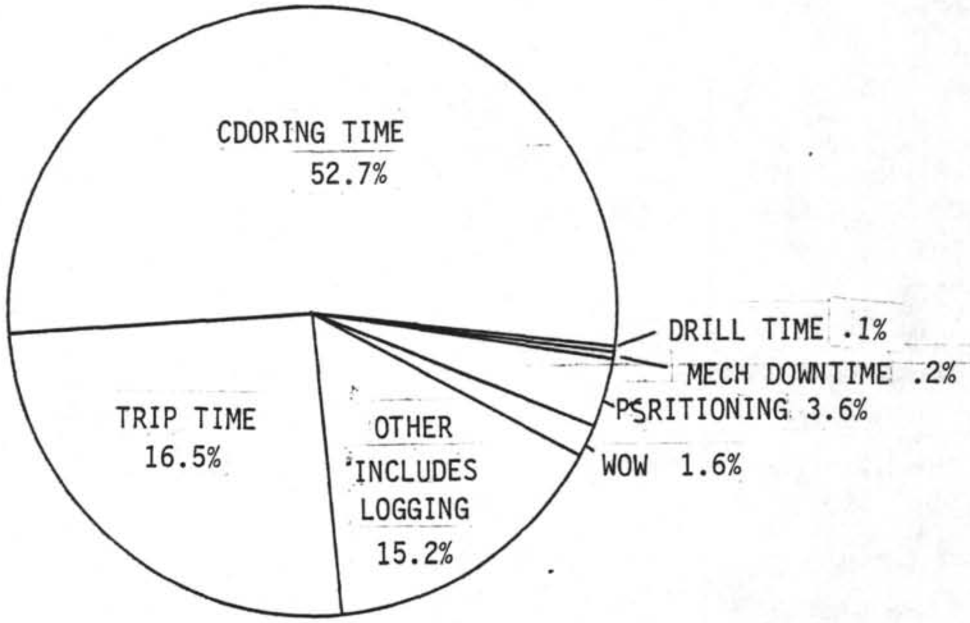

LEG 60 SITES
SITE 455
SITE 456
SITES 458 & 459
SITE 453
SITE 452
SITE 454
SITE 457
SITES 460 & 461
GUAM
25°
15°
130°
140°
150°

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT

TOTAL TIME DISTRIBUTION
LEG 60



ON SITE TIME BREAKDOWN
LEG 60



INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
BEACON SUMMARY
LEG 60

SITE	MAKE	FREQ kHz	SERIAL NUMBER	SITE TIME HOURS	REMARKS
452	ORE	13.5 (D.L.)	432	29.3	
452A	ORE	13.5 (D.L.)	432	57.0	
				86.3	
453	ORE	16.0	413	164.4	
454	ORE	16.0 (D.L.)	415	20.9	Pulled out of hole to wait on weather.
454A	ORE	16.0 (D.L.)	415	102.6	
			TOTAL HOURS ON SITE	123.5	
455	ORE	13.5 (D.L.)	434	31.0	
456	ORE	16.0 (S.L.)	387	40.8	
456A	ORE	16.0 (S.L.)	387	51.2	
			TOTAL HOURS ON SITE	92.0	
457	ORE	13.5 (D.L.)	433	25.5	
458	ORE	13.5 (D.L.)	435	103.2	
459	ORE	13.5 (S.L.)	450	18.4	
459A	ORE	13.5 (S.L.)	450	9.0	
459B	ORE	13.5 (S.L.)	450	192.0	
				219.4	
460	ORE	16.0 (D.L.)	416	52.4	
460A	ORE	16.0 (D.L.)	416	61.0	
			TOTAL HOURS ON SITE	113.4	
461	ORE	16.0 (S.L.)	448	28.0	
461A	ORE	16.0 (S.L.)	448	20.5	
			TOTAL HOURS ON SITE	48.5	

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
SITE SUMMARY
LEG 60

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
452	17° 40.19'N	148° 37.73'E	5838.0	3	3	100.0	28.0	27.35	97.7	- -	28.0	93.3	29.3	- -
452A	17° 40/17'N	148° 37.75'E	5872.5	5	5	100.0	46.5	21.72	46.7	- -	46.5	37.4	57.0	86.3
453	17° 54.42'N	143° 40.95'E	4703.0	64	63	98.4	605.0	236.83	39.1	- -	605.0	14.2	164.4	164.4
454	18° 00.78'N	144° 31.92'E	3828.5	5	4	80.0	38.5	22.51	58.4	- -	38.5	96.3	20.9	- -
454A	18° 00.78'N	144° 31.92'E	3828.5	16	15	93.7	142.5	40.92	28.7	29.0	171.5	19.2	102.6	123.5
455	17° 51.26'N	145° 21.48'E	3478.0	11	11	100.0	104.0	31.28	30.0	- -	104.0	47.2	31.0	31.0
456	17° 54.68'N	145° 10.77'E	3600.5	19	18	94.7	169.0	32.23	19.0	- -	169.0	20.7	40.8	- -
456A	17° 54.70'N	145° 10.87'E	3601.0	15	15	100.0	140.0	37.75	26.9	19.0	159.0	23.7	51.2	98.0
457	17° 49.99'N	145° 49.02'E	2647.0	7	5	71.4	61.0	19.42	32.0	- -	61.0	47.6	25.5	25.5
458	17° 51.85'N	146° 56.06'E	3459.0	49	46	93.8	465.5	97.83	21.0	- -	465.5	21.4	103.2	103.2
459	17° 51.75'N	147° 18.09'E	4129.5	1	1	100.0	3.5	3.28	93.7	- -	3.5	70.0	18.4	- -
459A	17° 51.75'N	147° 18.09'E	4129.5	- -	- -	- - -	- -	- - -	- -	67.0	67.0	55.0	9.0	- -
459B	17° 51.75'N	147° 18.09'E	4125.5	73	70	95.8	691.5	182.11	26.3	- -	691.5	20.9	192.0	219.4
460	17° 40.14'N	147° 35.92'E	6461.5	9	8	88.8	85.5	27.21	31.7	- -	85.5	13.1	52.4	- -
460A	17° 40.02'N	147° 35.16'E	6453.5	11	11	100.0	99.5	36.67	36.8	- -	99.5	18.0	61.0	113.4
461	17° 46.05'N	147° 41.18'E	7039.0	3	3	100.0	20.5	8.62	42.0	- -	20.5	12.2	28.0	- -
461A	17° 46.02'N	147° 41.26'E	7044.0	2	2	100.0	15.5	7.26	46.8	- -	15.5	16.3	20.5	48.5
			TOTALS	293	280	95.5	2716.0	832.99	30.6	115.0	2831.0	19.7	1007.2	1007.2

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
BIT SUMMARY
LEG 60

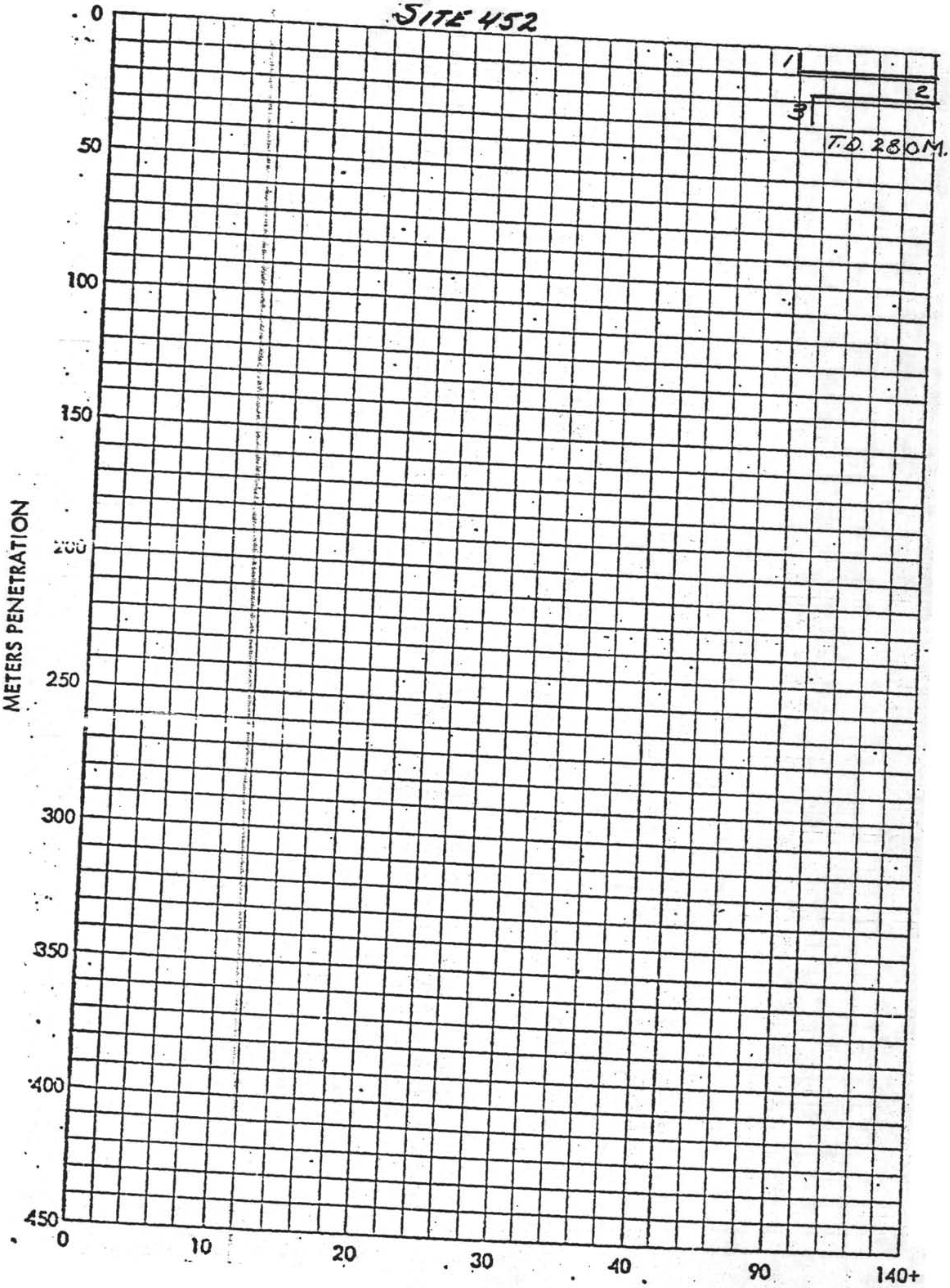
HOLE	MFG	SIZE	TYPE	SERIAL NUMBER	METERS CORED	METERS DRILLED	METERS TOTAL PENET	HOURS ON BIT	CONDITION	REMARKS
452	Smith	9 7/8"	F94CK	189FF	28.0	- -	28.0	.26		Bit lost with part of BHA.
452A	Smith	9 7/8"	F94CK	943FE	46.5		46.5	2.08	T1-B1-SEI	
453	Smith	9 7/8"	F94CK	943FE	605.0		605.0	42.53		Bit released
						TOTAL TIME		44.61		
454	Smith	9 7/8"	F93CK	652KR	38.5		38.5	0.4		Pulled above mod line & used on 454A.
454A	Smith	9 7/8"	F93CK	652KR	142.5	29.0	171.5	8.9		Bit released.
						TOTAL TIME		9.3		
455	Smith	9 7/8"	F93CK	277JZ	104.0		104.0	2.2	T1-B1-SEI	Will rerun on 456.
456	Smith	9 7/8"	F93CK	277JZ	169.0		169.0	8.15		Will rerun on 456A.
456A	Smith	9 7/8"	F93CK	277JZ	140.0	19.0	159.0	6.7		Bit released
						TOTAL TIME		17.05		
457	Smith	9 7/8"	F93CK	644KR	51.5		51.5	1.08	T1-B1-SEI	Will rerun on 458.
458	Smith	9 7/8"	F93CK	644KR	465.5		465.5	21.7	T1-B2-SEI	
						TOTAL TIME		23.5		
459	Smith	9 7/8"	F93CK	276JZ	3.5		3.5	.05		
459A	Smith	9 7/8"	F93CK	276JZ	- -	67.0	67.0	1.2		Bit released
459B	Smith	9 7/8"	F93CK	276JZ	691.5		691.5	33.0		
								34.25		
460	Smith	9 7/8"	F93CK	647KR	85.5		85.5	6.58		Bit released prematurely.
460A	Smith	9 7/8"	F93CK	275JZ	99.5		99.5	5.55		Will rerun on 461.
461	Smith	9 7/8"	F93CK	275JZ	20.5		20.5	1.68	T1-B1-SEI	
462A	Smith	9 7/8"	F93CK	275JZ	15.5		15.5	.95		
						TOTAL TIME		8.18		

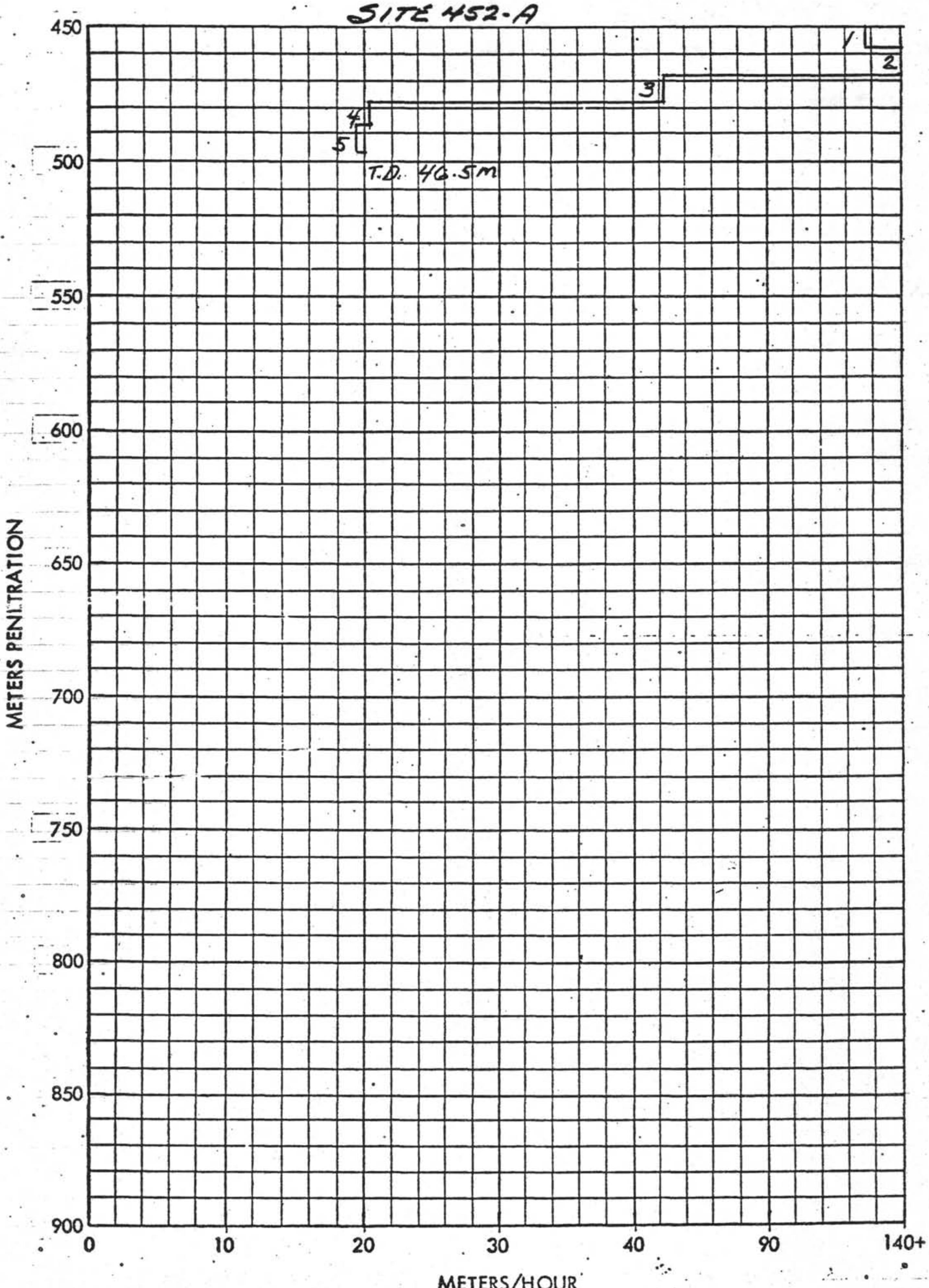
DEEP SEA DRILLING PROJECT
TIME DISTRIBUTION
LEG - 60

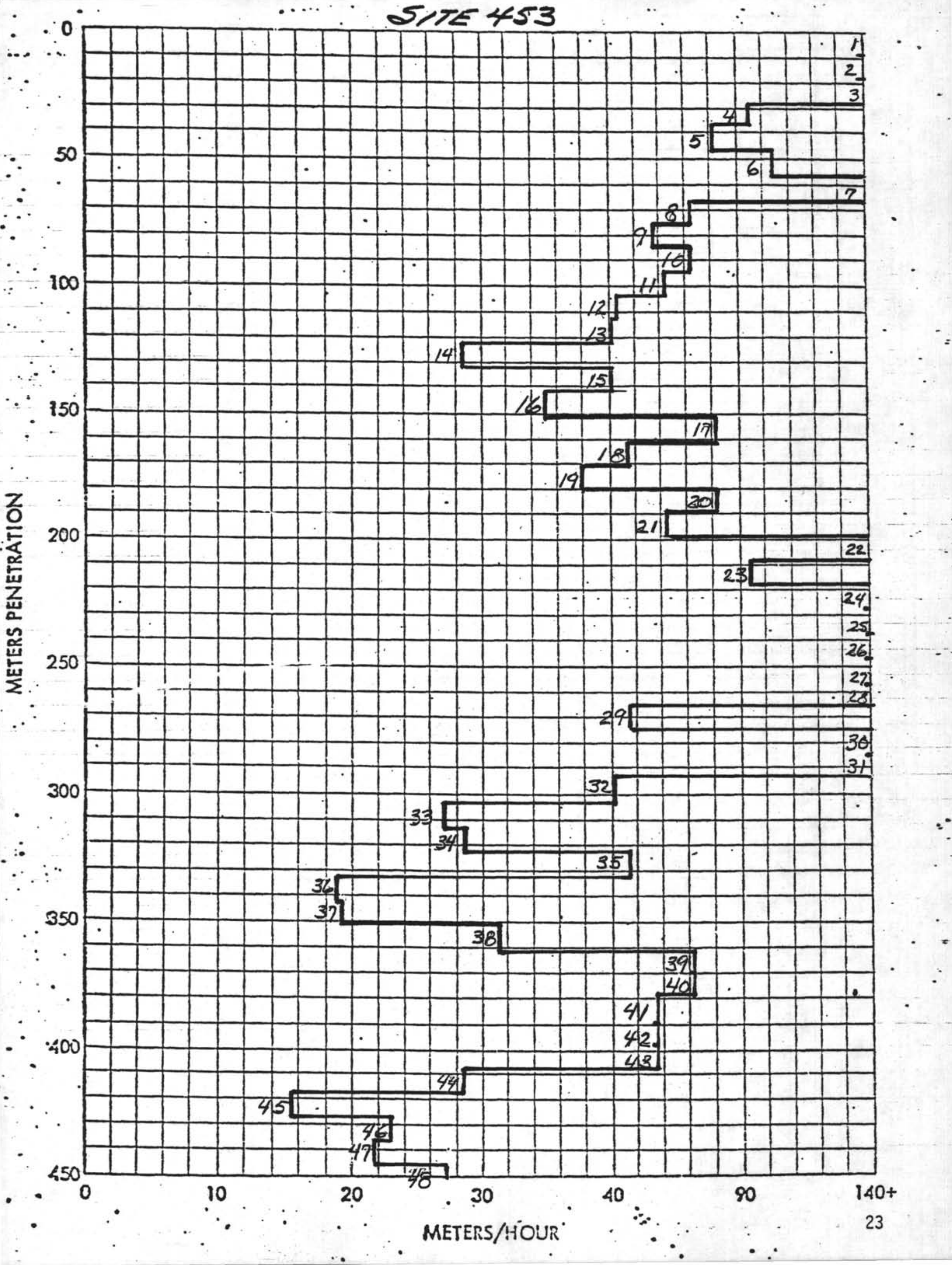
Date	Site No.	Cruise	Trips	Drill	Core	Stuck Pipe	W.O.W.	Position Ship	Mech. Repair	Port Time	Re-Entry	Other	Total Time	Remarks
3/15/78 3/21/78										153.7			153.7	
3/21/78 3/23/78		43.8											43.8	
3/23/78 3/24/78			18.0					11.3					29.3	
3/24/78 3/27/78			31.8		16.6				1.8			6.8	57.0	
3/27/78 3/28/78		32.3										.7	33.0	
3/28/78 4/4/78			24.1		130.2			1.3				8.8	164.4	
4/4/78		9.8										.2	10.0	
4/4/78 4/5/78			9.4		8.2			3.3					20.9	
4/5/78 4/9/78			13.8	.2	33.0		16.1					39.5	102.6	
4/9/78 4/10/78		12.5										.8	13.3	
4/10/78 4/11/78			15.9		13.9			1.2					31.0	
4/11/78 4/12/78		8.6										.4	9.0	
4/12/78 4/13/78			6.2		28.8			4.2				1.6	40.8	
4/13/78 4/16/78			6.4	.3	24.0			1.0				19.5	51.2	
4/16/78		13.0										.5	13.5	
4/16/78 4/17/78			14.0		7.5							4.0	25.5	
4/17/78 4/18/78		10.0										.3	10.3	
4/18/78 4/22/78			12.9		75.0			1.9				13.4	103.2	
4/22/78 4/23/78		28.0										.3	28.3	
4/23/78 4/24/78										17.0			17.0	

DEEP SEA DRILLING PROJECT
TIME DISTRIBUTION
LEG - 60

Date	Site No.	Cruise	Trips	Drill	Core	Stuck Pipe	W.O.W.	Position Ship	Mech. Repair	Port Time	Re-Entry	Other	Total Time	Remarks
4/24/78 4/25/78		23.8											23.8	
4/25/78 4/26/78			13.0		1.0			1.4				3.0	18.4	
4/26/78			7.2	1.8									9.0	
4/26/78 5/4/78			9.8		129.6			.7				51.9	192.0	
5/4/78		9.9										.2	10.1	
5/4/78 5/6/78			21.0		24.6			4.5				2.3	52.4	
5/6/78 5/9/78			32.0		24.3			2.0				2.7	61.0	
5/9/78		8.0											8.0	
5/9/78 5/11/78			16.8		8.0			3.2					28.0	
5/11/78			14.7		5.3			.5					20.5	
5/11/78 5/15/78		74.0										.5	74.5	


SITE 452
1
2
3
T.D. 280 M.
METERS PENETRATION
0
50
100
150
200
250
300
350
400
450
METERS/HOUR
0
10
20
30
40
90
140+


SITE 452-A
450
500
550
600
650
700
750
800
850
900
0
10
20
30
40
90
140+
1
2
3
4
5
T.D. 46.5m
METERS PENETRATION
METERS/HOUR


SITE 453
METERS PENETRATION
0
50
100
150
200
250
300
350
400
450
METERS/HOUR
0
10
20
30
40
90
140+
1
2
3
4
5
6
7
8
9
10
11
12
13
14
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16
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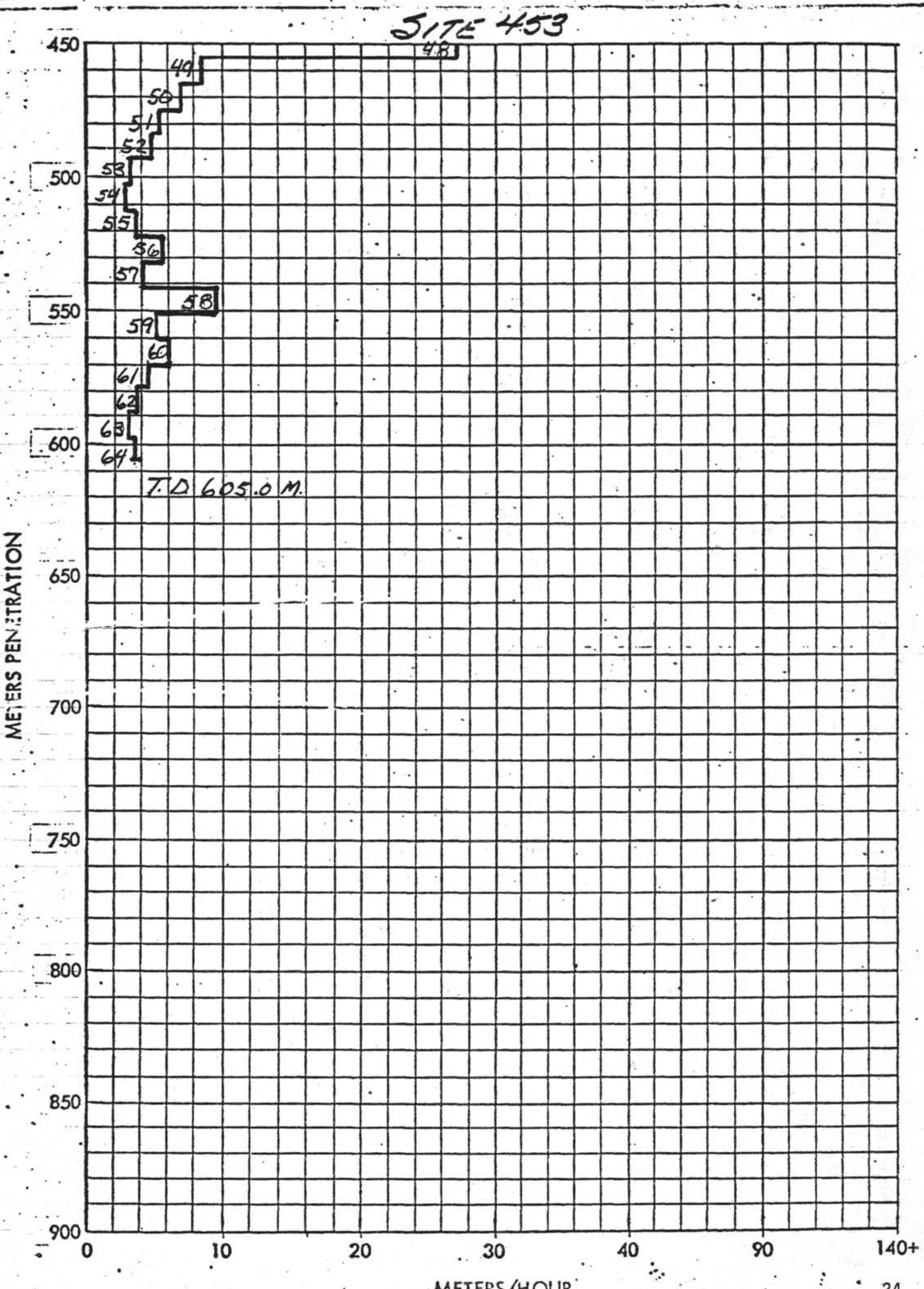
SITE 453
48
49
50
51
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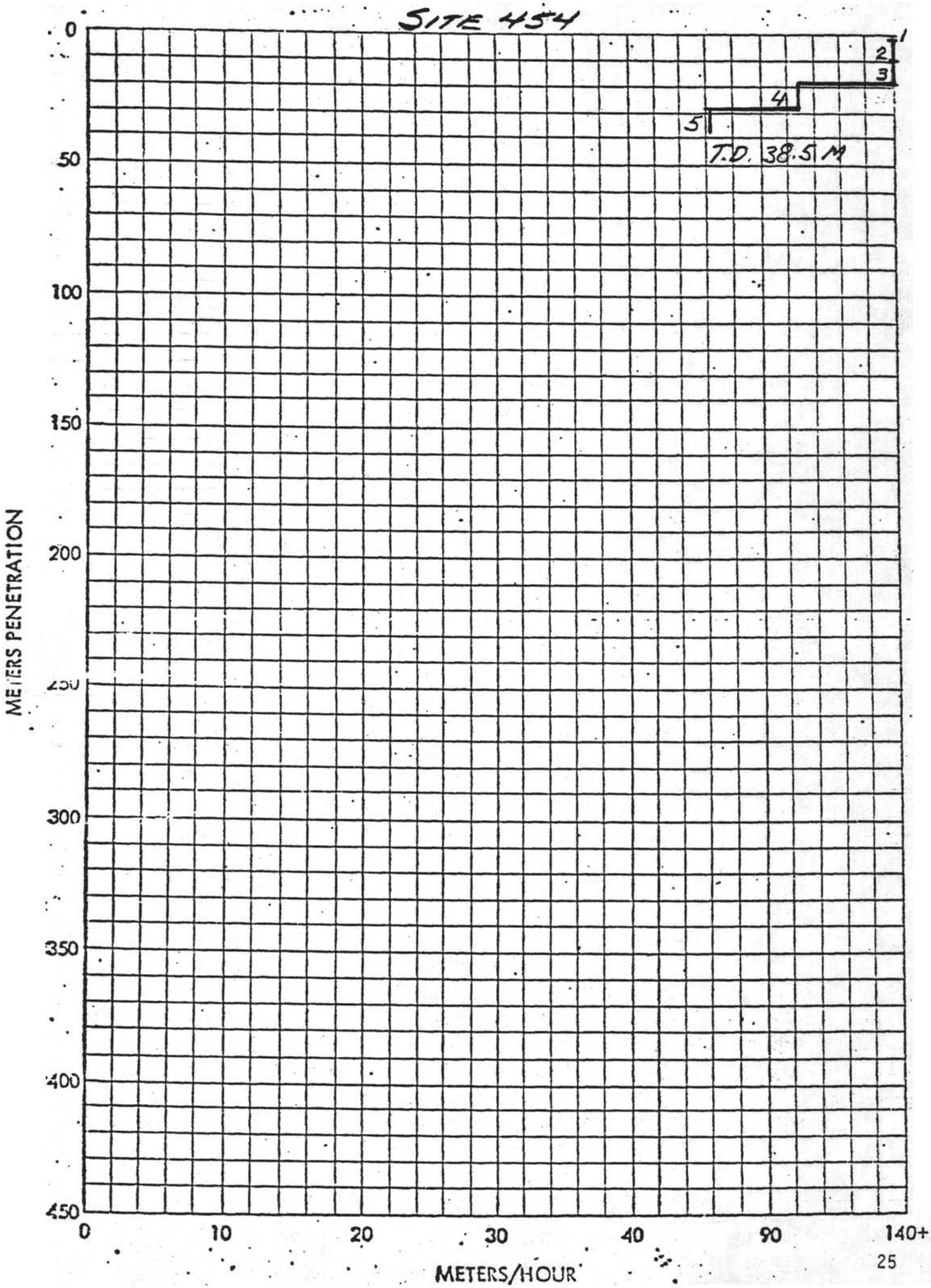
56
57
58
59
60
61
62
63
64
T.D 605.0 M.
450
500
550
600
650
700
750
800
850
900
METERS PENETRATION
0
10
20
30
40
90
140+
METERS/HOUR


SITE 454
1
2
3
4
5
T.D. 38.5 M
METERS PENETRATION
0
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200
250
300
350
400
450
METERS/HOUR
0
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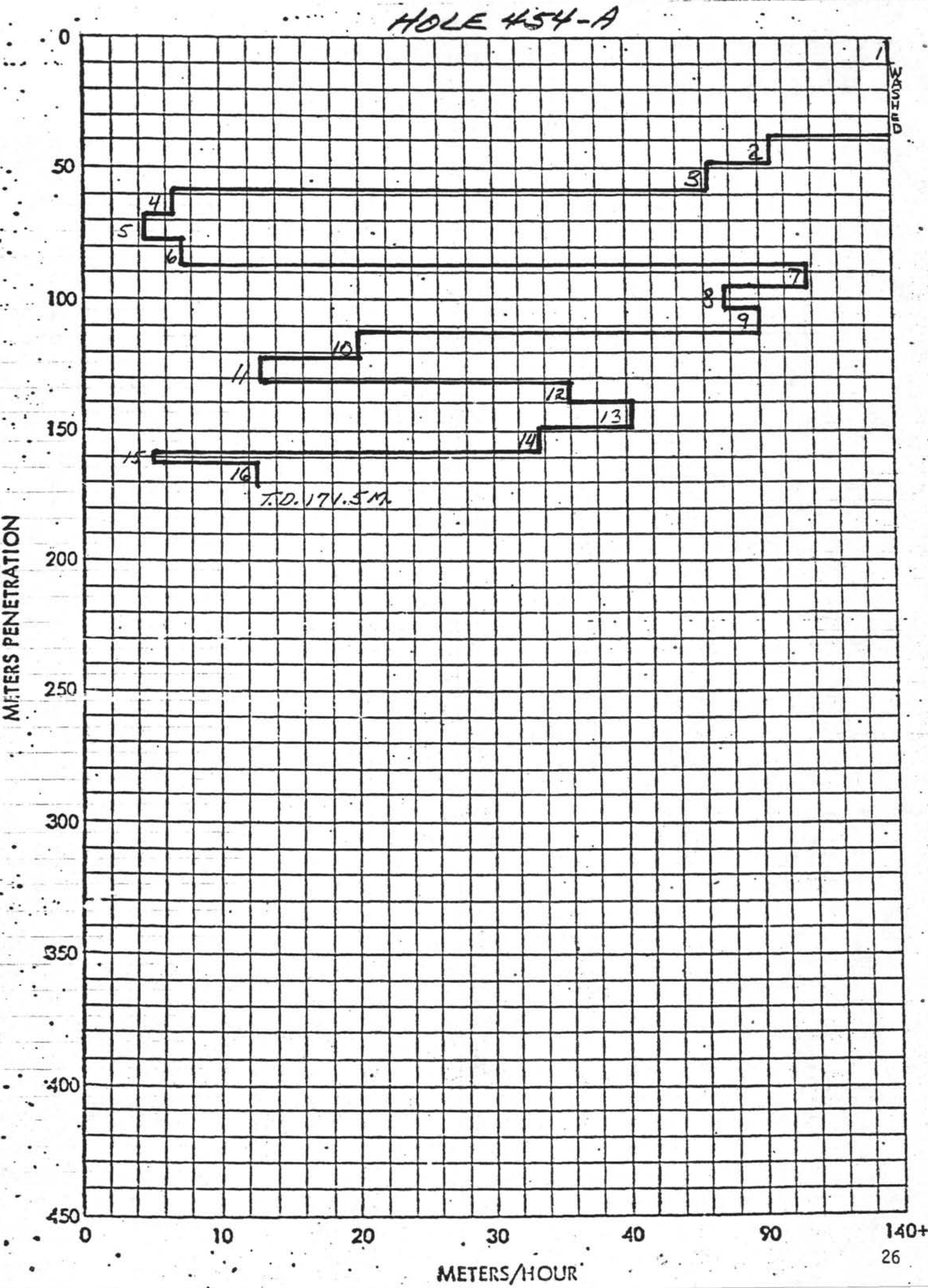
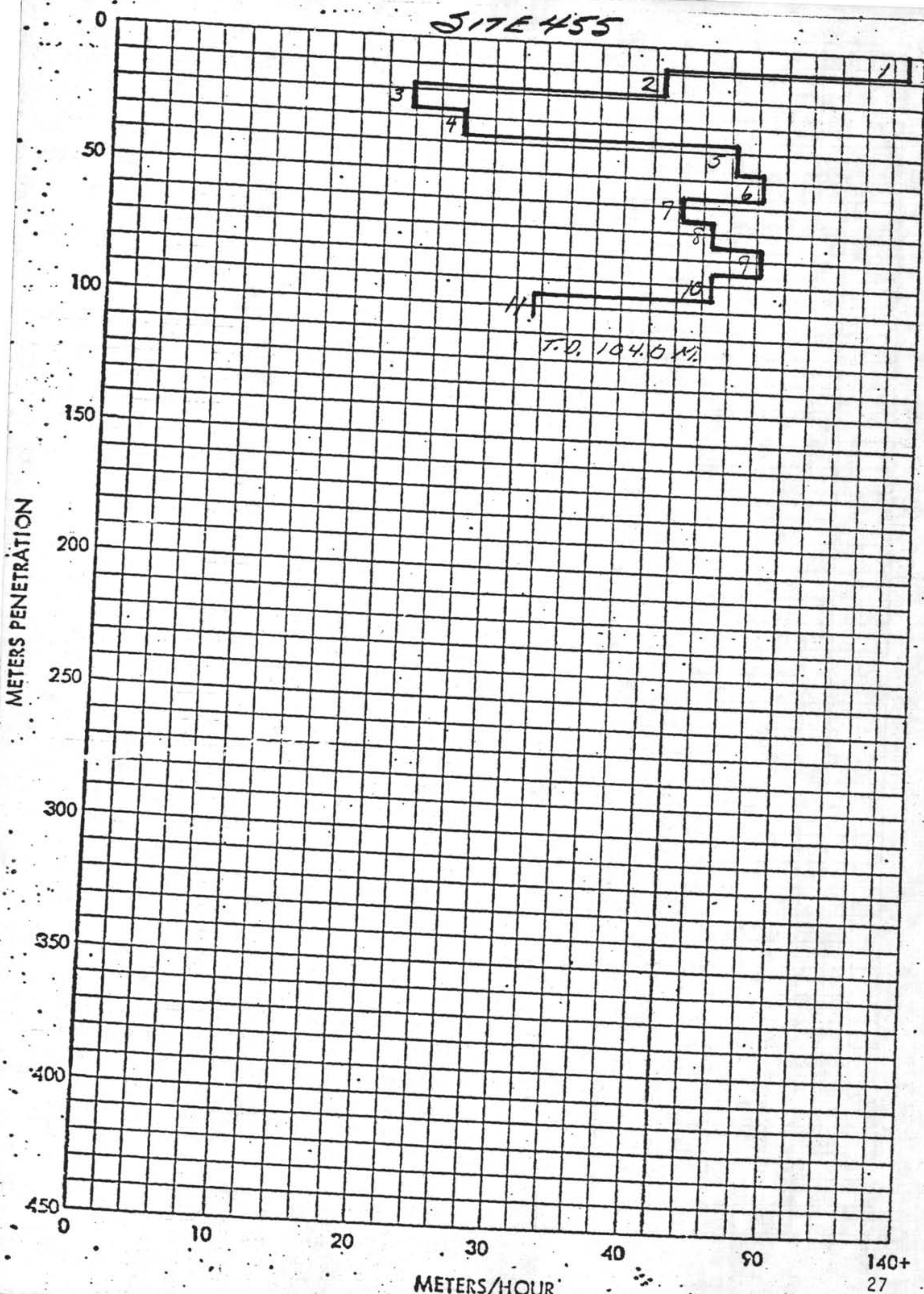
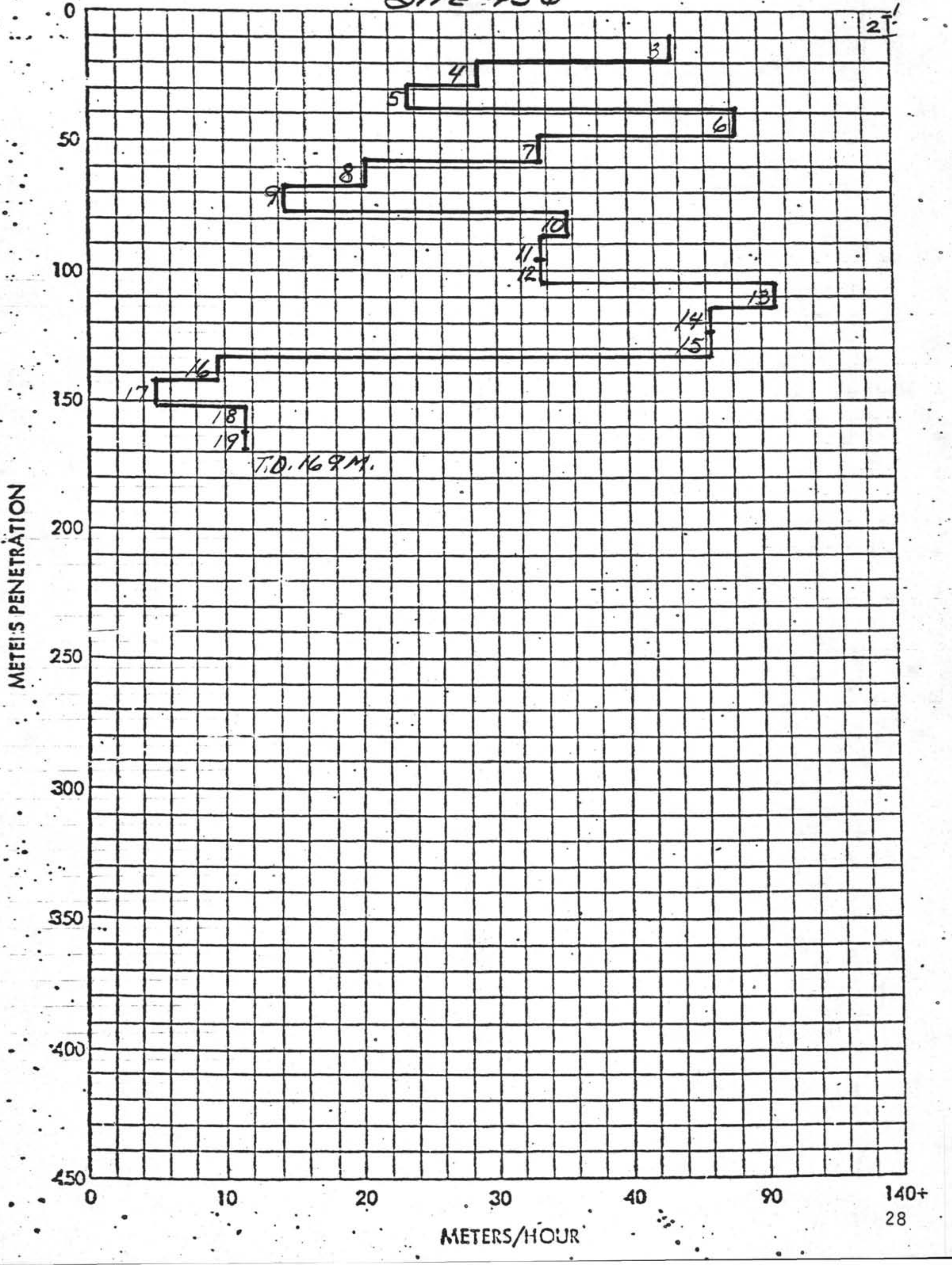
20
30
40
90
140+



HOLE 454-A
METERS PENETRATION
METERS/HOUR
0
50
100
150
200
250
300
350
400
450
0
10
20
30
40
90
140+
WASHED
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
T.D. 171.5 M.


SITE 455
METERS PENETRATION
0
50
100
150
200
250
300
350
400
450
METERS/HOUR
0
10
20
30
40
90
140+
1
2
3
4
5
6
7
8
9
10
11
T.D. 104.0 M.

SITE 456



2
3
4
5
6
7
8
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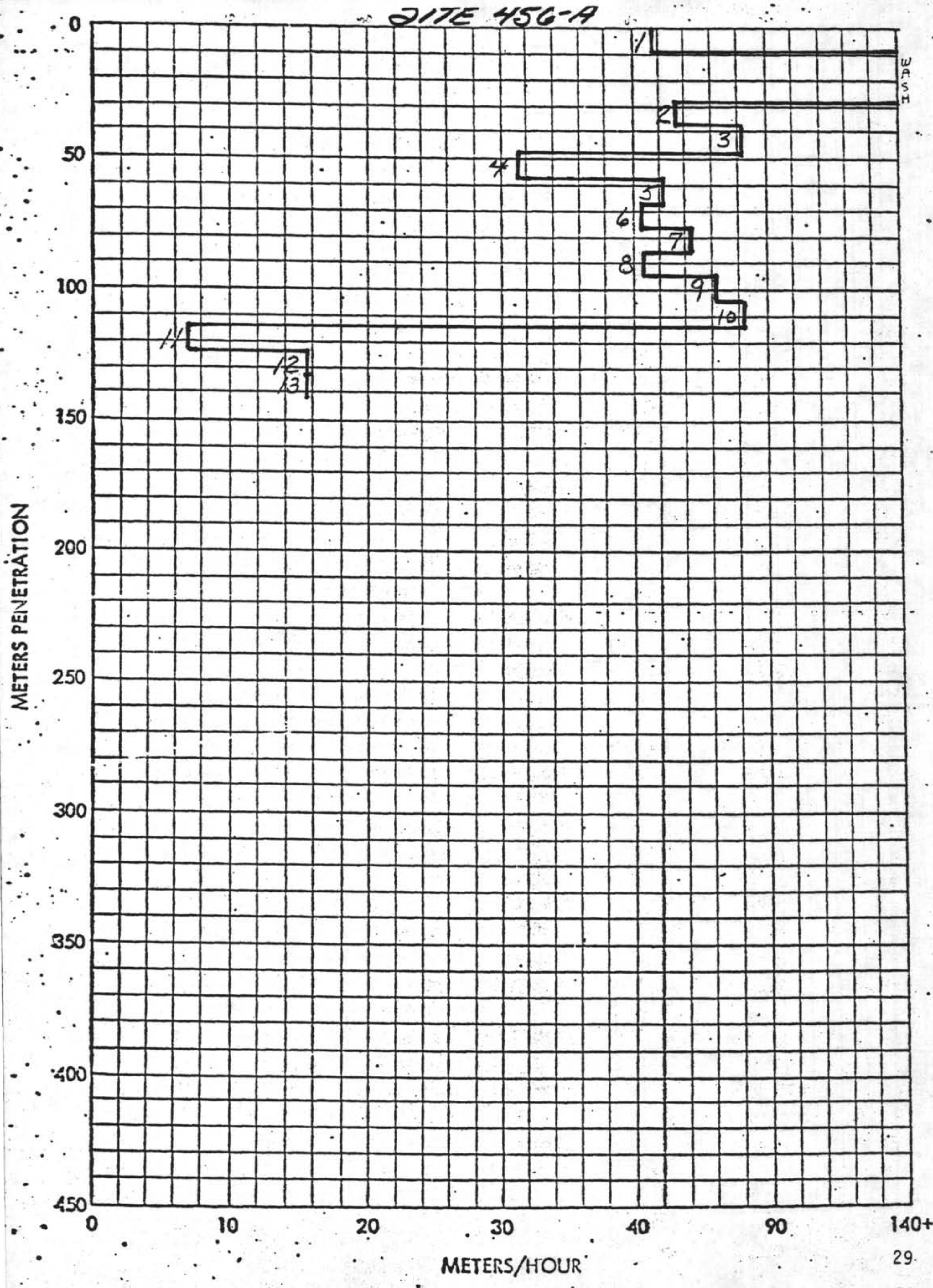
10
11
12
13
14
15
16
17
18
19
T.D. 169 M.
METERS PENETRATION
0
50
100
150
200
250
300
350
400
450
0
10
20
30
40
90
140+
METERS/HOUR


SITE 456-A
WASH
1
2
3
4
5
6
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8
9
10
11
12
13
METERS PENETRATION
0
50
100
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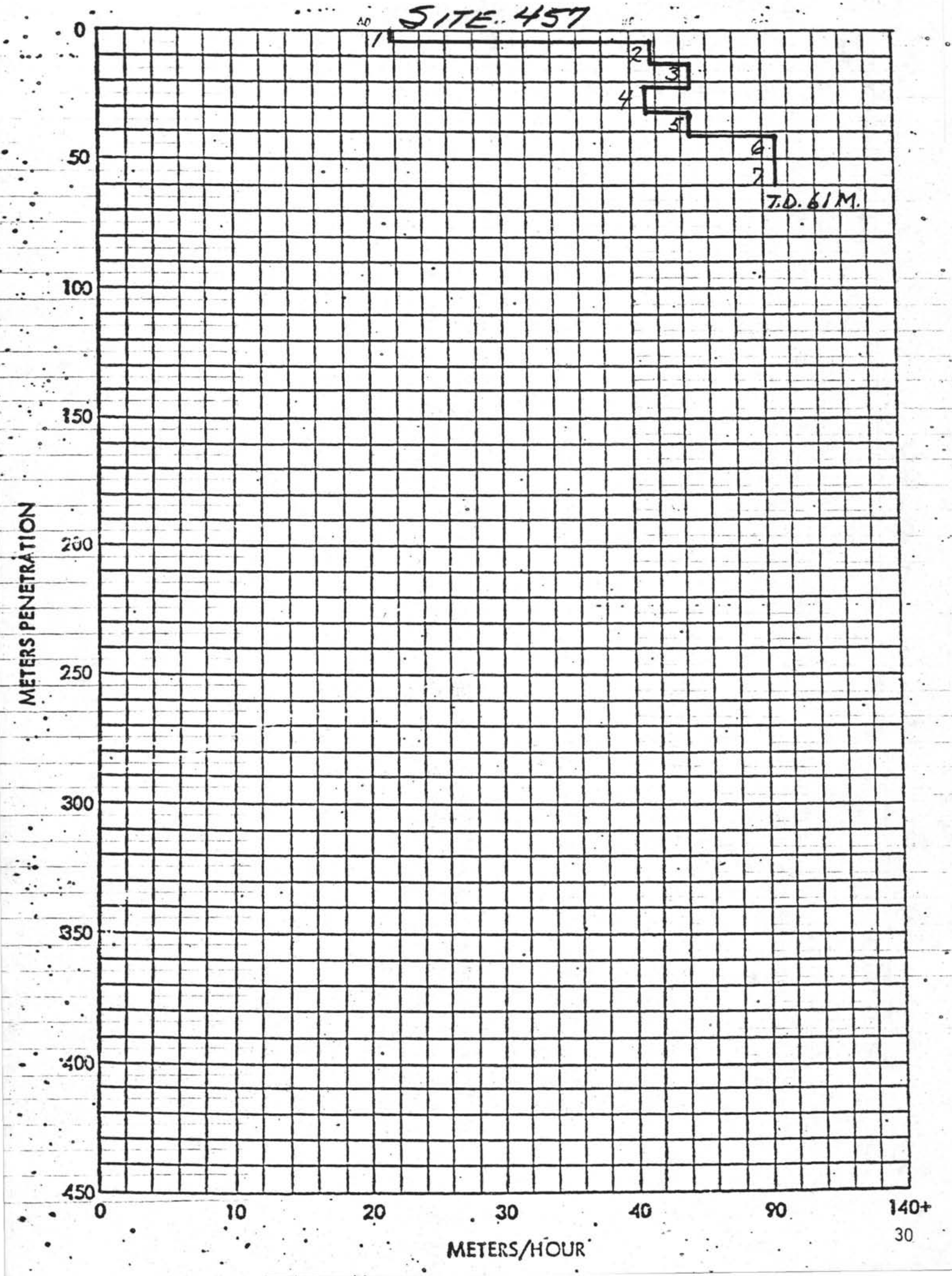
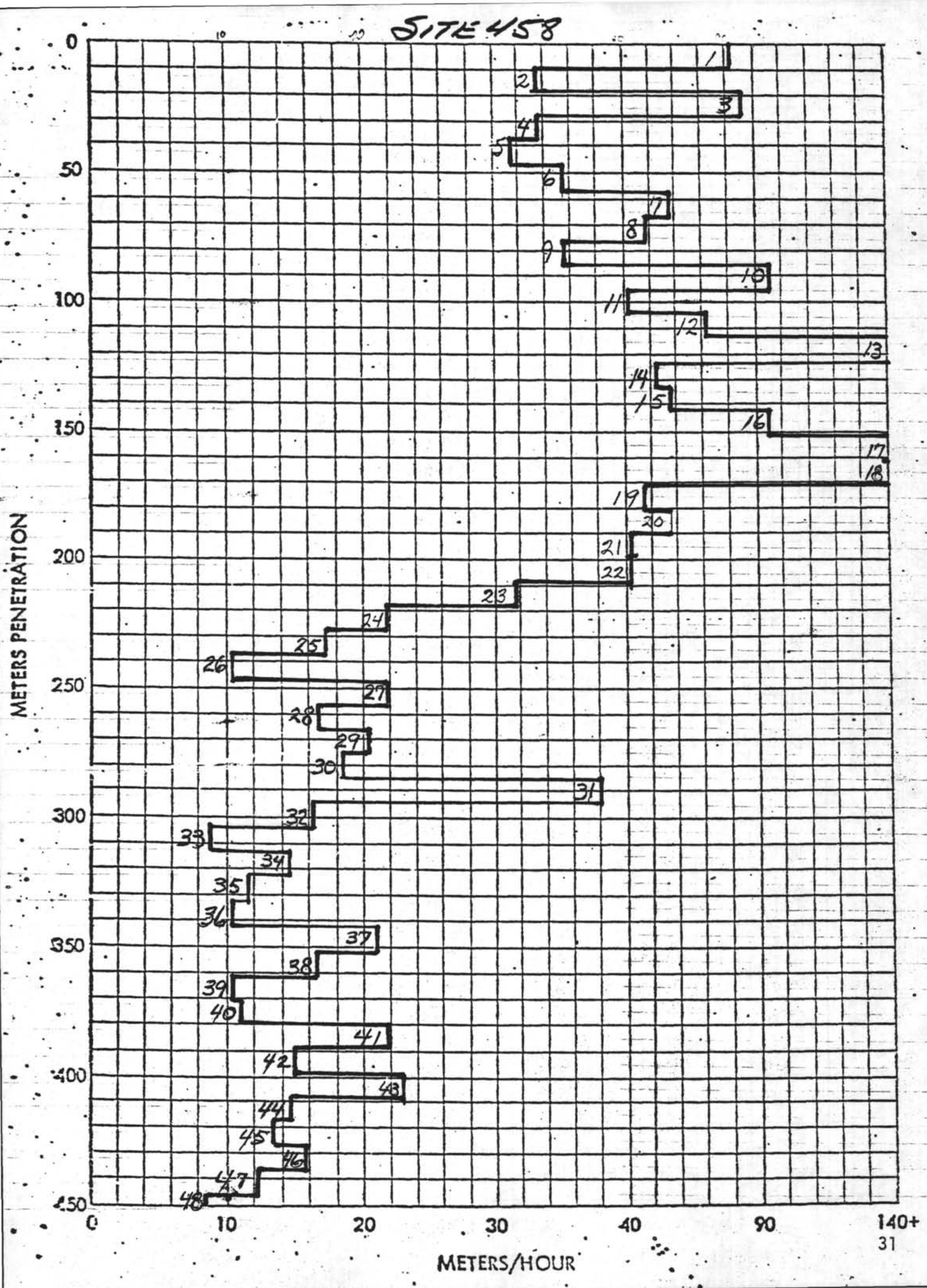
200
250
300
350
400
450
0
10
20
30
40
90
140+
METERS/HOUR


SITE 457
METERS PENETRATION
0
50
100
150
200
250
300
350
400
450
1
2
3
4
5
6
7
T.D. 61 M.
0
10
20
30
40
90
140+
METERS/HOUR


SITE 458
METERS PENETRATION
METERS/HOUR
0
50
100
150
200
250
300
350
400
450
0
10
20
30
40
90
140+
1
2
3
4
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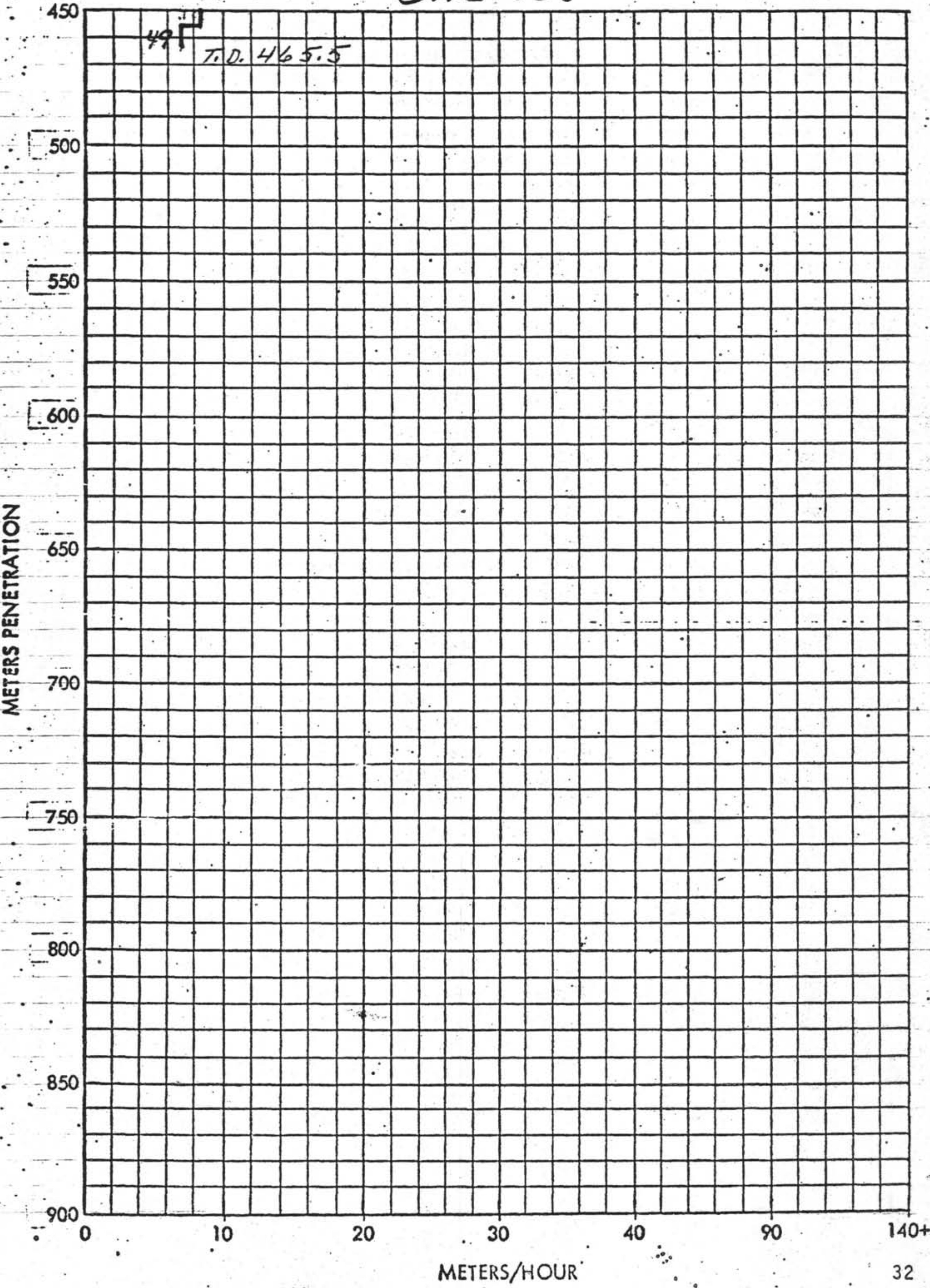
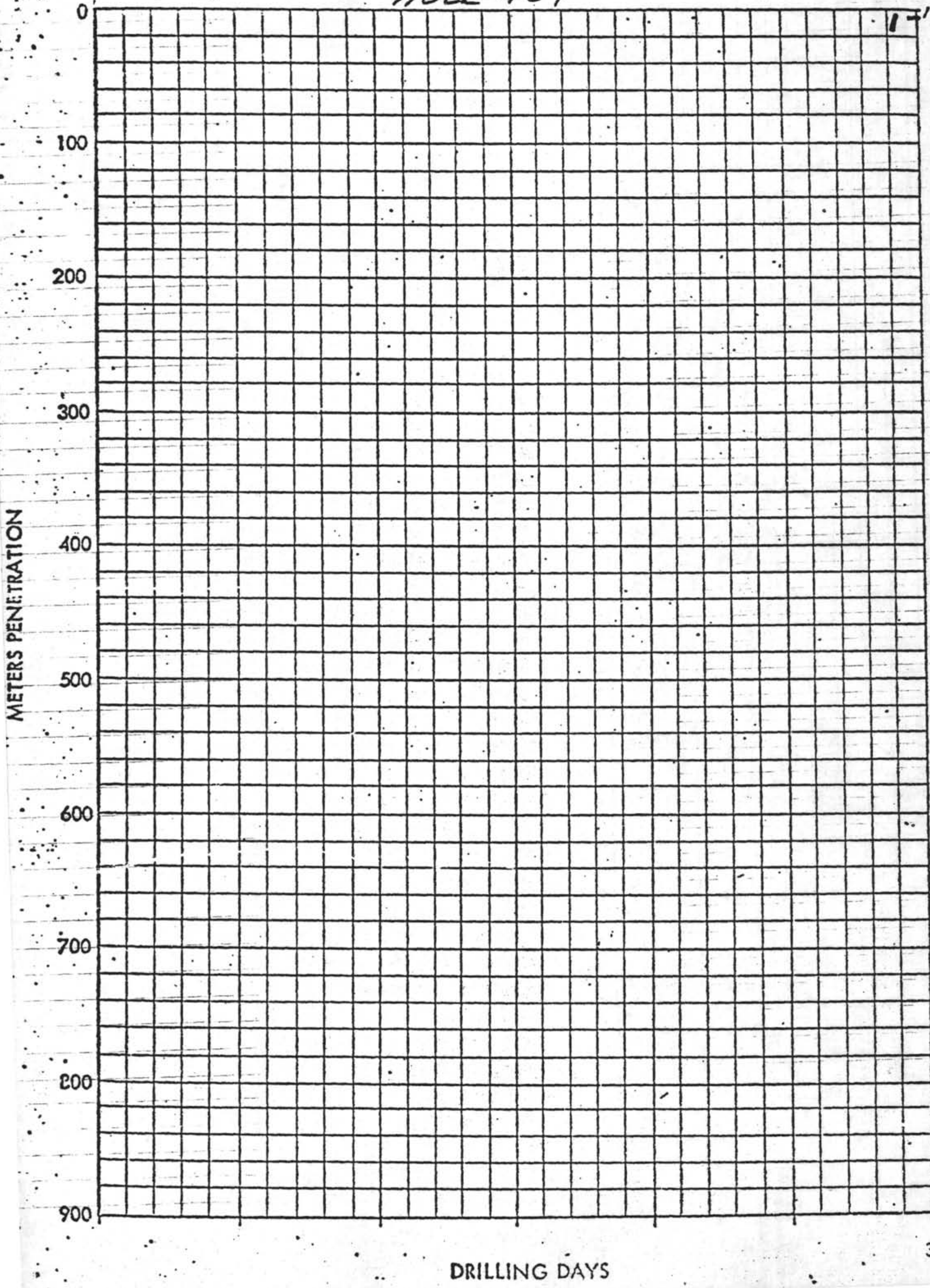
48

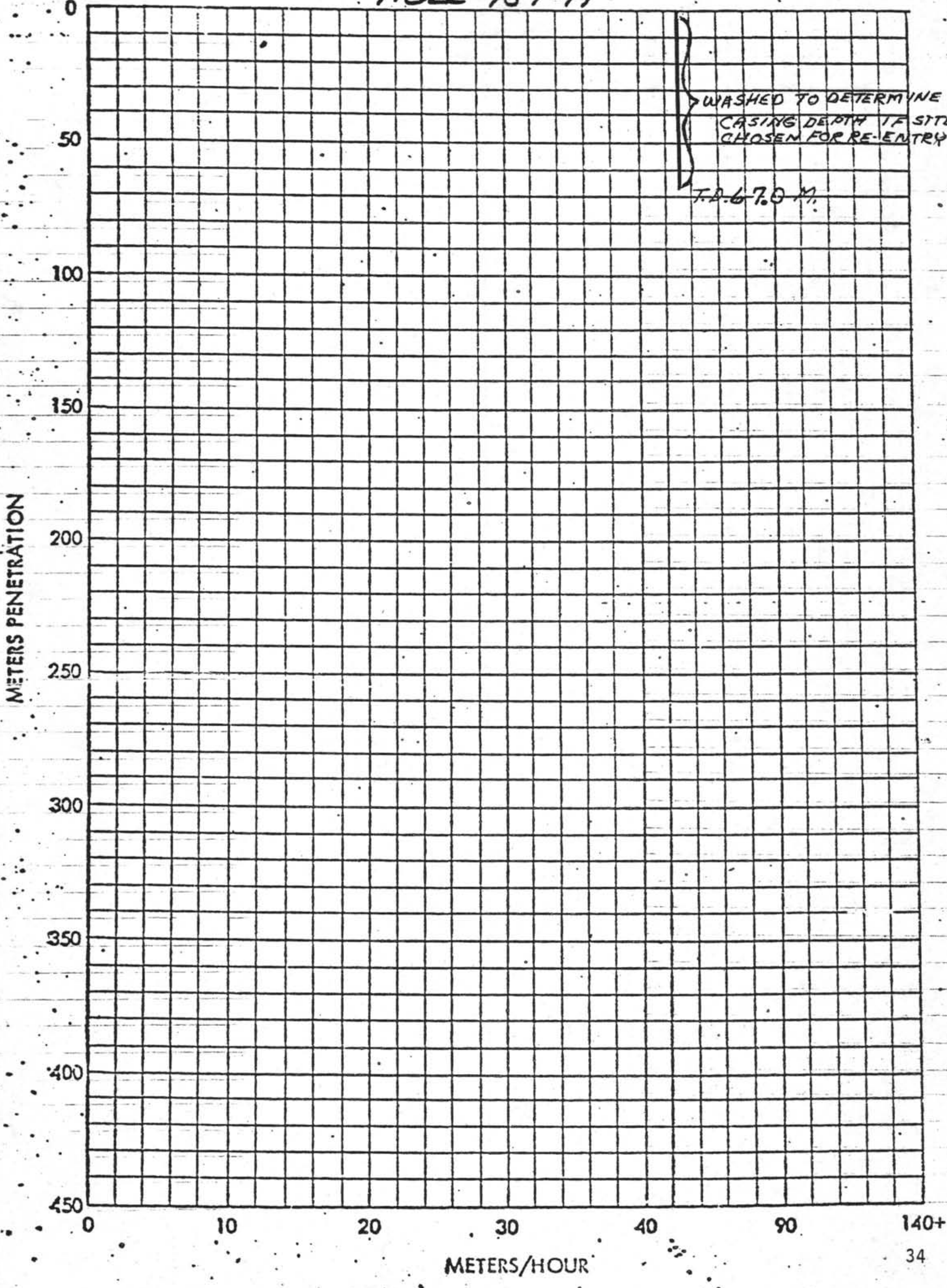
SITE 458


49
T.D. 465.5
450
500
550
600
650
700
750
800
850
900
METERS PENETRATION
0
10
20
30
40
90
140+
METERS/HOUR

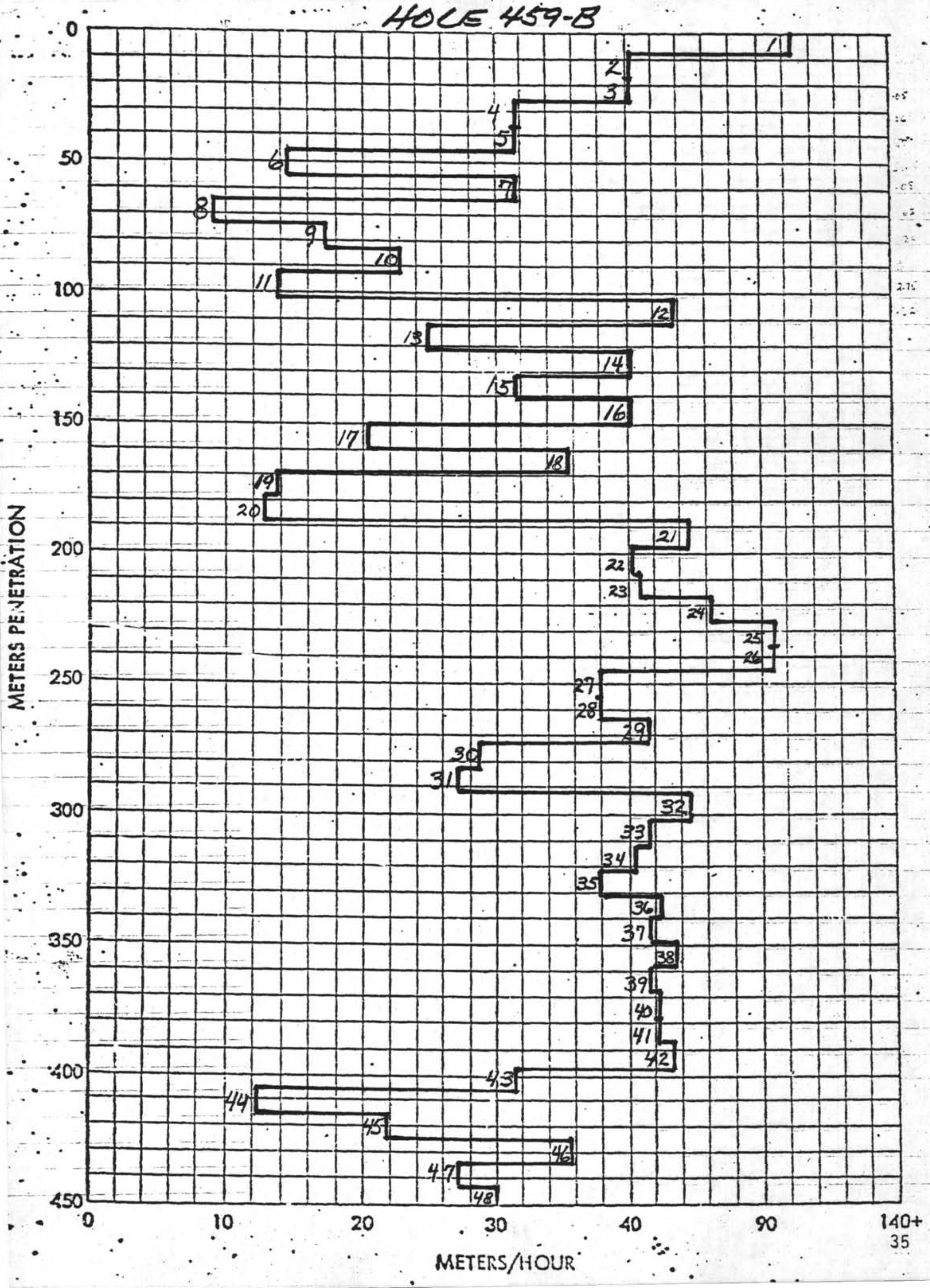
HOLE 459


0
100
200
300
400
500
600
700
200
900
METERS PENETRATION
DRILLING DAYS

HOLE 454-A



WASHED TO DETERMINE CASING DEPTH IF SITE CHOSEN FOR RE-ENTRY
T.D. 67.0 M.
METERS PENETRATION
0
50
100
150
200
250
300
350
400
450
METERS/HOUR
0
10
20
30
40
90
140+


HOLE 459-B
METERS PENETRATION
0
50
100
150
200
250
300
350
400
450
METERS/HOUR
0
10
20
30
40
90
140+
35
1
2
3
4
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11
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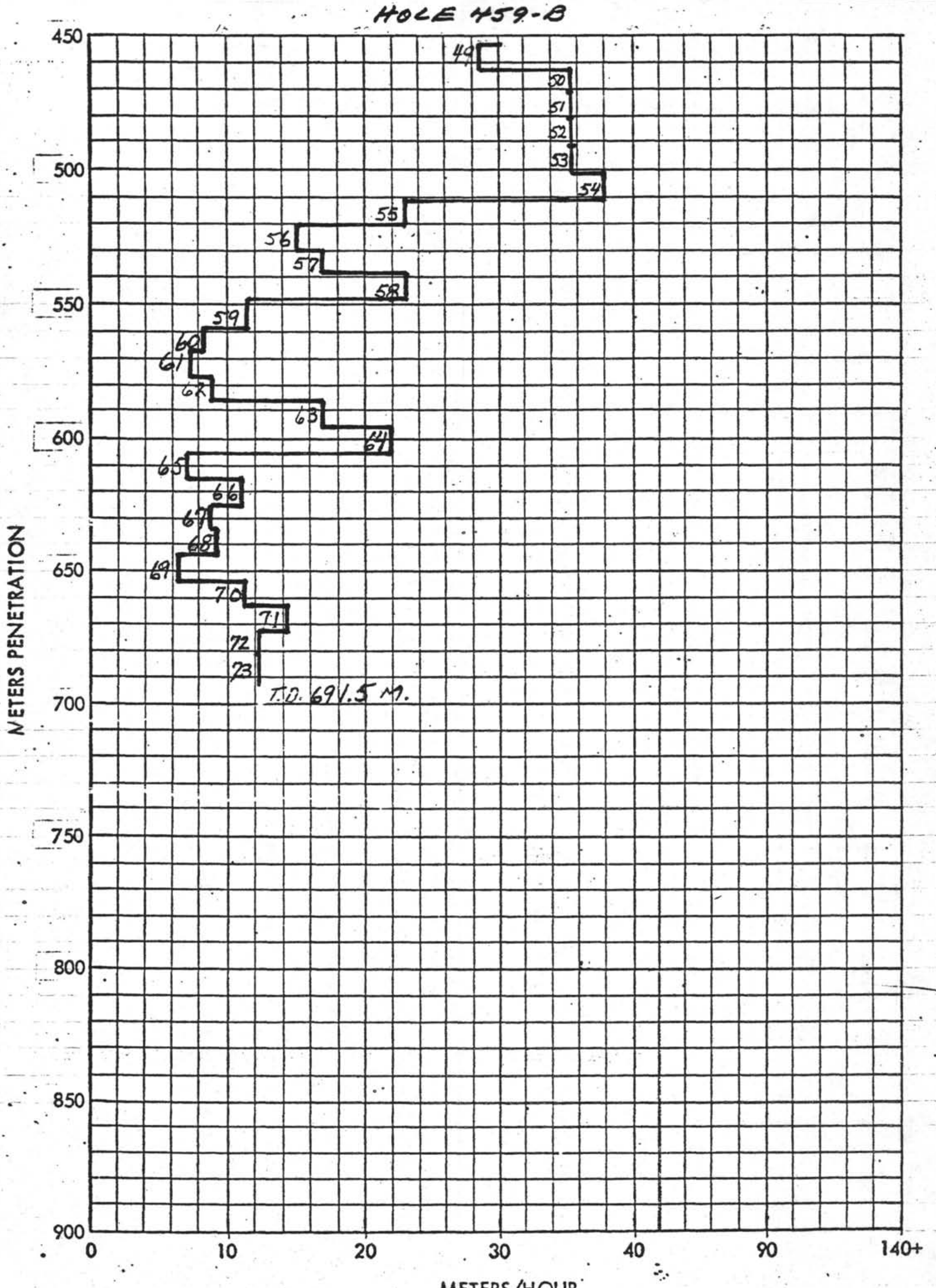
HOLE 459-B
METERS PENETRATION
450
500
550
600
650
700
750
800
850
900
0
10
20
30
40
90
140+
METERS/HOUR
49
50
51
52
53
54
55
56
57
58
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62
63
64
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66
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68
69
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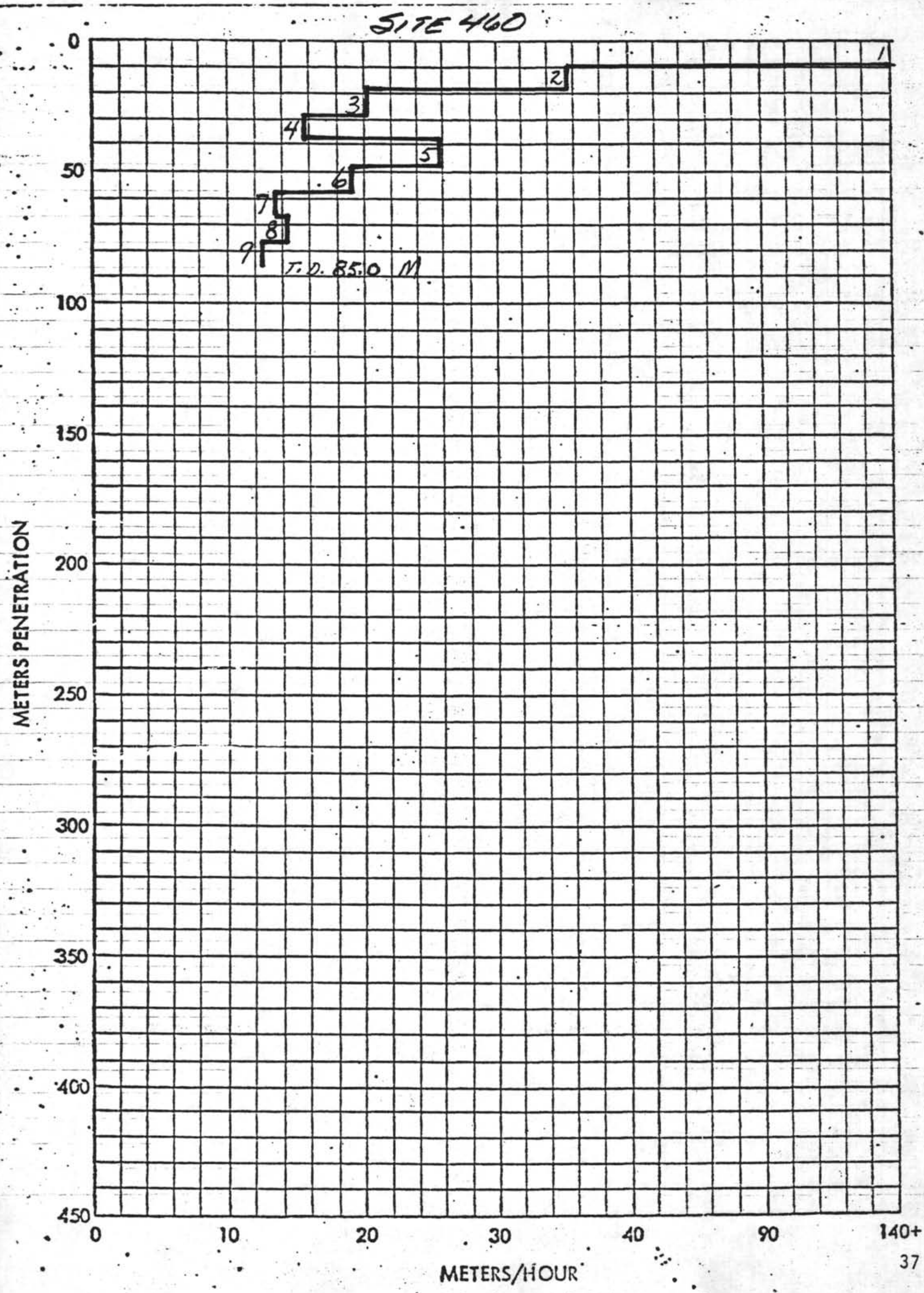
71
72
73
T.D. 691.5 M.


SITE 460
METERS PENETRATION
0
50
100
150
200
250
300
350
400
450
METERS/HOUR
0
10
20
30
40
90
140+
1
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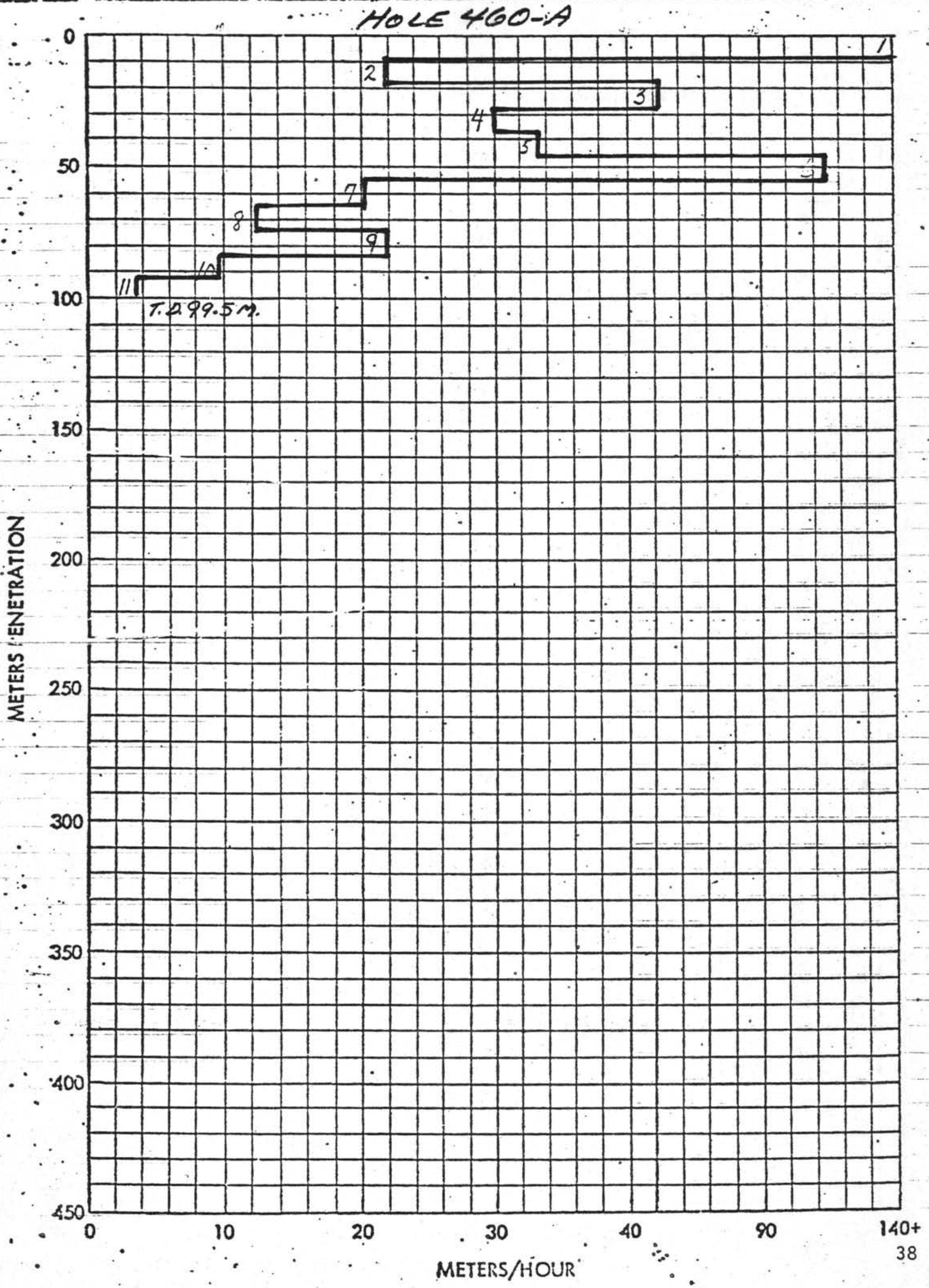
8
9
T.D. 85.0 M


HOLE 460-A
METERS PENETRATION
METERS/HOUR
0
50
100
150
200
250
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350
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450
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140+
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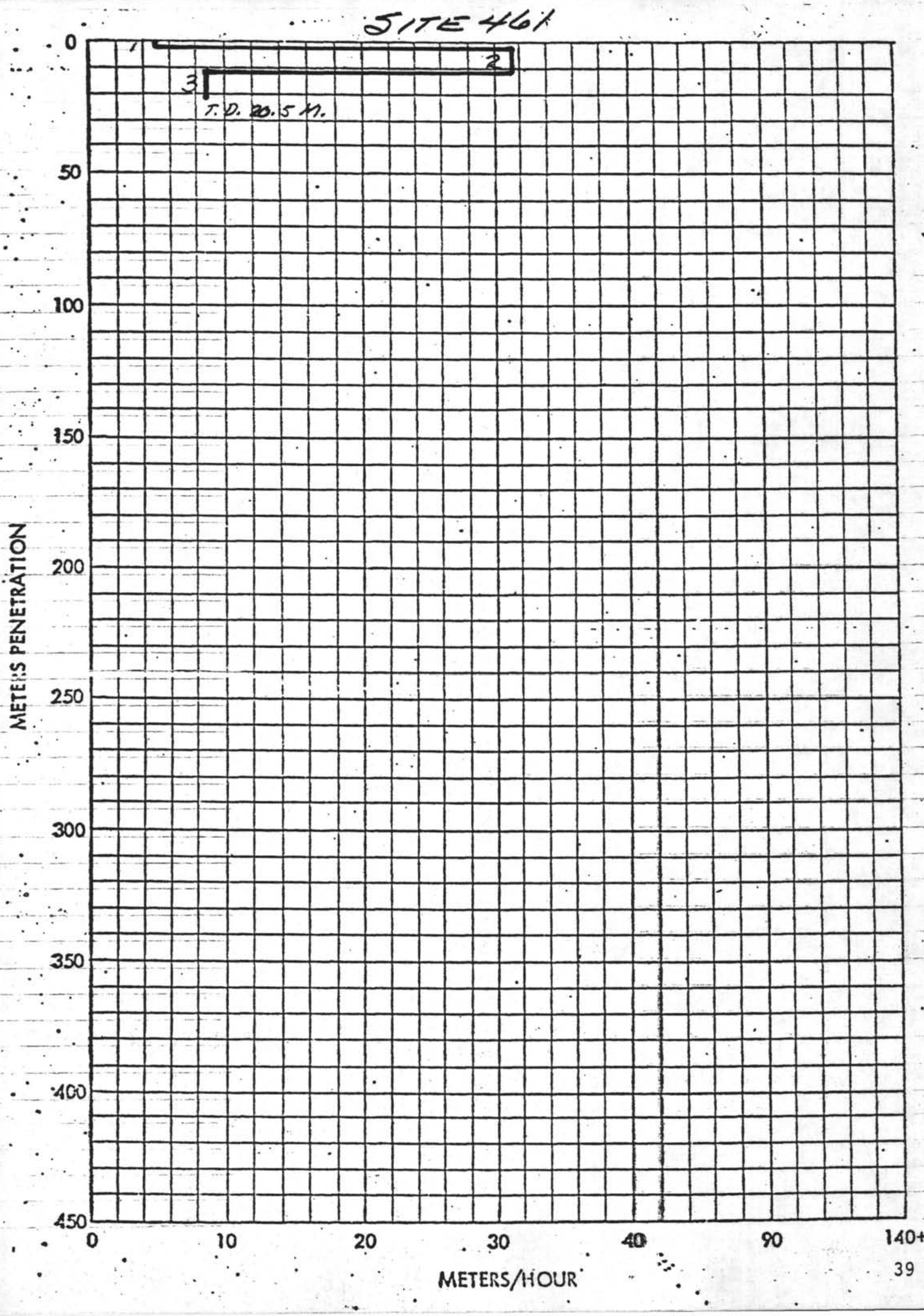
11
T.D. 99.5 M.


SITE 461
1
2
3
T.D. 20.5 M.
0
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150
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250
300
350
400
450
METERS PENETRATION
0
10
20
30
40
90
140+
METERS/HOUR

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
OPERATIONS RESUME
LEG 61

The 61st scientific voyage of the GLOMAR CHALLENGER represented a concerted attempt to penetrate into and sample the oldest oceanic crust of the Central Pacific. Determination of the age and nature of the basement rocks and the overlying sediments would contribute greatly to the understanding of the Mesozoic history of the Pacific Ocean basins.

The cruise commenced on May 15, 1978 at Apra Harbor, Guam and ended at Majuro Atoll, Marshall Islands on July 29, 1978. An interim port call was made at Majuro for crew change, resupply and thruster repairs.

The operations of Leg 61 were confined to a single site. The results of the coring program provided successes, problems and surprises, both technically and scientifically. 161 cores were attempted at Site 462, breaking the record for a single site. In addition Hole 462A was re-entered 15 times to break the old records of 13 re-entries for one hole and 12 for one leg.

Total length of the voyage was 75.0 days, of which 51.8 days were spent on-site, 11.9 days underway and 11.3 days in port. 6.7 days were spent in fishing operations and 1.1 days were lost due to mechanical difficulties.

GUAM PORT CALL

Leg 61 began with the first mooring line over at Berth F-1, Cabras Island, Apra Harbor, Guam, at 1218 hours on May 15, 1978. The vessel commenced fueling immediately and 296,500 gallons of diesel fuel were loaded. The following day the CHALLENGER moved a short distance to Berth F-2 for the remainder of the port call.

The major work item at Guam was the removal and reinstallation of both bow thruster gearbox units, necessitated by signs of bearing failure in one unit and cumulative operating time on the other. One unit was removed for rebuilding and was replaced by the onboard spare. Repairs were made to the other gearbox and it was reinstalled.

Other work items included special periodic inspections of the derrick and the vessel's structures, drill pipe inspection, top overhaul of No. 3 engine, installation of a new controller for the electric drawworks brake and special training for dynamic positioning system operations. The positioning system was upgraded by the installation of a backup digital-to-analog converter unit.

Core samples were offloaded for shipment to California and resupply of food items, drill water, and lube oil was accomplished. Various freight shipments were received, including 20 drill collars, three bumper subs and about 900 butyrate core liners.

GUAM TO SITE 462

The last line was cast off at Guam at 1110, May 22. As soon as the vessel was clear of the approaches to Apra Harbor, a stop was made for an operational test of the thrusters and the dynamic positioning system. The systems were found to operate satisfactorily, except for a slight anomalous vibration in bow thruster No. 2. Two positioning beacons were tested for submerged operation. The voyage resumed after a 1 1/4 hour delay.

A course had been chosen that would enable the CHALLENGER to profile across Heezen Guyot (a contingency drill site) and then to approach the prime drill site from the north-northwest. As the course headed the ship almost directly into trade winds and current for most of the distance, an average speed of only 8.3 knots was realized. The final 34 miles were traveled at six knots to provide better profiling conditions. The positioning beacon was launched on the first pass over the drill site coordinates. A transit time of six days, 13.3 hours was required for a total of 1297.5 nautical miles.

HOLE 462 - NORTHERN NAURU BASIN

The prime operating site of Leg 61 was situated between the Caroline and Marshall Island groups, about 155 miles northeast of Kusaie Island and 170 miles southwest of Kwajalein Atoll.

The vessel was stationed over the acoustic beacon with a 200 foot west offset to avoid disturbance of sediments at the future re-entry cone site. After the bottom-hole assembly was made up, the drill string was run in to put the bit just above the seafloor. This initial pipe trip was somewhat slower than normal as the drill string was concurrently measured and tallied and several joints downgraded at the Guam inspection had to be removed from the string.

As this was a re-entry exploratory hole, the establishment of the exact depth to seafloor was of particular importance. The precision depth recorder reading was 5191 meters and at 1915 hours on May 29, a punch core was attempted from 5189.5 to 5199 meters. No weight indication of contact was noted. However the core barrel was retrieved almost completely filled with sediment. One joint of drill pipe was set back and the punch core procedure was repeated. No core was recovered, but some sediment was found in the core catcher and coating the lower 1/2 meter of core liner. Water depth was set at 5189 meters.

A jetting test was then conducted to determine the length of the re-entry conductor casing string to be set. With the exception of a fairly resistant stratum at 45 to 47 meters BSF (below seafloor), the bit washed easily through the soft ooze to 86 meters with only minimal pumping. This depth was considered to be in excess of the length of casing required to provide adequate support for the re-entry cone. Also longer casing strings would require modification of the BHA and excessive drill collar weight.

The bit was then pulled clear of the mudline, the inner core barrel was tripped and continuous coring was begun at 5199 meters.

Coring proceeded smoothly and with good recovery except for an interval between about 370 and 460 meters BSF. This was a zone of interbedded chert nodules, limestone and soft chalk. The hard chert was responsible for slow penetration and repeated jamming of core catchers which resulted in low core recovery through the interval. No torquing or sticking of the drill string was experienced, however. Good coring conditions were enjoyed in the sediment section below the cherts.

An unexpected basalt sill was encountered at 560 meters BSF. A decreasing penetration rate after 57 meters of basalt drilling prompted a decision to terminate coring and to log the exploratory hole in preparation for the re-entry project.

The borehole was flushed with 50 barrels of bentonite mud and a wireline run was made to release the core bit. The end of the pipe was then pulled to 485 meters BSF and 150 barrels of mud were spotted to fill the upper section of the hole. The lower part of the hole was left full of seawater due to the presence of fresh water-sensitive clay strata. The drill string was pulled until only the BHA remained in the hole.

The first logging tool run was the differential temperature sonde. This is a small diameter tool normally used in production logging and, even with sinker bars, weighs only about 100 pounds. The sonde would not pass an apparent bridge only 40 meters below the end of the pipe. The logging tool was retrieved and two additional stands of drill pipe were added, putting the end of the pipe at 167.5 meters BSF. The temperature sonde and sinker bars were adaptable to the compensated density/gamma ray tool and this combination tool was made up to provide additional sonde weight. However the radioactive density source was left out of the tool for the first run until downhole conditions could be proven safe for radioactive logs. On this attempt, the tool was successfully lowered to within 20 meters of total depth, although "ledges" or other obstructions in the cherty zone about 400 meters BSF impeded the descent temporarily. Temperature was logged going into the hole and a Natural Gamma Ray log was recorded on the way out.

The next logging attempt was made with the Sonic/Caliper/Gamma Ray tool. This sonde also was stopped by obstacles in the cherty zone. After considerable effort, the tool was successfully worked through the trouble zone. It was apparently damaged in the process, however, and would not perform reliably enough to provide a log of the lower portion of the hole.

The next tool into the hole was the Induction/Gamma Ray log. After only minor hesitations in the chert zone, a good log was obtained from about 35 meters short of total depth up to the drill string.

Due to the scientific value of the sonic log, a second attempt was made with an alternate sonde carried onboard as a backup. The tool could not be worked past a bridge at about 350 meters BSF, however, and only the upper portion of the hole was logged. The caliper curve showed this entire interval to be washed out beyond the 15-inch diameter limit of the caliper and only the velocity of the borehole fluid was read on the sonic curve.

The compensated Density/Gamma Ray/Temperature log was attempted next and, after some difficulty getting down, an excellent log was recorded from 21 meters off total depth. In addition, a second good temperature log was obtained for comparison with the first run 36 hours earlier.

The final log attempt was a Guard/Neutron/Gamma Ray run. The Gamma Ray curve failed while running down the pipe and the Guard Log section was shorted out in a futile attempt to work the sonde past an obstruction at 460 meters BSF. A Neutron curve was recorded in the upper section of the hole, but was of little use due to excessive hole diameter.

The logging sheaves were rigged down and the remainder of the drill string was pulled. All pipe was on board at 1700 hours, June 8, 1978.

HOLE 462A

When the drill string had been recovered from Hole 462 operations, positioning offsets were entered to relocate the vessel about 500 meters to the north-northeast. This was done to avoid redrilling the thick basalt sill should it prove to be a localized occurrence.

The re-entry cone had been moved into place in the starboard casing rack area during the final stages of drilling on Hole 462 and required only the finishing touches prior to keelhauling. Rigging and keelhauling operations went smoothly and the cone was hung off beneath the moon pool only one and one half hours after the pipe was on deck.

Seven joints of 16", range 2, 75 lb casing were then made up to the tapered transition joint and hung off from a platform beneath the rig floor. A standard bottomhole assembly was put together with the exception of the casing running tool incorporated just below the upper bumper subs. The casing string was attached to the running tool and the entire assembly was lowered until it latched into the re-entry cone. The cone's supporting slings were then cut and the pipe trip continued normally, though at a reduced pace to lessen the effects of surge on the cone.

At a point just short of the seafloor, the power sub was picked up in preparation for jetting in the casing. Hole 452A was spudded at 1400 hours, June 9. The casing was jetted in without difficulty and, with the bit and casing shoe at 5260.5 meters, a sandline run was made with the shifting tool and the cone/casing assembly was released.

The hole was drilled ahead with spot cores in intervals of interest and/or low recovery as designated by science to supplement Hole 462 cores. The entire interbedded chert/limestone/chalk zone was recored. Continuous coring of Hole 452A commenced at 515.5 meters BSF. At 563 meters BSF, the drill again struck hard basalt. After 23 meters of very hard basalt had been cut, the rate of penetration dropped to about 1/2 meter per hour and damage to the bit from either chert or basalt was suspected. The first round trip for a bit change was begun at 0530 hours, June 13. The bit arrived on deck at 1700 hours that afternoon and was found to have 17 broken inserts, all in the drive rows of two cones.

FIRST RE-ENTRY - SECOND CORE BIT

Four drill collars were added to the BHA to increase the efficiency of the tungsten carbide bit in the extremely hard material being penetrated. The drill string was run back until the bit was at a depth of 5173.5 meters. The logging sheaves and line wiper/packoff were rigged with one stand of pipe up in the derrick. The sonar tool was run down the pipe and landed at the bit without incident. Upon commencement of scanning, the re-entry cone target was detected at a range of 43 feet. While the first approach maneuver was being made, power regulation to the sonar tool was lost and it was necessary to retrieve the tool.

When the sonar tool had been retrieved and detached from the logging cable, water was found inside the cable head connection. The cable head was disassembled and a cracked electrical connector body was found and replaced.

A backup sonar tool was made up to the cable and started down the pipe. After about 140 meters, the tool began to drag and then stopped in the pipe. The sonar was retrieved slowly to the surface against slight drag to determine the problem. A small threaded plug used to fill the motor housing with oil was discovered to have backed out partially to the point where it interfered with the tool's travel. The plug and all other fasteners were tightened securely and the tool was run down the pipe to the bit in the normal manner.

Sonar scanning and maneuvering the ship consumed 63 minutes before the re-entry stab was made. During this period the pipe had been lowered to put the bit at 5178.5 meters.

The sonar was retrieved and four stands of pipe were run to verify the re-entry. After the sheaves were rigged down, the bit was run back to total depth with no obstructions encountered. Only about two meters of fill were noted.

The new bit produced an improved drilling rate in the extremely hard basalt and diabase sill. However penetration of a short interval of fractured basalt resulted in a badly jammed core catcher. This apparently caused the inner barrel to be forcibly unlatched by the pressure of core entering the bit throat. This core then pushed the barrel upward and accumulated in the bit body, preventing the seating of subsequent core barrels. Attempts to dislodge the core fragments with chisel-type core breaker and deplugger tools were unsuccessful and the bit was pulled after only 40 meters penetration.

Upon recovery, about 1.5 meters of basalt core were found in the bit and bit sub. The bit was found to have ten broken inserts in the same position as on the previous bit. It was concluded that the extremely dense igneous material was too hard for the "general purpose" model F94CK bit.

SECOND RE-ENTRY - THIRD BIT

The bit was replaced with a new F99CK "hard formation" model. It was hoped that this bit would completely penetrate the interval of igneous intrusive bodies.

The initial pipe trip and preparations for re-entry were uneventful. However a routine in-pipe check of the sonar tool as it descended at about 1500 meters showed a loss of power regulation to the tool. The sonar was retrieved and a deck check revealed a malfunction in the transducer rotating mechanism.

A backup tool was attached, checked out and started down the pipe. It was landed in the bit without incident and scanning commenced. After 36 minutes of approach maneuvers, the bit swung over the cone and a stab was made. The sonar tool had been pulled to within 650 meters of the rig floor when the wireline suddenly jerked tight. The tension was momentary and had been released before the winch could be stopped. The remainder of the cable was retrieved and it was found that the cable head weak point had failed leaving the sonar tool somewhere in the pipe.

Two stands of drill pipe were run to verify the re-entry. The string began to "take weight" on the second stand, indicating that the re-entry stab had missed. The bit was then pulled above the elevation of the re-entry cone.

The upper fitting on the re-entry tool is only slightly larger in diameter than the rock cores recovered by the CHALLENGER. An overshot type fishing tool was quickly improvised from a slightly modified core catcher assembly and a standard inner core barrel. This assembly was lowered on the sandline and the tool was encountered, tightly stuck, at the point where it had been lost. It was firmly engaged by the core catcher and the first attempt to free it resulted in a sheared overshot pin, leaving the core barrel also in the pipe. On the second attemt, the fish was jarred loose with the link jars on the overshot and recovered. Except for scratches, the tool suffered no obvious damage. The wedging had apparently been caused by a foreign object in the pipe that was not recovered. A bolt was found to be missing from the bottom of the line wiper, however.

Because of shocks sustained by the sonar tool, a third tool was run for the subsequent re-entry attempt. Operations progressed smoothly from that point and a successful re-entry stab was made after 27 minutes scan time.

The bit's progress to bottom through the open hole was impeded by a bridge at the top of the basalt sill. The heave compensator and the power sub were picked up and the bridge was washed out easily. Seven singles were run to total depth without resistance and again only minimal fill was encountered.

On the morning of June 18, the signal from the original positioning beacon began to decline sharply and a fresh beacon of the alternate frequency was launched. The vessel was then stationed over the new beacon.

Coring continued at a slow pace in very hard igneous rock until a depth of 656 m BSF where sedimentary strata were encountered. About two meters of volcanogenic sandstone and siltstone were recovered from just below the sill. Drilling parameters indicated about 28 meters of firm sediment below that, but only very small fragments of core were recovered, even after another basalt sill had been reached. Pump pressure indicators were normal, but efforts were made to dislodge any possible obstruction. The "seating" pump pressure was ambiguous and a final two-meter core attempt was made before a round trip was made to determine the problem. It was found that the final core barrel had not latched in and about 65 cm of basalt core was recovered from the bit body and bit sub. No mechanical fault was found and no reason determined for the lack of recovery in the sediments.

THIRD RE-ENTRY - FOURTH BIT

A new bit of the same type (Type F99CK) was made up and the pipe was run to the re-entry position. Re-entry operations proceeded in the normal manner and a stab was made at the cone after only 15 minutes of scanning time. Visual and audible indications on the bridge were nearly ideal for a successful re-entry, but the rig weight indicator had become somewhat sluggish following the stab. This could have meant that the bit had been shoved into the soft seafloor sediment. Since there was reasonable doubt about the stab and since about 3 1/2 hours would be wasted in verifying a miss, the bit was pulled above the cone and scanning was reinitiated. After an additional 61 minutes of scanning and maneuvering, a second stab was made. This time all indications were positive and a successful re-entry was subsequently verified by adding three stands of pipe.

The core bit made a successful run of 49 rotating hours, cutting 74.5 meters of basalt and diabase and 22 meters of interbedded sediments. The decision to trip for a new bit was prompted by the gradual reduction of core diameter, indicating progressive bearing failure.

FOURTH RE-ENTRY - FIFTH BIT

Pipe trip and re-entry operations proceeded exceptionally smoothly on this round trip. Sonar scanning time was 22 minutes, ending in a successful re-entry stab. No obstructions in the hole were encountered and coring operations resumed at 790 meters below seafloor (BSF), only 24 1/2 hours after the trip was begun.

Coring continued through a complex of diabase sills and pillow basalts at a slow rate. The bit was pulled after a run of 53.3 rotating hours when decreasing core diameter was noted. A total of 89 meters had been cut.

FIFTH RE-ENTRY - SIXTH BIT

The pipe trip was begun by breaking down the BHA and checking all connections for fatigue cracks as the assembly was run through the rotary table. This fluorescent magnetic particle inspection is conducted once each leg and consumed about two additional hours of operating time.

The trip and re-entry were without incident and the re-entry was made after 14 minutes of scanning. The hole was found to be completely clean on the remainder of the pipe trip until slight drag was noted about 15 meters off bottom. At this point one stand of pipe was set back and the power sub was picked up.

Rotation of the pipe commenced as soon as the torque arms had been installed. A severe knocking vibration was noted to be originating in the power sub or in the swivel. After considerable difficulty in determining the faulty component, the problem was found to be failure of the main swivel bearing. The swivel was replaced by a spare unit carried on board. 4 1/2 hours of operating time were lost.

Slight reaming of the lowermost 15 meters was required before continuous coring of the basalt resumed. The cored interval was generally more broken and rubbly than the basalts up the hole. Occasional sporadic torquing was experienced throughout the interval. This was attributed to basalt fragments detaching from the borehole and temporarily wedging the drill collars. After 39 1/2 rotating hours and 76.5 meters penetration, the drill string began torquing up on bottom. The torque released whenever the bit was raised off bottom. Although fractured formation was suspected, there was a strong possibility of bit failure and a pipe trip was begun.

When the bit was recovered, it was found that all bearings had failed, one cone was missing and the remaining three cones were badly battered. The outer core barrel was noted to be badly scarred by junk for a distance of over six meters above the bit. The final seven meter core was recovered at this time with full core recovery. The core was severely reduced in diameter compared to the previous core.

SIXTH RE-ENTRY - FIRST FISHING ATTEMPT

The presence of a bit cone in the bottom of the hole would prevent any further coring operations until the cone could be retrieved or destroyed. A junk basket/ milling shoe fishing assembly was made up from components carried for such emergencies. The outside diameter of the shoe was reduced to compensate for probable undergauge hole cut by the badly worn bit. An abbreviated BHA was made up as less weight would be required for fishing than for coring.

At 1300 hours on July 3, the pipe trip began in an attempt to retrieve the lost bit cone. Passage of the re-entry transducer through the junk catcher basket was made possible by a temporary plastic retainer that held the spring-loaded dogs open. The sonar tool seated properly and a successful re-entry was made after only ten minutes of scanning.

Again the borehole was free of obstacles and only about five meters of "soft" fill was encountered. The hole was flushed with mud while the fishing assembly was washed to total depth and rotated on bottom for 15 minutes. Only very minor torque and bouncing were noted. A pipe trip was then begun to retrieve the assembly and, hopefully, the junk.

When the junk basket arrived on deck, it was found that the plastic retainer had not been sufficiently displaced or deformed to allow the catcher dogs to close. Only small fragments of basalt and sediment were recovered. They had been wedged beside the retainer sleeve.

SEVENTH RE-ENTRY - SECOND FISHING ATTEMPT

The same fishing assembly was redressed with a shorter and less substantial plastic retainer in the catcher. The drill string was run back to re-entry depth and re-entry operations began.

The dynamic positioning system was apparently slow to regain tight stationkeeping following an earlier heading change. After 85 minutes of sonar scanning, all power was lost at the bridge sonar console. The problem was traced to a failed console power supply and was rectified after 45 minutes. It was not necessary to retrieve the downhole tool. After 41 minutes of additional scanning, the re-entry stab was made.

Again, about five meters of fill was noted at total depth. Since the earlier milling attempt had apparently been too brief, the junk mill was rotated on bottom for one hour and 45 minutes. Again, there was no positive indication of junk on bottom. A slug of weighted mud was pumped around into the annulus and allowed to equalize by flowing back into the pipe. This was intended to carry junk up into the basket and appeared to plug the pipe in a few seconds.

The pipe was tripped and the junk basket assembly recovered. Eleven of the twelve catcher fingers or dogs had been broken out of the "cage" body and it appeared that rotation on bottom had been too prolonged on this occasion. No rock or junk fragments were recovered.

EIGHTH RE-ENTRY - SEVENTH BIT

Considering that the failed bit had cut and recovered core to total depth and that the outer barrel was scarred by junk for several meters, it was felt that the lost cone might have been wedged tightly and safely into a fracture in the side of the hole. The decision was made to attempt coring operations with a bit and to determine positively whether a junk problem existed.

A new F99CK hard formation bit was chosen with the positive attitude that, should coring be possible, the remainder of site time would be spent coring without interruption. The longer BHA used with earlier bits was again employed.

Prior to running pipe, a fresh 16 kHz double-life positioning beacon was dropped. Approximate offsets were determined during the pipe trip and positioning was switched over from the slowly weakening 13.5 kHz beacon. This was done prior to re-entry so that precise re-entry offsets could be determined for future reference.

One hundred and forty one minutes of scanning time were required before the drill pipe was finally induced to make the proper swing over the re-entry cone.

The bit was run to bottom with some reaming required in the lower part of the hole. As soon as total depth was reached, it became apparent that there was junk at the bottom of the hole. Characteristic severe torquing and bouncing were observed. When these conditions had persisted for one hour without improvement, the string was pulled to prevent an additional catastrophic failure.

The bit was retrieved in a somewhat battered condition with 25 broken inserts. All bearing seals were intact.

NINTH RE-ENTRY - THIRD FISHING ATTEMPT

The junk basket was rigged for a third time and the short BHA assembled. An inner core barrel had been spaced out with a small diameter wireline fishing magnet to place the magnet just above the catcher. The plan included pumping down the core barrel following re-entry to put the magnet in a position to contact junk during the fishing operation and rotating the mill for a shorter period of time to prevent loss of the catcher fingers.

As the re-entry sonar tool was being lowered in the pipe, a routine check revealed the loss of indication of transducer rotation. The tool was retrieved from about 2200 meters and replaced with a backup tool. About two hours time was lost.

A successful re-entry stab was made after a 33 minute scan. The pipe was run to a point just off total depth and the inner barrel was dropped. The deviation survey tool had been included in the barrel and the survey was recorded before operations proceeded.

Two meters of fill were noted as the shoe was washed to bottom. After the shoe had been turned for about five minutes on bottom, the inner barrel with the magnet and survey tool was retrieved. Only rust scale from inside the drill pipe was clinging to the magnet. The milling shoe was again set on bottom and rotated for an additional ten minutes.

The drill string was recovered and all the catcher teeth were found to be missing. It was inferred that the catcher assemblies, which were fixed inside the bit sub, were being damaged by contact with the pedestal of "core" being produced as the mill shoe cut into the basalt.

TENTH RE-ENTRY - FOURTH FISHING ATTEMPT

Various options and tools on board were reviewed. Best chances of recovering the cone or cone fragments were considered to be by means of a slightly different model junk basket carried on board. This basket featured a free-rotating catcher assembly. A plywood retainer ring held the fingers of the catcher open for the re-entry transducer.

The drill pipe hung within a few feet of the re-entry cone for 99 minutes of sonar scanning before the proper reflector pattern was observed and the re-entry was made.

The junk basket was run to a depth of 6122 meters. After the hole was flushed with mud, a through pipe Gamma Ray/Neutron log was run to provide correlation of lithologic units in cores and in Hole 462. About five hours were consumed by the logging operation.

The drill string was run to total depth and the junk shoe was rotated on bottom for only about two minutes before the pipe was tripped. On recovery of the fishing assembly, the basket catcher was found to be fully intact and to contain two large chunks of basalt. No metal was recovered, but the recovery of objects similar in size and shape to the bit cone was encouraging.

The drilling equipment was then secured for sea and the vessel departed the site at 0500 hours, July 9 for Majuro and change of crew.

SITE 452 TO MAJURO

The CHALLENGER departed the site on the reciprocal of the base course for Majuro and streamed seismic gear. A 180° turn was then executed and the transit began with passage over the beacon.

Most of the distance was covered at reduced speed as full speed would have resulted in arrival at the reef pass before daybreak.

The vessel reached the pilot station off Majuro Atoll at 0630 hours, July 11. Due to a communications mixup with Radio Majuro concerning arrival time, no pilot was on hand and the CHALLENGER negotiated the channel without assistance. The pilot came aboard after the vessel was well inside the lagoon.

As the docking area was approached, it was learned that the only pierside berth was occupied by a freighter. The CHALLENGER stood off for about one hour as the freighter had been requested to move to an anchorage. It was then learned that the freighter's master had refused to move for about 36 hours. The port call began offically when the CHALLENGER's anchor was let go at 0946 hours.

MAJURO PORT CALL

The Senior Trust Authority in Saipan ruled that the freighter had priority to remain at the pier while discharging cargo. The CHALLENGER then shifted to anchorage closer inshore where repair and resupply activities were begun.

The local harbor tug was engaged to come alongside the CHALLENGER and assist in the installation of the tunnel thruster covers. In addition, a small interisland freighter was chartered to ferry freight, baggage and personnel to and from the pier for crew change and resupply activities.

When No. 2 bow thruster tunnel had been dewatered and the thruster inspected, the water leakage was found to be due to seven broken studs in the gearbox mounting flange. The studs and seals were replaced and the gearbox was flushed and refilled with oil.

The vessel was finally able to move to the pier at 0900 hours July 14. During the next 21 1/2 hours, 62,000 gallons of drill water and a spare sandline were loaded.

Official departure from Majuro was at 0630 on July 15.

MAJURO TO SITE 462

The return to the site was uneventful. The signal of the positioning beacon was acquired at midnight July 16 and automatic positioning commenced at 0130 on July 17.

ELEVENTH RE-ENTRY - FIFTH FISHING ATTEMPT

An expert on fishing and remedial work had boarded the CHALLENGER in Majuro as a special consultant. The revised plan to save Hole 462A was aimed toward destruction of the bit cone, rather than its retrieval. One of the junk mills carried on board was modified for this purpose.

Re-entry operations commenced after a routine pipe trip. The sonar target was detected at an initial range of 80 feet and a successful stab was made after two hours and 10 minutes of scanning.

The hole was clean except for about 25 meters of fill that was washed out without difficulty. One hour and 40 minutes were spent milling on bottom with a center bit in place. At the end of this time most indications of junk in the hole had disappeared and a pipe trip was made to put on a core bit. The milling shoe was retrieved in fairly good condition, but scarred from rotating on junk.

TWELFTH RE-ENTRY - EIGHTH BIT

A hard formation F99CK core bit was made up on a drilling BHA and the bit was run in to re-entry position.

The re-entry sonar suddenly stopped at about 1800 meters while it was being lowered through the pipe. Attempts to raise and lower the tool were hampered by drag in the pipe. The sonar was recovered and a bolt used in its assembly was found to have backed out part way. The bolt was replaced and an operational check of the sonar was made before the tool was rerun. Operational checks in the pipe were satisfactory but an electrical problem had developed when the sonar landed at the bit and scanning was attempted. The tool was retrieved and the problem was found to be near the terminal end of the logging vable. Total time lost due to the cable problem was 5 3/4 hours. Re-entry was made after two hours and 32 minutes scanning.

The bit was run to total depth and coring commenced with no indication of junk in the hole. Continuous coring of basalt continued until July 21, when a considerable decrease in core diameter, indicating bit failure was noted. The bit was pulled after 34 1/2 rotating hours. A small portion of one bit cone was found to have been broken off, but it had apparently been broken up by continued drilling.

THIRTEENTH RE-ENTRY - NINTH BIT

Due to the slow penetration realized with the previous bit, a general purpose F94CK core bit was chosen. Because of time constraints, this was to be the final bit run.

The pipe trip, re-entry (77 minutes scanning) and a trip to total depth, proceeded without difficulty. The hole was clean except for four meters of fill.

Coring recommenced at 1945 on July 22. Following the first core, the bit was apparently partially plugged with core fragments and/or cuttings. The situation was rectified after two deplugger runs and two mud flushes with about five hours lost time. Coring operations continued until noon on July 25, when possible bit failure was inferred on the basis of very low core recovery on the previous two cores. The bit had 37.2 rotating hours at a total depth of 1068.5 meters BSF.

Although hole conditions remained good, coring operations were terminated due to scheduling commitments and the bit was pulled in preparation for logging.

FOURTEENTH RE-ENTRY - LOGGING

When the core bit had been recovered, the full diameter logging shoe was made up on a modified and abbreviated logging BHA. The pipe trip was uneventful and the re-entry was made after only 16 minutes scanning.

Inspection of the logging cable on recovery of the re-entry sonar indicated that reheading would be advisable before logging operations were begun. About 1 1/4 hours were spent in reheading.

The first log to be run was the Sonic/Gamma Ray/Caliper log. The sonde descended freely to about 20 meters off total depth and logging commenced. A successful log was obtained, except that a spooling problem with the cable winch resulted in a missed interval of about 130 meters in the upper (washed out) portion of the hole.

The sonic tool was being retrieved at a relatively high rate of speed when the tool was pulled into the line wiper device at the top of the pipe and the cablehead weak point failed. The free end of the cable was recovered and the tool (with cablehead attached) fell back down the pipe, presumably to the bottom of the hole.

Due to economic and time considerations, it was decided that no attempt would be made to fish for the sonde. A second logging tool, the Guard/Neutron/Gamma Ray sonde was made up and started down the pipe. The tool met a solid obstruction in the pipe at about 140 meters. The guard tool was retrieved and after five stands of pipe had been pulled, the sonic sonde was recovered from the pipe. Due to a malfunction in the tool, the caliper arms had not closed and had caused the tool to become lodged at a tool joint.

FIFTEENTH RE-ENTRY - LOGGING ATTEMPT

During the recovery of the logging tool, the end of the drill string had been pulled clear of the re-entry cone and another re-entry was required before logging operations could continue.

In-pipe checks of the sonar were satisfactory, but no re-entry cone or bottom target could be acquired on initiation of scanning. The sonar was retrieved and water was found inside the transducer/extender assembly. The transducer and extender were replaced, the tool was run back down the pipe, and a successful re-entry was made after 56 minutes of scan time. Total lost time due to the leak was 4 1/2 hours.

During the retrieval of the sonar tool, one strand of the logging cable's outer armor parted and became fouled at the line wiper. The unraveled strand was removed and the loose ends were secured to allow retrieval of the remainder of the line. The damaged interval was near the midpoint of the cable and further logging operations were considered too risky to undertake with the weakened line.

The drill string was retrieved and operations at Site 462 were terminated. The vessel got under way at 1724 hours on July 27 to Majuro.

SITE 462 TO MAJURO

The return trip to Majuro was routine with good weather prevailing. At 1348 hours on July 29, the vessel dropped anchor inside the channel entrance of Majuro Atoll, officially ending Leg 61. Following the transfer of scientific and technical personnel to another vessel, the GLOMAR CHALLENGER departed for the first Leg 62 drill site.

DRILLING AND CORING EQUIPMENT

Hole 462 and the upper portion (first bit) of Hole 462A, were drilled with the "general purpose" DSDP bottomhole assembly. This consisted of the bit, core barrel assembly, three 8 1/4" drill collars, one five-foot stroke Baash-Ross bumper sub, three 8 1/4" drill collars, two bumper subs, two 8 1/4" drill collars, 5 1/2" F.H. x 6 5/8" F.H. crossover sub, one 7 1/4" drill collar and one joint range three 5 1/2" drill pipe. To provide more bit weight in the very hard igneous rocks in Hole 462A, the BHA was modified to include three additional drill collars below the upper bumper subs and one extra collar above them. Also the 7 1/4" collar was replaced by an 8 1/4" collar. The lower bumper sub remained in the same position solely to protect the re-entry cone from impact loading on re-entry stabs. The fourth collar above the top bumper subs was left out on the final two bit runs. Abbreviated assemblies were used for logging and fishing operations where weight requirements were less. Torque jars were included just above the lowermost stand of collars in the BHA employed in milling up the lost bit cone.

The only failure of drilling equipment affecting operations was that of the main swivel bearing. Severe binding and "knocking" occurred when the weight of the drill string was picked up on the swivel following rotation on the rotary table. Also, oil leaking from the lower seal of the swivel was noted to contain metal particles. Since overhaul of the swivel is beyond shipboard capabilities, the assembly was not dismantled and details of the failure were not determined.

On one occasion, an inner core barrel was retrieved with the pin connection of the upper 15-foot inner barrel section completely broken off. The assembly, containing a core, was held together only by the tight fit of the butyrate liner. On the final retrieval of the BHA a crack was found encompassing about one half the circumference of a bumper sub mandrel. Both are suspected fatigue cracks and will be investigated further.

CORE BITS

Five F94CK (intermediate-length chisel inserts) and four F99CK (short projectile-tipped inserts) were employed in drilling the long basalt and diabase section of Site 462. This was the hardest sustained drilling ever undertaken by DSDP and proved a severe test for core bits. Somewhat higher penetration rates were achieved by the F94CK bits, but this was more than offset by the fact that fairly severe cutting structure damage was sustained by the F94CK's prior to bearing failure, thus shortening effective bit life. These are the results to be expected when drilling a formation too hard for the bit type. Only relatively minor cutting structure damage was observed on the F99CK bits and bearing failure was the normal failure mode.

One roller cone was lost from an F94CK bit and locking was noted after 39.6 rotating hours. The pristine condition of the bearing race and various downhole phenonema strongly suggest that the loss was due to the breakup of the cone and not to advanced bearing failure. A small portion of the "heel" of one cone was missing from the bit run immediately after the lost bit cone had been milled up. This damage may have resulted from drilling on junk fragments or from striking the re-entry cone during the re-entry stab.

ACOUSTIC BEACONS

Only three positioning beacons were deployed in the course of Leg 61. All were ORE "double-life" beacons and all had useful lives in excess of 400 hours. While the signal strength remained high well beyond the specified "guarantee period", considerably longer lives have been noted in the past on extended occupancy sites. Prolonged storage aboard the vessel may have weakened the batteries somewhat.

HEAVE COMPENSATOR

The Vertical Motion Compensator performed extremely well with no significant problems until June 20, when leakage of hydraulic fluid developed around the compensator piston. Discharge of the caustic liquid became a safety hazard and it was necessary to secure the system for the remainder of the voyage. The problem is the same as that which was experienced on Leg 59 and was subsequently repaired.

SPECIAL TOOLS

Six readings were taken with the recently redesigned self-contained temperature probe in Hole 462. Twelve and one half hours were expended on temperature measurements and no operational problems were encountered. Three of the readings were technically valid, but the data quality of the other three runs was adversely affected, apparently by a faulty thermistor.

Numerous deviation surveys were taken with the Eastman "Single Shot" instrument. Considerable difficulty was encountered in obtaining valid readings despite the use of previously proven techniques and the substitution of redundant components. Good readings were finally achieved by holding the bit off bottom and shutting down the mud pump while the readings were recorded. In the past, the bit had been set on bottom and the lower bumper sub partially closed to minimize the effects of vessel motion. Circulation had been maintained to protect the pipe from sticking. It is inferred that pump circulation may have been causing the inner core barrel to vibrate and thus degrade the quality of the angle measurements.

RE-ENTRY ELECTRONICS

Eight re-entry attempts were delayed or aborted due to problems with re-entry equipment. One delay was caused by a faulty main power supply (located in the bridge console). The remainder of the problems occurred downhole. Two malfunctions of the transducer rotating were experienced. On two occasions, electrical continuity troubles developed outside the sonar tool at or near the cable termination and were solved by reheading. Threaded fasteners used in the assembly of the sonar tool backed out of position twice and impeded movement of the tool through the drill pipe. In one case, a leaky seal allowed water to enter the transducer/extender assembly.

No major deficiencies in techniques or equipment design were indicated by these malfunctions and steps are being taken to reduce chances of recurrence of the motor and bolt problems.

DYNAMIC POSITIONING SYSTEM

The positioning system performed dependably through nearly 52 days of site occupancy and no serious positioning excursions occurred. One operational delay was experienced due to the apparent slow stabilization of the system following a heading change which preceded a re-entry attempt. This situation has been noted in the past, but very infrequently and is suspected to be a software phenomenon. It could not be duplicated in a subsequent operational check.

The use of one main positioning hydrophone was lost for a short time, but was regained by the replacement of a damaged cable leading from the hydrophone to the preamplifier housing. An alternate hydrophone array was used and there was no operational effect.

ENGINEERING

A failure of bow thruster No. 2 was the only item of operational impact within the cognizance of the Engineering Department. A thorough review is being conducted by GMI and Schottel to determine the cause of the loosening or stretching of the mounting stud(s) that led to the breakdown.

The prevailing calm weather resulted in a lower requirement for electrical power for positioning than on some recent voyages and the frequent pipe trips provided ample opportunity for maintenance. The high seawater temperature (87°F) resulted in relatively high operating temperatures for machinery, however. Virtually every piece of cooling and refrigerating equipment on the ship required frequent attention and servicing.

COMMUNICATIONS

Nearly all DSDP message traffic was sent and received via Naval Radio Station NPN in Guam. Communication with Scripps Station WWD was very difficult from the beginning due to the GLOMAR CHALLENGER's remote position in the Central Pacific and to the fact that the ship's operating heading placed the drilling derrick directly in the line of transmission. About halfway through the cruise, the high-powered (TMC) transmitter became incapacitated because of leakage of rainwater into the chassis. On board repair could not be made due to lack of parts.

No message traffic was received by the vessel for a period of two weeks early in the leg. After repeated checks with the Navy, it was found that about 15 messages for the CHALLENGER had been transmitted on a "mercast" schedule that was not being copied by the vessel. Following this incident, NPN was very conscientious in transmitting GLOMAR CHALLENGER traffic directly to the vessel.

A large number of personal "phone patch" calls were placed with the assistance of several amateur radio operators on the West Coast and in Hawaii.

WEATHER AND CURRENTS

Leg 61 operations were conducted within a seasonal tropical convergence zone. The weather was typically cloudy, warm and humid. There were very few days without at least one period of rainfall. Winds within the rain squalls vaired from 0 to 45 knots and were always of relatively short duration. On two occasions, short operational delays were experienced when the vessel was displaced a few hundred feet off station by squalls. Vessel motion was never a problem due to the absence of sustained strong winds or large swells. Topside painting and preservation efforts were hampered by the persistent rain.

The drill site was located near the boundary of the equatorial current and the opposing equatorial countercurrent. The currents encountered were therefore highly variable in direction and velocity, but remained at less than 1 to 1 1/2 knots. They were never a problem but often a factor in positioning.

PERSONNEL

Nearly all personnel were relieved at the first Majoro port call after a standard eight-week DSDP leg. The cruise was a particularly demanding one, however, especially for the contractor's personnel. Frequent pipe trips in heat and rain were required of the rig crew without the normal underway period between sites to break the monotony. During one six-day period, 11 1/2 miles of drill string was handled. In addition, the engine room temperature remained consistently above 130°F, placing considerable stress on Engineering Department personnel.

The uncertainty of homeward travel arrangements and a resulting four-day cruise extension had a negative effect on general shipboard morale. This was somewhat accentuated by disappointingly slow progress toward the drilling objective, end-of-leg shortages of fresh food, etc. These factors did not preclude professional and effective performance by GMI, SIO and visiting scientific staff personnel.

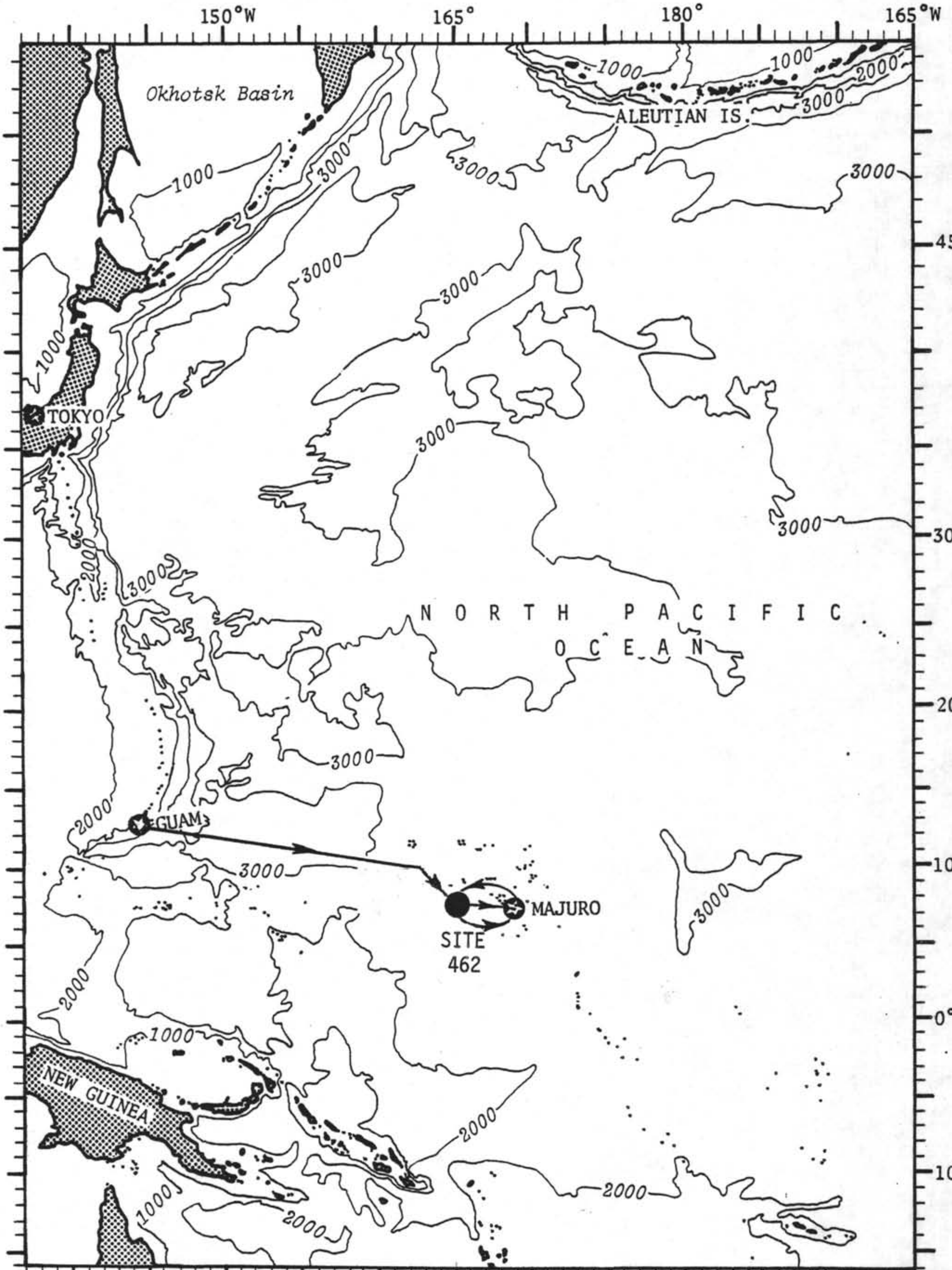
No serious or debilitating illnesses or injuries occurred, although there were several minor injuries to Drilling and Deck Department personnel and one DSDP technician sustained a minor back injury.

Glen N. Foss

Glen N. Foss
Cruise Operations Manager
Deep Sea Drilling Project

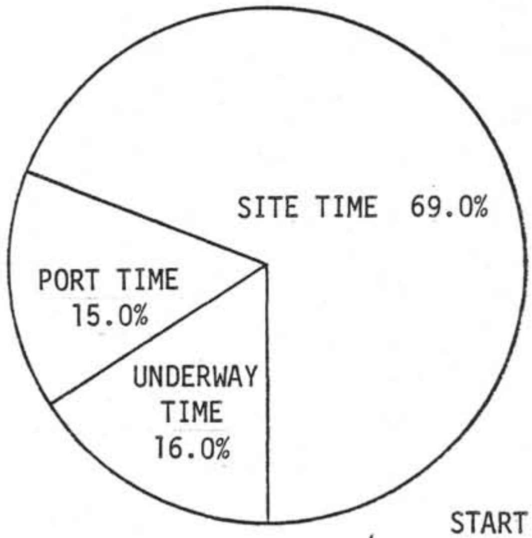
INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
OPERATIONAL RESUME
LEG 61

Total Days (May 15, 1978 - July 29, 1978)		74.98
Days In Port		11.28
Days Underway		11.95
Days On Site		51.75
Coring Time	25.3	
Drilling Time	0.4	
Trip Time (Days)	8.8	
Re-entry & Related	4.0	
Fishing Operations	6.7	
Downhole Measurements	3.7	
Mechanical Downtime	0.4	
Hole Trouble & Stuck Pipe	0.3	
Other	2.1	
Total Distance Covered (Nautical Miles)		2449
Average Speed (Knots)		8.25
Sites Investigated		1
Holes Drilled		2
Number of Cores Attempted		161
Number of Cores With Recovery		156
Percent of Cores With Recovery		96.9
Total Meters Cored		1245.5
Total Meters Recovered		665.7
Percent of Recovery		58.9
Total Meters Drilled		440.0
Total Meters Penetration		1685.5
Percent Penetration Cored		73.9
Maximum Penetration (Meters)		1068.5
Minimum Penetration (Meters)		617.0
Maximum Water Depth (Meters)		5189.0
Minimum Water Depth (Meters)		5186.0



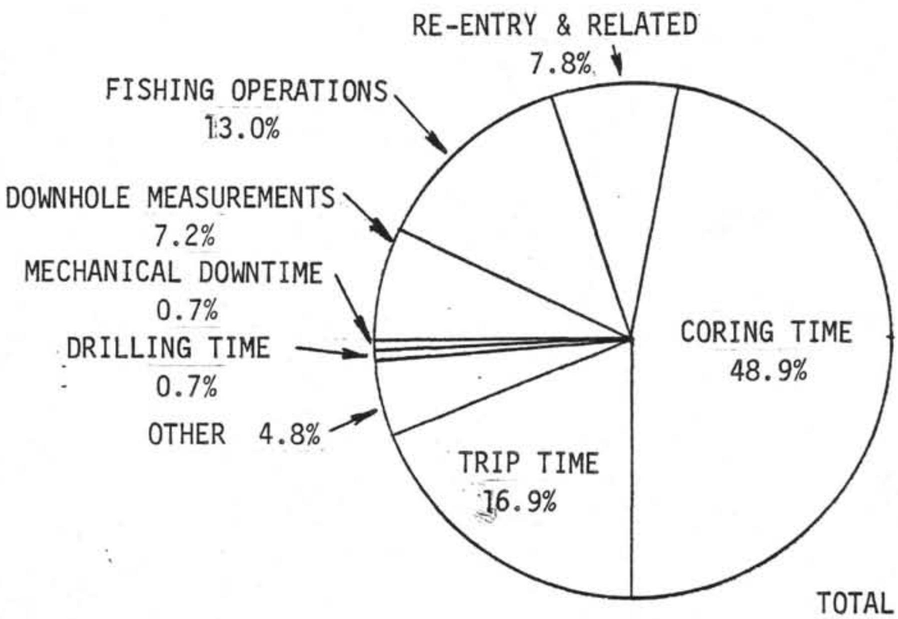
LEG 61 OPERATING AREA

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
TOTAL TIME DISTRIBUTION
LEG 61



START LEG: May 15, 1978
FINISH LEG: July 29, 1978
TOTAL TIME: 74.98 Days

ON-SITE TIME DISTRIBUTION



TOTAL TIME ON SITE: 51.75 Days
TOTAL SITES: 1
TOTAL HOLES: 2

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
BEACON SUMMARY
LEG 61

SITE NO.	MAKE	FREQ kHz	SERIAL NUMBER	SITE TIME HOURS	REMARKS
462	ORE	16	418	254.2	Double life - strong for duration.
462A	ORE	16	418	233.1	Signal strength dropped sharply a.m. of the 20th day.
			TOTAL	487.3	
462A	ORE	13.5	436	417.7	Double life; performed well; signal dropping faster after 17th day.
462A	ORE	16	422	443.4	Double life; dropped 1630 hours July 5 for continued operations after Majuro port call; signal strength held to completion of operations.

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
SITE SUMMARY
LEG 61

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
462	7^{0} 14.25'N	165^{0} 01.83'E	5189	69	69	100.0	616.5	376.8	61.1	0.5	617.0	13.6	254.2	
462A	7^{0} 14.495'N	165^{0} 01.898'E	5186	92	87	94.6	629.0	348.7	55.4	439.5	1068.5	3.5	987.8	1242.0
TOTAL LEG 61				161	156	96.9	1245.5	665.7	58.9	440.0	1685.5	4.8		1242.0

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
BIT SUMMARY
LEG 61

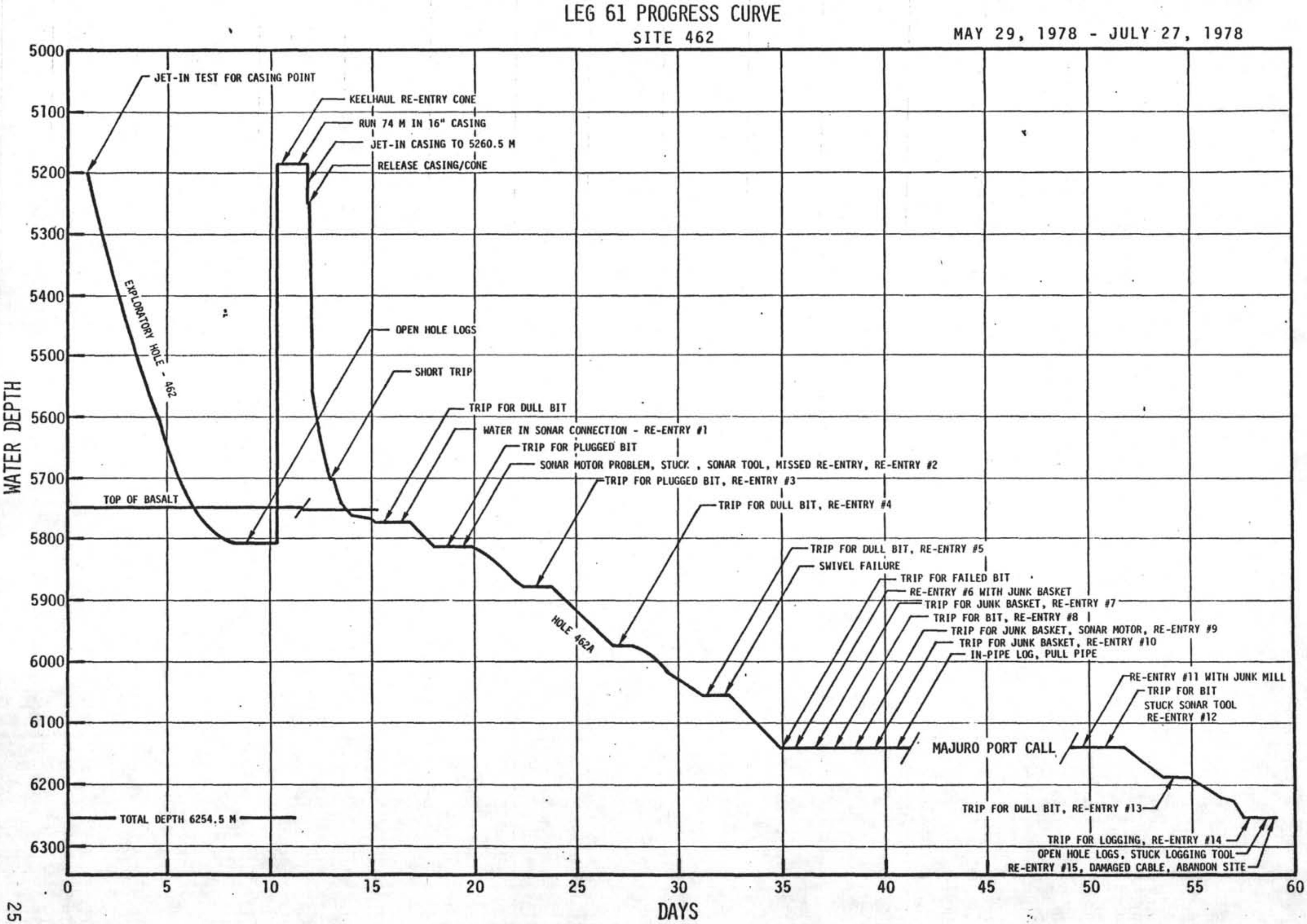
HOLE	MFG.	SIZE	TYPE	SERIAL NUMBER	METERS CORED	METERS DRILLED	METERS TOTAL PENET.	HOURS ON BIT	CONDITION	REMARKS
462	Smith	9 7/8"	F94CK	124FF	616.5	0.5	617.0	45.3	Unknown	Released for logging.
462A	Smith	9 7/8"	F94CK	198FF	146.5	439.5	586.0	40.3	T1BT-B2SE-0 1/16	565 m sediment in 13.6 hrs; 21 m basalt in 26.7 hrs; 17 bkn teeth in dr rows, cones 2 & 3
462A	Smith	9 7/8"	F94CK	195FF	40.0	- - -	40.0	17.3	T1BT-B1SE-I	Pulled due to core blocking throat; 10 broken teeth in drive rows, cones 2 & 3.
462A	Smith	9 7/8"	F99CK	155FE	65.0	- - -	65.0	38.3	T0-B1SE-I	33 m basalt in 32.5 hrs. Pulled due to core in throat.
462A	Smith	9 7/8"	F99CK	154FE	96.5	- - -	96.5	49.1	T0-B5 - 0 1/16	74.5 m basalt in 45.4 hrs. Pulled due to reduced core diameter.
462A	Smith	9 7/8"	F99CK	153FE	89.0	- - -	89.0	53.3	T1-B6 - 0 3/16	All basalt, one loose cone, 13 random broken inserts.
462A	Smith	9 7/8"	F94CK	945FE	76.5	- - -	76.5	39.6	T7-B8LC - 0 3/16	All basalt, one cone gone, drilled on junk.
462A	Smith	9 7/8"	F99CK	157FE	- - -	- - -	- - -	1.0	T2BT-B0SE-0 1/8	Drilled junk. 25 broken inserts.
462A	Smith	9 7/8"	F99CK	156FE	50.0	- - -	50.0	33.8	T1-B7SF - 0 1/8	Small portion of one cone broken off.
462A	Smith	9 7/8"	F94CK	159FF	65.5	- - -	65.5	37.2	T5-B2SE-I	

DEEP SEA DRILLING PROJECT
TIME DISTRIBUTION
LEG - 61

Date	Site No.	Cruise	Trips	Drill	Core	Stuck Pipe	W.O.W.	DOWNHOLE MEASUREMENTS	Mech. Repair	Port Time	Re-Entry	Other	Total Time	Remarks
5/15/78 5/29/78		157.3								166.9		1.3	325.5	Guam to Site 462
5/29/78 6/08/78	462		21.9		147.9			68.6	1.0		4.7	10.1	254.2	Hole 462
6/08/78 7/09/78	462A		217.4	8.9	354.2	6.5	0.8	10.8	7.6		85.2	40.6	732.0	Hole 462A
7/09/78 7/11/78		51.8											51.8	Hole 462A to Majuro
7/11/78 7/17/78		32.1								103.7*			135.8	Majuro to Hole 462A
7/17/78 7/27/78	462A		60.0		105.3		1.5	9.9	0.5		36.3	42.3	255.8	Hole 462A Continuation
7/27/78 7/29/78		44.4											44.4	Hole 462A to Majuro
5/15/78 7/29/78	Leg 61	285.6	210.4	8.9	607.4	6.5	2.3	89.3	9.1	270.6	96.5	212.9**	1799.5	TOTALS

*Includes 17.5 hours breakdown time

**Includes 161.9 hours fishing operations


LEG 61 PROGRESS CURVE
SITE 462
MAY 29, 1978 - JULY 27, 1978
WATER DEPTH
DAYS
JET-IN TEST FOR CASING POINT
KEELHAUL RE-ENTRY CONE
RUN 74 M IN 16" CASING
JET-IN CASING TO 5260.5 M
RELEASE CASING/CONE
EXPLORATORY HOLE - 462
OPEN HOLE LOGS
SHORT TRIP
TRIP FOR DULL BIT
WATER IN SONAR CONNECTION - RE-ENTRY #1
TRIP FOR PLUGGED BIT
SONAR MOTOR PROBLEM, STUCK , SONAR TOOL, MISSED RE-ENTRY, RE-ENTRY #2
TRIP FOR PLUGGED BIT, RE-ENTRY #3
TOP OF BASALT
TRIP FOR DULL BIT, RE-ENTRY #4
TRIP FOR DULL BIT, RE-ENTRY #5
SWIVEL FAILURE
TRIP FOR FAILED BIT
RE-ENTRY #6 WITH JUNK BASKET
TRIP FOR JUNK BASKET, RE-ENTRY #7
TRIP FOR BIT, RE-ENTRY #8
TRIP FOR JUNK BASKET, SONAR MOTOR, RE-ENTRY #9
TRIP FOR JUNK BASKET, RE-ENTRY #10
IN-PIPE LOG, PULL PIPE
HOLE 462A
RE-ENTRY #11 WITH JUNK MILL
TRIP FOR BIT
STUCK SONAR TOOL
RE-ENTRY #12
MAJURO PORT CALL
TRIP FOR DULL BIT, RE-ENTRY #13
TOTAL DEPTH 6254.5 M
TRIP FOR LOGGING, RE-ENTRY #14
OPEN HOLE LOGS, STUCK LOGGING TOOL
RE-ENTRY #15, DAMAGED CABLE, ABANDON SITE
5000
5100
5200
5300
5400
5500
5600
5700
5800
5900
6000
6100
6200
6300
0
5
10
15
20
25
30
35
40
45
50
55
60

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
OPERATIONS RESUME
LEG 62

Leg 62 commenced on July 29th at Majuro Atoll, Marshall Island, when a scientific crew change was made. While the Leg was initially intended to drill one site southwest of Midway, then proceed north eastward and drill three holes in the Gulf of Alaska, and end in Seattle, these plans were changed as a result of the extended drilling operations on Leg 61. The revised program called for drilling only the southern sites and none of those in the Gulf of Alaska. The Leg ended in Honolulu on September 6th, where both the crew and scientific party departed. The ship was then scheduled on to Los Angeles for dry-dock with a new crew and no scientists.

On Leg 62, the GLOMAR CHALLENGER traveled 3933.6 nautical miles and attempted to drill 5 holes at 4 sites. Water depths ranged from 2165.5 meters to 4670 meters. A total of 218 cores or 1976 meters were cut and 635.21 meters recovered. This represented a very good showing as the ship was on site for a relatively short 19.85 days. The recovery was lower than normal (32.1%) because of the large amount of chert that was encountered; however, the material recovered provided a great deal of new and important geological information.

The time distribution for the Leg was a short 48 minutes or .03 days in Majuro Lagoon for the scientific crew change which is probably some kind of record for the CHALLENGER, 19.92 days cruising and 19.85 days on site. The on-site time breakdown was 2.4 days tripping, .02 days drilling, 13.9 days coring, 1.3 days with stuck pipe, .03 days of mechanical repairs and 2.2 days of other, which included time spent making heat probe investigations. No time was lost due to weather.

DRILLING AND CORING ASSEMBLIES

A basic bottomhole assembly was used on Sites 463 and 464 and consisted of a bit, bit sub, 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, three 8 1/4" drill collars, a crossover sub and one joint of 5 1/2" heavy wall pipe. This assembly was changed after becoming stuck in Hole 464 in an effort to minimize the chances of again becoming stuck. The change was in the top stand of collars, one 7 1/4" collar replaced one of the 8 1/4" collars. This assembly was used on Holes 465, 465A and 466.

BITS

A new special core bit was used on the first site (463) of Leg 62. It was a 9 3/4" O.D. x 2 5/16 F94CP. It cuts a slightly smaller core than the F94CK but allows use of the new style pressure core barrel. It performed very well with 86.26 hours of rotation in penetrating 822.5 meters before it was pulled. At Site 464, a regular F94CK bit was used which was lost after 14.6 hours when the drill string became stuck and was shot off. On Holes 465 and 465A another F94CK was used but was not drilled to destruction because the pipe stuck again and was pulled when it was not certain if the pipe was intact or not. At Site 466, another 9 3/4" O.D. F94CP was run, but was pulled after only 5.35 hours rotating time and 312 meters when it became plugged with chert cuttings. It was in good condition as would be expected.

BEACONS AND POSITIONING

Five beacons were used on this leg; three 13.5 kHz single life, one 13.5 kHz double life and one 16.0 kHz single life. All of them worked well with the exception of the 13.5 kHz single life which was dropped at Site 466. Here, after the profiling gear had been pulled aboard and the ship was returning toward the beacon drop area, no pulse could be detected by the ship's hydrophones. After two hours of searching, a 16.0 kHz beacon was dropped and the ship positioned with it normally.

Otherwise, the positioning system worked well except for a thruster relay failure at Site 463. This resulted in a ship's excursion of approximately 500 feet from the hole; however, there was no damage to the drill string. After it was repaired, drilling continued for seven more days without a reoccurrence of the problem. Strong variable ocean currents were encountered at Sites 465 and 466 which caused unusual positioning problems. One excursion caused by currents at Site 465 required the pipe to be pulled above the mudline and only after satisfactory positioning was reestablished was Hole 465A drilled. Additional excursions, due to the current, occurred at these two sites but did not require the pipe to be pulled.

WIRELINE PRESSURE CORE BARREL (MOD II)

During Leg 62, a new pressure core barrel was tested five times at two different sites. None of the holes were deeper than 3000 meters (total drill string length) and a great deal of chert was encountered in each of them. However, three of the five tests were successful.

The first test was simply a drop test to be sure that the tool would operate properly after free falling to the bottom of the drill string. After the bottom-hole assembly was made up and two stands of pipe were added, the tool was dropped and worked as it should with no damage to the tool.

Runs Two and Three recovered cored material under pressure. The first was in a nanno ooze and the second in chalk and hard ooze with some chert. Test Four recovered a few chert chips and no pressure; while Test Five, which had also sampled in a cherty section, had no recovery.

From these results it would appear that the pressure core barrel may soon become an operating tool and can be expected to perform best in sediments that do not contain chert.

The pressure core barrel will be returned to La Jolla for further evaluation. The experience gained with this prototype during the leg should assist greatly in the development of a reliable and useful tool.

COMMUNICATIONS

During Leg 62 the ship was in direct communication with Navy Station NPN, Guam and all Project traffic was handled with ease. At the beginning of the Leg, the main TMC transmitter was down for repairs, but this did not hinder our Project communication as the ship's RCA equipment could reach the Navy with no problem. The outgoing traffic was usually sent during the ship's working day and most of the messages were at the Project at the beginning of their working day. Incoming traffic was received directly from NPN. The overall communications with Navy Station NPN was a good experience for both parties as it was very much appreciated by us and at the same time was of great practical experience to the operators at NPN who seldom have the opportunity of practicing their CW skills. The TMC transmitter was used for commercial radio-telephone calls during the first part of the Leg until such time as direct communication was made with Scripps Radio Station WWD at the last location. From then on the ship was in continuous daily contact with WWD. Many personal radio calls were made by the amateur radio station with very satisfying morale results. An estimated number of calls was about 200. About six commercial calls were made during the trip.

The radars worked very well during the trip after some repairs made by Global's Electronic Technician.

PERSONNEL

Although all of the scientific objectives of the leg were not accomplished, the morale and enthusiasm of the scientists was unusually good. Some of the scientists were required to remain on Majuro Atoll for two weeks while Leg 61 was completed. Despite this, they then came aboard and worked hard on a much shorter program than had been originally planned. On the positive side, however, there were new and rewarding geological discoveries shared by everyone.

Global Marine personnel, particularly the drilling department, teamed together to make the Leg successful. As an example, when a roughneck quit at Majuro and he was replaced by a member of the ship's stewards department, who did a fine job. On August 10th, another member of the drilling crew cut off the tip of his finger and could not work again on the Leg. The balance of the drilling crew each rotated in working part of an extra shift to cover this loss of man power and it worked well.

The SIO marine technician crew provided their usual excellent service which was greatly appreciated by the scientific parts. In particular, new areas involving the new pressure core barrel and heat probe measurements were handled well.

SITE 463

The first site to be investigated on Leg 62 was located 874 miles northeast of Majuro Atoll. A 13.5 kHz beacon was dropped at 0508 hours on August 3. The ship was in the automatic positioning mode at 0742 hours and the make up of the drill string was started. After the bottomhole assembly and two stands of drill pipe were made up and run, a test was made on the new pressure core barrel. It was allowed to free fall at this point to determine if the tool would operate properly after landing. It took 14 minutes to land and showed no damage when recovered. It probably took this length of time to drop because of the close tolerance between the tool and the inside diameter of the drill pipe. After this test the drill pipe was made up and run to 2525.0 meters when the Bowen sub was picked up. The hole was spudded at 1322 hours and established the mudline at 2532 meters as compared to 2535 meters recorded by the Precision Depth Recorder (PDR).

The hole was then continuously cored to 34 meters subbottom where the first pressure core barrel (PCB) core was taken. (The results of this and other PCB cores are listed under another section of this report). The hole was again continuously cored to 199.5 meters where the next PCB core was taken and following this, continuously cored to a total subbottom depth of 822.5 meters where it was abandoned when the bit wore out.

Only one drilling problem developed while the hole was cored and that occurred while Core 47 was being cut. After four meters had been cut, the pipe became stuck and could not be rotated or circulated. However, the bumper subs were still capable of being moved which indicated that the pipe was stuck below this point. After working the pipe for two hours with pulls of up to 475,000 pounds, the inner core barrel was retrieved and circulation was regained. Then 50 barrels of mud were circulated and after 20 minutes, the pipe came free and remained free until the hole was completed.

Core recovery for the hole averaged 36%, which is somewhat lower than usual. The main reason for the lower recovery was the occurrence of chert fragments which began early and continued intermittently as the hole was deepened. Higher pump pressure than normal was required to prevent plugging of the bit and this resulted in washing away the softer sediments. The bit wore out before the basement rocks were penetrated, but a good geological picture was developed from the material that was recovered. The hole was abandoned on August 11th with a total of 86.6 hours of rotation on the bit.

SITE 464

After completing the drilling at Site 453, the ship traveled 111.4 miles north and dropped a 13.5 double life beacon on August 16th at the first of two sites which had been planned to investigate the Hess Rise. After the ship was positioning in the automatic mode, the drill string was made up and run to 4632.5 meters. At this time the heat flow tool housing was lowered on the sandline to a new pressure case which had been designed and fabricated by the Marine Technicians aboard ship to overcome restrictions caused by the PCB barrel bit. Fortunately this test was made prior to installing the electronics, because when the tool was recovered, the pressure case had collapsed. Plans were then made to modify the tool further before it was run with the instrumentation.

The Bowen sub was then picked up and an attempt was made to establish bottom with a mudline core. The first core barrel recovered had only what appeared to be a smear of sediment in the bottom of the core catcher sub. The second core attempt, after adding a single, recovered only water. When the next inner barrel was dropped, a higher than normal pressure was observed as the barrel was pumped down and after it had landed. As the bit was possibly plugged, the core barrel was retrieved and a center bit dropped. After this was recovered and another inner barrel dropped, the pressure appeared to return to normal. Another mudline core was then attempted but no apparent resistance was encountered until six meters had been lowered on a second single. When the inner barrel was recovered, a small mud ball and four small manganese nodules were recovered and the mudline was set at 4670.0 meters even though the PDR had indicated a corrected water depth of only 4647 meters.

Then continuous coring began and progressed routinely with recovery better than 60% until Core 10 at 89 meters subbottom. From this core on to total depth, recovery dropped to about 6%. This was once again attributed to the presence of chert material scattered through the sediments. Again, as at Site 463, then higher pump pressure needed to prevent bit plugging causing the softer sediments to be washed away. The coring continued until Core 34, when 76 minutes were required to core one meter. Then the inner barrel was pulled to determine if the bit was plugged and causing the slow drill rate. From the observed pressure as the new inner barrel was being pumped down, the bit appeared to be unplugged. However, when the barrel landed, it was discovered that the drill string was stuck. While the hole could be circulated, the drill string could not be rotated, nor did the bumper subs operate. After about an hour of working the pipe with pulls of 550,000 lbs, the pipe could be rotated reluctantly and the string was moved enough to allow a single to be set back. However, the ability to rotate was lost shortly after this and no additional pipe could be recovered in this manner. Then the pipe was worked for another 8 hours before it was decided that the only course of action was to shoot off the pipe. Due to somewhat adverse weather conditions, the assembly of the shooting equipment was deferred an additional 12 hours.

The shooting charge and a collar locator were then assembled and lowered into the pipe. However, the collar locator did not work even though it checked properly before the charge had been attached. Despite this, the charge was lowered with the hope that the collar locator would operate after the shooting switch had been turned on rather than bring it back on deck which could be very dangerous with the proficiency of the operators. The shot was then lowered to 4830 meters and the switch changed to shoot position. However, the collar locator failed to work. It was then decided to go strictly on cable measurements. At this point it was learned that the depth indicator had slipped twice while running in and was thought to be off about 7 meters in depth. Based on this information, it was decided to lower to 4837 meters which was calculated to place the charge in the second single above the heavy wall of the BHA. This was done and the charge fired and the weight decrease indicated the shot had been successful. The drill string was pulled and when recovered, it was found that the charge had been fired at the connection between the first and second drill collars at the top of the BHA. The top drill collar was recovered along with the heavy wall drill pipe and all of the 5" drill pipe. The pin and the lower few inches of the drill collar were slightly belled out, which indicated that the charge had been exploded here. The measuring device had obviously slipped more than 7 meters and the shot was fired at 4875 meters rather than 4837 meters. The site was then abandoned at 2245 hours on August 21, 1978.

SITE 465

Site 465 was the second location for investigating the Hess Rise. It was located about 435 miles southeast of Site 464.

After two days cruising, a 13.5 kHz single life beacon was dropped at 0845 hours on August 24th. When the ship began positioning in the automatic mode, the drill string was made up and run to 2144.5 meters where the Bowen sub was picked up. The PDR had shown the bottom to be 2162 meters. The drill pipe was lowered and recovered a mudline core which placed the mudline at 2165.5 meters. The hole was then continuously cored until Core 10 had been recovered, at which point the first heat flow measurement was made. Following this, Core 11 was cut and after it had been recovered, it became necessary to pull the drill string out of the hole because the ship could no longer maintain position due to particularly strong eddy currents. This condition caused the ship to move off position over 500 feet. The bit cleared the mudline at 0600, August 26th and the hole was officially abandoned.

HOLE 465A

This hole was spudded at 0800 August 25th after the ship had been positioning for two hours in an effort to establish the most favorable heading. After spudding in, without taking a mudline core, the hole was washed to a subbottom depth of 39 meters before continuous coring was started.

While the hole was being cored to a subbottom depth of 476.0 meters, three heat flow measurements were attempted at 96.0, 115.0 and 172.0 meters subbottom with moderate success. Also, as the dip of the sediments recovered slowly increased, there was some concern that the hole was getting too far from vertical. Therefore a single shot survey was made at 409.5 meters subbottom and the hole was found to have only a 5^{o} deviation. All parties felt that this amount of hole angle would not create problems.

Recovery for this hole was low, 24.8% because of the chert which was encountered at about 65 meters subbottom and continued through the balance of the cored section. Most of it was probably found in relatively soft sediments which were washed away with the necessary increased pump pressure and only the chert was recovered.

Regardless of the low percentage of recovery, sufficient material was recovered to make the hole a geological success.

While dropping a new inner core barrel after recovery of Core 46, circulation, rotation, and bumper sub action was lost. The pipe was worked for over five hours with no change. This included pulling on the pipe to with up to 550,000 pounds and retrieving the inner barrel in hopes that circulation could be reestablished. At the end of this time the only course of action appeared to be to shoot off the pipe above the bottomhole assembly. A collar locator and severing charge were rigged and run in the hole and the top of the BHA was found to be at 2508 (collar locator). The charge was then pulled to the second section above the BHA or 2489 meters and the firing switch was activiated. No explosion was felt in the drill pipe so the switch was triggered again with the same results. It appeared that the charge had misfired and would have to be pulled and rearmed. When the severing charge was recovered at the rig floor, it was found that the detonator cap had fired; however, it appeared that the charge itself had burned rather than detonated.

The cannister that had contained the charge was blackened and had collapsed. Due to the concern for safety, the change unfortunately was thrown overboard before it could be more closely examined. The pipe was then raised in the elevators and was found to be free with a normal hook weight. The drill string was then pulled and found to be intact when the bit arrived at the derrick floor. This site was officially abandoned at 1712 hours on August 28th.

SITE 466

After abandoning Hole 465A, the ship traveled about 28 miles east north easterly and dropped a 13.5 single life beacon at 2312 hours on August 28th. The profiling gear was taken aboard and the ship returned to be positioned for Site 466. However, the beacon pulse could not be detected, so at 0132 hours on August 29, a 16.0 kHz beacon was dropped and the ship then positioned on this beacon for the duration of this site.

The PDR had indicated bottom to be at 2675 meters and the mudline core established it at 2672 meters. Nine continuous cores were cut and recovered when a pressure core barrel core was attempted. It was not successful in recovering a core, probably because of the chert in the sediments. The same problem developed the next time the pressure barrel was tried and no core recovery was obtained. Recovery overall at the site was reduced considerably from this depth on to total depth by the presence of the chert. If too little pump pressure was used, the bit tended to become plugged and if the pump pressure was increased, the softer sediments were washed away leaving only the chert.

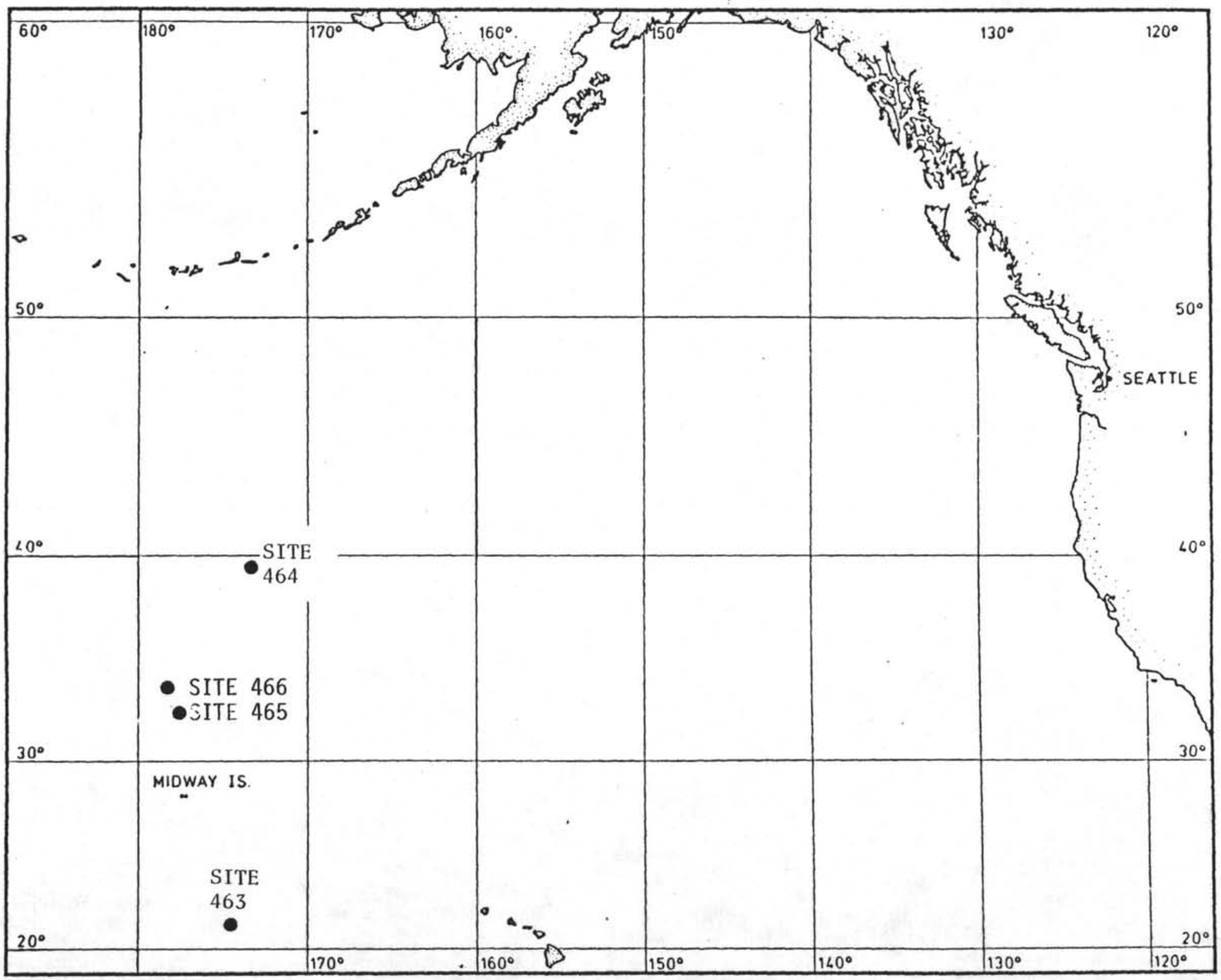
After recovery of Core 25, the bit was plugged for about three hours and then again after Core 35. The last plugging caused the abandonment of the site because there was not sufficient time to try and unplug the bit and still have time to depart for Honolulu on schedule.

Geologically, the site was quite successful despite the low recovery and was reportedly to add greatly to a better understanding of the area. It was abandoned at 1154 hours on August 31st and the ship then departed for Honolulu and the end of the leg.

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

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
OPERATIONAL RESUME
LEG 62

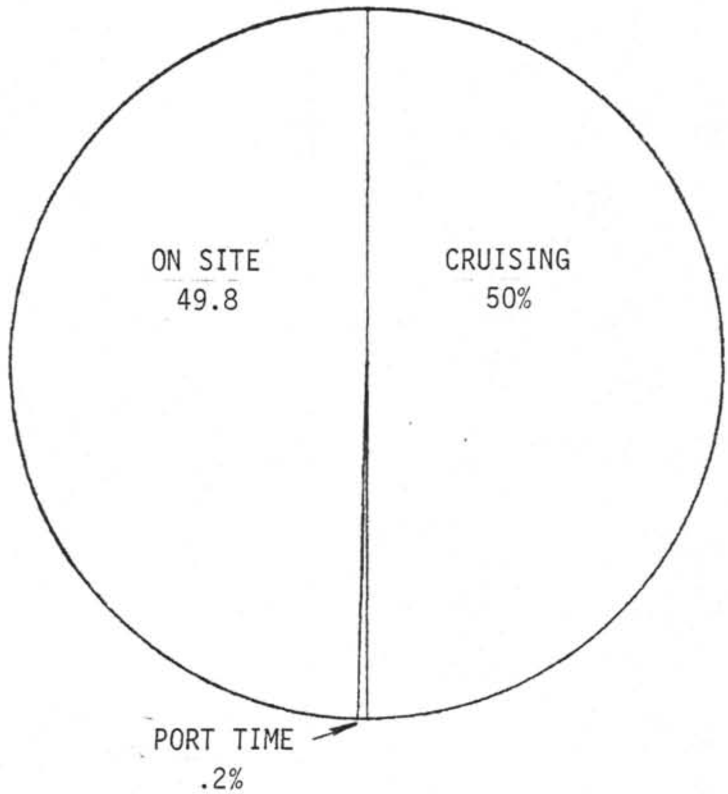
Total Days (July 29, 1978 - September 6, 1978)		39.8
Total Days In Port		.03
Total Days Cruising Including Site Survey		19.92
Total Days On Site		19.85
Trip Time	2.4	
Drilling Time	.02	
Coring Time	13.9	
Waiting On Weather	1	
Stuck Pipe	1.3	
Mechanical Repair	.03	
Other	2.2	
Total Distance Traveled Including Survey (Nautical Miles)		3933.6
Average Speed (Knots)		
Number of Sites		4
Number of Holes Drilled		5
Number of Cores Attempted		218
Number of Cores With Recovery		215
Percentage of Cores With Recovery		98.6
Total Meters Cored		1976
Total Meters Recovered		635.27
Percentage Recovery		32.1
Total Meters Drilled		39
Total Meters of Penetration Cored		2015
Percentage of Penetration Cored		98.1
Maximum Penetration (Meters)		822.5
Minimum Penetration (Meters)		96.0
Maximum Water Depth (Meters)		4670.0
Minimum Water Depth (Meters)		2165.6



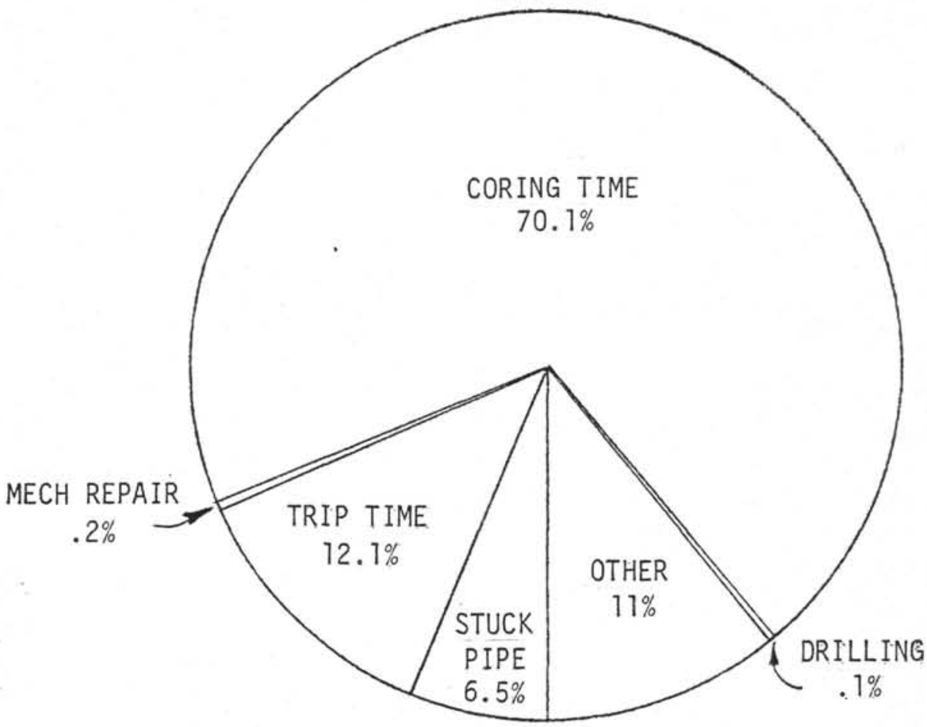
LEG 62

● Sites drilled

TOTAL TIME DISTRIBUTION
LEG 62



ON SITE TIME BREAKDOWN
LEG 62



DEEP SEA DRILLING PROJECT
TIME DISTRIBUTION
LEG - 62

Date	Site No.	Cruise	Trips	Drill	Core	Stuck Pipe	W.O.W.	Position Ship	Mech. Repair	Port Time	Re-Entry	Other	Total Time	Remarks
7/29/78		8.3							1.1	.8*			10.2	*Change 61 & 62 staff
7/30/78		24.0											24.0	
7/31/78		24.0											24.0	
8/1/78		24.0											24.0	
8/2/78		24.0											24.0	
8/3/78		5.1											5.1	
TOTAL		109.4							1.1	.8			111.3	
8/3/78	463		6.1		9.6							3.2*	18.9	*Positioning & check PCB
8/4/78					24.0								24.0	
8/5/78					23.3							.7*	24.0	Pos. ship after relay failure
8/6/78					23.3							.7	24.0	Position Ship
8/7/78					24.0								24.0	
8/8/78					23.7							.3	24.0	
8/9/78					24.0								24.0	
8/10/78			3.0		21.0								3.3	
TOTAL			12.4		172.9							4.9	190.2	
8/11/78		20.5										.2	20.7	
8/12/78		24.0											24.0	
8/13/78		24.0											24.0	

DEEP SEA DRILLING PROJECT
TIME DISTRIBUTION
LEG - 62

Date	Site No.	Cruise	Trips	Drill	Core	Stuck Pipe	W.O.W.	Position Ship	Mech. Repair	Port Time	Re-Entry	Other	Total Time	Remarks
8/14/78		24.0											24.0	
8/15/78		24.0											24.0	
8/16/78		21.7											21.7	
TOTAL		138.2										.2	138.4	
8/16/78	464											2.3*	2.3	Position Ship
8/17/78			9.5		4.1							10.4	24.0	Pos Ship & Heat Flow Check
8/18/78					24.0								24.0	
8/19/78					24.0								24.0	
8/20/78					10.3	13.7							24.0	
8/21/78			7.2			6.7						8.8	22.7	Rig & run-shoot off tool & pick up new BHA
TOTAL			16.7		62.4	20.4						21.5	121.0	
8/21/78		.7										.6	1.3	
8/22/78		24.0											24.0	
8/23/78		24.0											24.0	
8/24/78		8.7											8.7	
TOTAL		57.4										.6	58.0	
8/24/78	465		6.7		5.4							3.2	15.3	Position Ship
8/25/78			.3		5.7								6.0	
TOTAL			7.0		11.1							3.2	21.3	
8/25/78	465A			.5	9.4							8.1	18.0	Pos ship & heat flow

DEEP SEA DRILLING PROJECT
TIME DISTRIBUTION
LEG - 62

Date	Site No.	Cruise	Trips	Drill	Core	Stuck Pipe	W.O.W.	Position Ship	Mech. Repair	Port Time	Re-Entry	Other	Total Time	Remarks
8/26/78	465A				21.8							2.2	24.0	Heat Flow
8/27/78					22.7				1.0			.3	24.0	Position Ship
8/28/78			5.7		.7	10.8							17.2	
TOTAL			5.7	.5	54.6	54.6			1.0			10.6	83.2	
8/28/78		5.6										.4	6.0	
TOTAL		5.6										.4	6.0	
8/28/78	466											.8	.8	Position to find beacon
8/29/78			6.5		15.4							2.1	24.0	Position for final site
8/30/78			.3		19.4							4.3	24.0	Unplugging bit
8/31/78			8.5									3.4*	11.9	*Complete Magnaflux BHA
TOTAL			15.3		34.8							10.6	60.7	
8/31/78		12.1											12.1	
9/1/78		24.0											24.0	
9/1/78		24.0*											24.0	*Cross int. date line
9/2/78		24.0											24.0	
9/3/78		24.0											24.0	
9/4/78		24.0											24.0	
9/5/78		23.0											23.0	
9/6/78		12.3											12.3	
TOTAL		167.4											167.4	

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
BIT SUMMARY
LEG 62

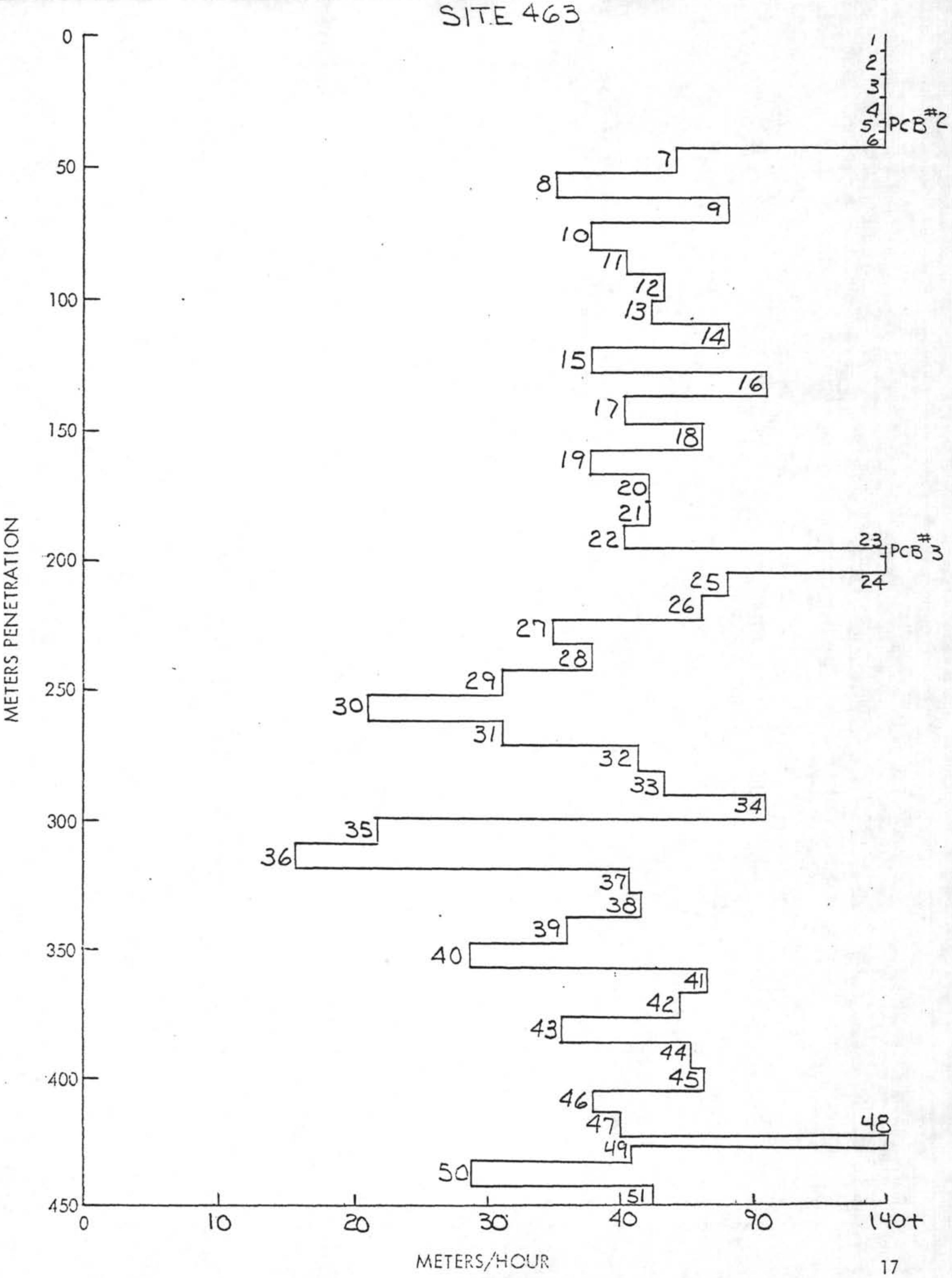
HOLE	MFG.	SITE	TYPE	SERIAL NUMBER	METERS CORED	METERS DRILLED	TOTAL METERS PENET	HOURS ON BIT	CONDITION	REMARKS
463	Smith	9 3/4"	F94CP	142PJ	822.5		822.5	86.26	T2-B8 SFO 1/4"	
464	Smith	9 7/8"	F94CK	639RR	308.5		308.5	14.6		Bit lost when BHA shot off.
465	Smith	9 7/8"	F94CK	640RR	96.0		96.0	.9	T1-B1-SEI 1/16"	Pulled bit when ship off position.
465A	Smith	9 7/8"	F94CK	640RR	437.0	39.0	476.0	18.5		Respud with same bit for 465A.
466	Smith	9 3/4"	F94CP	143PJ	312.0		312.0	5.35	T1-B1-SE	Gauge reads 9 5/8 as does new bit so gauge probably OK.

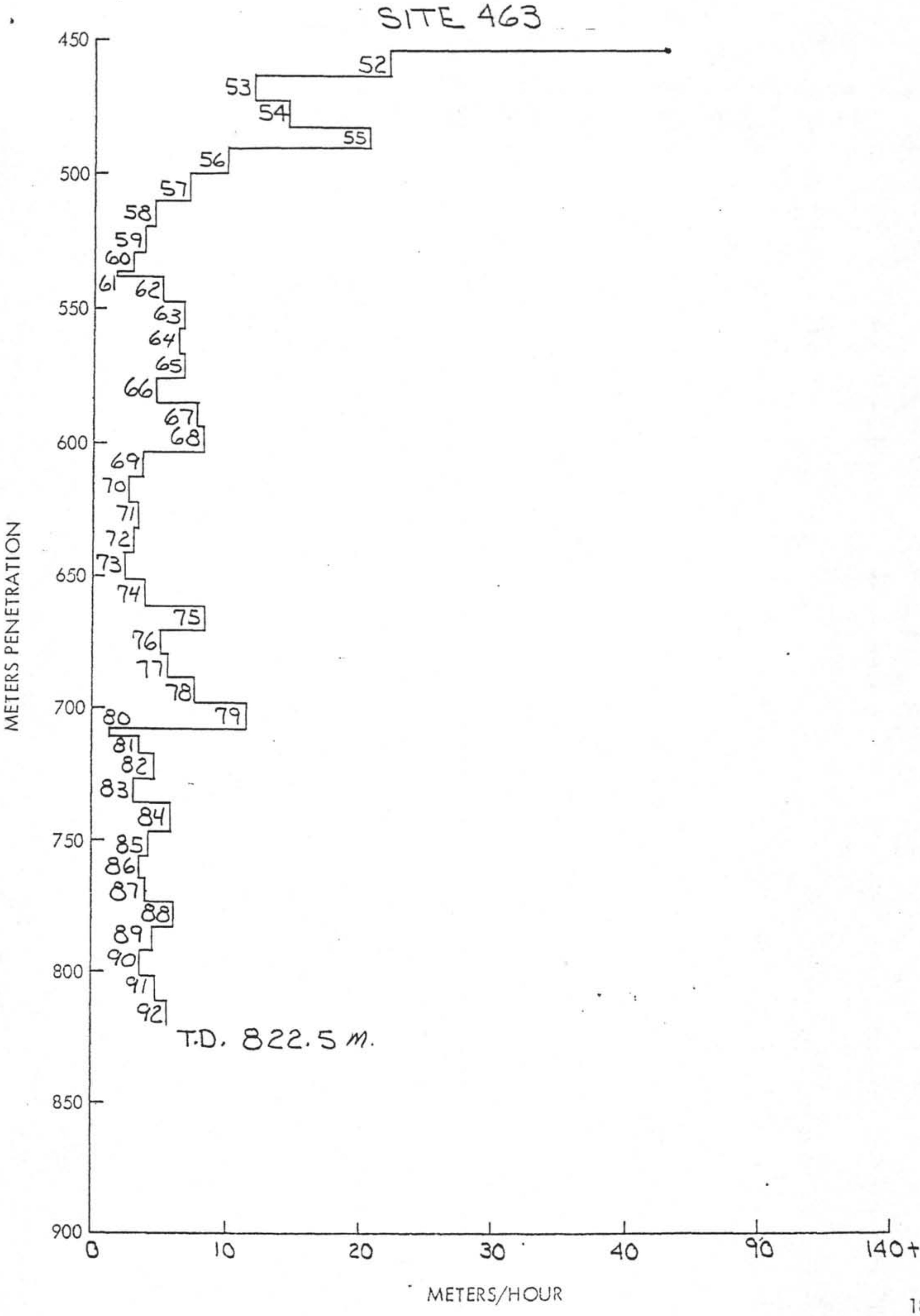
INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
SITE SUMMARY
LEG 62

HOLE	LATITIDE	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
463	21° 21.01'N	174° 40.07'E	2532.0	92	92	100.0	822.5	301.8	36.6		822.5	9.5	190.2	190.2
464	39° 51.64'N	173° 53.33'E	4670.0	34	34	100.0	308.5	75.66	24.5		308.5	21.1	121.0	121.0
465	33° 49.23'N	178° 55.14'E	2165.5	11	11	100.0	96.0	43.89	45.7		96.0	106.0	21.3	
465A	33° 49.23'N	178° 55.14'E	2165.5	46	45	97.8	437.0	108.5	24.8	39.0	476.0	24.5	83.2	104.5
466	34° 11.46'N	179° 15.34'E	2672.0	35	33	94.2	312.0	105.42	33.7		312.0	58.3	69.7	60.7
		TOTAL		218	215	98.6	1976.0	635.27	32.1	39.0	2015.0	43.8	476.4	476.4

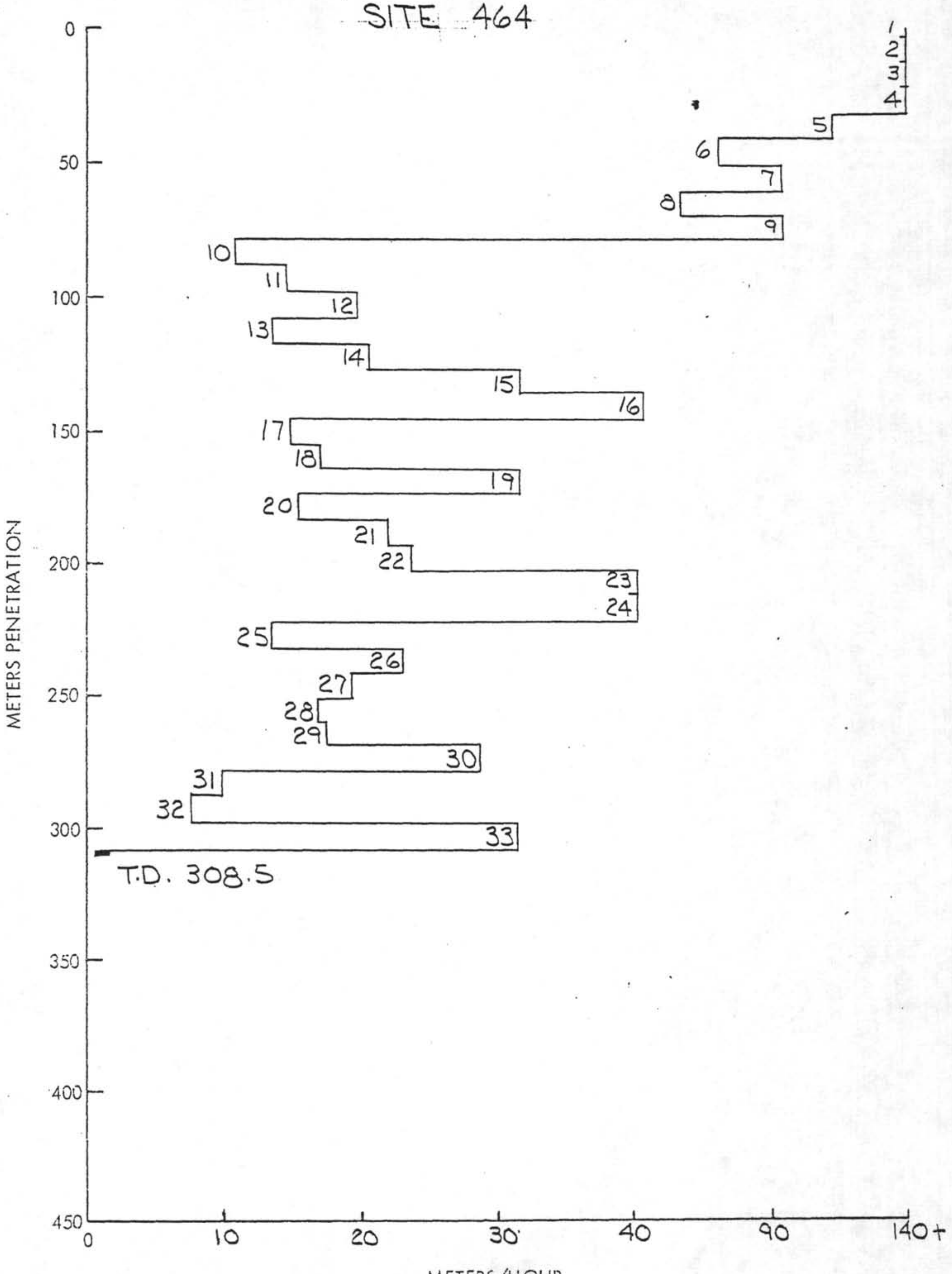
INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
BEACON SUMMARY
LEG 62

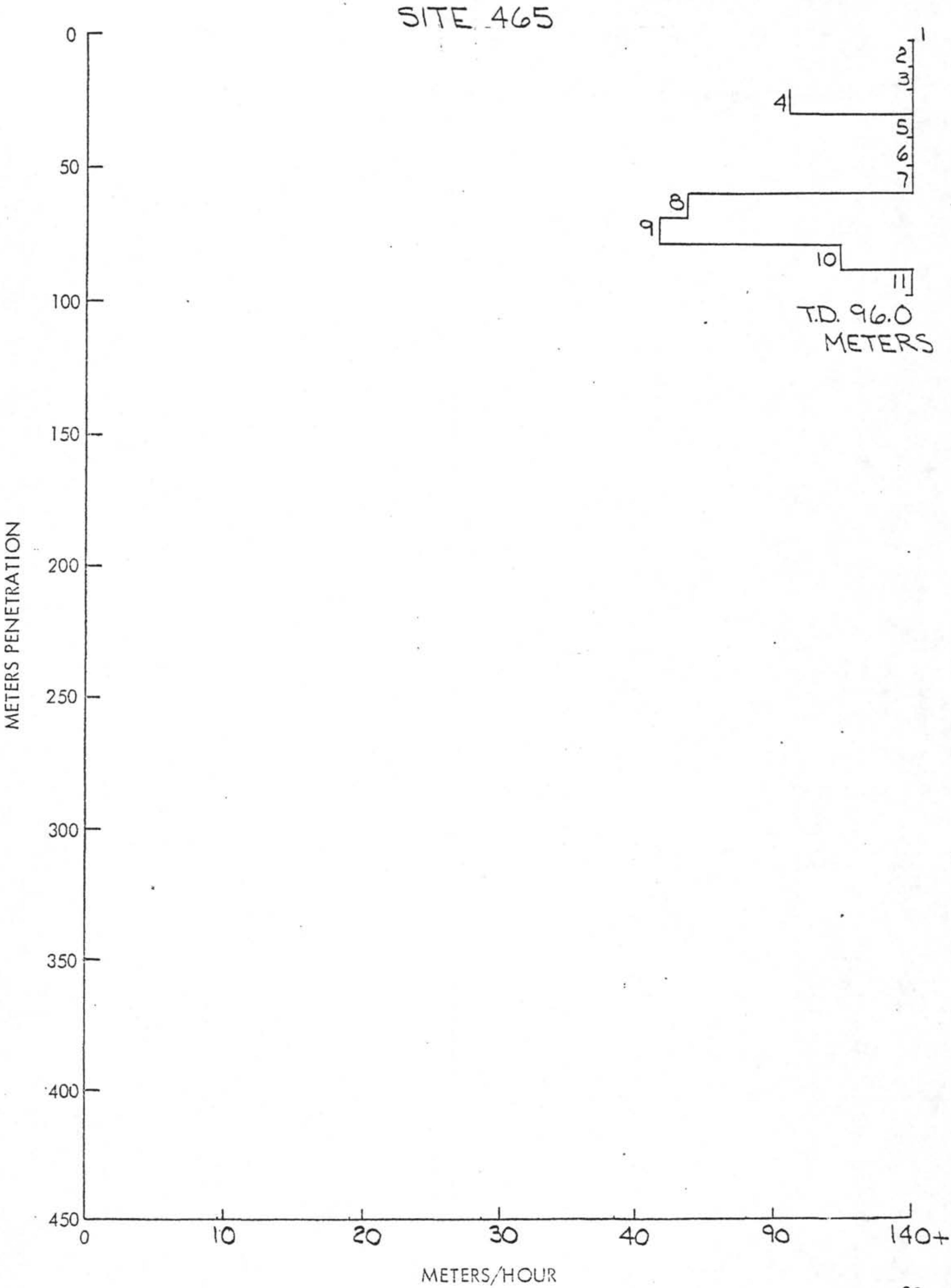
SITE NO.	MAKE	FREQ. kHz	SERIAL NUMBER	SITE TIME HOURS	REMARKS
463	ORE	13.5 S.L.	449	190.2	
464	ORE	13.5 D.L.	437	121.0	
465/465A	ORE	13.5 S.L.	446	104.5	
466	ORE	13.5 S.L.	447		
466	ORE	16.0 S.L.	429	60.7	Dropped when 13.5 could not be located.

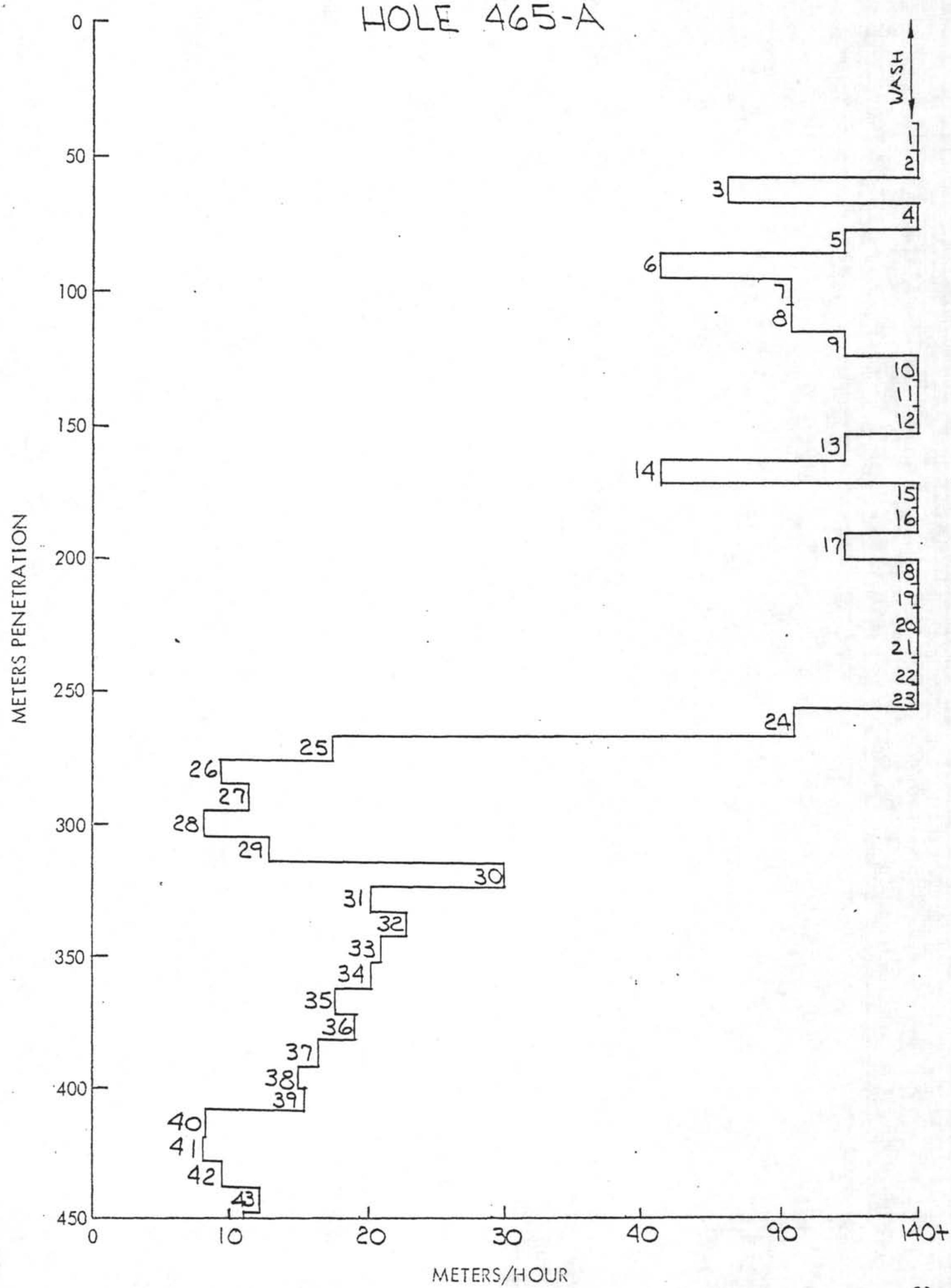

SITE 463
METERS PENETRATION
METERS/HOUR
0
50
100
150
200
250
300
350
400
450
0
10
20
30
40
90
140+
1 2 3 4 5 6
PCB #2
7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
PCB #3
24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51



SITE 463
METERS PENETRATION
450
500
550
600
650
700
750
800
850
900
52
53
54
55
56
57
58
59
60
61
62
63
64
65
66
67
68
69
70
71
72
73
74
75
76
77
78
79
80
81
82
83
84
85
86
87
88
89
90
91
92
T.D. 822.5 m.
0
10
20
30
40
90
140+
METERS/HOUR


SITE 464
METERS PENETRATION
METERS/HOUR
0
50
100
150
200
250
300
350
400
450
0
10
20
30
40
90
140+
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
T.D. 308.5


SITE 465
METERS PENETRATION
0
50
100
150
200
250
300
350
400
450
1
2
3
4
5
6
7
8
9
10
11
T.D. 96.0
METERS
0
10
20
30
40
90
140+
METERS/HOUR


HOLE 465-A
WASH
METERS PENETRATION
METERS/HOUR
0
50
100
150
200
250
300
350
400
450
0
10
20
30
40
90
140+
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
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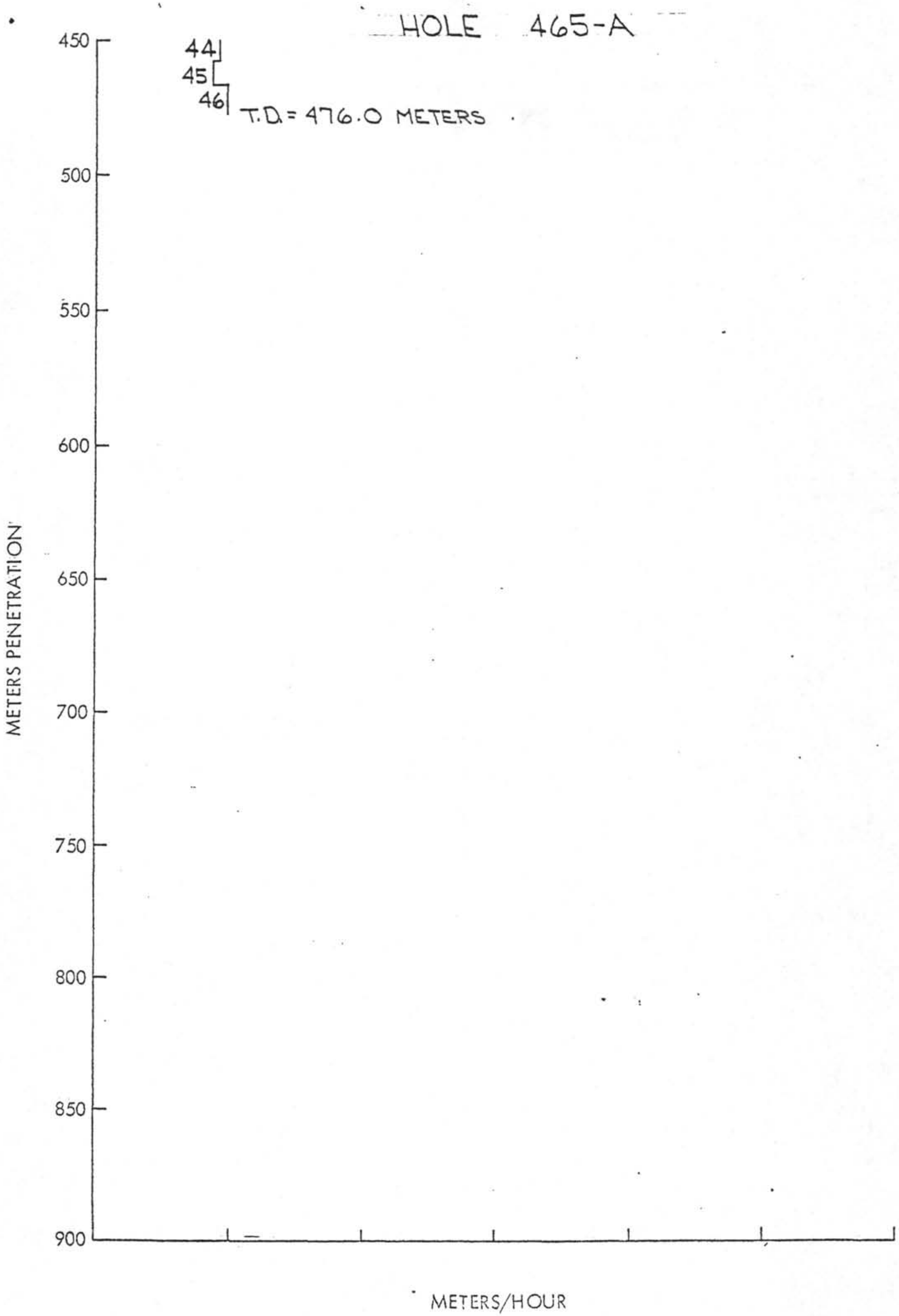
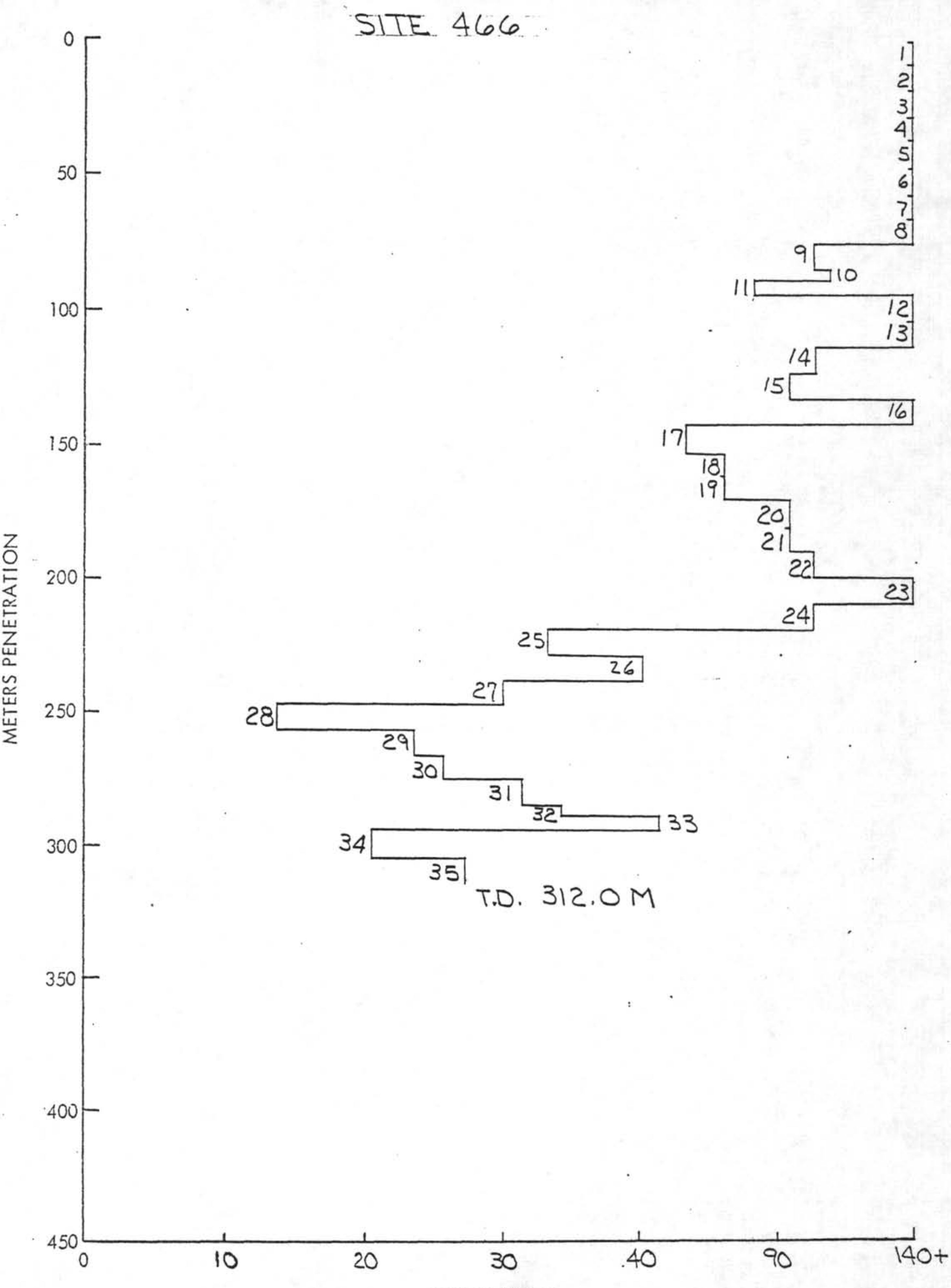
37
38
39
40
41
42
43


HOLE 465-A
450
500
550
600
650
700
750
800
850
900
44
45
46
T.D = 476.0 METERS
METERS PENETRATION
METERS/HOUR


SITE 466
METERS PENETRATION
0
50
100
150
200
250
300
350
400
450
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
T.D. 312.0 M
0
10
20
30
40
90
140+
METERS/HOUR

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
OPERATIONS RESUME
LEG 63

Seven drill sites extending from a location near the Channel Islands of California to the mouth of the Gulf of California were investigated on Leg 63 of the Deep Sea Drilling Project. Principal objectives of the voyage included paleo-environmental studies of the influence of the California current and a better understanding of the complex tectonic history of the western margin of North America.

Igneous basement was reached at five of these sites and a considerable amount of basalt and diabase core was recovered in addition to the overlying sediments. The total cored interval of 3940.7 meters exceeded the previous record for a DSDP voyage by 130.5 meters. A successful program of downhole measurements was also accomplished.

The voyage commenced on September 6, 1978 at Honolulu, Hawaii and ended at Mazatlan, Sinaloa, Mexico on November 27, 1978. A twenty day port call was made at Los Angeles/Long Beach for drydocking and shipyard upkeep and a two-day emergency stop was made at Long Beach for thruster repairs following operations at the first drill site.

The "scientific" portion of the expedition commenced with the boarding of the scientific party on October 7 in Los Angeles and ended 51 days later in Mazatlan. Total length of the leg was 81.7 days of which 37.7 days were spent on-site and 20.9 days under way. 23.1 days were consumed by port calls and mechanical breakdowns.

HONOLULU TO LOS ANGELES

The official beginning of Leg 63 came at 1342 hours on September 6, 1978, with the first mooring line over at Berth 9, Honolulu Passenger Terminal, Honolulu, Hawaii.

The Honolulu port call was brief and was made primarily for the purpose of crew change. In addition to GMI crew relief, all the scientists and most of the SIO staff disembarked. Fresh food items, a few supplies and 40,000 gallons of fresh water were onloaded.

The CHALLENGER departed Honolulu 26 hours after her arrival and proceeded on a "deadhead" voyage to Los Angeles. The transit was uneventful except that fairly rough seas were encountered for the final three days. Average speed of advance was 8.7 knots and the vessel arrived at the Bethlehem Steel Shipyard, Los Angeles Harbor, Terminal Island, at 1600 hours, September 18.

LOS ANGELES PORT CALL/DRYDOCKING

The ship remained dockside at the shipyard only long enough for arrival formalities and for the unloading of cores and certain equipment going ashore for repair or modification.

At 0500 hours the following morning, a shift was made to nearby Bethlehem Drydock #2. During the ensuing 13-day drydock period, mandatory periodic inspection of the vessel and its systems were conducted by Global Marine, the U. S. Coast Guard, the American Bureau of Shipping and other agencies. Routine cleaning and painting of the hull, maintenance and inspection of sea valves and other tasks possible only in drydock were accomplished. In addition numerous repair jobs were performed. Some of the more important repair items included extensive structural repairs to transverse frames 15 through 26 in the forward ballast tanks/thruster tunnel area (the frames had separated from the bottom plating due to wastage and/or vibration); replacement of both propeller tail shafts and associated bearings and packing; replacement of two stern thruster and one bow thruster gearboxes with new or rebuilt units; removal, preservation and inspection of all four vertical hydrophone arms; major overhaul of three main engines and repair of the heave compensator and drilling swivel by factory representatives.

On October 2, upon completion of work requiring drydocking, the CHALLENGER was refloated and was towed across the channel to Berth 58 in the Los Angeles Outer Harbor at San Pedro. Several repair jobs begun in the shipyard were completed during the four days spent at San Pedro. In addition, various stores, equipment, bulk mud materials, lube oil and fresh water were onloaded in preparation for the forthcoming drilling leg.

SEA TRIALS

The vessel departed her San Pedro berth at 1515 hours on October 6 and quickly cleared Los Angeles Harbor for sea trials in the San Pedro Channel near Santa Catalina Island. A loud squeal in the port stern tube bearing caused some concern, but was determined to occur only at low speeds and to be the result of a newly installed bearing that was not "worn in" and therefore was not sufficiently water lubricated.

Upon arrival in the test area, routine checks indicated proper functioning of the ship's systems with the exception of malfunctions in three of the four positioning hydrophones. Further investigation revealed that an underwater electrical cable connection had been pulled loose from the hydrophones, apparently during the shipyard refurbishment. As these connections were located at the bottom of the extension arms, they could not be reconnected without the removal of the complete assemblies from the ship, which requires the use of a dockside crane. These repairs were therefore set aside until later.

A total of twenty hours was spent "hove-to" in the sea trial test area. Most of this time was consumed in special vibration tests of the bow thrusters under various rpm and ballasting conditions. Upon completion of the vibration tests, the CHALLENGER got under way for Long Beach Harbor and arrived at Berth 210, Pier F (Exxon fuel pier) at 1645 hours, October 7.

LONG BEACH PORT CALL I

Fueling began immediately after arrival and continued until 0900 hours the following morning. Approximately 403,000 gallons were taken aboard.

Plans to remove the hydrophone arms with a mobile crane at the fuel pier were frustrated by port regulations and tugs arrived at 1100 hours, following GMI crew change, to assist in moving the CHALLENGER a short distance to Pier C, Berth 22. The move was accomplished in one hour and work commenced on the port hydrophones. Six hours later the tugs and pilot returned and turned the ship around for removal of the starboard hydrophones. Repairs were completed and the vessel departed Long Beach for the first drill site at 0120 hours, October 9.

SITE 467 - SAN MIGUEL GAP

The GLOMAR CHALLENGER arrived at the operating area, about 18 miles southwest of San Miguel Island, after a 15 1/2 hour transit from Long Beach. The positioning beacon was launched after about an hour of pre-site profiling and on-site operations began.

The initial pipe trip was slowed by unsuccessful attempts to deck test the hydraulic bit release, an unsuccessful attempt to run aluminum drill pipe and by measuring the drill string. Then one "water core" was taken as a result of an eight-meter difference between actual water depth and the precision depth recorder (PDR) reading. Hole 467 was finally spudded at 1053 hours, October 10.

On the fifth day of site operations, a loud vibration was noted in the forward part of the ship. Investigation revealed a pronounced thump coming from the gearbox of the No. 2 (forwardmost) bow thruster. On the recommendation of the Chief Engineer, the thruster was secured for the remainder of Site 467 operations and arrangements were made for repair in port prior to the continuation of the voyage.

No hole problems were encountered and coring proceeded smoothly. Core recovery was somewhat lower than normal which was attributed to the somewhat brittle nature of the siliceous claystone and shale penetrated. Drilling operations were terminated at a depth of 1041.5 meters below seafloor (BSF) in conformance with depth limitations recommended by the JOIDES Safety Panel. Then a wireline run was made to shift the mechanical bit release and leave the pipe open-ended. The hole was flushed and then filled with bentonite mud for logging.

After pulling the drill string up the hole approximately 950 meters for logging, the first tool run was the combination sonic/caliper/gamma ray. A very successful log was obtained. The borehole was found to be in quite good condition. Next a combination temperature/formation density/gamma ray log was attempted. This tool requires logging temperature as the tool is run into the hole and the other parameters as it is retrieved. Temperature was therefore being recorded as the sonde passed out of the drill pipe into open hole. A "bridge" or obstruction was encountered about 75 meters below the end of the drill pipe, but an ambiguous weight indication and a continuing rise in temperature after the winch was stopped were interpreted as signs that the tool had fallen through the bridge. The winch was restarted and again weight fell off, only to be apparently regained a few seconds later. This indication was repeated several times until a permanent weight loss and stable temperature were noted. On reversing the winch, it was soon found that excessive slack had apparently been put into the line and shortly after the full weight of tool and line had been regained the line pulled tight. This tension decreased when the drill string was raised, indicating that the line was knotted at the end of the pipe and could not enter it.

Since the formation density sonde contained a radioactive source, it was imperative that all possible steps be taken to recover the tool. This was accomplished by clamping off and cutting the logging line at the rig floor, installing a special rope socket with an inner core barrel pulling neck on the logging line and then engaging the pulling neck with the sandline overshot. Using this arrangement, the drill string was "stripped-over" the logging line and recovered. With this done, the line was then reattached to the winch drum, retrieved, and the logging tool and source safely recovered at 0400 hours on October 18.

Although considerable hydrocarbon gas was noted escaping from cores recovered from the upper portion of Hole 467, the gas was considered to be originating strictly from solution in the interstitial water. There was no indication of a gas phase or significant hydrocarbon accumulation in any stratum penetrated. Since it was necessary to pull the drill pipe to recover the logging tool, it was not possible to plug the hole in accordance with the guidelines of the JOIDES Panel on Pollution-Prevention and Safety.

LONG BEACH PORT CALL II

The CHALLENGER arrived at Pier E, Berth 122, Long Beach Harbor, at 1800 hours, October 18. A representative of Schottel Inc. (maker of the gearbox) and a mobile crane were on hand to assist in the replacement of the thruster gearbox. The ship's divers assisted in the installation of the temporary covers on the forward thruster tunnel and in the dewatering of the tunnel. A rebuilt gearbox unit was delivered the following day for installation.

In addition to the thruster work, outside personnel were called in to assist with troubleshooting of the heave compensator and weight indicator systems. Drill pipe elevators used in handling aluminum pipe were further modified in the vendor's shop. Seven additional drill collars and the ship's refurbished 350-ton pipe elevators were onloaded and all fresh water tanks were topped off. The logging line which was cut on Site 467 was replaced by the full length on-board spare.

When the gearbox had been replaced, the ship's departure was delayed about four hours by a series of potentially serious mechanical problems that occurred during preparation for sailing. First the boom clutch on the 50-ton crane malfunctioned as the heavy logging cable was being lifted, then the main bearing of DC generator 9B burned out and the ship's port steering motor was found to be grounded out. A replacement steering motor was located and delivered to the vessel and the other casualties were found to be within the repair capabilities of the ship's crew.

Finally, the CHALLENGER departed Long Beach after a two-day stay, at 2215 hours, October 20. Following passage between nearby Santa Catalina and San Clemente Islands, rough seas and winds reaching gale force slowed progress to less than seven knots for a few hours. The 128-mile distance to the operating area was covered in 18 hours (approximately 7 knots). The weather abated as the site was approached, however, and the positioning beacon was dropped at 1830 hours after about 1 1/2 hours of pre-site profiling.

SITE 468 - PATTON ESCARPMENT

The drill site was located in the Southern California Borderland area about 150 miles west of San Diego or 80 miles west-southwest of San Clemente Island. The running of the drill string was routine, however, a delay of 1 3/4 hours was experienced due to problems in the electrical circuitry to the drawworks motors and the positioning beacon failed as the power sub torque arms were being rigged prior to spud-in. An additional 1 1/2 hours were lost while a replacement beacon was launched and stable positioning was reestablished. Two "water cores" were taken due to a 19-meter discrepancy between PDR and actual water depths. This discrepancy was attributed to the steep slope of the seafloor and Hole 468 was finally spudded at 1215 hours on October 22 in 1859 meters of water.

Coring proceeded routinely to about 100 meters BSF when a loose turbidite sand about 15 meters thick was encountered. Very little of the sand was recovered and surprisingly it did not cause hole problems. The sand was underlain by a thick volcanic sequence with friable tuff and vesicular basalt rubble. Coring continued, with periodic mud flushes, to 241 meters BSF. The unstable volcanic sequence was still being penetrated and hole fill, torquing and sticking were on the increase, when the hole was finally abandoned by filling it with weighted mud. The risk of loosing a significant part of the drill string was judged too great.

HOLE 468A

The bit was pulled well clear of the seafloor and the ship was moved about one kilometer to the northeast, using positioning offsets on the beacon from the previous hole. The new position was upslope from Hole 468 in an area where seismic profiles showed a much thinner or absent volcanic sequence. The move and stabilization of positioning consumed 2 3/4 hours. Hole 468A was spudded where the water depth was 1752 meters and continuous coring began. When core number four had been retrieved about half way, the sandline parted a few hundred meters below the rig floor. The core barrel and broken line fell back down the drill pipe.

An attempt was made to fish the broken line with a wireline spear. The wire was engaged but was found to be stuck and the sandline parted again just above the fishing assembly. The complete drill string was then pulled to recover the tools and junk wire.

HOLE 468B

The vessel was offset about 300 meters and about 2500 meters of worn sandline was disposed of. The Hole 468A offsets were then re-entered on the positioning control console and the drill string was run back to the seafloor. The bit was washed in to 16.5 meters BSF where continuous coring began. The interval between 111.5 and 197 meters was drilled and cored on alternate joints as it was a repetition of the section cored in Hole 468. Continuous coring then proceeded to a total depth of 415.5 meters BSF. Most of the troublesome volcanics were avoided and fairly good hole conditions prevailed. Coring was terminated when most scientific objectives had been met because of scheduling considerations.

The shifting go-devil for the hydraulic bit release was pumped down and, after some difficulty, the bit assembly was dropped to leave open-ended pipe for logging. The hole was flushed with bentonite mud and then filled with weighted bentonite/barite mud to conform with plugging requirements.

The drill string was pulled up until only the BHA remained in the hole and logging operations began. Due to time constraints, a limited logging program was planned for the hole, consisting of a sonic/caliper/gamma ray log followed by a temperature/density/gamma ray run. The sonic tool was started down the pipe, but began to draw too much current and was retrieved. The backup sonic sonde was then run to total depth in apparently good working order. When logging commenced, however, both the travel time and gamma ray presentations were found to be malfunctioning. The sonde was recovered and the downhole problems rectified. At this point trouble developed in the computer located in the logging cab. When the problem had not been resolved after two hours of troubleshooting, Site 468 operations were terminated as the time allocated for the Site had been used and the information to be gained from logging was not expected to be great. The drill string was recovered and the short move was made to Site 469.

SITE 469 - FOOT OF PATTON ESCARPMENT

The 20-mile shift to the base of the escarpment, including pre-site survey time and positioning over the new beacon, consumed five hours. The pipe trip was routine and a wireline run was made to retrieve a core after the bit had been lowered to 3800.5 meters. (PDR depth was 3800 meters and a possible indication of bottom had been noted on the weight indicator). As the overshot approached the bottom of the pipe, it was found that the length of remaining sandline had been miscalculated and that it would be too short for use at Site 469. The line was retrieved and the sinker bar/overshot assembly was installed on the "standby" drawworks sandline. The core barrel was then retrieved and found to be empty. One joint of drill pipe was added and a second punch core was attempted. This core barrel was recovered with only a trace of sediment. A third "mudline" core attempt was made for the same interval as the previous try and over seven meters of core was recovered. Water depth was officially established at 3802.5 meters and continuous coring commenced.

Three hundred sixty-five meters of sediment were penetrated, including some volcaniclastics that again caused minor hole problems and required mud flushes. Then a very hard and unfractured dolerite sill 22 meters thick was cored. This was underlain by nine meters of soft chalk over a "basement" of badly fractured, rubbly pillow basalts. Fifty-seven point five meters of basalt had been penetrated when the bit failed and began locking up. Hole problems were concurrently reaching an intolerable level and a 2 1/2 hour delay had been experienced due to plugging of the bit with cuttings.

The hole was then flushed with 50 barrels of bentonite mud followed by 20 barrels of special high viscosity crosslinked guar gum.

A shifting go-devil was pumped down the drill pipe to activate the hydraulic bit release. After the go-devil had seated, the pipe was pressured up repeatedly without a pressure drop to indicate separation of the bit. A wireline run was made and the go-devil was retrieved with the overshot. A second go-devil was deployed and again repeated attempts failed to release the bit. At this point intentions of logging were abandoned and the drill string was pulled.

SITE 469 TO SITE 470

The short sandline remaining on the Bowen winch was disposed of prior to departure from Site 469. Then a 1 3/4 hour post-site survey was conducted before a course was set for the next drill site. The actual transit to the Site 470 operating area was made in 30 hours at an average speed of over 10 knots due to a following wind and current. At the site approximately eight hours were spent in pre-site profiling and finally the beacon was launched at 2000 hours on November 2.

SITE 470 - GUADALUPE ISLAND

The drill site was located about 40 miles east of Guadalupe Island or 105 miles southwest of Punta San Antonio, Baja California. The location was situated only about 2 1/2 miles south-southwest of the Project Mohole test site drilled in 1961. Water depth by PDR was 3559 meters. The first punch core was attempted to 3564 meters with no conclusive weight indication. Upon retrieval, the inner core barrel was found to be completely filled with sediment. One joint of drill pipe was set back and a punch core to 3554.5 meters was attempted for a definitive mudline determination. This core barrel was recovered without a trace of sediment and water depth was set at 3554.5 meters.

The sediment section was found to be extremely soft and somewhat thinner than expected. Basalt basement was encountered at only 168 meters BSF.

Due to severe core disturbance and low recovery in certain horizons of paleontological interest, these intervals were to be recored before the basalt drilling was begun.

HOLE 470A

The core bit was pulled clear of the seafloor and respudded. The new hole was drilled to a depth of 47 meters BSF before the inner core barrel was changed and spot coring commenced. The first core of Hole 470A was brought on deck just three hours after the final core of Hole 470. A total of 54 meters of sediment was recored before continuous coring of basalt commenced.

Basalt coring proceeded slowly at first in hard, fairly homogeneous rock with healed fractures. After 20 to 30 meters, however, the material began to become more glassy and fractured. The penetration rate increased but hole stability began to deteriorate. At 215.5 meters BSF, the drill string became stuck near the bit and over two hours of effort were required to free it. Coring was terminated at this depth.

The hole was flushed with 40 barrels of bentonite mud and 20 barrels of cross-linked guar gum and a wireline run was made to actuate the mechanical bit release.

Due to the shallow depth of the hole, the end of the pipe was pulled to only 63 meters BSF in an attempt to maximize the logged interval. The logging sheaves were rigged and the sonic/caliper/gamma ray sonde was run down the pipe. When the end of the pipe was reached, the logging tool stopped and would descend no further. The sonic curves gave open-hole readings which indicated that the lower part of the tool had emerged from the pipe. The gamma ray counts remained subdued, however, and after several attempts to enter open hole, the sonde was retrieved. It was felt that a clay "bridge" had formed beneath the pipe. The tool was inspected and one stand of drill pipe was added. The sonic tool again would not clear the pipe. An attempt was made to open the caliper arms, but they were held closed, confirming that the upper part of the tool remained in pipe. The caliper was returned to the closed mode and the drill pipe was raised in the derrick. The logging tool moved upward with the pipe instead of remaining outside. When the drill pipe was lowered to its former position, it "took weight", indicating a strong possibility that the hole had been lost in the very soft shallow sediment.

Chances of obtaining successful logs appeared remote and further attempts were abandoned. As retrieval of the sonde was begun, it pulled tight in the outer core barrel latch sleeve. When the tool was recovered, one caliper arm assembly was found to be severely damaged.

SITE 471 - MAGDALENA AREA

Site 471 was located about 470 miles east-southeast of Site 470 and about 70 miles south-southwest of Magdalena Bay, Baja California. The move to the immediate site area was made in 47 hours and 6 1/2 hours were spent on a pre-site survey. The beacon was launched at 1500 hours, November 8. As preparations were being made to spud the hole, a broken wire in the generator switchboard disabled the port main shaft and both stern thrusters. A 45-minute delay resulted.

PDR depth was 3111 meters and the first mudline punch core attempt was to 3115.5 meters. As there was no trace of sediment recovered, a second core was punched to 3125 meters. When this core barrel was recovered, it was completely full. Therefore, water depth was established as 3115.5 meters.

Coring operations proceeded rapidly the first day in soft pelagic sediments. Successful temperature-probe measurements were taken at 3210.5 and 3258 meters. The sandline was damaged on the latter attempt and a 1 1/2 hour delay ensued. At about 3275 meters (160 m BSF), a sequence of thin, hard porcellanite and carbonates, interbedded with soft clays, was encountered. This interval produced very low core recovery, plugging of the bit and some torquing and sticking tendencies. However, conditions improved after about 75 meters and several mud flushes. Then a monotonous 510 meter section of silty claystone was penetrated and hole conditions were excellent.

Igneous rock was encountered at about 745 meters BSF. It was highly altered diabase and a relatively good penetration rate was enjoyed. Although hole conditions remained good, the throat of the bit became plugged on three occasions and repeated runs with the bit deplugger were required to clear it. Due to scheduling considerations, core number 88 was designated as the final core with total depth at 3938.5 meters. During retrieval operations, the inner barrel was found to be stuck in the bit and could not be retrieved on the first wireline attempt. The release pin was sheared and the core barrel was apparently jarred loose in the process. It was retrieved easily on the second attempt.

Torquing and some evidence of rubble in the hole were noted on the final two cores. The hole was flushed with 30 barrels of bentonite gel mud and 20 barrels of seawater based guar gum mud. The go-devil was then pumped down and the hydraulic bit release was actuated. The hole was filled with freshwater bentonite mud for logging.

Because of the very soft upper sediment section and the experience of the previous site, the end of the pipe was pulled only to about 158 meters BSF for logging. A full suite of seven logs, involving five round trips with logging sondes, was run. The hole was found to be in perfect condition, as no problems were encountered in running the tools to total depth and only about one meter of fill accumulated in about 36 hours during logging operations. About 45 minutes were spent in repairing the outer armor of the logging cable during the final log run. Due to the occurrence of natural gas in the cores, the hole was plugged with cement from 585 meters to about 150 meters BSF.

SITE 472 - BAJA SEAMOUNT PROVINCE

The new operating area was about 90 miles west-southwest of Site 471 and about 225 miles west of the tip of the Baja California Peninsula. After nine hours under way and 2 1/2 hours surveying, the beacon was launched at 0100 hours on November 18.

The PDR water depth was 3841 meters, but when pipe had been run to about 3400 meters, a repeated loud jar was felt as a stand of pipe was being picked up. The jar was identified by rig personnel as the operation of a bumper sub and was accompanied by an apparent loss of about 15,000 pounds on the recording weight indicator. The stands were set back and the pipe was circulated with normal pressure indication. The core barrel in place was then retrieved and a replacement was pumped down. All phases of the operation were routine indicating no damage to the bottomhole assembly. With all conditions normal, the pipe trip continued and an additional 15 stands were run without incident.

This apparent "running into bottom" remained an unexplained false indication and no trouble developed.

The first core was attempted at 3843.5 meters with no recovery. Water depth was found to be 3847 meters on the subsequent core. While core number eight was being retrieved, the dynamic positioning system became unstable and the problem was traced to the vertical reference gyro. The system was switched over to the standby gyro without lost time and an attempt was made to minimize positioning error through the introduction of offsets to compensate for differences in gyro alignment. Then during the retrieval of core number nine, one of the hydraulic pumps powering the sandline winch failed. Four hours were spent replacing the pump before this core, which had been pulled half way up the drill pipe, could be brought on deck. On operation, the replacement pump was found to leak so much oil that it was necessary to switch the overshot to the drawworks sandline until more extensive repairs could be made.

One temperature probe measurement and five additional cores were taken before basalt was encountered at 112.5 meters BSF. Operations continued to be plagued by interruptions; two due to engine room electrical problems and one from a fouled sandline.

The sediment cover was somewhat thinner than expected and a planned second temperature-probe measurement was not obtained. Coring was abandoned after 25 meters of fresh rubble basalt had been penetrated due to hole stability and time considerations.

HOLE 472A

The drill string was pulled above the sea floor and respudded for the purpose of a second temperature-probe measurement at 107 meters BSF and for a second attempt to recover core of the sediment/basalt contact. Unfortunately, basalt was hit at 94 meters BSF while the hole was being drilled ahead with full pump volume and neither objective was achieved. The discrepancy in basement depth was attributed to basement relief and the positioning error introduced by changing vertical reference gyros. Due to the uncertainties involved, no further time was allowed for operations at Site 472 and the drill string was pulled.

SITE 473 - TRES MARIAS ISLANDS

The final drill site of Leg 73 was located just outside the Gulf of California about 45 miles west-southwest of the Islas Marias and 140 miles southwest of Mazatlan.

Operations began after a 41-hour transit from Site 473 and a 5 1/2 hour pre-site survey. The first core attempt recovered 22 cm of sediment from a depth of 3268 meters. Water depth was set at 3267.5 meters as compared with a PDR reading of 3257 meters.

The sediment section was again found to be soft, grading downward from soft clay to fractured silty claystone. This allowed five successful temperature probe runs before igneous rock was encountered at 247.5 meters BSF. Coring continued for 40 meters at a slow pace in a very hard diabase sill.

With the end of the cruise approaching, plans called for coring operations to conclude with core number 35 and to be followed by a limited logging program. Low pump pressure indicated that core barrel number 35 did not latch into place. As the schedule did not allow time for pumping down and retrieving a deplugger, the core barrel was retrieved and preparations for logging were begun.

A shifting tool, attached to an inner core barrel, was pumped down and the hole was flushed with bentonite mud. A wireline run was then made to shift the mechanical bit release so as to leave the bit at total depth. Then the open-ended pipe was pulled to 120 meters BSF for logging.

On the first log attempt, the sonic/caliper/gamma ray sonde passed out of the pipe and stopped almost immediately on a "bridge". It was felt that the pipe possibly had been pulled too high into the soft sediment section in an effort to maximize the open hole interval. The logging tool was recovered and one stand of pipe was added to wash out the bridge and to reach firmer formation.

The sonic tool was again deployed. After some difficulty getting past a "mud accumulation" just below the pipe, the tool traveled to about 190 meters BSF where it again came to rest. After much "working" at this depth, the tool traveled freely to about 230 meters BSF. The hole was solidly obstructed at this point (about the top of basement) and a log of the sediment interval was attempted. The caliper curve showed the entire open hole section to be badly washed out; most beyond the 18-inch full extension of the caliper arms. The only exception was an 8 1/2 inch restriction at the 190 meter ledge. Due to the large hole diameter, the sonic log gave only "water" readings and it was evident that little useful information would be gained by attempting other logs.

As insufficient site time remained for a cleanout run to bottom with the drill string, a temperature log of the sediment section was attempted for comparison with the probe measurements. Unfortunately the light sonde could not be worked past the 190 meter ledge, although some useful data were obtained from the upper part of the hole.

The drill string was then recovered with about 1 1/2 hours being required to lay out the aluminum drill pipe in singles for inspection at Mazatlan.

SITE 473 TO MAZATLAN

The CHALLENGER departed Site 473 at 1100 hours November 26 and arrived at the roadstead outside Mazatlan Harbor at the appointed time of 0600 hours the following morning. It was then necessary to lie to for 2 1/2 hours while a freighter in the harbor of Mazatlan was moved to make room for the CHALLENGER. When the pilot arrived, the CHALLENGER entered the harbor quickly and the first mooring line was put over at 0918 hours November 27. This officially ended Leg 63.

DRILLING AND CORING EQUIPMENT

The bottomhole assembly used on all sites was of the standard DSDP configuration with the addition of a bit release to permit logging operations. The assembly consisted of a core bit, bit release assembly (with float valve and inner core barrel support bearing), outer core barrel assembly (modified 8 1/4" x 4 1/8" drill collar), three 8 1/4" drill collars, one 5' stroke Baash-Ross bumper sub, three 8 1/4" drill collars, two 5' stroke bumper subs, two 8 1/4" drill collars, one 7 1/4" drill collar and one joint 5 1/2" range three drill pipe.

Mechanical bit releases were used on Sites 467, 470, 472, and 473. No problems were encountered and releases were effected routinely with the shifting tool except on Hole 472 where no attempt was made to release the bit. The new hydraulic bit release was employed at Sites 468, 469 and 471. Initial attempts to actuate the release with the downhole go-devil at Hole 468B were unsuccessful and separation of the bit occurred unexpectedly only after an unsuccessful attempt to retrieve the go-devil with the wireline overshot. The failure to release at Hole 469 was found, upon inspection of the equipment, to be the result of an unacceptably tight fit between the bit disconnect and the top connector. The bit disconnect, a part common to both types of bit release, had been manufactured with the inside diameter below design tolerance. It was noted that the hydraulic release mechanism had functioned properly. The bit was released in Hole 471 according to plan, except that it was necessary to bleed off the pressure in the drill string and repressure before separation occurred. Minor problems involved in dressing and testing the hydraulic release have been mostly resolved and the design appears to be viable.

As a preliminary step toward increasing the CHALLENGER's depth capabilities, 42 joints of five inch aluminum drill pipe were onloaded in Los Angeles for field testing. A specially modified set of pipe elevators was provided for handling the pipe which is somewhat larger on the outside diameter than the steel pipe. Unfortunately a dimensional problem with one of the elevators resulted in the first joint of aluminum pipe picked up at Site 467 becoming firmly stuck in the elevator. Attempts to dislodge the pipe were unsuccessful and that joint eventually had to be destroyed. The elevators were modified further at the second Long Beach port call and only very minor handling difficulties were experienced in subsequent operations. The 375 meter aluminum interval was incorporated in the drill string at Sites 468, 470, 471, 472 and 473. No particular operational problems were associated with the pipe, although a pronounced increase in drag was noted by sandline winch operators as core barrels were pulled through the aluminum pipe. The inside diameter is slightly less than that of the steel pipe in use and is considered to have precipitated the parting of the worn sandline at Hole 468A. No obvious wear or deterioration of the pipe was noted during the leg. However, the pipe was broken out and laid down on the final pipe trip of Leg 63 in preparation for a scheduled internal optical inspection during the Leg 63/64 port call at Mazatlan.

The vertical motion compensator was picked up on Site 467 and was employed for the cutting of only one core. A malfunction in the antislingshot valve contol system prevented the manual closing of the valve when the core had been cut. Early troubleshooting attempts were unsuccessful and the compensator was set aside for the remainder of operations at the site. Considerable additional work was done during the second Long Beach port call and the problem was thought to be solved. The compensator was deployed on Hole 468 and the valve again failed to functuon properly. Although some additional efforts at repair were made, the unit was not used for the remainder of the leg.

During the voyage sandline problems were responsible for over 21 hours of lost rig time. The most serious incident was the breakage that caused the abortion of Hole 468A. The line was worn and was scheduled for replacement as soon as the operating schedule would permit. It had been scheduled for disposal at Site 467 to demonstrate stripping operations. This was demonstrated with the electric wireline and changing of the sandline deferred to Site 468, on which the line broke and the drawworks sandline was used for the rest of the cores on that site. On two later occasions, the newly installed sandline was damaged by slacking during temperature-probe measurements, which involved running a core barrel down the pipe with the sandline. Both times it was necessary to shorten the line and to pour new rope sockets for the attachment of the sinker bar/overshot assembly. During Hole 472 operations, a marker flag became fouled in the line wiper at the beginning of a wireline trip for a core. This resulted in slacking and kinking and the line again had to be shortened.

The retrieval of another Hole 472 core was interrupted by the failure of the starboard Bowen hydraulic pump, one of the two that power the sandline winch. The end plate was forcibly blown off one of the swash plate positioning cylinders. It was necessary to replace the entire pump with a backup rebuilt unit before the wireline trip could be completed. The replacement pump was found to be leaking oil profusely as the core was retrieved. The sinker bar/overshot assembly was again transferred to the drawworks sandline until seals and gaskets could be replaced.

CORE BITS

Good bit performance was enjoyed on all sites and only one of the seven bits deployed was run to destruction. No premature or unusual failures occurred. Type 93 long-insert roller cone bits were run on sediment sites while the intermediate length insert Type 94 was employed where significant basement penetration was anticipated. Two rebuilt F94CK bits were utilized and their performance was considered equivalent to that of new bits.

SPECIAL TOOLS

Eight successful temperature probe measurements were obtained from the upper sediment sections of Holes 471, 472 and 473. Utility of this tool is restricted by the degree of compaction of the sediment. Some of the desired shallow data were sacrificed due to the inability of the sediment to support the weight of the lower stand of drill collars. The availability of the heave compensator would have permitted the adjustment to a lighter bit weight and therefore measurements in softer sediments. Judgment must also be exercised in discontinuing probe attempts before the induration of the sediment becomes sufficient to cause damage to the probe tip and possible consequent loss of the hole. As in the past, some damage to sandlines was sustained in running the core barrel, with probe attached, down the pipe with the sandline. The final measurement was taken after free-falling the tool to the bit and results indicated that the improved design of the new tool will enable it to withstand the shock involved.

Eastman "single shot" surveys were utilized to determine hole deviation with generally good results. Cuttings accumulations in the borehole interfered with some measurements by causing action of the lower bumper subs. On two occasions the bit was found to be plugged following drift shots due to backflow of cuttings. Deviation surveys were discontinued when the value of the data was not considered sufficient to warrant the risk to operations.

POSITIONING BEACONS

A total of eight beacons were deployed during Leg 63. All performed up to specification with the exception of the ORE 15 kHz single life beacon dropped on arrival at Site 468. Signal strength dropped sharply to an unacceptable level after about three hours operating time.

A prototype 16 kHz beacon provided by Benthos, Inc. was utilized at Site 467. Its performance was equivalent to that of the normally used ORE beacons for the duration of the 8.5 days on site.

DYNAMIC POSITIONING SYSTEM

Vertical reference gyro failures occurred on Sites 472 and 473. In both cases unstable positioning resulted and the system was quickly switched over to a standby gyro unit. No significant positioning excursions occurred due to good weather conditions and the alertness of personnel. No other significant positioning system problems were experienced.

ENGINEERING

The failure of the gearbox in bow thruster No. 2 was, by far, the most serious breakdown of the voyage in terms of lost time and necessitated the emergency port call and 2.8 days of mecahnical downtime. No problems were noted with the replacement unit or with the other three thrusters for the remainder of the leg.

The vessel's departure from the second Long Beach port call was delayed about 2 1/2 hours when a serious ground was discovered in the port steering gear motor. A replacement motor was found and delivered to the ship and the motor was installed at sea.

Operations were halted on two occasions by broken wires in main electrical switchboards. In one instance both stern thrusters and one main shaft were disabled. This occurred prior to spud-in and no serious excursion resulted due to good weather. The breaks were attributed generally to brittleness due to age and high operating temperature.

LOGGING AND CEMENTING UNITS

The Mohole logging winch was used extensively on the numerous logging attempts. The unit performed dependably with no serious mechanical problems. A sliding connection in the depthometer drive of the reeling arm assembly was found to be frozen on the first logging run and about 3 1/4 hours were required to dismantle the assembly and correct the malfunction. On the final log run, at Site 471, about 3/4 hour was spent in repairing a broken outer armor strand of the logging cable.

The cementing unit was utilized for hole plugging and for mixing batches of special polymer muds. No mechanical problems were experienced with the unit.

COMMUNICATIONS

Due to the proximity to local U.S. communications systems, little difficulty was encountered in ship-to-shore communications. During the first half of the voyage, numerous voice calls, both official and personal, were placed through the marine radiotelephone operators in Santa Barbara, San Pedro and San Diego. UCSD radio station WWD handled both incoming and outgoing business traffic directly on a daily basis and two or three business telephone patches were made through WWD with good results. A large number of personal phone patches were made with the aid of two active amateur radio operators in the crew and several helpful shorebased "hams". No equipment breakdowns occurred that affected communications.

WEATHER AND CURRENTS

Site 467 was located near Point Conception and San Miguel Island in an area known for being windy, rough and generally unpleasant. The CHALLENGER's stay in the area was no exception, but conditions remained within the vessel's station-keeping capabilities with one exception. On October 16, with a malfunctioning bow thruster off-line, winds began gusting to about 35 knots and the vessel lost heading with a subsequent 900-foot excursion. 1 1/4 hours weather downtime resulted (total for the leg). Again on October 29, wind and swell conditions became marginal, this time during Site 468 operations, due to the passage of a weather front. The weather abated just before it would have been necessary to terminate drilling. Weather conditions improved considerably to nearly ideal on the more southerly sites. Wind, current and swell were generally light and aligned in roughly the same direction.

NAVIGATION

Leg 63 provided an opportunity for evaluation of the various navigational systems installed. Satellite navigation was again the primary means of finding and verifying drill site coordinates, but difficulties were encountered due to the "bunching" of satellites. Two or more satellites would be acquired by the receiver simultaneously with mutual interference and no usable fix could be obtained. These "busy" periods were followed by intervals of several hours with no satellite passes.

The newly installed LORAN receiver performed well and provided useful data while the vessel operated in U.S. waters. The more southerly sites lay outside the LORAN coverage area, however.

The Omega navigation system provided its best performance since installation on the Mexican portion of the voyage. The coordinates on the Omega readout were very close to those of the SAT NAV on these latter sites, however, some problems were encountered with Omega transmitting stations going off line.

The pitometer or speed log remains out of commission.

PERSONNEL

The morale of shipboard personnel often suffers a decline in the course of a long, demanding voyage, but Leg 63 was an exception. The complete disruption of shipboard systems and routines associated with the drydocking period, together with the numerous mechanical problems early in the operating leg, placed a burden on nearly everyone aboard. Spirits improved with the cumulative operational successes and the better weather toward the end of the leg. There was justified pride on the part of the crew that they had "put the ship back together" and gone on to complete a highly successful cruise.

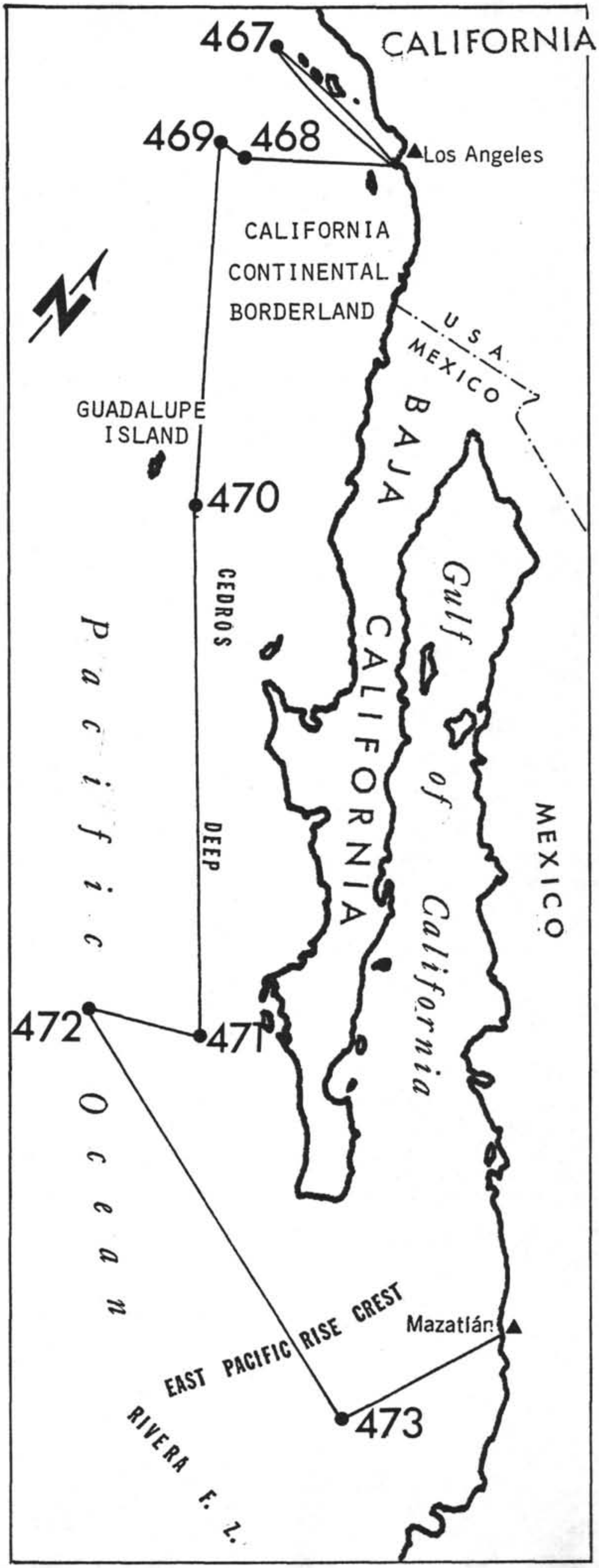
The drilling crew operated on a modified basis following the loss of a driller at the second Long Beach port call. His position was filled by the junior drilling foreman and the drilling superintendent performed "toolpusher" duties. An additional rotary helper was hired to work daylight hours. He was a valuable addition because much work normally done under way between sites had to be done while coring operations were in progress.

The science and DSDP technical staffs performed professionally under a consistently heavy workload. A record 389 cores were processed and some individuals were truly impressive in their response to the challenge.

Colds and influenza-like symptons occurred sporadically but there was no serious illness. There were a few minor finger and toe injuries, but no serious or lost time injuries.

Glen N. Foss
Cruise Operations Manager
Deep Sea Drilling Project

LEG 63 OPERATING AREA



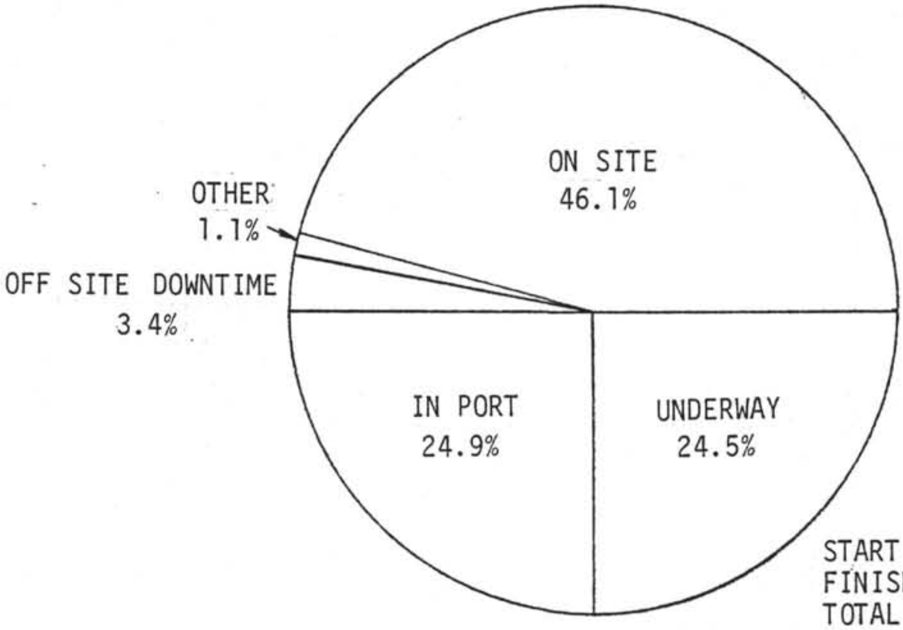
INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
OPERATIONAL RESUME
LEG 63

Total Days (September 6, 1978 - November 27, 1978)		81.69
Total Days - Scheduled Port Calls		20.33
Total Days Under Way		20.89
Transit	18.7	
Site Survey	1.3	
Sea Trials & Tests	0.9	
Total Days Off-Site Downtime		2.76
Total Days On-Site		37.71
Trip Time	4.1	
Drilling Time	0.1	
Coring Time	24.2	
Downhole Measurement Time	4.2	
Mechanical Downtime	0.5	
Stuck Pipe & Hole Trouble	0.2	
Weather Downtime	0.1	
Other	4.3	
Total Distance Traveled (Nautical Miles)		4288.2
Average Speed (Knots)		8.8
Sites Investigated		7
Holes Drilled		11
Number of Cores Attempted		398*
Number of Cores With Recovery		389
Percent of Cores With Recovery		97.7
Total Meters Cored		3640.8**
Total Meters Recovered		1522.8
Percent Recovery		41.8
Total Meters Drilled		272.3
Total Meters Penetration		3913.0
Percent Penetration Cored		93.0
Maximum Penetration (Meters)		1041.5
Minimum Penetration (Meters)		35.5
Maximum Water Depth (Meters)		3847.5
Minimum Water Depth		1752.0

* DSDP Record for continuous scientific staff leg

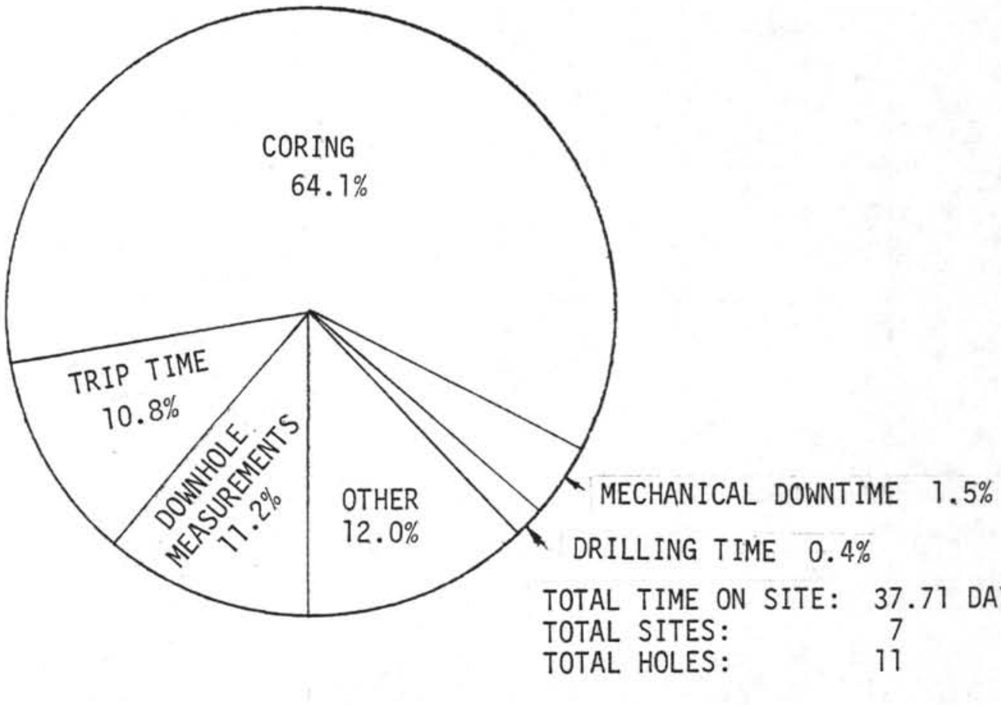
** DSDP record for any leg

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
TOTAL TIME DISTRIBUTION
LEG 63



START LEG: SEPTEMBER 6, 1978
FINISH LEG: NOVEMBER 27, 1978
TOTAL TIME: 81.69 DAYS

ON SITE TIME BREAKDOWN
LEG 63



TOTAL TIME ON SITE: 37.71 DAYS
TOTAL SITES: 7
TOTAL HOLES: 11

DEEP SEA DRILLING PROJECT
TIME DISTRIBUTION
LEG - 63

Date	Site No.	Cruise	Trips	Drill	Core	Stuck Pipe	W.O.W.	Downhole Measurement	Mech. Repair	Port Time	Re-Entry	Other	Total Time	Remarks
09/06/78 09/18/78		260.8								26.2			287.0	Honolulu to Los Angeles
09/18/78 10/09/78		7.8								461.6		20.2	490.6	LA-LB port call & sea trials
10/09/78		15.6										1.0	16.6	Long Beach to Site 467
10/09/78 10/18/78	467		18.9		147.0		1.3	14.2	2.7			18.7	202.8	
10/18/78 10/21/78		19.6							66.2				85.8	467 to 468 & LB port call II
10/21/78 10/23/78	468		8.4		24.5	0.5		0.5	2.0			9.2	45.1	
10/23/78 10/24/78	468A		2.4		2.8							11.4	16.6	
10/24/78 10/26/78	468B		3.3	0.7	40.0			9.6	0.3			7.4	61.3	
10/26/78 10/27/78		5.0											5.0	468 to 469
10/27/78 11/01/78	469		15.4		92.2	2.6		1.2				12.1	123.5	
11/01/78 11/02/89		38.0											38.0	469 to 470
11/02/78 11/04/78	470		7.0		19.3							4.1	30.4	
11/04/78 11/06/78	470A		6.1	1.6	30.2	1.7		13.4				2.3	55.3	
11/06/78 11/08/78		53.4											53.4	470 to 471
11/08/78 11/17/78	471		11.8		142.7	0.5		37.5	0.7			21.2	214.4	
11/17/78 11/18/78		11.4											11.4	471 to 472
11/18/78 11/20/78	472		14.2	0.9	26.7			1.4	7.2			9.3	59.7	incl. 472A
11/20/78 11/22/78		46.3											46.3	472 to 473
11/22/78 11/26/78	473		10.1		55.0			24.0	0.3			6.6	96.0	
11/26/78 11/27/78		22.4											22.4	473 to Mazatlan
TOTALS		480.3	97.6	3.2	580.4	5.3	1.3	101.8	79.4	487.8	0	123.5	1960.6	

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
SITE SUMMARY
LEG 63

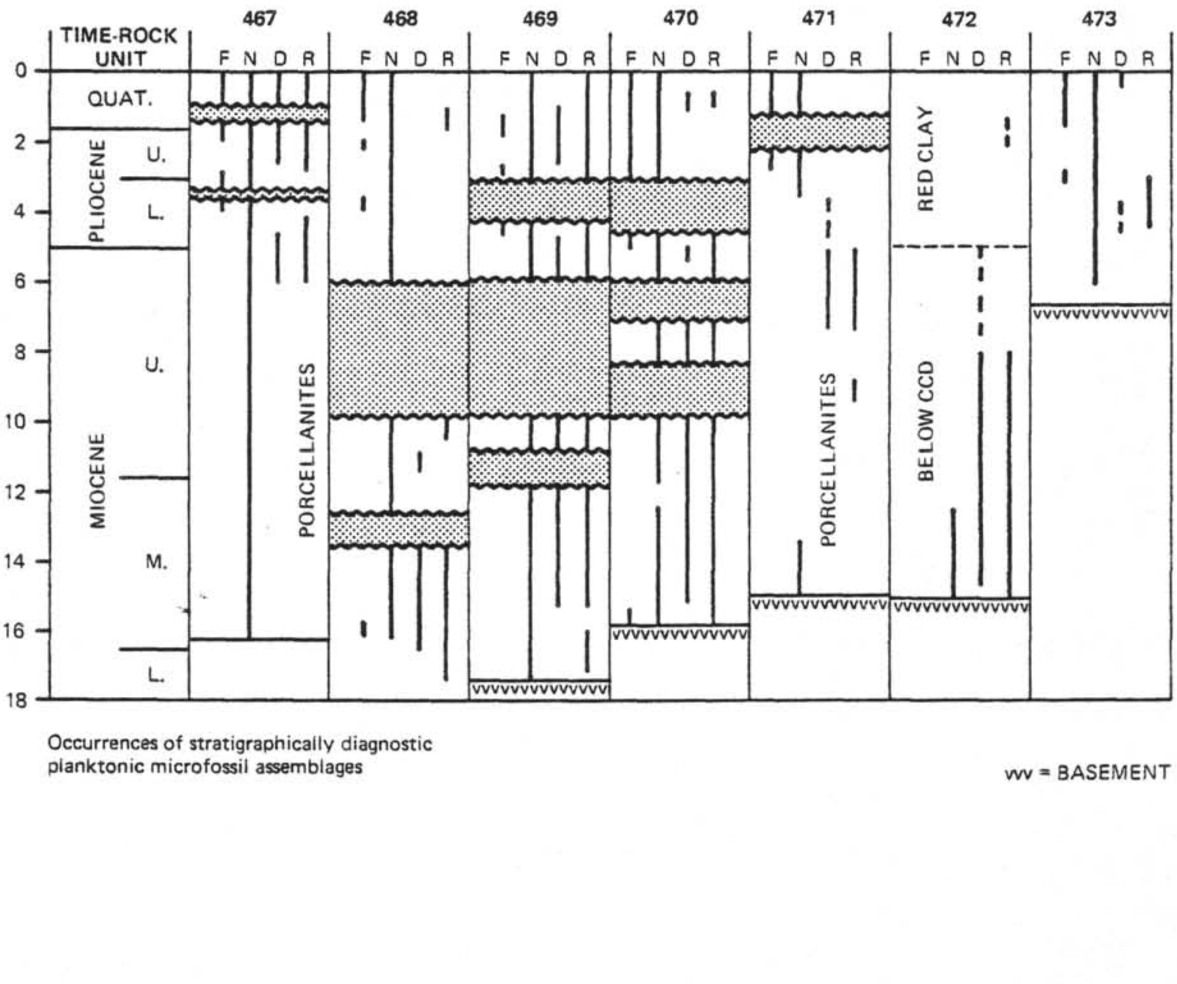
HOLE	LATITUDE	LONGITUDE	WATER DEPTH METERS	NUMBER OF CORES	CORES WITH RECOVERY	PERCENT OF CORES WITH RECOVERY	METERS CORED	METERS RECOVERED	PERCENT RECOVERED	METERS DRILLED	TOTAL PENET METERS	AVG RATE PENET.	TIME ON HOLE	TIME ON SITE
467	33° 50.97'N	120° 45.47'W	2146.0	110	106	96.4	1041.5	426.3	40.9	0.0	1041.5	21.5	202.8	202.8
468	32° 37.03'N	120° 07.07'W	1859.0	26	26	100.0	241.0	83.7	34.7	0.0	241.0	48.4	45.1	
468A	32° 37.41'N	120° 06.55'W	1752.0	4	4	100.0	35.5	27.7	78.0	0.0	35.5	236.7	16.6	
468B	32° 37.41'N	120° 06.55'W	1752.0	37	36	97.3	351.5	104.6	29.7	64.0	415.5	38.7	61.3	123.0
469	32° 37.00'N	120° 32.90'W	3802.5	51	50	98.0	453.5	178.5	39.4	0.0	453.5	11.9	123.5	123.5
470	28° 54.46'N	117° 31.11'W	3554.5	18	18	100.0	168.0	90.0	53.6	0.0	168.0	68.1	30.4	
470A	28° 54.46'N	117° 31.11'W	3554.5	13	13	100.0	101.5	48.2	47.5	114.0	215.5	13.6	55.3	85.7
471	28° 28.93'N	112° 29.78'W	3115.5	88	85	96.6	823.0	356.4	43.3	0.0	823.0	16.1	214.4	214.4
472	23° 00.35'N	113° 59.71'W	3847.5	16	16	100.0	137.5	65.1	47.4	0.0	137.5	15.9	46.3	
472A	23° 00.35'N	113° 59.71'W	3847.5	1	1	100.0	0.2	0.2	100.0	94.3	94.5	153.2	13.4	59.7
473	20° 57.92'N	107° 03.81'W	3267.5	34	34	100.0	287.5	142.1	49.4	0.0	287.5	12.9	96.0	96.0
			TOTAL	398	389	97.7	3640.7	1522.8	41.8	272.3	3913.0	34.2		905.1

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
BIT SUMMARY
LEG 63

HOLE	MFG.	SIZE	TYPE	SERIAL NUMBER	METERS CORED	METERS DRILLED	METERS TOTAL PENET.	HOURS ON BIT	CONDITION	REMARKS
467	Smith	9 7/8	F93CK	279JZ	1041.5	0	1041.5	48.6	Unknown	Released for logging; core diameter decreasing.
468	Smith	10 1/8	F93C	KN264	241.0	0	241.0	5.0	Unknown	String not pulled for offset.
468A	Smith	10 1/8	F93C	KN264	35.5	0	35.5	0.2	TO-BOSE-I	
468B	Smith	10 1/8	F93C	KN264	351.5	64.0	415.5	10.8	Unknown	Released for logging.
					628.0	64.0	692.0	16.0		
469	Smith	10	RBF94CK	SZ217	453.5	0	453.5	38.1	TO-B8LC-0	27.6 hrs in basalt;1 cone gone other 3 loose.
470	Smith	9 7/8	F94CK	641RR	168.0	0	168.0	2.5	Unknown	String not pulled for respud.
470A	Smith	9 7/8	F94CK	641RR	101.5	114.0	215.5	15.8	Unknown	Released for logging.
					269.5	114.0	383.5	18.3		
471	Smith	10	RBF94CK	SZ081	823.0	0	823.0	51.3	Unknown	Released for logging.
472	Smith	9 7/8	F93CK	275JZ RR	137.5	0	137.5	8.7		8.2 previous hrs.
472A	Smith	9 7/8	F93CK	275JZ	0.2	94.3	94.5	0.6	T1-B1-I	
					137.7	94.3	232.0	9.3		8 hrs in basalt-17.5 total hrs.
473	Smith	10 1/8	94CJS	JZ236	287.5	0	287.5	22.3	Unknown	Released for logging.

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
BEACON SUMMARY
LEG 63

SITE NO.	MAKE	FREQ. kHz	SERIAL NUMBER	SITE TIME HOURS	REMARKS
467	Benthos	16.0	005	202.8	Satisfactory in all respects; held signal strength well.
468	ORE	13.5	452	14.6	Single life. Signal strength dropped suddenly to unusable level.
468	ORE	16.0	430	45.1	Single life. Used for offsetting to 468A.
468A	ORE	16.0	430	16.6	
468B	ORE	16.0	430	61.3	
				123.0	Total
469	ORE	16.0	453	123.5	Single life.
470	ORE	13.5	443	30.4	Single life.
470A	ORE	13.5	443	55.3	
				85.7	Total
471	ORE	13.5	438	214.4	Double life.
472	ORE	16.0	427	46.3	Single life.
472A	ORE	16.0	427	13.4	
				59.7	Total
473	ORE	13.5	361	96.0	Double life.



Occurrences of stratigraphically diagnostic planktonic microfossil assemblages

vvv = BASEMENT

FIGURE 3

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
OPERATIONS RESUME
LEG 64

SUMMARY

Leg 64 of the Deep Sea Drilling Project was the first of two voyages planned to investigate the Gulf of California on the West Coast of Mexico. Operations were conducted both in an area near the mouth of the Gulf and in the Guaymas Basin mid-way up the Gulf. The leg began at Mazatlan, Mexico and ended in Los Angeles, California when the GLOMAR CHALLENGER arrived for drydocking and thruster repairs.

MAZATLAN PORT CALL

Leg 64 began with the first mooring line over at Berth 4, Mazatlan, Mexico at 0918 hours on November 27, 1978. The vessel commenced fueling and 147,969 U.S. gallons of diesel fuel were loaded. Core samples were off-loaded for shipment to California and resupply of food items, fresh water, etc. was accomplished. Various freight shipments were received, including a new spool of logging cable which was installed after removal and off-loading of the old reel. Other work items included inspection of aluminum drill pipe (both coated and non-coated) and drilling of eight drill collars at both ends for purpose of installing especially designed locking sleeves while running a drilling-in casing system.

The Mazatlan port call was the occasion to celebrate the 10th Anniversary of the GLOMAR CHALLENGER drill ship and of the Deep Sea Drilling Project. On the evening of the 28th, GMI offered a "MEXICAN FIESTA" to crews of both Legs 63 and 64. There were drinks, good food, Mexican music and dancers and enthusiasm grew unceasingly until the party was called off at 2400 hours.

The Mazatlan port call was also marked by difficulties with Mexican immigration authorities. They considered that the visas obtained by most of the crew members were not adequate for Leg 64 in Mexican waters and ship departure was therefore delayed by 24 hours. The situation was finally cleared by December 1st at 0800 hours and the last line was cast off at Mazatlan at 0846 hours, December 1, 1978.

At 0935 hours the ship started "heaving-to" off the entrance of Mazatlan Harbor. Hydrophones were lowered and tested to assure that all cables were of the same length and the thrusters were checked for proper operation. This work was completed at 1310 hours and the GLOMAR CHALLEMBER departed to Site 476 (GCA-5).

SITE 474 - HOLE 474

The first site to be investigated on Leg 64 was located 145 miles west from Mazatlan and 30 miles south-southeast from Cabo San Lucas. The positioning beacon was launched at 0747 hours December 2 after about two hours of pre-site profiling. The ship was in the automatic positioning mode at 0930 hours and the make up of the drill string was started. The PDR indicated a water depth of 3033 m. The hole was spudded at 1450 hours and established the mud line at 3043 m below the rotary table. The first two cores were punched without rotation and circulation.

Coring them proceeded routinely to 3225.5 m (182.5 meters BSF) where it was decided to run the Heat Flow/Pore Water Sampler after Core No. 20 was pulled out with almost no recovery. The core bit was about 9 meters from bottom when the heat flow tool was landed on the core barrel support bearing. The bottomhole assembly and heat flow tool were then lowered together slowly and landed on bottom with 12,000 lbs set on the bit. The tool was left on bottom for about 15 minutes.

A first attempt to retrieve the tool failed and the pin on the overshot was sheared. A second attempt confirmed that the heat flow tool was stuck in the bottomhole assembly. Before pulling out of the hole, a last and unsuccessful attempt was made to release it by pulling on the tool with the sandline while slowly rotating the string with weight on the bottom. It was then decided to pull the drill string to the surface and to abandon Hole 474. When the bit was recovered it was found that the tail pipe of the heat flow instrument had been bent and broken at a point about two inches below the core bit. Deep dents made on the concave side of the bend during fishing attempts confirmed that the tool was bent while being lowered to bottom for heat flow measurement and water sampling.

HOLE 474A

After the bit had been pulled to the surface, the ship was moved about 300 meters southeast toward the beacon. The move and stabilization of the ship did not consume any operational time.

Hole 474A was spudded at the same water depth of 3043 m and was drilled down to 3206.5 m in two hours. Continouous coring was then resumed, providing an overlap of about 20 meters with Hole 474. Coring operation proceeded rapidly in mostly claystone with mud turbidites down to 3560 m where terrigenous layers were encountered.

A deviation survey taken at 3539 m showed a deviation of 4 1/2 degrees. After penetrating a few alternating layers of hard formations and sediments, the core bit entered into continuous basalt at 3570 m. Hole conditions remained generally good but the throat of the bit became plugged at 3615 m and the core barrel stuck at the same time. Fortunately, the bit came unplugged when the drill pipe was being pulled out with a high drag, and a strong backflow washed the bit clean. After flushing the hole with 50 barrels of mud, the core barrel could be retrieved, then the hole was washed clean down to bottom and coring resumed. Thereafter, the hole was then flushed with 30 barrels of mud after each core.

Coring was continued to 3669 m, which was selected by the Co-Chief scientists as the final depth. After flushing the hole with 30 barrels of mud plus seawater, the shifting go-devil was pumped down the drill pipe to activate the hydraulic bit release. Differential pressures of 1,500 psi, then 2,000 psi, then 2,300 psi were successively applied to the go-devil without actuating the release. The core bit was lowered to bottom, the drill string was slowly rotated, without any result. The same sequence of operations was repeated three times without success. It was then decided to retrieve the go-devil. It came free after a few attempts and was pulled to the surface. All packings were missing.

Circulation was then difficult, and it was decided to pull the end of the drill string above the gauge hole cut through the basalt and then to recover full circulation and clean up the hole before trying a new attempt on the hydraulic bit release. The string was pulled up to 3570 m with up to 70,000 lbs of drag. The hole was then washed down to bottom and flushed with 100 barrels of gel mud.

A second go-devil was then launched and pumped down very slowly, in two hours. No pressure increase was observed and it was concluded that the core bit had been released after pulling the first go-devil free. No firm conclusions about when, how and why were possible.

However, the hole was filled with 250 barrels of gel mud to stabilize it before logging. The open ended pipe was pulled to 3178 m and positioned just below the loose sands zone observed on Hole 474.

After rigging up logging equipment in a force eight gale, 5 runs of combined recording devices were made within 24 hours without any major difficulty. The first two combinations would not go below an obstruction in the hole at 3585 m. The third combination went to bottom, the fourth was a mis-run because of a tool malfunction (Induction) and the fifth run again went to bottom. Accordingly, no fill was observed in this hole 30 hours after filling it up with mud and the small bridge observed at 3585 m was probably destroyed after the first two runs. For further details, wee the logging summary attached.

The hole was then plugged with cement from 3235 to 3135 m and 110 lbs mud from 3135 m to the seafloor.

SITE 475 - HOLE 475

The new site was about 6.8 miles northwest of Site 474. After 2.15 hours steaming, a 13.5 kHz beacon was dropped and the ship continued on course 1.5 miles beyond the beacon. When the vessel returned to the beacon area, it was found that the signal was very weak and it was necessary to wait for a satellite fix. The hydrophones were lowered and the gain was increased to the maximum and a second beacon, 16 kHz, was dropped at the location of the weak 13.5 kHz unit. Six hours were consumed in positioning over Site 475.

On spudding in, the water depth was found to be 2650 m (against 2641 m for the PDR). Coring started in diatom mud and continued in soft clay down to 2798.5 m with high recovery. At about 2806 m, the core bit entered a hard conglomerate (rubble of stones) where recovery became very low. After a penetration of about 40 m into this rubble, the drill string started experiencing more and more torque and finally became stuck. The pipe had to be worked on bottom for nearly two hours before being pulled free and worked above the rubble zone. The hole was then abandoned due to concern for the safety of the drill string. Heavy mud was pumped into the hole to assist in pulling out of the rubble. No logging was requested in this shallow hole.

HOLE 475A

The bit was pulled well clear of the floor and the ship was offset 1500 feet north and 2900 feet west of the same 16 kHz beacon. There "water cores" were taken due to a 30 meter discrepancy between the PDR and actual water depth. The hole was finally spudded in 2590 m of water and washed to 2607.5 m when the core bit hit a hard formation. The drill pipe was pulled out of the hole and the core barrel retrieved with a 0.10 m sample of formation which correlated with the hard claystone covering the rubble zone of Hole 474.

It was then decided to move the ship to a median position between Hole 475 and 475A/

HOLE 475B

The bit was pulled well clear of the seafloor again and the ship was offset 1150 north and 1170 west or 1600 feet on a heading of 310 degrees true from the 16 hKz beacon. The PDR indicated a water depth of 2603 m, but the mudline was found at 2629.5, after three water cores had been taken. The two discrepancies observed on Holes 475A and B, confirm an observation made during Leg 63 that the PDR reads a water depth shallow than the true depth in areas where the seabottom has a steep slope.

After cutting a 9.5 m core below the mudline, the hole was washed down from 2639 m to 2705.5 m where hard formation was encountered earlier than anticipated. Continuous coring then started immediately in a fractured basalt zone with very low recovery (0.50 m for 19 m cored). Torquing and sticking were on the increase and the penetration rate became practically nil after 20 meters in this unstable volcanic sequence. The hole filled up as soon as the core bit was pulled a few feet off of the bottom. One more time, the hole was abandoned due to concern for the safety of the drill string. The core bit and the hydraulic bit release were recovered and no logging was requested in the hole.

SITE 476

All drilling equipment was secured for sea (wind gusting to 55 miles/hour) and the vessel got under way to profile over Hole 475B, thence to profile a parallelogram area of 25 miles passing over Hole 474.

At 2135 hours on December 18, a 13.5 kHz beacon was dropped on Site 476 (GCA-7A) about two miles west from the previous hole, 475B. The profiling gear was retrieved and the water depth was read at 3613 m (PDR) after positioning over the beacon.

A standard drilling assembly, including hydraulic bit release system was run and the seafloor was found at 2629 m after a water core had been taken (the seabottom was not flat, but not as steep as on Site 475). Coring proceeded in diatom mud and very soft clay with good recovery. At about 2625 m, the core bit entered a series of formations where recovery remained very low (never exceeding 0.70 meters for each 9.5 meters cored). The hole was bottomed at 2723.5 m due to hole conditions. About 30 meters of deeply altered and crushed granite was penetrated and produced an increasing propensity to bottom hole filling, bit plugging and lost circulation, torquing and hole drag. Even heavy mud could not keep the lower part of the hole from filling. Samples brought to the surface in the core barrel showed that the granite grain size distribution was ranging from very fine particles of few tenths of millimeters to pieces of ten centimeters or more. It was obviously impossible to clear the hole of the coarser elements through seawater or even gel mud circulation.

Accordingly, it was decided to actuate the hydraulic bit release and to log the hole. About 100 barrels of mud were pumped into the hole before sending the go-devil in order to reduce filling and sticking propensities while working on the hydraulic bit release system. This operation was anticipated to be time consuming due to former experience in Hole 474A and the presence of the fine granite grains in the hole.

Recommended releasing procedures were followed from the beginning of the operation. After landing of the go-devil had been observed (travel time was 20 minutes), differential pressures of 1,500, 2,000 and 2,500 psi were applied without any results. The core bit was slowly rested on bottom, slowly rotated without any effect. Pressure was bled off, four stands of pipe were pulled out of the hole and a new complete cycle of releasing operations was made without success. An empty core barrel was even dropped on the go-devil in order to check the ffect of some downward impact.

Accordingly, it was decided to abandon the site. The drilling string was pulled out of the hole which was left full of mud. No hydrocarbon show had been observed during core analyses.

When brought to surface, the hydraulic bit release was found completely jammed and the inner mechanism was locked with granite grains and various sediments. The release sleeve had not been shifted upward.

SITE 477

After completing the drilling at Site 476, the ship left the tip of Baja California area and traveled 251 miles north to the Guaymas Basin. On December 18, 1978, at 0040 hours, a 16 kHz beacon was dropped on Site 477 (GCA-12) and the ship went on its course for one to two miles and returned to the site of the beacon drop by using a radar fix. The hydrophones were lowered but only a faint signal was received from the beacon. With maximum gain setting, the hydrophones were raised and the area was reprofiled and a second beacon, 13.0 kHz, was dropped on the selected site at 0310 hours. As the mudline was known to be very soft in the Guaymas Basin, it was thought that the 16.0 kHz beacon which had a tether of only 5 feet, may have sunk into the mud. Accordingly, the 13.5 kHz beacon was dropped with a tether of about 12 feet.

After positioning the ship over the beacon, the bottomhole assembly was made up with a mechanical bit release and run in to the seafloor. The PDR indicated a water depth of 2013 meters and the mudline was found at 2020 m by the first core. Coring then progressed in very soft sediments to about 2979 m. All this interval was cored without pumping and without rotation; however, the recovery remained at a low average of 24.3%. The hole then entered a sill of basalt where the average recovery was even lower. At 2120 m, the core bit entered into a new sedimentary section and progressed rapidly (4 to 8 minutes per core with water circulation at a minimum) down to 2211 m where the Co-Chief Scientists asked that operations standby for awhile to give time for core examination. Various but confusing indications of hydrocarbons had been reported since the core bit broke through the basalt sill. To spend time in a more useful manner than merely circulating on the bottom, it was proposed and accepted that a limited logging program be run through the drill pipe. The hole was conditioned and gel mud was displaced into the annulus. In order to avoid the possibility of the logging tool pushing the float valve open and becoming stuck in the valve, a recoverable plug was set above the float valve. A first run was made with the gamma ray-neutron combination and a second with the thermometer. Both were suc cessful and the three logs showed anomalies. The sudden change in temperature gradient was difficult to interpret and could have been the result of an entry of fluid in the hole. Some support to this hypothesis could be derived from the anomaly shown by the neutron at the same depth. However, no one on the ship was familiar enough with log interpretation to formulate a final conclusion.

Gearhart-Owen representatives decided to run a maximum reading thermometer with their gamma ray neutron tool. As no special housing was provided on this small sized tool, the Gearhart-Owen operators decided to use adhesive tape to fix the 8" x 1/2" pressure case containing the thermometer onto the gamma neutron tool. Accordingly, the pressure case was lost in the hole during the first run.

When logging was completed, two attempts to fish the small steel case with a magnet were made but were unsuccessful. It was then decided to try to retrieve the plug from the drilling assembly. The overshot latched will around the neck of the plug, but is was impossible to move it upward because of the "locking effect" of the steel case. As no other means of fishing this small steel case was available on board, it was necessary to abandon this hole and to spud Hole 477A as soon as possible. One hundred barrels of heavy mud (11.0 lbs) were pumped into the hole and the drill string was pulled out. When recovered, the maximum thermometer indicated a temperature of 190^{o}F.

HOLE 477A

The plan was to spud Hole 477A at no more than 100 feet from Hole 477, on the same seismic line. However at 0510 hours, December 20, when the ship was ready to move, the 13.5 kHz beacon on which the ship was positioning commenced to fade rapidly. A 16 kHz beacon with a 25 foot tether was quickly picked up and dropped at 538 hours. At 0545 the 13.5 kHz beacon was completely unaudible. From the average of several satellite fixes, it was found that Hole 477A was about 350 feet northwest from Hole 477 on the same seismic line.

Hole 477A was spudded in 2020 m of water at 1000 hours, December 20. Soft sediments were washed to 2052 m where hard basalt was encountered well before the bottomhole assembly was buried. Drilling and coring with no more than 12,000 lbs weight across 32 m of basalt took more than two hours. After the bit broke through the basalt sill, the hole was washed down to 2201.5 m where continuous coring was resumed. The formation to be cored was soft but very sticky and it was necessary to keep circulation of seawater at a medium to high rate to avoid sticking. Accordingly, recovery was generally very poor.

However, as in the previous hole, samples of formation brought to the surface showed various and confused shows of hydrocarbons (methane, ethane, dark brownish and oil stains on the sediments and on the fluids recovered, etc.). Most of the samples recovered were clay and fine sand with some pieces of medium grained consolidated sandstones. It was also noted that bottom hole temperature was probably very high since even with a circulation rate of 500 to 700 gallons per minute of seawater, some plastic inner barrel liners were badly scorched. After discussion of the situation, the Co-Chief Scientists and Operations Manager agreed to terminate the hole at 2287 m.

The hole was conditioned and 150 barrels of 11.0 lbs mud were pumped inside. The mechanical bit release was then actuated without any difficulty and the open ended pipe was pulled to 2158 m.

A complete logging program including gamma ray, neutron, caliper, sonic, variable density, guard, induction and temperature was run in the open hole section within less than 24 hours. A gamma ray neutron was recorded up to the mudline through the drill pipe.

After completion of the logging program, a cement plug of 20 barrels was set across the gaged section of hole cut through the basalt sill from 2050 m to 2080 m thus ensuring a complete plugging of the hole.

HOLE 477B

After Hole 477A was abandoned, the ship left Site 477 and traveled to rendezvous with the Mexican Warship G08 in the Lee of Santa Inez Island, Baja Conception, Baja California. The ship was anchored and the divers went to inspect stern thruster No. 1 which was leaking oil. They found a fishing line wrapped around the shaft, but were unable to see the source of the oil leak. The Mexican vessel than came along side the GLOMAR CHALLENGER. Two GMI and three Scripps personnel were disembarked and one GMI and five Scripps personnel were embarked along with some equipment such as the piston corer and a compliment of material for the drilling-in casing system. The ship then departed to reoccupy Site 477 after extensive profiling of the area.

After repositioning on the beacon, the standard bottomhole assembly was modified to test the new hydraulic piston corer (HPC). A special core bit and a special sub were run and a stand of three 8 1/4" drill collars was left on the rig floor. The core bit was positioned at 2016.5 m; that is to say 3.5 m above the drilling mudline as measured on Holes 477 and 477A. The HPC was then pumped down while attached to the sandline to about 1500 m. The pump was then shut off and the HPC was lowered onto its seat. Pressure was then built up for 30 seconds at a maximum rate of 350 gallons per minute to 1,700 psi. A brief drop of pressure was observed attesting that the piston corer had been actuated, but no pressure release was observed. Pressure was then slowly built up to 2,000 psi and the pump turned off. No pressure decline was observed for one minute. Pressure was then bled off at the stand pipe and the HPC was pulled out. While pulling out, at approximately 1000 m, a sudden decrease of weight on the sandline was observed and when the HPC was brought onto the rig floor, the inner core barrel, the core liner and the double pin sub were missing.

It was thought that the lost components had gone through the bit throat and a second HPC was made up and run down the pipe following the same procedures. While mechanical seating was observed on the sandline, only a steady pressure of 350 psi could be achieved while pumping water at 350 gpm. The pressure was slowly increasing with the pumping rate, but it was not seating. The HPC was pulled out and a standard core barrel of the same length was run and seated, apparently in the correct position. The core bit was lowered to 2100 m and a last attempt was then made with the HPC. Once more, hydraulic seating was not obtained at 350 gallons per minute and the pumping rate was slowly increased to about 450/500 gpm. Suddenly the HPC seated and pressure started building up very rapidly. At 2500 to 3000 psi, the safety valve on top of the drill pipe blew off and the HPC was pulled to the surface. It was found that the inner barrel had been shot through the double pin sub lost in the hole and the sub was sliced into two pieces. A 3.46 m mud core was recovered in the core liner. The Co-Chief Scientists then decided to terminate the HPC testing and the bottomhole assembly was pulled out. During these tests it was observed that all of the chevron seals used were destroyed or badly damaged after each run. They were the cause of most of the time lost on the rig floor.

SITE 478

After abandoning HOle 477B, the ship traveled about 6.5 miles northwest to Site 478 where a 13.5 kHz beacon with a 15-foot tether was dropped. The ship went on profiling for 30 minutes before returning to and positioning on the beacon. A standard bottomhole assembly was made up and run with the 9 3/4" special pressure core barrel bit in preparation for running the pressure core barrel. The bottomhole assembly was also fitted with a mechanical bit release. The PDR read a water depth of 1899 m and the mudline was found at 1913 m after a water core had been taken.

Continuous coring then proceeded rapidly with good recovery through a thick layer of soft diatom ooze with turbidites. Heat flow runs were made at 70 m, 146 m, and 165 m. A pressure core barrel was run at 155.5 m and 322.5 m BSF. Only the first heat flow was successful. After going through various layers of silicified siltstones, basalts, chert and diatom mud with turbidites, the core bit entered a continuous layer of basalt at 337 m BSF where recovery reached 74%. Deviation was measured at 5^{o} at 410 m BSF. Coring was terminated at 464 m BSF. The hole was conditioned, the mechanical bit release successfully actuated and filling the hole with mud had commenced when the 13.5 kHz beacon used to position the ship showed sudden massive loss of signal strength and died within 14 minutes. Another beacon of 16 kHz was promptly dropped overboard before complete extinction of the first beacon signal and the incident did not turn into a loss of BHA because of the quick and very effective reaction from GMI marine and drilling crews. Fortunately, the sea and the wind were at their lowest when the incident took place.

After complete fill up of the hole with 11.0 lbs mud, the open ended pipe was pulled to 2056 m and logging started. After a successful first run to total depth with a combination including, density, gamma ray, caliper and temperature, the second combination composed of sonic-gamma ray and caliper was run to bottom and recording started. At 2250 m (337 m BSF) the tool became stuck in a very small bridge observable on the caliper of the first run. Based on the core descriptions the bridge was probably built with hard claystones on broken basalt at the contact of sediments and basalt and it was impossible to pull free. The weak point cable connection to the tool was broken while working on the cable at 6,000 lbs of traction. A fishing attempt was then made with a core barrel after lowering the open ended pipe to just above the sonic tool. The attempt failed and it was decided to continue logging the upper section of the hole. Open ended pipe was pulled to 2027 m and logging was resumed after making up a new cable connection. Guard, neutron, gamma ray and induction were then recorded from 2245 m to 2008 m without any more problem. The hole was then left full of 11.0 lbs mud with a cement plug set from 2110 m to 2050 m.

SITE 479

Site 479 was located about 46 miles north of Site 478 in the Guaymas Basin. The first beacon prepared failed during a test soak. A second was prepared and dropped while passing over the site. After retrieving the air gun gear and "heaving-to" in the area of the beacon drop, the hydrophones were lowered but no signal could be picked up. The area was then reprofiled after a satellite fix and a third beacon was prepared and dropped on the site. When returning to the site, an erratic signal from the second beacon could be picked up but did not disturb positioning of the ship. A standard BHA was made up, including a mechanical bit release. The mudline was found at 766 m (PDR reading 757 m). Continuous coring started and progressed briskly. Forty seven cores were cut and pulled and three heat flow mwasurements made (at 98 m, 164.5 m and 231 m FSB) within the next 29.2 hours. Very quickly gas shows were observed in the cores and the C_2/C_1 ration climbed to values of about 2.2×10^{-3} at 275 meters BSF and then decreased. Presence of sands and shaly sands was observed in several cores. Hydrocarbon odor was general and heavy gas components propoane and iso-butane increased to a maximum of 400 m BSF and then decreased. Isopropane increased unceasingly. Penetration was suspended several times for ten to fifteen minutes to give time to analyze cores and run gas samples through the chromatography. All the limited investigation means available on board were suggesting penetration in a cap rock* formation and the hole was terminated at 440 m BSF. A wiper trip was made, the mechanical bit release was actuated with success and the hole was filled with 180 barrels of heavy 11 lb mud. Open ended pipe was pulled to

*Cap rock here is used in the context of that impermeable layer above a hydrocarbon reservoir and not the classical geologic term associated with the layer overlying a salt dome.

889.5 m and five runs of logs were made. Density, gamma-ray, caliper, temperature sonic, neutron, guard, and induction and again temperatures were recorded. A 30 barrel cement plug was set in a gauged section of hole from 920 to 870 m and the drilling assembly was pulled out.

SITE 480

After completing Site 479, the ship traveled 4 miles north-northeast to Site 480 for testing of the hydraulic piston corer. The special bottom-hole assembly was made up and run to the mudline which was found at 674.5 m against 655 m indicated by the PDR. From 2000 hours December 31 to 0645 hours January 2, 31 cores totaling 147.2 m were cut with an average recovery of 80%. Only one core attempt had no recovery. The hole was terminated at 152 m BSF and was abandoned full of seawater.

SITE 481

After abandoning Site 480, the ship traveled 37 miles south-southeast to Site 481. After profiling for several hours, a first beacon was dropped at 2200 hours January 2 and the ship continued profiling for 1.5 hours. All attempts to relocate the beacon were unsuccessful and a second beacon had to be dropped at 0230 hours January 3. The ship was positioned and a piston core assembly (only 6 x 8 1/4 drill collar) was run to the mudline. The PDR indicated 2008 m of water.

In order to locate the first hard layer, a first hole was washed down to 2102 m without problems. The BHA was then pulled above the mudline and piston coring started at 2007.5 m and the hole was piston cored down to 2068.75 m in 21.5 hours. The hole was abandoned full of seawater at that depth and the piston core BHA was pulled out.

HOLE 481A

A standard bottomhole assembly, including eight 8 1/4" O.D. drill collars, one 7 1/4" O.D. drill collar, three bumper subs core barrel assembly and a mechanical bit release was madeup and run to the mudline. The heave compensator was also picked up in this last drill string.

Hole 481A was first washed from 2016.5 m to 2058.5 m where a heat flow measurement and pore water sample were taken. Continuous coring then progressed in alternating layers of soft sediments and basalt sills. The recovery was often very poor with the core catchers jamming in hard basalt and then the interbedded soft sediments were washed away even at very low seawater pumper rated. At 2362.5 m the core bit plugged and despite numerous "hits" with the center bit, it was impossible to clear the BHA of all pieces of hard basalt. At 2400.5 m the float valve did not close any more and three more runs with the center bit could not free it. As the continuation of coring could have completed filled the lower BHA with pieces of cores and could have made bit release for logging impossile, it was necessary to terminate penetration at 2600.5 m. The mechanical bit release was successfully actuated and the hole was conditioned and filled with 200 barrels of 11.0 lbs mud. Open-ended pipe was then pulled to 2111 m. After the recording of a complete logging program (density, gamma-ray, caliper, sonic, neutro, guard, induction, temperature), a cement plug was set in the hole from 2250 to 2170 m and the site was abandoned at 1030 hours January 8 when the ship departed for Los Angeles and the end of the leg (January 14 at 1300 hours).

DRILLING AND CORING ASSEMBLIES

A basic bottomhole assembly was used on all sites except the three holes where the hydraulic piston corer was tested. It consisted of a bit, bit release (hydraulic on Sites 474, 475 and 476 and mechanical on subsequent sites) 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, one 7 1/4" drill collar and one joint of 5 1/2" drill pipe. This assembly was changed when coring with the hydraulic piston corer in an effort to minimize the chances of losing a BHA while working for extended periods of time with bumper subs not buried. This change was in leaving out two 8 1/4" and one 7 1/4" drill collars. A special core bit and sub were incorporated in the hydraulic piston corer BHA but no bit release was employed. As no weight is needed when coring with the HPC, the BHA could certainly be redesigned in order to further reduce the risk of losses.

BITS

Most of the bits used were F94CK type. However, a 9 3/4" O.D. x 2 5/16" F94CP pressure core barrel bit was used on Site 478 and performed very well producing high recovery because of its slightly smaller throat. Hard cores can move upward more easily through the core catchers, are easier to trap by the fingers and accordingly produce less core catcher jamming. In soft plastic clays, the slightly smaller cores have more room for expansion after being squeezed through the throat and reduced frictional forces in the plastic liner and produce higher recovery in low shear strength formations.

On Holes 477B, 480 and 481, the special HPC bit was used without problem. Eighty six meters of soft mud were washed with this bit on Site 481.

HYDRAULIC PISTON CORER

The Hydraulic Piston Corer was tested on Sites 477B, 480 and 481 to recover sediments from the mudline. The first test on Hole 477B was not successful because of various problems with the top sub packings which were destroyed after each run and also because of the piston rod. Only one 4.6 m core was recovered in 18.5 hours. The second test on Site 480 worked much better after various modifications made by the Lab Officer and 31 cores were cut in 40 hours. Total penetration was 152 m and recovery reached an excellent average of 80%. On the third site, operations went slower, mostly because of the water depth of 2,000 m compared to the 760 m at Site 480. Problems with the tool itself reduced the penetration rhythm (52 m in 36 hours) and the recovery (64.4%). It would appear from these results that the Hydraulic Piston Corer will become an operational tool in soft sediments.

A comparison of performance between the HPC on Site 480 in 674 m of water and the standard core barrel (SCB) system on Site 479 in 766 m of water, shows the following results:

HPC: Cored 147 m, recovered 118 m in 31 hours rig time

SCB: Cored 155 m, recovered 102 m in 7 hours rig time

Accordingly, the cost per meter of core with the HPC is 3.82 times higher than the cost per meter with the standard core barrel.

On Site 481 in 2016 m of water, the same comparison between performance of the HPC from the mudline to 68.5 m and the SCB from 58.5 to 115.5 m BSF shows a ratio slightly better (2.96) but still strongly in favor of SCB. Furthermore, the extra round trip of drill pipes must be considered because of the special BHA required by HPC. When this is taken into consideration (and it has to be since Site 481 was supposed to be penetrated much deeper than the HPC possibilities) this extra time brings the cost permeter ratio to 4.28 in favor of the standard core barrel system.

According to results of Leg 64, "undisturbed sediments" are about 4 times more expensive than sediments recovered with the standard system.

WIRELINE PRESSURE CORE BARREL

Two runs with this tool were made at Site 478 and were not very successful. The first run at 159.5 m BSF recovered a few centimeters of diatom ooze and a sampling chanber at 3000 psi which contained mostly compressed air. The second run at 326.5 BSF recovered only 20 centimeters of sandstone (out of 4 m cut) with no pressure in the chamber.

HYDRAULIC BIT RELEASE (HBR)

The HBR was run three times on Sites 474, 475 and 476 and actuated only twice since logging was not required on Site 475.

On both occasions the HBR could not be actuated according to recommended procedures. On Hole 476 the BHA became stuck in the hole while trying to release. The go-devil plug was retrieved and when the bottomhole assembly could be pulled free (with considerable drag), it was observed that the bit had been released. It was impossible to tell when and how. On Hole 476, it was impossible to release the bit and logging could not be run.

A close observation of the tools when brought to the surface showed that in both cases the inner mechanisms of the HBR were completely jammed with sediments and mostly with sand and gravel. Comparison of sediments recovered in the mechanisms with cores showed that jamming took place as soon as the core bit penetrated formations containing sand or gravel (pure distom ooze mud is probably washed out). When pressure is applied, the sleeve cannot even be pressed upward (case of Hole 476) or the dogs cannot fall down completely in their housing when the latch segment support is pulled upward because the void (housing) is immediately filled in by sucked in sediments.

The HBR is not yet operational only because of the jamming by hard sediments. Should an efficient protection against invasion of inner mechanisms be designed (which seems to be easy), the tool would probably be an excellent solution for releasing core bits.

MECHANICAL BIT RELEASE

The Mechanical Bit Release (MBR) was successfully used in four holes and appears to be fully operational.

LOGGING

Logging operations were performed in six holes at five sites. The program included the complete set of tools available on board the ship, i.e., density, gamma-ray, caliper, sonic, neutron, guard, induction and temperature. In the standard program, tools were run in five different combinations designed to speed up operations and to collect data by order of interest. Gamma ray was used in all combinations (except temperature) to provide precise correlation.

COMBINATION NO. 1 - DENSITY, GAMMA-RAY, CALIPER, TEMPERATURE

Temperature recorded while running in the hole. Recording versus time on bottom.

COMBINATION NO. 2 - SONIC, GAMMA RAY, CALIPER

COMBINATION NO. 3 - GUARD, NEUTRON GAMMA RAY

COMBINATION NO. 4 - INDUCTION, GAMMA RAY

COMBINATION NO. 5 - TEMPERATURE

Recording versus time on bottom for a period depending upon hole conditions.

A sixth combination made of NEUTRON, GAMMA RAY (both tools of small O.D.) was used in Hole 477. This special combination was made up for logging through drill pipes and drill collars since the bottom of the BHA was plugged with a stuck go-devil plug.

Conditioning of the holes for logging started while cutting the cores and consisted of several mud flushes. Before releasing the core bit, the holes were flushed with a mud plug followed by seawater before being finally filled up with 8.9 lbs to 11.0 lbs mud. Only one problem developed in the five holes logged when the SONIC-GAMMA RAY CALIPER got stuck in Hole 478 at the top of the basalt section where a bridge of hard claystone or fractured basalt built up very quickly during the first and second runs. Fishing attempts were unsuccessful and the tool had to be abandoned in the hole. A total of 13,000 meters of logs were recorded during Leg 64 with only two misruns due to the malfunctioning of one tool.

BEACONS AND POSITIONING

Leg 64 experienced very unusual problems with beacons. Sixteen ORE beacons were used on the legs for eight sites; eight 13.5 kHz double life and eight 16 kHz double life.

Four of them could not be detected by the ship's hydrophone when returning toward the beacon drop area after pulling the profiling gear aboard. Two others showed erratic and intermittent signals but no good and permanent signal could be picked up despite a search supported by satellite fixes and radar range and bearing readings.

One beacon died on board during a soak test and three others showed a total loss of signal within 15 to 30 minutes while the ship was holding position with the BHA in the hole (the first failed after 42 hours, the second after 52 hours and the last after 91 hours). Thanks to very prompt reaction from GMI marine and drilling crews and also to very good weather conditions prevailing when the failures occurred, the BHA suffered no damage.

After the first two accidents, it was thought that the beacons might be sinking into very soft sediments at the mudline. The unusual dead weight used to drop beacons (junk steel available on board and barely streamlined for vertical fall) was also incriminated. Therefore, the standard 5-foot tether lines were length ened to 10 and 15 feet. However, the same problems persisted. Several pictures of the signals from fading beacons confirm that the origin of the problems must be electronic and not in deployment. Altogether, beacons were responsible for about 24 hours of lost time for positioning and/or repositioning.

By mid-December, an oil leak was discovered on the after thruster and some seawater was found in the oil. An inspection by divers showed a small fishing line wrapped on the thruster but the origin of the oil leak could not be spotted. However, the decision was made to terminate Leg 64 no later than January 9, 1979 at 1200 hours after completion of the Guaymas Basin program and to bring the ship back to Los Angeles drydock in order to change the seals on all thrusters. Accordingly, drilling of Site GCA 1 at the tip of Baja California was postponed to Leg 65.

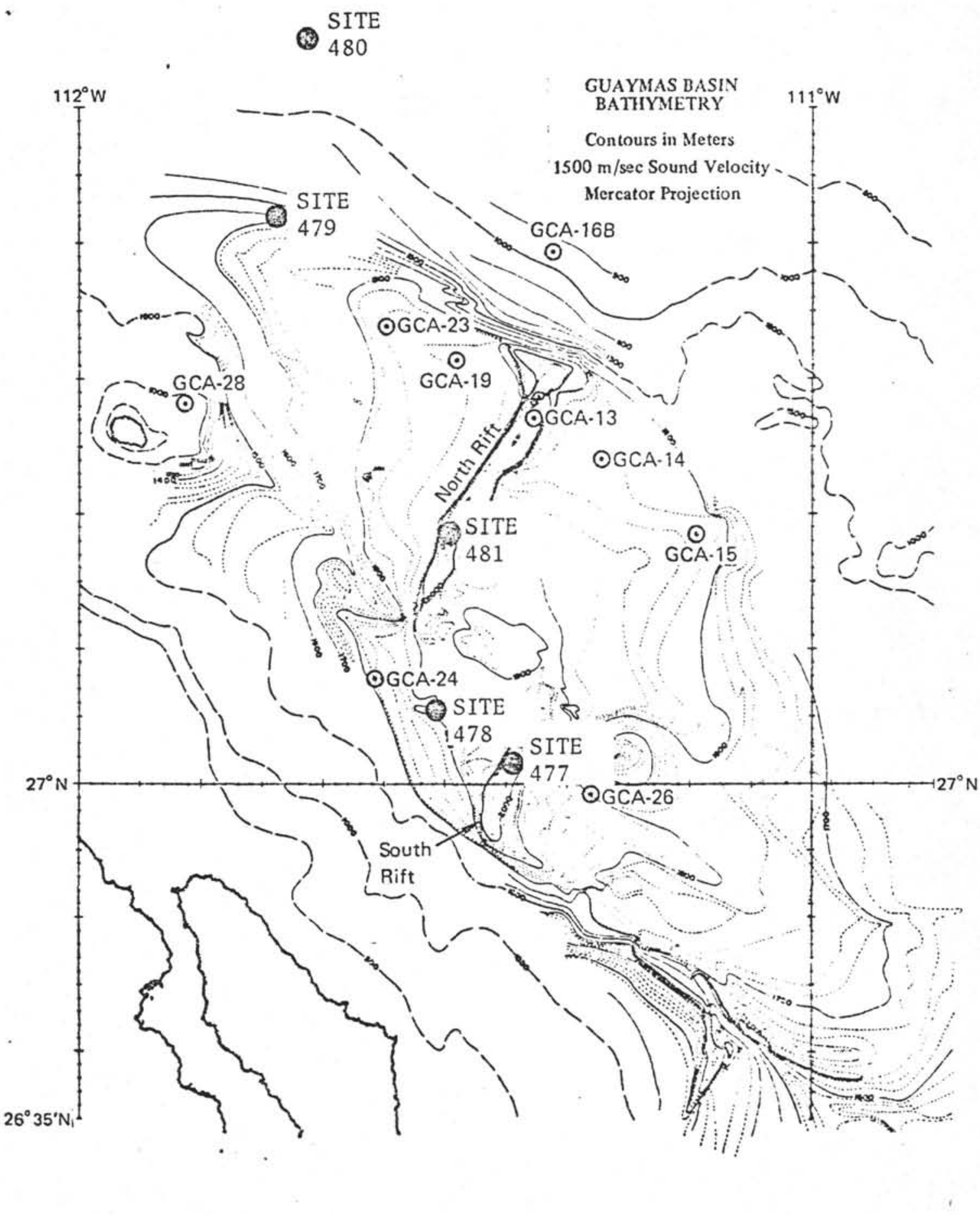
H. F. Martial
Cruise Operations Manager
Deep Sea Drilling Project

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
OPERATIONAL RESUME
LEG 64

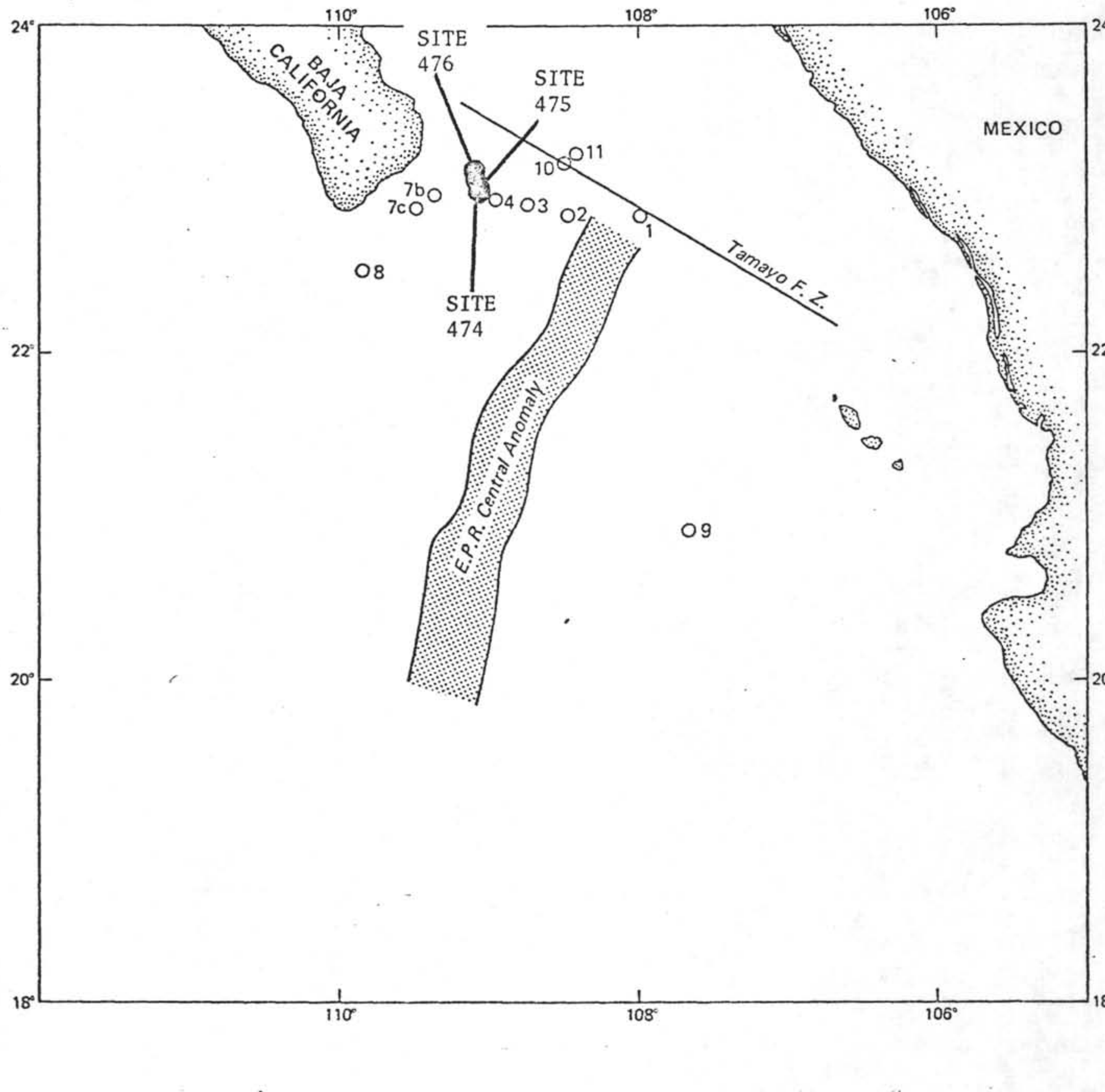
Total Days (November 27, 1978-January 14, 1979)	48.08
Total Days in Port	3.97
Total Days Cruising Including Site Survey	11.92
Total Days On Site	32.19

Total Time	5.15
Drilling Time	0.60
Coring Time	17.92
Waiting On Weather	0
Stuck Pipe	0
Downhole Measurements	4.58
Mechanical Repair	0
Other	3.77

Average Distance Traveled Including Survey (Naurical Miles)	2002.2
Average Speed (Knots)	8.46
Number of Sites	8
Number of Holes Drilled	14
Number of Cores Attempted	344
Number of Cores With Recovery	322
Percentage of Cores With Recovery	93.6
Total Meters Cored	2936.0
Total Meters Recovered	1631.35
Percentage Recovery	55.56
Total Meters Drilled	526.3
Total Meters of Penetration	3462.3
Percentage of Penetration Cored	84.8
Maximum Penetration (Meters)	626.0
Minimum Penetration (Meters)	5.6
Maximum Water Depth (Meters)	3043.0
Minimum Water Depth (Meters)	674.5



Drilled, Leg 64



Drilled, Leg 64

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
BEACON SUMMARY
LEG 64

SITE NO	MAKE	FREQ. kHz	SERIAL NUMBER	SITE TIME HOURS	REMARKS
474	ORE	16.0	421	200.5	
476A	ORE	16.0	421		
475	ORE	13.5	440	0	Too weak signal
475	ORE	16.0	419		
475A	ORE	16.0	419	63.9	
475B	ORE	16.0	419		
476	ORE	13.5	451	65.0	
477	ORE	16.0	420	0	Dead. No signal after reaching mud line.
477	ORE	13.5	464	51.8	Signal dropped suddenly at 0500 hrs 12/20/78 Abandoned at 0545 hrs.
477A	ORE	16.0	454	88.5	Dropped in replacement of #464.
477B	ORE	16.0	454		
478	ORE	13.5	465	91.0	Massive loss of signal at 1830 hrs 12/27/78. Total loss at 1844 hrs.
478	ORE	16.0	455	27.7	Dropped in replacement of #465.
479	ORE	13.5	466	0	Failed during test soak.
479	ORE	16.0	456	?	Erratic signal.
479	ORE	13.5	467	54.5	
480	ORE	16.0	458	39.8	
481	ORE	13.5	468	?	Looked good going down. Major problem finding it when coming back. Could not locate. Probably erratic.
481	ORE	16.0	459	48.0	Loss of signal 1/5/79 0450 hrs. Going down very fast.
481A	ORE	13.5	469	77.0	Dropped in replacement of #459.

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
BIT SUMMARY
LEG 64

HOLE	MFG.	SIZE	TYPE	SERIAL NUMBER	METERS CORED	METERS DRILLED	METERS TOTAL PENET	HOURS ON BIT	CONDITION	REMARKS
474	Smith	9 7/8"	F94CK	194FF	182.5	0.0	182.5	3.85		
474A	Smith	9 7/8"	F94CK	194FF	462.5	163.5	626.0	41.47	Unknown	Released for logging
				TOTAL	645.0	163.5	808.5	45.32		
475	Smith	9 7/8"	F94CK	103FJ	196.0	0.0	196.0	4.57		
475A	Smith	9 7/8"	F94CK	103FJ	1.0	15.0	16.0	0.25		
475B	Smith	9 7/8"	F94CK	103FJ	29.5	66.5	96.0	7.32		
				TOTAL	226.5	81.5	308.0	12.14	T1,B2 In Conage	Recovered
476	Smith	9 7/8"	F94CK	143RT	294.5	0.0	294.5	11.28	T1,B2 Gaged	Recovered
477	Smith	9 7/8"	F94CK	147RT	191.0	0.0	191.0	7.98	T1,B3 Gaged	Recovered
477A	Smith	9 7/8"	F94CK	152RT	120.5	146.5	267.0	9.28	Unknown	Released for logging
477A	Smith	10"	Piston Core	126489	4.6	1.0	5.6	HPC	Like New	Recovered
478	Smith	9 3/4"	F94CP	693PE	464.0	0.0	464.0	37.03	Unknown	Released for logging
479	Smith	9 7/8"	F94CK	144RT	440.0	0.0	440.0	7.58	Unknown	Released for logging
480	Smith	10"	Piston Core	126489	147.2	4.8	152.0	HPC	Like New	Recovered
481	Smith	10"	Piston Core	126489	52.25	86.0	138.25	HPC	Like New	Recovered
481A	Smith	9 7/8"	F94CK	814RV	342.0	42.0	384.0	16.13	Unknown	Released for logging

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
SITE SUMMARY
LEG 64

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
474	22° 57.77'N	108° 58.84'W	3043.0	20	19	95.0	182.5	77.75	42.6	0.0	182.5	47.3	47.2	
474A	22° 57.77'N	108° 58.68'W	3043.0	50	49	98.0	462.5	291.20	63.0	163.5	626.0	15.1	153.3	200.5
475	23° 03.03'N	109° 03.19'W	2650.0	21	21	100.0	196.0	127.90	65.2	0.0	196.0	42.9	37.9	
475A	23° 03.44'N	109° 03.83'W	2591.0	1	1	100.0	9.5	0.10	0.1	16.0	16.0	64.0	7.5	
475B	23° 03.36'N	109° 03.57'W	2629.5	4	4	100.0	29.5	10.05	34.0	66.5	96.0	13.1	18.5	63.9
476	23° 02.43'N	109° 05.35'W	2429.0	32	31	97.0	294.5	165.00	56.0	0.0	294.5	26.1	65.0	65.0
477	27° 01.84'N	111° 24.02'W	2020.0	23	21	91.3	191.0	50.44	26.0	0.0	191.0	23.9	51.8	
477A	27° 01.80'N	111° 23.93'W	2020.0	12	11	91.6	120.5	16.03	13.3	146.5	267.0	28.8	54.0	
477B	27° 01.76'N	111° 23.95'W	2020.0	1	1	100.0	4.6	3.46	75.2	1.0	5.6	HPC	18.5	124.3
478	27° 05.81'N	111° 30.46'W	1913.0	54	51	94.4	464.0	310.27	66.9	0.0	464.0	12.5	118.0	118.0
479	27° 50.76'N	111° 37.49'W	766.0	47	42	89.4	440.0	266.50	60.6	0.0	440.0	58.0	54.5	54.5
480	27° 54.10'N	111° 39.34'W	674.5	31	30	96.7	147.2	117.95	80.0	4.8	152.0	HPC	39.8	39.8
481	27° 15.18'N	111° 30.46'W	2016.5	11	10	91.0	52.2	33.6	64.4	86.0	138.2	HPC	36.0	
481A	27° 15.18'N	111° 30.46'W	2016.5	37	31	86.1	342.0	161.1	47.1	42.0	384.0	23.8	94.5	130.5

DEEP SEA DRILLING PROJECT
LOGGING SUMMARY
LEG 64

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
474A	3043	3669	3178	Mud	9 7/8	27.25	1	Density	3585	3179	
				8.9				Gamma-Ray	3585	3179	
								Caliper	3585	3179	
								Temperature	3178	3585	Recorded going down.
							2	Sonic	3580	3180	
								Gamma-Ray	3580	3180	
								Caliper	3580	3180	
							3	Variable Density	3580	3180	
								Gamma-Ray	3580	3180	
							4	Guard	3668	3180	
								Neutron	3668	3180	
								Gamma-Ray	3668	3180	
							5	Induction	3669	3180	Misrun because of gamma-ray.
								Gamma-Ray	3669	3180	
							6	Temperature	3669	3180	Recorded going up.
475	2680	2846			9 7/8						No logging requested.
475A	2591	2607			9 7/8						No logging requested.
475B	2629	2725			9 7/8						No logging requested.
476	2429	2723.5			9 7/8						No logging-Impossible to release core bit.

DEEP SEA DRILLING PROJECT
LOGGING SUMMARY
LEG 64

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
477	2020	2211		Sea Water	9 7/8	6.00	1	Gamma-Ray	2204	2020	Logging thru d.p. w/bottom plug in BHA
								Neutron	2204	2020	Mud in annulus.
							2	Temperature	2202	2020	Idem.
477A	2020	2287	2122	Mud 1.32	9 7/8	20.25	1	Density	2284	2122	
								Gamma-Ray	2284	2122	
								Caliper	2284	2122	
								Temperature	2122	2284	
							2	Sonic	2122	2284	
								Gamma-Ray	2122	2284	
								Caliper	2122	2284	
							3	Guard	2282	2021	
								Neutron	2282	2021	
								Gamma-Ray	2282	2021	
							4	Induction	2281	2121	
								Gamma-Ray	2281	2121	
							5	Gamma-Ray	2122	2021	
								Neutron	2122	2021	
							6	Temperature	2284	2100	

DEEP SEA DRILLING PROJECT
LOGGING SUMMARY
LEG 64

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
477B	2020	2024.5									No logging requested.
478	1913	2377	2026	Mud 1.32	9 3/4	18.5	1	Density	2377	2027	
								Gamma-Ray	2377	2027	
								Caliper	2377	2027	
								Temperature	2377	1900	
							2	Sonic	2377	2253	Tool stuck in hole at 2250 m.
								Gamma-Ray	2377	2253	Parted line at tool connection.
								Caliper	2377	2253	Tried to fish-Failed-Abandoned to log
		2250	2007				3	Guard	2245	2008	For runs 3 & 4. Impossible to
								Neutron	2245	2008	record below stuck sonic.
								Gamma-Ray	2245	2008	
		2250	2007				4	Induction	2245	2008	
								Gamma-Ray	2245	2008	
479	766	1206	859	Mud 1.32	9 7/8	13.0	1	Density	1194	860	
								Gamma-Ray	1194	860	
								Caliper	1194	860	
								Temperature	860	1194	Recorded while going down.
							2	Sonic	1194	860	
								Gamma-Ray	1194	860	
								Caliper	1194	860	

DEEP SEA DRILLING PROJECT
LOGGING SUMMARY
LEG 64

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
479	766	1206	859	Mud 1.32	9 7/8	13.0	3	Guard	1194	860	
								Neutron	1194	860	
								Gamma-Ray	1194	860	
							4	Induction	1194	860	
								Gamma-Ray	1194	860	
							5	Temperature	860	1194	Recorded while going down.
											Thirty minutes on bottom.
480	674.5	826.5									No logging requested.
481	2016.5	2064									No logging requested.
481A	2016.5	2400.5	2111	Mud 1.32	9 7/8	20.0	1	Density	2395	2111	
								Gamma-Ray	2395	2111	
								Caliper	2395	2111	
								Temperature	2111	2397	
							2	Sonic	2395	2111	
								Gamma	2395	2111	
								Caliper	2395	2111	
							3	Guard	2395	2111	Misrun
								Neutron	2395	2111	Tool did not work.
								Gamma-Ray	2395	2111	

DEEP SEA DRILLING PROJECT
LOGGING SUMMARY
LEG 64

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
481A	2016.5	2400.5	2111	Mud 1.32	9 7/8	20.0	4	Guard	2395	2111	#3 repeat run.
								Neutron	2395	2111	OK
								Gamma-Ray	2395	2111	
							5	Induction	2395	2111	
								Gamma-Ray	2395	2111	
							6	Temperature	2395	2111	

DEEP SEA DRILLING PROJECT
TIME DISTRIBUTION
LEG - 64

Date	Site No.	Cruise	Trips	Drill	Core	Stuck Pipe	W.O.W.	DOWNHOLE MEAS.	Mech. Repair	Port Time	Re-Entry	Other	Total Time	Remarks
11/28/78 12/01/78										71.4			71.4	
12/01/78 12/02/78		18.7										4.4	23.1	
12/02/78 12/04/78	474		11.5		22.0			7.3				6.4	47.2	
12/04/78 12/10/78	474A		13.3	2.5	93.5			28.2				15.8	153.3	
12/10/78		6.3											6.3	
12/10/78 12/12/78	475		9.0		22.5	2.0		2.5				1.9	37.9	
12/12/78	475A		1.5	2.0	1.5							2.5	7.5	
12/12/78 12/13/78	475B		7.0	0.8	8.2	1.0						1.5	18.5	
12/13/78	476	6.0											6.0	
12/13/78 12/16/78			10.7		34.8	8.0		2.5				9.0	65.0	
12/16/78 12/18/78		35.3											35.3	
12/18/78 12/20/78	477		7.8		25.0			11.3				7.7	51.8	
12/20/78 12/22/78	477A		9.9	5.0	17.4			20.2				1.5	54.0	
12/22/78 12/23/78		16.0											16.0	
12/23/78	477B		10.2									8.3	18.5	Testing Piston Corer
12/23/78 12/29/78	478	11.5											11.5	
12/29/78 12/31/78	479		4.5		26.7			16.0				7.3	54.5	
12/31/78 01/02/79	480		5.5	0.5	28.5							5.3	39.8	
01/02/79 01/04/79	481		8.0	2.0	21.5							4.5	36.0	
01/04/79 01/08/79	481A		14.8	1.5	47.5			21.5				9.2	94.5	
01/08/79 01/14/79		146.50											146.50	

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
OPERATIONS RESUME
LEG 65

Leg 65 began on January 14, 1979 at 1318 hours when the first line from the GLOMAR CHALLENGER was brought ashore at Bethlehem Shipyard in San Pedro, California and ended 57.7 days later at 0806 hours, March 13, 1979 when the first line went ashore in Mazatlan, Mexico. The leg was the second of the two voyages which had been scheduled for the investigation of the Gulf of California. Operations were conducted near the mouth of the Gulf where plans for the leg called for the drilling of one deep re-entry hole and, if unsuccessful, several single bit holes. Three re-entry cones were set and each time a mechanical problem developed such as "shooting-off" the pipe in the hole and having a cone fall over after the first bit. Despite these problems, many new scientific objectives were realized.

The leg was rescheduled in December to begin in San Pedro rather than Mazatlan because of the need for drydocking facilities to repair a stern thruster. The ship was in drydock making the necessary repairs for four days and then was in port taking on fuel and supplies for two additional days. The ship left San Pedro for the first hole, Site 482, when the last line was released at 1218 hours, January 20, 1979.

During the next seven and a half weeks, the CHALLENGER traveled 1036.4 nautical miles and attempted to drill 15 holes at four sites. Water depths varied only slightly and ranged from 2996.5 meters to 3084 meters. The depth of penetration ranged from 5.0 meters to 331.0 meters. The shallow penetrations were primarily caused by a lack of soft sediments which provide needed support for the bottom-hole assembly (BHA). Twice during the leg it was necessary to shoot off BHA's when they became stuck. Additionally, two outer core barrels were lost, one was broken off and the other simply unscrewed or "backed-off".

Time distribution for the leg was 5.9 days in port, 5.5 days cruising and 46.3 days on-site. The on-site time consisted of 10.1 days tripping the drill string, 1.1 days drilling, 30.9 days coring, 1.3 days working stuck pipe, 0.8 days making mechanical repairs, 2.4 days making re-entry, 3.3 days making downhole measurements and 6.4 days for miscellaneous items.

SITE 482

The ship arrived in the operating area after a five and two-thirds day transit from San Pedro, California. The positioning beacon was dropped after about five hours of pre-site profiling and on-site operations began shortly thereafter when the ship began positioning in the automatic mode.

This initial pipe trip was delayed about two hours while the drilling crew attempted to unplug a cooling line for the heat exchanger in the Bowen hydraulic power unit. The drain line, which discharged on the port side of the ship, had been plugged with wood while in dry dock in San Pedro. This plug could not be removed and a temporary discharge line, into the moonpool, was constructed.

After the drill string was assembled, one water core was taken as a result of a nine meter difference between the drill string measured water depth of 3017.0 meters and the precision depth recorder (PDR) reading of 3008.0 meters. The hole was then spudded at 0233 hours, January 25, 1979.

After the recovery of the mudline core drilling was delayed about three hours due to an overspeed problem with the bow thrusters. The problem was attributed to a relay becoming intermittently de-energized and stopping one motor. The dead motor had the feedback assignment to the exciter which with no feedback information applied full power to the remaining motor and caused it to overspeed. The overspeed safety switch then tripped and stopped the thruster motors. The problem was corrected when the intermittent relay was replaced.

After the thruster was repaired, the hole was washed to 61 meters. This was done to establish how much 16-inch casing could be attached to a re-entry cone and then washed in without rotation. The drill string was then pulled above the mudline and the hole abandoned.

HOLE 482A

After Hole 482 was abandoned and the bit was pulled clear of the mudline, the ship was positioned using new offsets which placed the hole 500 feet east of the beacon. The move and stabilization of positioning consumed 1 1/4 hours.

Hole 482A was spudded at 0945 hours, January 25 and a mudline core established bottom at 3015 meters. The hole was then continuously cored to a depth of 44.0 meters when a positioning problem developed. The ship was then positioned in manual and the drill string was pulled clear of the mudline at 1447 hours. Hole 482A was abandoned.

HOLE 482B

After abandoning Hole 482A, the ship was positioned in manual while a problem in a computer power supply was solved. The power failure occurred in the A-D converter section and appeared to be a failure of a capacitor in this unit. The capacitor was replaced with a new one and the problem was corrected. This repair was completed in about 1 1/2 hours and the ship was again placed in the automatic mode of positioning. Using the same offsets as for 482A, 500 feet east and zero feet north of the beacon, Hole 482B was spudded at 1705 hours on January 25.

The hole was then washed to 44 meters BSF where continuous coring began. The hole was taken to a depth of 229 meters, of which the upper 137 meters were clayey Pleistocene age sediments and the lower 92 meters were basalt. While drilling the basalt portion of the hole, knobby joints of pipe were used in the top part of the drill string due to the slow drilling rate (about 1.6 meters per hour). When all nine of these joints had been used in the drilling, they had to be replaced with regular 5" drill pipe. This replacement began, but after four joints had been set back the drill string was found to be stuck and efforts were immediately begun to free the pipe. Thirty barrels of mud were spotted and the pipe was worked with pulls up to 450,000 pounds. Some movement of the bumper subs was observed but with a reduction in stroke. After working the pipe for over eight hours with pulls to 550,000 pounds, the pipe had moved less than one meter.

In an effort to gain more circulation capabilities, a shifting tool was lowered on the sandline to release the bit disconnect assembly. The tool seated and when pulled, an increase in weight to 8500 pounds was noted and then it fell off. This is the normal reaction when the bit is released. However, when the overshot was recovered, it was found that the crossover sub between the sinker bars and the overshot had broken and left the overshot at the bottom of the drill string. Pulling on the pipe continued for another hour before the decision was made that the pipe should be shot off above where it was stuck.

The logging sheaves were rigged, and the collar locator assembly was picked up, and then run in the hole to check its operation. This was necessary as it had not worked properly downhole at a previous site after being checked at the surface. This run was successful and after the tool was back on the derrick floor, the severing charge was assembled and attached to it. The tool was then run to 3051.5 meters to sever the pipe in the first joint of drill pipe above the BHA. The shot was fired and an immediate loss in drill string weight indicated that the pipe had been successfully severed. The pipe was pulled and when the severed end of the pipe reached the derrick floor, the hole was officially abandoned.

HOLE 482C

Before this hole could be spudded, it was necessary to pick up and assemble a new bottomhole assembly. This assembly included a bit release sub which would not only allow downhole logging, but would also make it possible to emplace the special equipment in the drilled hole for the University of Hawaii's seismic experiment.

The new BHA and drill string were made up and the hole was spudded at 1030 hours on January 30. The hole was washed to 44.5 meters where continuous coring began and continued to a total depth of 184.0 meters below the seafloor (BSF). During the coring operation, three heat flow measurements were taken at 54.0, 82.5, and 120.5 meters, with very satisfactory results.

Knobby joints of heavy drill pipe were used at the top of the drill string as the drill rate decreased in hard basaltic rock. Six of these joints had been drilled down and were about to be exchanged for regular drill pipe when, after the first one had been laid down, the balance of the drill string was found to be stuck. It was worked free after five minutes, but a decision was made to stop drilling and attempt the logging and seismic experiment programs. The knobby joints were changed out and the hole was then circulated clean with 40 barrels of mud. The shifting tool for the bit release was dropped and the bit was released. After the bit was released, the hole was flushed with 20 barrels of bentonite mud and 20 barrels of cross-linked guar gum. The bottom of the drill string was then pulled to 3170.0 meters or 155.0 meters BSF. It was not pulled higher than this to ensure the emplacement of the seismic experiment equipment in the basaltic section of the hole. The logging sheaves were rigged and the temperature-gamma-density sonde was run down the pipe. The tool was run in to 3176 meters which verified the release of the bit. The gamma log identified the top of basalt at 3153 meters of 138 meters BSF. The sonde was then pulled to 3000 meters and the hole logged down to 3190.0 meters. The tool was hung at this depth for one hour to record the temperature. This was done to make sure the bottomhole temperature would not exceed the limits required for the proper operation of the seismic tool. The tool then logged the density of the hole as it was pulled out. When it arrived at the derrick floor, it was exchanged for the gamma-neutron sonde. While running in with this tool, it was necessary to stop at 2970 meters because one strand in the armor of the logging cable had broken and had balled up on the line wiper. The cable was repaired and the line wiper was disconnected before the tool was run in to 3190 meters. The hole was then logged and the tool returned to the derrick floor with no more problems.

The seismic experiment tool was then made up and tested. After the testing, the tool was lowered to the bottom of the hole, 3199 meters, and then pulled nine meters off bottom and secured. The cable was then cut at the derrick floor and reheaded so it could again be connected after the drill pipe had been stripped out over it. This stripping-over operation required about six hours to complete. After recovering all of the drill pipe, the other end of the cable was reheaded and the two parts were connected. The tool was then lowered to the bottom of the hole and checked for proper operation.

Following the final instrument check, the ship began to move southerly to allow the balance of the logging cable, about 25,000 feet, to be spooled off onto the ocean floor. This operation was stopped when there was about three wraps of cable remaining on the cable drum. The cable was then tied off at the derrick floor with a "T" bar and cut. After it had been cut, it was reheaded and keel-hauled and brought to the main deck forward, port side. Here the recording instruments were connected and tested. This operation required about six hours to complete. After the operation check was completed, a 1 1/4" polypropylene rope was attached to the recording equipment in order to lower it to the ocean floor. While this line was unspooled, for two kilometers, the ship was allowed to drift in a controlled manner to ensure a taut line. After the line had been spooled off, it was tied off while a recovery package buoy was attached. This assembly and the 1 1/4" line were, in turn, attached to a 1/2 inch polypropylene ine approximately 4800 feet long. This line would serve to supply the final tension to the system as these last instruments were lowered to the bottom. This final phase required about one hour. When the line finally parted due to the tension as planned, the ship returned to the location where Hole 482C had been drilled. When the ship was positioning in the automatic mode, two ocean bottom seismic instruments were dropped and Hole 482C operations were considered completed.

HOLE 482D

After new offsets had been placed in the computer, Hole 482D was located 340 feet east southeast of 482C. As soon as the ship began automatic positioning, the final preparations for picking up and keelhauling a re-entry cone began. The cone was in place beneath the moonpool just before midnight February 3rd.

A 16-inch casing string, 59.63 meters long, was made up of seven joints of J-55 casing including the casing shoe and was latched into the cone. The hang-off cables were cut and this assembly was then lowered to 2985.0 meters. The hole was spudded at 1515 hours on February 4th and was washed in to 3071.0 meters which placed the top of the cone at 3009.0 meters. After the cone was released, the drill string was washed to 3083.5 meters at which depth continuous coring began.

As the seventh core was being recovered, one of the ship's crew informed the ship's officer on watch that a yellow line was floating in the water near the bow of the ship. This line was immediately recognized as the 1 1/4" polypropylene line that had been attached to the seismic equipment (Hole 482C) placed on the bottom of the ocean about 5 kilometers south of the ship's current location. Apparently the timer on the instrument package recovery buoy had malfunctioned and released the line prematurely. The ship's personnel managed to recover the line and secured the buoy and instrument package to the side of the ship. While this recovery was taking place, the drill string was pulled out of the hole and the bit brought to the derrick floor. After the drill string had been recovered, the ship was allowed to drift and was positioned so the line could again be played out so the seismic package could again be placed at the proper location. This area was finally reached and the release package was again dropped to the bottom and the ship returned to the drill site. While this operation was in progress, the empty logging cable reel was replaced so that re-entry could be attempted when the ship returned to the hole and the drill string was made up. In addition to these activities, a ship arrived and transferred to the CHALLENGER a scientist and a photographer and took off the two scientists who had been involved with the seismic experiment.

After the drill string had been made up and run to 2998.5 meters, the re-entry tools were made up and run to the same depth. The first re-entry was accomplished with a successful stab after one hour and 20 minutes of maneuvering the ship. After the re-entry, the drill string was run to bottom and continuous coring began again. Six cores were cut and recovered when it became apparent that the bit was wearing out because the core diameter had decreased to 5.1 centimeters. The hole was then circulated clean because plans were to fill the hole with cement. The hardened cement was to be drilled out after the bit was changed. It was hoped that by doing this the hole conditions could be stabilized. The five knobby joints in the string were replaced with regular drill pipe and preparations began to run in when 9-B generator failed and power to the rig floor was cut off. After an hour and a quarter, power was restored but the drill pipe could not be run to bottom due to fill. A core barrel was then dropped so the hole could be cleaned out without plugging the bit. The hole was then circulated clean and the inner barrel retrieved. The Bowen sub was set back and a circulating head was installed on a single in the mouse hole. Hoses were attached to the circulating head and the single was placed in the string.

When the pipe was picked up and circulation started, the bit was plugged and the string could not be moved. Attempts to move the pipe began with pulls of 400,000 pounds. These operations continued for six hours with no success. Finally, it was decided that the only solution would be to shoot off the bottomhole assembly. The logging sheaves were rigged and the severing charge assembled with the collar locator. This was lowered to 3057.3 meters and the pipe was shot off in the 5 1/2" heavy wall pipe at the top of the BHA. The pipe was then recovered and the hole considered abandoned when the severed end of pipe reached the derrick floor at 1448 hours on February 8th.

HOLE 482E

After the severed drill string had been recovered, assembly of a new re-entry cone was begun immediately. After the cone was completed and keelhauled, a new bottomhole assembly was picked up and assembled.

New offsets were put into the computer which moved the location of Hole 482E some 610 feet northwest of the cone at 482D. This was done to minimize possible confusion if the two cones were too close together when re-entry was attempted.

The BHA was latched into the cone with 57.19 meters of 16" casing. This assembly was run to bottom and the washing-in process began at 2115 hours on February 9th. After washing for 7 hours, the casing would not penetrate deeper than 3063.5 or 48.5 meters into the bottom. For the mudskirt to be on bottom, it would require that the casing be washed in another 12 meters.

This apparently could not be accomplished at this site so the cone and casing were pulled above the mudline and the hole was abandoned. No good explanation could be found to explain the failure of the washing-in process. A pilot hole, located nearby, had been washed deeper than the bottom depth reached at this location and the casing at Hole 482D had also been washed to a greater depth.

HOLE 482F

When the cone and casing were rcovered from 482E, new offsets were placed in the computer for a location 445 feet southwest of Hole 482E and 770 feet west northwest of 482D. With the cone and casing hanging from the drill pipe, the ship was moved to the new coordinates and this hole was spudded at 0618 hours on February 10th.

The cone was washed to 47.5 meters and again encountered the resistent material which would not allow it to be washed any deeper. A decision was made to release the cone with the hope that as the 14 7/8" hole was drilled, the cone and casing would follow it down until the mud skirt rested on the ocean bottom. A shifting tool was run in the pipe and the cone/casing was released. After this the washing-in program began, but after 16 minutes of rotating time, only two meters had been drilled. At this point the center bit was removed and a regular core barrel replaced it.

The hole was then washed and cored to a subbottom depth of 145.0 meters. The hole was then reamed several times through the interval 49.0 to 145.0 meters.

The drill string was then pulled to 3135.0 meters, or 120.0 meters subbottom. The Bowen sub was set back and the logging sheaves were rigged. The gamma neutron log was picked up and run in the hole in an effort to determine if the casing had moved down in the hole after being drilled and reamed. The log was run and the result seemed to indicate that the casing had not moved. The drill string was then pulled to the derrick floor and the bit changed. A new BHA was made up and the pipe run in to 2995.5 meters where it was hung off while the logging sheaves were rigged to attempt a re-entry.

The re-entry tool was assembled and run to 2995.5 meters and began scanning on all the ranges at both the 8° and 45° down scan angle. Nothing could be identified that resembled the typical reflections from a re-entry cone. The pipe was then lowered to 3007 meters so the mud ring display could be checked, but touched something at 3004 meters and was pulled up immediately. When the transducer was lowered again, it failed to operate properly so it was pulled to the derrick floor. A new tool was attached to the cable and was lowered again. This time a target was observed but it still did not resemble the typical display of a re-entry cone. The area was searched for over three hours and this one target was passed over seven times. After analyzing this display, it was decided that this was the cone lying on its side. Only one refector could be identified and was probably one of the floating reflectors attached as a backup to those attached to the cone. The balance of the display appeared to be a cross-sectional view of the upper cone, mud skirt and lower part of the cone. Based on this interpretation, it was assumed that the cone had fallen over when the support of the drill string was removed for the bit change. The drill string was then pulled and the hole abandoned at 0915 hours, February 12th.

SITE 483

Site 483 was located 42 miles west of Site 482. It was to be the first of three sites to be drilled and evaluated for another deep re-entry hole. The move was made in seven hours and a 16.0 kHz beacon was dropped at 1812 hours, February 12th.

PDR water depth was 3080 meters but the first core recovered 50 cm of sediments from a depth of 3085 meters and the water depth was then set at 3084 meters. The hole was then cored continuously to a subbottom depth of 204.5 meters. A heat flow measurement was made at 3170.5 meters or 86.5 meters BSF. Basaltic material was first encountered at 107 meters BSF and continued to total depth with some interlayered sedimentary rocks. When coring was stopped, the bit had a total of 53.3 rotating hours but was still performing very well.

Thirty barrels of mud were spotted and the hole circulated clean. This was done to allow the string to be run back to about three meters from total depth where the bit was released. The drill string was then pulled to 3205.0 meters and a downhole logging program was started.

The first tool run was a gamma-density-temperature log. The tool was lowered to about two meters from total depth with no proglems. The temperature measurements were recorded during this lowering operation. The gamma-density log was then run to 3224 meters. The tool was then lowered again and a repeat section was logged. The caliper arms were closed at 3210 meters and the balance of the hole was logged through the drill pipe. The next tool was the gamma-BHC sonic which was run into

2497 meters and stopped for an operation check. The tool failed to operate properly and was replaced with a new tool. This new tool operated when checked at 3095 meters and was then run to 3275 meters. The hole appeared to be filling so the tool was pulled to 3252 meters for the start of logging. However, when the tool was turned on, it failed to operate properly and was pulled without obtaining a log. The last logging tool to be run was the gamma-guard-neutron which stopped at 3235 meters which indicated that the hole conditions were deteriorating. The drill pipe was then pulled to 3186.5 meters to allow the tool to record the basalt-sediment contact, estimated to be at about 3191 meters. After the tool was pulled from 3254 to 3189 meters, it could not be lowered into the hole again for a repeat section. Apparently the sediments were badly washed away at the contact and the tool could not be lowered into the hole without possible damage. This concluded the logging program. The pipe was then retrieved and this hole was abandoned at 1328 hours, February 17th when the top connector reached the derrick floor.

HOLE 483A

The geological information obtained from Hole 483 satisfied the requirements for a re-entry site and plans were made to accomplish this.

The ship was offset 330 feet east of Hole 483 and a drill string with a 14 7/8" bit was made up to determine the amount of 16" casing to be used on the re-entry cone. The bit was washed to 67 meters in 25 minutes. The pipe was then pulled and the hole ended when the bit was back on the derrick floor at 0130 hours on February 18th.

HOLE 483B

When the drill string had been recovered from Hole 483A, assembly of the re-entry cone began. The rigging and keelhauling of the cone required about seven hours before it was hung off beneath the moon pool. Seven joints of 16" range 2, 75 lb/ft casing, totaling 65.91 meters, were then made up and hung off above the cone in the moon pool. A standard bottomhole assembly was then put together with the addition of a casing running tool located just below the upper two bumper subs and a 14 7/8" bit on the bottom. The casing string was attached to the running tool and then lowered and latched into the re-entry cone. The cone's hang off cables were then cut and the trip to place the cone in the bottom began.

The bottom of the pipe was run to 3058.5 meters at which time the Bowen power sub was picked up in preparation for jetting in the casing. Additional pipe was then picked up and Hole 483B was spudded at 1957 hours, February 18th with the same offsets of 330 feet east and 0 feet north of the beacon that were used for Hole 483A. The casing was jetted in without difficulty in a total 86 minutes until the bit and casing shoe were at 3151.5 meters. A sandline run was then made with the shifting tool and the cone/casing assembly was released. The hole was then washed ahead with the 14 7/8" bit to 3151.5 meters where coring began. Four cores were cut and recovered to a depth of 3211.0 meters. This placed the bottom of the hole approximately 20 meters below the sediment-basalt contact. The reason for drilling a 14 7/8" hole to this depth was to permit 11 3/4" casing to be cemented into the basalt and hopefully have better hole conditions for deep drilling. Before the drill pipe was pulled, 20 barrels of mud were used to circulate the hole clean and then the hole was filled with 90 barrels of mud. During the trip out, the air motor for the pipe racker skate broke down and three hours were required for replacement.

FIRST RE-ENTRY - 11 3/4" CASING

When the drill string was recovered, assembly of the 11 3/4" casing string began. Thirteen joints of range 2 and 3, 47 lb/ft casing totaling 122.62 meters were made up. Each joint was tack welded and the casing string was hung off in the moon pool while the casing lowering and cementing assemblies were made up. After these were made up they were attached to the casing hanger with the left-hand running nut thread. The balance of the BHA was made up. Then the drill pipe was made up and the casing was lowered for re-entry to 3070.0 meters, which was 10 meters above the top of the re-entry cone. The logging sheaves and line wiper/packoff were rigged with one stand of pipe up in the derrick. The sonar was run down the pipe and landed in the cementing shoe without incident. Upon commencement of scanning, the target was observed at 40 feet and the pipe was then lowered to 3076 or 4 meters above the cone. After about 40 minutes of maneuvering, the sonar tool lost the ability to be regulated and it was necessary to retrieve the tool. The tool was replaced. After running the sonar tool back to bottom, the pipe was again positioned at 3076 meters, where after scanning and maneuvering for 70 minutes, the re-entry stab was made.

The sonar tool was retrieved and one additional stand was run to verify the re-entry. After the sheaves were rigged down the casing shoe was run to 3184 meters and the Bowen sub was picked up. The casing was then run into 3208.0 meters without incident and was released. About three hours were spent rigging and cementing the casing with 60 sacks of Class "H" neat cement followed by the displacement plug and 25 additional sacks of neat cement. The cementing assembly was then pulled to the derrick floor to make up a new drilling BHA.

SECOND RE-ENTRY - SECOND BIT

While the new BHA was being made up with a F94CK bit, the ship was moved 1500 feet east of Hole 483B to allow the drilling of Hole 483C while waiting for the cement to harden around the 11 3/4" casing in Hole 483B.

The drill string was made up and run and Hole 483C drilled (see next section for details). After the bit was pulled above the mudline to a depth of 3043.5 meters, the ship was maneuvered back to Hole 483B. While this move was being made, the logging sheaves were rigged to run the re-entry sonde. After returning to Hole 483B, the drill pipe was lowered to 3072 meters and the sonar sonde was lowered. When the tool reached bottom and began scanning, the target appeared at 30 feet. The pipe was lowered to 3076 meters and when the tool began scanning again, the target was only 15 feet away. However, it moved no closer so maneuvering began. After one hour and 46 minutes, the pipe was stabbed and the re-entry was verified after the sonde had been recovered. The pipe was then lowered and drilling out cement and the cementing shoe began. The cementing shoe was drilled and the hole cleaned and drilled to the previous total depth of 3011 meters. After reaching this depth 20 barrels of mud were circulated to clean out the hole and the overshot was lowered to retrieve the core barrel which had been in the pipe to recover any debris from the drilling up of the cementing shoe. However, the inner barrel could not be recovered and the shear pins were sheared with the plan of coring one-half to one meter in an attempt to loosen the inner barrel. The hole was then deepened from 3211.0 to 3214.0 meters and when the overshot was again lowered, the core barrel was recovered easily. However, when the barrel reached the derrick floor there was no rock in it, only the top part of the cement emplacement plug. Another barrel was dropped and three more meters were cored. This barrel came up empty and the pressure gauge indicated that the bit was plugged. After the center bit was dropped and retrieved, the pressure returned to normal. Three cores were cut with reduced recovery in each and then two more were cut and the core barrels were empty when recovered. Pressure appeared to be normal so it was assumed that something had happened to the bit that would require pulling the drill string. When the bit was recovered, several large rounded basalt boulders were found wedged in the throat of the bit which the center bit was unable to dislodge.

THIRD RE-ENTRY - THIRD BIT

The bit was replaced and the pipe was again run in to 3072.0 meters to begin the re-entry procedure. The sonar tool was rigged and run into the bottom of the pipe and the first series of rotations detected the target at 50 feet. The pipe and tool were lowered to 3076 meters and following one offset change, the stab was made after only 25 minutes. The tool was pulled and the re-entry was verified when one more stand of pipe was lowered without weight loss. The pipe was run to bottom and after picking up a knobby joint, coring began again. Twenty barrels of mud were spotted as the first core was being cut. Two 5-meter and one 4.5 meter cores were cut when recovery was reduced to 0.07 meters. Pump pressure was not normal so a center bit was dropped and when it was recovered, pressures returned to normal. Another 4.5 meter core was cut and the core barrel was empty when recovered. Pressures were again higher than normal and a center bit was again dropped, but when it was recovered pressure remained high. It was dropped a second time and when recovered, the pressure still remained high which indicated a plugged bit. Twenty barrels of mud were circulated and then the hole was filled into the 11 3/4" casing before the trip out of the hole began. When the bit reached the derrick floor there was nothing in it. The only explanation was that the plugging material fell out during the trip out of the hole.

FOURTH RE-ENTRY - FOURTH BIT

A new bit and BHA were made up and the trip in was started at 0220 hours on February 26th. At 0255 hours the 16.0 kHz beacon suddenly died and a new 13.5 kHz beacon was picked up and dropped at 0310 hours. Positioning then began on the new beacon. There was some concern that with this change, the ship could have moved off of position the search for the re-entry cone would be very difficult. However, when the sonar tool began scanning, the cone was observed at

70 feet. The stab was made after maneuvering for only 38 minutes and the sonar tool was pulled and re-entry verified. Coring then began and continued for 73 meters when it was time to pull the bit. During the coring period the length of cored interval was reduced to 4.5 meters per core and a definite increase in core recovery percentage was obtained. Also, 20 barrel slugs of mud were spotted while each core was being cut which may have contributed to better recovery. The bit was pulled after 36.6 rotating hours to avoid any possibility of junk being left in the hole. The hole was flushed with 20 barrels of mud and then filled to the 11 3/4" casing with 30 more barrels before starting out of the hole. When the bit was recovered all the cones were intact but the bearings were showing some wear and the diameter was out of gauge 1/16".

FIFTH RE-ENTRY - FIFTH BIT

A new bit was made up to the BHA and the drill string was again run to 3072 meters The sonar tool was made up and run but at the 1000 meter operational check the tool failed to function properly and was pulled out of the hole. When checked at the surface it worked satisfactorily so it was again run into the hole. Again when checked at 500 meters, it failed to operate so it was pulled and replaced with a different tool. When checked later the problem was found to be a leak in the connection between the Gearhart-Owens cable head and the tool adapter head. After the tools were exchanged, the running of the new tool was delayed for one hour while a blown hydraulic line was replaced in the Schlumberger unit motor. After this was repaired the tool was run to the bottom of the pipe and scanning began with the cone observed at 40 feet. The re-entry stab was made after 98 minutes of maneuvering and the tool was started out of the hole. While recovering the tool the ship's positioning system lost power and allowed the ship to move off position well over 400 feet. The pipe was pulled and as it was started up an overpull of about 75,000 pounds was noted on the weight indicator. The positioning system failure was due to a burned out resistor in the propulsion motor field circuit. This was repaired and the ship was repositioned in about one hour so that another re-entry attempt could be made.

While this repositioning was being accomplished, electrical power was lost to the logging unit for about seven minutes due to a switch being turned off accidentally. This turned off the computer in the logging unit which had the depth display for the re-entry tool. The depth was reset when power was restored from the mechanical depth recorder outside the logging unit.

SIXTH RE-ENTRY - FIFTH BIT

When the computer positioning problem was corrected, the ship was again positioned with the established offsets. The sonar tool was lowered to the bit which was located at 3072 meters. When scanning began the cone was observed at 20 feet and maneuvering began. An hour and 58 minutes of this were re-required before the stab was made. A loss in weight was noted and the sound from the sonar tool indicated a strong possibility for re-entry. The sonar tool was recovered and a verifying stand was run. The decrease in weight persisted so the rotary table was turned and it was found that the drill pipe would not rotate. This stand was pulled and the original stand used in the stab was tried to be rotated but again would not, so the pipe was pulled. When the BHA reached the derrick floor, the top two stands of drill collars were clean but the next bumper sub and three 8 1/4" drill collars were coated with mud. In addition, the balance of the BHA was missing. This included the bit, bit sub, core barrel and the top sub. The assembly had broken off between the top and head subs. The inner core barrel was wedged in the drill collar above the head sub. It had been dropped before the extra stand had been added after the stab. It was unclear whether the core barrel had broken off when the ship moved off position or had been damaged when this happened and then broken off when the stab was made into the mud. Another re-entry attempt would be necessary to determine whether or not the core barrel was still in the cone and casing.

SEVENTH RE-ENTRY - RERUN BIT

Four new drill collars were picked up to replace the core barrel and three questionable collars recovered from the last trip out of the hole. The remaining parts of the BHA were given a fluorescent magnetic particle inspection, checking all connections for fatigue cracks as the assembly was run through the rotary table. This inspection is conducted once each leg and takes about three hours of operating time. The pipe was then run in to 3073 meters and the re-entry sheaves were rigged. The sonar tool was picked up and run to the same depth without incident. The pipe and tool were lowered to 3076 meters and when scanning began, the cone was only 15 feet away. One change in positioning was made and the stab was made after 26 minutes. As the pipe was lowered it stopped abruptly at 3092 meters and lost about 15,000 pounds. The pipe was pulled to 3076 meters and maneuvering began again. The stab was made after 31 minutes and again the pipe stopped at 3092 meters. This was only 8 meters below the mud line and 12 meters below the top of the cone. The pipe was picked up 5 meters and lowered twice with the same results. It was decided that either the core barrel was wedged in the casing or the casing and casing hanger had been damaged and would not permit re-entry. The unknown nature of the blockage and its shallow depth in the cone ruled out any attempt at fishing out the suspected core barrel. The drill string was then pulled, after the sonar tool had been retrieved, and the hole abandoned at 0430 hours, March 3rd.

HOLE 483C

After the 11 3/4" casing had been cemented in 483B, the pipe was pulled to replace the cementing assembly with a new bit and bottomhole assembly. While this was being assembled, the ship was offset 1500 feet east of 483B to allow another hole to be drilled while the cement was hardening around the casing. The drill string was run to bottom and then washed in to 38.5 meters where a heat flow measurement was made. A 9.5 meter core was cut and recovered and a second heat flow measurement made. Following this, the hole was washed an additional 38 meters where a third heat flow as taken. Three cores were then cut and recovered. The sediment basalt contact was crossed with these cores and the hole was drilled approximately 7 meters into the basalt.

The drill string was then pulled above the mud line and the ship was moved back to the original offsets because enough time had passed to allow the cement to have hardened. Hole 483C ended at 1042 hours on February 22nd when the bit cleared the mud line.

SITE 484

Site 484 was located about 26.5 miles northeast of Site 483 and took about 4 1/2 hours of travel to reach it. A 13.5 kHz double-life beacon was dropped at 0952 hours March 3rd. After the profiling gear had been retrieved and the ship was completing its positioning, this beacon suddenly stopped transmitting. A 16.0 kHz double-life was picked up and dropped at 1042 hours and the ship completed positioning on it.

The drill string was made up to take the mud line core. The PDR depth was 2893 meters and when the hole was spudded, the water depth was determined to be 2899.5 meters. This mud line core penetrated into the bottom only five meters and suddenly stopped as the weight indicator lost 15,000 pounds. This thin section of sediments was not thick enough to support the BHA and allow coring to continue.

The hole was abandoned when the bit was pulled above the mud line at 1850 hours, March 3rd. The ship was then moved to a better location in the immediate area.

HOLE 484A

The seismic records were re-examined and based on a reinterpretation the ship was moved about 1000 feet easterly. This was accomplished with the pipe hanging at 2825.5 meters. After the positioning system had settled down, a mud line core to a total depth of 2904.5 was attempted. The PDR depth was calculated to be 2901 meters. However, this first core attempt recovered only water. The next attempt to 2914 meters also recovered water as did the one to 2923.5 meters. The PDR was turned on and still indicated a corrected bottom reflection of 2901 meters. One more attempt to 2933.0 meters also recovered water so it was decided to move the ship. It was possible that the ship was positioned over a sloping bottom and the PDR was recording the first arrival and not the true depth. The ship was moved about 1000 feet and the PDR again indicated bottom to be at 2901 meters. A mud line core from 2904.5 to 2914 meters recovered sediments and established the mud line at 2906.0 meters. Continuous coring of the sediments began but while cutting Core No. 7 at a subbottom depth of 59.5 meters, some very resistive material was encountered. An attempt was made to core the material which was a very dense igneous rock, but after three hours of rotating only one more meter had been drilled. While drilling considerable torque developed and because of this, plus the lack of support for the BHA, the hole was abandoned.

One more location was selected and with the drill pipe hanging at 2825.5 meters the ship was moved to the new area. About half way the ship was stopped to check the pipe motion. At this time a weight loss was detected on the weight indicator of about 10,000 pounds. The pump was started and the pressure indicator showed a pressure loss similar to that when the bit release has shifted the bit. While the ship remained in the automatic mode, the drill string was pulled to the derrick floor. When it was recovered it was discovered that the pipe had unscrewed at the connection between the top sub and the head sub and allowed the core barrel, bit release sub and bit to fall to the bottom. This unscrewing was probably the result of the intermittent torquing experienced while drilling the very hard igneous rock. The bottom of the BHA was at the derrick floor at 2100 hours, March 4th and at this time Site 484 was abandoned.

SITE 485

Site 485 was located about 38 miles southeast of Site 484 and after 8.5 hours of travel a 16 kHz beacon was dropped at 0650 hours, March 5th at this location.

The drill string was made up and a mud line core determined that bottom was at 2996.5 meters. Six cores were cut and recovered to a depth of 50.5 meters. The first heat flow measurement was then taken at this depth. After the test was completed, the overshot was run in on the sandline to retrieve the tool. However, after the overshot was latched, the tool could not be moved. The shear pins were sheared and the overshot was pulled to the derrick floor. The pipe was then pulled and when the bit was recovered, the probe was found sticking out and bent so badly it could not be pulled through the throat of the bit. The hole was then abandoned and the ship offset 50 feet east for Hole 485A.

HOLE 485A

While the ship was repositioned to the new location, make up of the drill string began. A new bit was used because there was some concern that the old bit may have been damaged internally from the bent probe. The drill string was made up and spudded at 0935 hours, March 6th. No mudline core was taken because the offset was so small and the hole was then washed to 50.5 meters where continuous coring began. The seismic section indicated approximately 140 meters of sediments before the first reflector would be penetrated. Basalt was recovered in Core No. 11 at a BSF depth of 153.5 meters. Below this the section consisted of 178 meters of interlayered massive basalts, turbidites and minor amounts of sandstone and pyrite bearing claystone.

Drilling was stopped at 331.0 meters to allow for a logging program and a clamped geophone experiment to be completed before proceeding to port call at Mazatlan, Mexico.

A wiper run was made to just above the first basalt layer and then back to bottom and the hole was circulated clean with 50 barrels of mud. The bit release "go-devil" was then dropped to release the bit for logging. The tool landed and the pressure built to 2000 psi but the pressure bled off indicating that the "go-devil" had not seated properly. It was retrieved with an overshot and another tool was pumped down. When this one seated the pressure built and then decreased indicating the bit had been released. A flow of water from the pipe at the derrick floor also proved the bit and float valve were gone. The pipe was then pulled to 3158.0 meters and the logging program began. Three logging tool combinations were run. They were, gamma-density-temperature, gamma-sonic and gamma-guard-neutron and they were run in the hole in this order. After running the gamma-sonic, the tool was lowered to bottom again and a new program was placed in the computer. The tool was then pulled and recorded the VDL or variable density log. The total suite of logs required only 13 hours to record.

After the logging was completed an oblique seismic experiment began using a clamped geophone. The geophone was connected to the logging cable and given an operational check at the derrick floor. The tool was then lowered to 3215 meters which placed it in a unit of basalt about 13 meters thick and one which the caliper log showed to be fairly close to bit size. The tools clamping arm was activated and operational checks began. After 2 1/2 hours of checking the tool was not operating properly and was pulled to the derrick floor. A back-up hydrophone tool was then connected to the cable and lowered to the same depth, but it too was pulled after about an hour because it was not operating properly.

While the clamped geophone tool was being repaired, a temperature sonde was hooked up to the logging cable and after an operational check was lowered to 3240 meters. However, when it was turned on to record the temperature, it too failed to be operational. It was pulled and when the logging cable head was checked a leaking connector was discovered. This required a partial reheading of the cable and when this was completed, the geophone was also operational. The geophone was connected and run in to 3215 meters again and clamped. The MV Kana Keoki of the University of Hawaii Institute of Geophysics arrived in about a half hour. A charge was set off and the tool reacted properly. A shooting program was then initiated which lasted 12 hours with charges being fired every three minutes. This began at 1900 hours on March 11th and ended at 0715 hours March 12th. The tool was then pulled and one last attempt was made to run the temperature tool before pulling the drill string and departing for Mazatlan. The tool was made up and checked and run to bottom. It was allowed to seat in the fill that had collected in the hole. A good temperature record was obtained. The tool was then pulled to the derrick floor and the sheaves set back. The drill pipe was pulled and the Bowen sub magnafluxed. The ship then departed Site 485A at 2000 hours for the transit to the port of Mazatlan and the end of Leg 65.

DRILLING AND CORING EQUIPMENT

The standard bottomhole assembly was used on all the sites with some minor variations as circumstances required. The standard drilling assembly consists of a bit, outer core barrel (bit sub, drill collar, top sub and head sub), three 8 1/4" drill collars, one 5' stroke bumper sub, three 8 1/4" drill collars, two 5' stroke bumper subs, two 8 1/4" drill collars, one crossover sub, one 7 1/4" drill collar and one joint 5 1/2" range three drill pipe. This standard assembly was used on Holes 482D (after the casing and re-entry cone assembly were set), 483A and 483B (also after setting re-entry cone).

When the re-entry cone and 16" casing were run the BHA was changed to a bit, core barrel, five 8 1/4" drill collars, crossover sub, lowering tool sub, two 5-foot bumper subs, three 8 1/4" drill collars, a crossover, one 7 1/4" drill collar, one joint 5 1/2" R-3 drill pipe. This assembly was used at Holes 482D, 482E, 482F and 483B. In addition, when 11 3/4 inch casing was run at Hole 483B, the running string consisted of a "stab-in" sub, 5' long 5" drill pipe pup, two joints 5" drill pipe, 5' pump joint, 9 joints 5" drill pipe, crossover sub, three 5-foot bumper subs, 11 3/4" hex-Kelly left-hand running tool, crossover sub, two 8 1/4" drill collars, crossover sub, one 7 1/4" drill collar. Another variation of the standard assembly used when the mechanical bit release was substituted for the bit sub at Holes 482, A, B, C; 483; 484, A. When all the mechanical bit releases were lost, the hydraulic bit release was run, Holes 485 and 485A.

When the mechanical bit release was used, no problems in releasing the bit were experienced. However, when the hydraulic release was used, it was necessary to make two runs with the releasing "go-devil" before the bit released.

BITS

All of the 9 7/8" bits used were type F94CK and all performed very well. Three of these bits provided over 40 rotating hours and in each case core recovery was good with the core diameter remaining at about 6 cm. Unfortunately, due to logging operations, these bits were released and left in the hole which prevented evaluation. When basalt was encountered on the last two sites drilled, the core length was changed to 4.5 meters from the normal 9.5 m and recovery improved.

A 14 7/8" bit was used to wash-in for determining casing length at the re-entry sites and then was part of the bottomhole assembly when the cone and casing were washed in. It performed well with good recovery in both sediments and basalt.

LOGGING

Downhole logging was performed in four holes at three sites. Three combinations of tools were run which made it possible to obtain five different logs. These combinations were as follows:

(1) Temperature, gamma ray, caliper, density
(2) Sonic, gamma ray
(3) Gamma ray, guard, neutron

The five logs obtained were:

(1) Temperature
(2) Gamma ray-density
(3) Gamma-ray-sonic
(4) Gamma ray (variable density log) resistivity
(5) Gamma ray-neutron

The holes were conditioned before logging by flushing the hole clean with mud, but the holes were not filled with mud because of the concern that fresh water in contact with some sediments could cause hole deterioration and bridging. This system seemed to work well with the only problem being a gradual settling of cuttings and filling of the hole.

In addition to the logging program, an oblique seismic experiment was performed at the last Hole 485D. The geophone was clamped in a section of basalt and recorded the data that developed from charges dropped by a shooting ship. The program required the tool to be clamped to the hole for 12 hours while charges were dropped every three minutes. Despite this long time, the clamps retracted and the tool was recovered without difficulty.

BEACONS AND POSITIONING

Eight ORE beacons were used on this leg and all performed well with two exceptions.

The first of these occured at re-entry Hole 483B when, while making a bit change, the beacon died without warning after 14 days service. A new beacon was dropped and offsets were placed in the dynamic positioning system that hopefully would allow re-entry without an excessive amount of maneuvering. These offsets proved to be surprisingly good and when the sonar tool was lowered and began scanning, "lo and behold" the cone was at 70 feet. The second beacon problem occurred at Site 484. The beacon was dropped at 0952 hours and at 1031 hours it stopped transmitting a signal. Another beacon was dropped at 1042 hours and normal positioning began.

The usual excursions associated with sudden wind and current changes were experienced on the leg and were handled well by the positioning system. However, on Hole 483B, a resistor burned out in the circuits controlling a propulsion motor and before the necessary switches in assignments could be made, the ship had moved off position well in excess of 400 feet. This incident occured just after re-entry had been made and as the re-entry tool was being recovered. An order was given to pull the string above the mud line and as this was implemented, there was a momentary increase in the drill string weight of 75,000 pounds. After repositioning the ship, the sonar tool was rerun and another re-entry attempt was made but apparently missed the cone. The string was then pulled and the outer core barrel from the head sub to the bit was found to be missing. A new BHA was made up and two more attempts were made to re-enter. Neither could enter deeper than 12 meters into the cone before the BHA began taking weight. Either the bottom part of the BHA was wedged in the casing or the casing hanger had been badly damaged and would not allow the drill string to enter.

The following is a summary of Leg 65 experience on a hole by hole basis:

LEG 65 BEACON AND POSITIONING SUMMARY

Beacons Dropped

466 DL 13.5 kHz
470 DL 13.5 kHz
460 DL 16.0 kHz
461 DL 16.0 kHz
471 DL 13.5 kHz
472 DL 13.5 kHz
462 DL 16.0 kHz
453 DL 16.0 kHz

All beacons worked well with the exception of 461 and 472.

461 dies suddenly after 14 days of good stable operation.

472 was good when dropped but was dead when vessel returned.

HOLE	SERIAL NO. BEACON	WATER DEPTH	OFFSETS	COMMENTS
482	466	9,900'	0 N, 330 E	Good positioning until bow thruster power was lost due to faulty relay.
482A	466	9,900'	0 N, 500 E	Good positioning until power was lost in a hydrophone interface due to a capacitor failure.
482B	466	9,900	0 N, 500 E	Good positioning. Drill string stuc and severing charge used.
482C	466	9,900	160 S, 780 E	Good positioning.
482Cx	470	9,900	1000 N, 340 W	Good positioning after Elmer clearec
482Cr	466	9,900	60 S, 780 E	Good positioning.
482D	466	9,900	270 S, 1090 E	Good positioning. Good re-entry but drill string stuck and severing charge used.
482E	460	9,900	410 N, 360 W	Good positioning.
482F	460	9,900	200 N, 590 W	Good positioning. Cone bent on attempted re-entry.
483	461	10,100	0 N, 0 W	Good positioning.
483A	461	10,100	0 N, 330 E	Good positioning.
483B	461	10,100	0 N, 330 E	Good positioning. Good re-entry four times.
	461		10 S, 350 E	Beacon S/N 461 died abruptly after 14 days.
	461		30 S, 320 E	
483B	461	10,100	0 S, 340 E	
	471		40 S, 40 W	Good positioning & good re-entry.
483C	461	10,100	10 S, 1850 E	Good positioning.
484	472			Beacon good when dropped but dead when vessel returned.
484	462	9,500	0 N, 0E	Good positioning.
484A	462	9,500	1000 S, 250 E	Good positioning. Computer relay burned out. Vessel excursion 600'+.
485	463	9,800	0 N, 0 W	Good positioning. Tool stuck in drill string and hole abandoned.
485A	463	9,800	0 N, 50 E	Good positioning.

COMMUNICATIONS

All communication for Leg 65 was handled by SIO Radio Station WWD, La Jolla, California. The Station could be contacted any time during their working hours which coincided with the ship's daylight hours as most of the leg was spent in the Gulf of California. Several phone patches were made via WWD to DSDP and other institutions regarding the various seismic experiments being conducted in the same area that the CHALLENGER was working in plus direct communication with the vessels involved in these experiments. Many amateur phone patches were made from the two amateur radio stations on board the CHALLENGER and these met with very satisfying results. Communication equipment breakdown was minimal and repaired immediately. It was also routinely checked under the preventive maintenance program. The traffic amounted to about 33,000 words going out and about 12,000 being received.

SPECIAL TOOLS

In addition to the oblique seismic experiment in Hole 485A (see logging section of report), a downhole seismometer was placed in Hole 482. After reaching total depth, the bit was released and a suite of downhole logs was run. Then a seismometer instrument package was lowered on the logging cable. When it reached bottom, the cable was cut at the rig floor and the drill pipe was stripped out over it. Then the cable was reheaded and connected to the remaining cable still on the drum. The ship was then allowed to move off location as the cable was reeled off. Approximately 25,000 feet of cable was eventually unspooled and laid on the ocean floor. When the cable neared the end of the spool it was clamped off, cut and headed. The cable was then attached to a recording package to which a 1 1/4 inch polypropolyne line was attached. While the cable was unspooled and laid on the ocean floor, a positioning beacon was dropped so the ship's direction of movement could be controlled. The recording package was lowered to the seafloor and the polyprop rope was uncoiled under tension in order to ensure that the cable would not be piled in a heap. Four kilometers of 1 1/4" rope was deployed. At the end of this rope an anchor with a recovery buoy and acoustic release was attached. A 3/4 inch polupropylene rope was attached to this assemblage to lower the buoy to bottom. This was unspooled and finally broke under tension as planned. The ship was then positioned back to Site 482 for more drilling. On the following day the 1 1/4 inch yellow polyprop rope was observed floating ahead of the ship. How it managed to float back the distance that had been spooled off still remains somewhat of a mystery. The recovery buoy which had tripped prematurely was picked up and the whole procedure of stretching the rope was repeated and again the buoy was dropped. This time it remained in place.

During the voyage ten heat flow measurements were made and to avoid possible sandline problems, the tool was pumped down in free fall. This method was successful 60% of the time and the problems that did develop were remedied by changing switch locations in the tool and by stopping the pumps several minutes before the tool landed. The pumps were turned on briefly to verify latching of the core barrel. On the last attempt the probe was bent when it encountered a hard rock layer in the soft sediment section. It was bent enough that it could not be recovered with the sandline and the drill string had to be pulled.

RE-ENTRY ELECTRONICS

Thirteen re-entry attempts were made with four tool malfunctions all of which were a result of water leakage in the connector between the tool and cable. All re-entries were accomplished rather quickly with scanning time ranging from 27 minutes to one hour and 42 minutes. The sonar display was very good to excellent which made for an easier than usual interpretation of which way to move the ship.

PERSONNEL

Although many of the scientific objectives were not realized, particularly in not being able to achieve a really deep penetration at the re-entry site, the morale and enthusiasm of the scientists was very good. The thin sediment sections did not allow much material for the sedimentologists to work with so they helped out with other work in the lab. All of the scientific staff cooperated fully to make the best of a leg with many operational reverses.

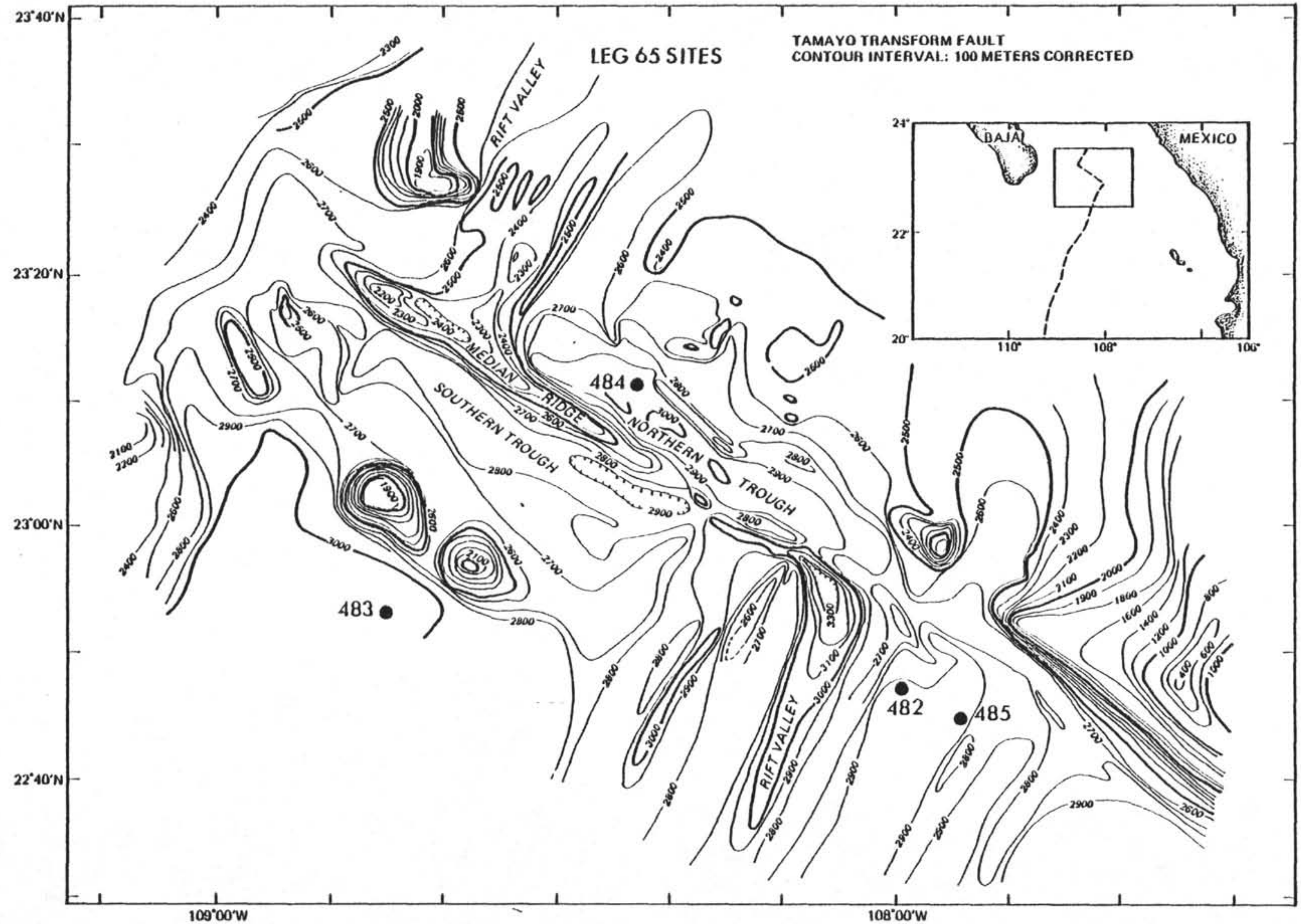
Global Marine personnel, particularly the drilling department, teamed together to make the leg as successful as possible. Because of the many holes drilled and the shallow water depth, they were very busy the entire leg.

The SIO marine technicians provided their usual excellent service which was greatly appreciated by the scientific participants.

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

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
OPERATIONAL RESUME
LEG 65

Total Days (January 14, 1979 - March 13, 1979)		57.7
Total Days in Port		5.9
Total Days Cruising Including Site Survey		5.5
Total Days On Site		46.3
Trip Time	10.1	
Drilling Time	1.1	
Coring Time	20.9	
Stuck Pipe	1.3	
Mechanical Repair	.8	
Re-entry	2.4	
Downhole Measuring	3.3	
Other	6.4	
Total Distance Traveled Including Survey (Nautical Miles)		1036.4
Average Speed (Knots)		7.7
Number of Sites		4
Number of Holes Drilled		15
Number of Cores Attempted		179
Number of Cores With Recovery		172
Percentage of Cores With Recovery		96.0
Total Meters Cored		1323.0
Total Meters Recoveree		750.43
Percentage Recovery		56.7
Total Meters Drilled		680.0
Total Meters of Penetration Cored		2003.0
Percentage of Penetration Cored		66.0
Maximum Penetration (Meters)		331.0
Minimum Penetration (Meters)		5.0
Maximum Water Depth (Meters)		3084.0
Minimum Water Depth (Meters)		2899.5


LEG 65 SITES
TAMAYO TRANSFORM FAULT
CONTOUR INTERVAL: 100 METERS CORRECTED
BAJA
MEXICO
24°
22°
20°
110°
108°
106°
RIFT VALLEY
MEDIAN RIDGE
SOUTHERN TROUGH
NORTHERN TROUGH
RIFT VALLEY
484
483
482
485
23°40'N
23°20'N
23°00'N
22°40'N
109°00'W
108°00'W

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
BEACON SUMMARY
LEG 65

SITE NO.	MAKE	FREQ kHz	SERIAL NUMBER	SITE TIME HOURS	REMARKS
482(A,B,C,D)	ORE	13.5 D.L.	455	233.7	
482C	ORE	13.5 D.L.	470	14.5	Used for positioning after cable run off on seismic experiment.
482(D,E,F)	ORE	16.0 D.L.	460	90.9	
483(A,B,C)	ORE	16.0 D.L.	461	304.2	
483B	ORE	13.5 D.L.	471	121.5	
484	ORE	13.5 D.L.	472	0.0	Failed to operate after drop.
484A	ORE	16.0 D.L.	462	34.9	
485(A)	ORE	16.0 D.L.	453	180.9	

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
BIT SUMMARY
LEG 65

HOLE	MFG.	SIZE	TYPE	SERIAL NUMBER	METERS CORED	METERS DRILLED	METERS TOTAL PENET.	HOURS ON BIT	CONDITION	REMARKS
482	Smith	9 7/8"	F94CK	154RT	4.0	61.0	65.0	.8		Rerun on 482A.
482A	Smith	9 7/8"	F94CK	154RT	44.0		44.0	.4	45.7	Rerun on 482B.
482B	Smith	9 7/8"	F94CK	154RT	185.0	44.0	229	44.5	Unknown	Bit lost when drill pipe shot off.
482C	Smith	9 7/8"	F94CK	151RT	120.5	63.5	184.0	33.8	Unknown	Released for downhole measurements.
482D	Smith	9 7/8"	F94CK	426RS	115.0	71.5	186.5	29.8	Unknown	Lost when drill string shot off.
482E	Smith	14 7/8"	F94CK	697AN	-	48.5	48.5	7.2		Rerun on 482F.
482F	Smith	14 7/8"	F94C	697AN	39.0	106.0	145.0	7.6	T1-B1-I	
483	Smith	9 7/8"	F94CK	597RS	204.5	-	204.5	53.3	Unknown	Bit released.
483A	Smith	14 7/8"	F94C	697AN	-	67.0	67.0	0.4		Rerun to wash for csg & core short way into basalt.
483B	Smith	14 7/8"	F94C	697AN	-	-	-	-		
483B	Smith	9 7/8"	F94CK	146RT	42.0	0	42.0	16.9		
483C	Smith	9 7/8	F94CK	146RT	37.5	76.5	114.0	5.05	T1-B1-SE-1	Stablized pads worn somewhat.
483B	Smith	9 7/8	F94CK	155RT	25.0	-	25.0	15.3	T1-B1-SE-1	
483B	Smith	9 7/8"	F94CK	831RV	73.0	-	73.0	36.6	T1-B4-SQ-1/16 O	
483B	Smith	9 7/8"	F94CK	813RV	-	-	-	None		Bit lost when outer core barrel broken off at top sub.
484A	Smith	9 7/8"	F94CK	148RT	67.0	-	67.0	6.2	Unknown	Bit lost when pipe unscrewed from head sub.
485	Smith	9 7/8"	F94CK	145RT	50.5	-	50.5	.35	T1-B1-SE-1	Changed bit because of possible bearing damage when heat probe bent against it.
485A	Smith	9 7/8"	F94CK	811RV	280.5	50.5	331.0	49.03	Unknown	Dropped with bit release for logging.

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
SITE SUMMARY
LEG 65

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 HRS.	TIME ON SITE
482	22° 47.38'N	107° 59.63'W	3017	1	1	100.0	4.0	3.94	98.5	61.0	65.0	77.8	20.1	
482A	22° 47.38'N	107° 59.60'W	3015	5	5	100.0	44.0	33.25	75.7		44.0	114.7	6.3	
482B	22° 47.38'N	107° 59.60'W	3015	24	24	100.0	185.0	99.87	53.9	44.0	229.0	5.4	99.6	
482C	22° 47.34'N	107° 59.57'W	3015	15	15	100.0	120.5	84.56	70.2	63.5	184.0	5.4	122.2	
482D	22° 47.31'N	107° 59.51'W	3012	13	13	100.0	115.0	64.41	56.0	71.5	186.5	6.2	114.2	
482E	22° 47.37'N	107° 59.56'W	3015	0	0	0	0	0	0	48.5	48.5	6.7	37.9	
482F	22° 47.36'N	107° 59.61'W	3015	5	5	100.0	39.0	16.07	41.2	106.0	145.0	19.0	53.0	453.3
483	22° 53.00'N	108° 44.90'W	3084	26	26	100.0	204.5	110.92	54.2	0	204.5	3.8	114.9	
483A	22° 52.99'N	108° 44.84'W	3084	0	0	0	0	0	0	67.0	67.0	167.5	12.0	
483B	22° 52.99'N	108° 14.84'W	3084	32	27	84.3	175.5	91.78	52.2	91.5	267.0	3.3	298.8	
483C	22° 52.98'N	108° 44.58'W	3084	4	4	100.0	37.5	26.24	69.9	76.5	114.0	22.5	16.2	441.9
484	23° 11.32'N	108° 23.60'W	2899.5	1	1	100.0	5.0	5.0	100.0	0	5.0	60.0	8.7	
484A	23° 11.15'N	108° 23.62'W	2906.0	8	7	87.5	62.0	41.15	66.4	0	62.0	10.0	26.2	34.9
485	22° 44.95'N	107° 54.21'W	2996.5	6	6	100.0	50.5	36.93	73.1	0	50.5	144.2	18.9	
485A	22° 44.92'N	107° 54.23'W	2996.5	39	38	97.4	280.5	136.31	48.6	50.5	331.0	6.8	162.0	180.9
		TOTALS		179	172	96.0	1323.0	750.43	56.7	680.0	2003.0			111.0

DEEP SEA DRILLING PROJECT
LOGGING SUMMARY
LEG 65

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
482C	3015.0	3199.0	3170.0	Sea Water	9 7/8"	5 hrs	1	temperature	3015	3190	Recorded for one hour at 3190.0 M after logging downhole.
	3015.0	3199.0	3170.0	Sea Water	9 7/8"	1 h 50 m	2	gamma-density	3015	3190	
	3015.0	3199.0	3170.0	Sea Water	9 7/8"	4 h 50 m	3	gamma-guard neutron	3015	3190	
482F	3015.0	3160.0	Bit On 3135.0	Sea Water	14 7/8	4 h 15 m	1	gamma-guard neutron	3124	2980	Run to attempt to find location of casing shoe.
483	3084.0	3288.5	3205.0	Sea Water	9 7/8"	2 h 44 m	1	temperature	3078	3286	
	3084.5	3288.5	3205.0	Sea Water	9 7/8"	2 h 6 m	2	gamma-density	3084	3286	
	3084.0	3288.5	3205.0	Sea Water	9 7/8	6 h 20 m	3	gamma-sonic	3252	3275	First tool dies as did second tool. No sonic log.
	3084.0	3288.5	3205.0	Sea Water	9 7/8"	3 h 55 m	4	gamma-guard neutron	3254	3189	
485A	2996.5	3327.5	3158.0	Sea Water	9 7/8"	3 h 0 m	1	temperature	2990	3325	Logged down.
	2996.5	3327.5	3158.0	Sea Water	9 7/8"	2 h 4 m	2	gamma-density	3307	3161	Hole filling
	2996.5	3327.5	3158.0	Sea Water	9 7/8"	2 h 4 m	3	gamma-sonic	3294	3158	
	2996.5	3327.5	3158.0	Sea Water	9 7/8"	1 h 23 m	4	gamma-vol	3294	3158	
	2996.5	3327.5	3158.0	Sea Water	9 7/8"	3 h 29 m	5	gamma-guard neutron	3262	3158	
	2996.5	3327.5	3158.0	Sea Water	9 7/8"	3 h 12 m	6	temperature	2992	3235	Logged down.

DEEP SEA DRILLING PROJECT
TIME DISTRIBUTION
LEG - 65

Date	Site No.	Cruise	Trips	Drill	Core	Stuck Pipe	W.O.W.	DOWNHOLE MEAS.	Mech. Repair	Port Time	Re-Entry	Other	Total Time	Remarks
1/14/79 1/20/79										143.0			143.0	
1/20/79 1/24/79		89.5										6.6	96.1	
1/24/79 1/25/79			7.9	1.7	2.7				5.2			2.6	20.1	
1/25/79			.5		4.9							.9	6.3	
1/25/79 1/29/79			5.8	.5	69.8	18.1			2.2			3.2	99.6	
1/29/79 2/03/79			22.8	.5	51.2			11.2				36.5	122.2	
2/03/79 2/08/79			34.1	3.9	43.5	13.8			.7		6.3	11.9	114.2	
2/08/79 2/10/79			7.1	7.0								23.8	37.9	
2/10/79 2/12/79			19.1	5.2	11.0			4.6			12.0	1.1	53.0	
2/12/79		8.2							.7				8.9	
2/12/79 2/17/79			10.3		85.8			14.0	.5			4.3	114.9	
2/17/79 2/18/79			11.3	.7									12.0	
2/18/79 2/21/79			30.2	2.8	15.8				6.9		9.2	23.6	88.5	
2/21/79 2/22/79			1.3	1.5	9.1							4.3	16.2	
2/22/79 3/03/79			53.6	1.8	102.6				2.0		30.0	20.3	210.3	
3/03/79		4.7										.9	5.6	
3/03/79			5.6		.5							2.6	8.7	
3/03/79 3/04/79			3.3		13.2							9.7	26.2	
3/04/79 3/05/79			8.4									1.4	9.8	
3/05/79 3/06/79			10.5		5.3							3.1	18.9	

DEEP SEA DRILLING PROJECT
TIME DISTRIBUTION
LEG - 65

Date	Site No.	Cruise	Trips	Drill	Core	Stuck Pipe	W.O.W.	DOWNHOLE MEAS.	Mech. Repair	Port Time	Re-Entry	Other	Total Time	Remarks
3/06/79 3/12/79			18.7	.5	88.9			50.4				3.5	162.0	
3/12/79 3/13/79		12.1										.3	12.4	

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
OPERATIONS RESUME
LEG 66

Leg 66 of the Deep Sea Drilling Project was devoted to the drilling of eight sites comprising a transect of the Middle America Trench off the coast of the State of Guerrero, Mexico. A composite sedimentary section was sampled and basement core work was recovered at three sites. The cores, together with previously recorded seismic data, will be a major contribution to the understanding of the history and structure of the complex East Pacific continental margin.

The voyage commenced on March 13, 1979 in Mazatlan, Sinaloa, Mexico and terminated at Manzanillo, Colima, Mexico on May 2, 1979. The cruise was a week shorter than normal, but the close grouping of drill sites and minimal steaming time provided sufficient site time for the achievement of most of the scientific objectives. The amount of core handled and findings recorded has been exceeded by few previous DSDP legs.

Total length of the voyage was 50.4 days, of which 38.8 days were spent on-site, 6.1 days in port and 5.5 days under way. 1.3 days were lost to mechanical breakdowns.

MAZATLAN PORT CALL

Leg 66 began at 0806 hours, March 13, with the first mooring line ashore at Berth Four, Mazatlan Harbor, Sinaloa, Mexico. It was the CHALLENGER's second visit to Mazatlan in four months. The port call was characterized by a greater than normal amount of maintenance activity. Significant work items included a top overhaul of No. 6 engine, replacement of a bearing on No. 1 AC generator, final checkout of the new 9B DC generator, replacement of the motion compensator accumulator cylinder, partial rewiring of the main switchboard and replacement of several sections of ballast transfer pipe. Modifications were made to the electrical circuitry of the dynamic positioning system. Rusted casing was offloaded, fitted with protective coverings and reloaded. The derrick and other parts of the vessel were subjected to non destructive inspections.

Normal reaupply of provisions, consumables and fresh water was accomplished and 277,000 gallons of fuel was taken on.

Sailing from Mazatlan was delayed approximately 17 hours by the failure of certain welds, associated with the piping replacement job, to pass inspection for watertight integrity. Official departure came with the last line off at 1115 hours, March 18.

MAZATLAN TO OPERATING AREA

All the Leg 66 drill sites were located within a few miles of each other in an area centered about 70 miles southeast of Acapulco and about 25 miles off Bahia Dulce. A cruise of about 660 miles down the Mexican coast was required to reach the operating area. An average speed of 9.65 knots was made good and the CHALLENGER profiled across the first site location at 0815 hours, March 22.

HOLE 486 - TRENCH AXIS

After a brief pre-site seismic survey, a 13.5 kHz positioning beacon was launched at 0930 hours. A strong beacon signal was noted as the seismic gear was retrieved, but the signal faded abruptly about 30 minutes after launch and before the ship could return to the drop position. A very faint signal remained, however, and the positioning system was able to home in on it with considerable difficulty. With the vessel back over the first beacon, a backup 16 kHz beacon was dropped. After the beacon had reached the seafloor (about 45 minutes) an attempt was made to switch to automatic positioning on the new frequency. It was the found that the computer would not accept the signal pulses. Although the pulse was strong and apparently normal, a frequency check showed the beacon to be operating at 14.7 rather than 16.0 kHz. The ship was positioned on the second beacon in the normal mode while a third beacon (13.5 kHz) was tested, dropped and allowed to sink to bottom. It was possible to use a second 13.5 kHz beacon only because the signal from the first beacon was so weak that it could be "tuned out". The third beacon functioned normally and automatic stationkeeping was finally achieved at 1450 hours.

With a precision depth recorder (PDR) reading of 5146 meters, the water at Site 486 was the deepest of all the planned sites. The pipe trip to the seafloor was interrupted by a brief operational test of the pressure core barrel and to lay out eight joints of drill pipe downgraded in the last magnetic inspection. The drill string was lowered to 5157 meters with no weight indication of contact with the seafloor. The inner core barrel was recovered at this point with traces of sediment in the core catcher and the water depth was set at 5157 meters.

Very firm sediment was encountered immediately after cutting of the second core began and concern for the bottomhole assembly was generated. Thirty minutes, with rotation and intermittent circulation, were required to cut the core. The core barrel was recovered nearly full of fine muddy sand and with a collapsed and jammed plastic liner. Subsequent cores exhibited reduced recovery and looser, coarser sand. The core bit plugged briefly following recovery of core No. 4. When core No. 5 had been recovered and a new inner barrel dropped, the bit was again found to be plugged and the drill string was stuck, both vertically and rotationally. The pipe was freed after working it about 45 minutes and the hole was abandoned due to impossible drilling conditions. After the seafloor had been cleared, the inner barrel was pulled to clear the still-plugged bit. The barrel contained about five meters of sand, though the bit had not reached total depth on the final coring attempt.

HOLE 486A

On the hope that the sand deposit was a localized occurrence, the vessel was repositioned about 970 meters to the southwest using positioning system offsets. The PDR reading was four meters shallower and spudding encountered hard bottom at 5152 meters. Drilling conditions and sediment lithology were found to be virtually unchanged from the previous hole. A plugged bit and temporarily stuck inner barrel after three cores and a penetration of only 22 meters forced a decision to abandon operations at Site 486. The drill string was recovered and the bit was on deck at 1040 hours, March 24.

SITE 487 - SEAWARD OF TRENCH AXIS

Two and one half hours were required to move the CHALLENGER to the beacon drop point four miles southwest of Site 486 over a small basin of relatively thin sediments. The beacon was dropped at 1338 hours on March 24 and the pipe trip began an hour later after seismic gear had been retrieved and positioning established.

A pressure core barrel test was again conducted during the pipe trip. About two and one quarter hours were consumed.

A mudline punch core established water depth at 4777 meters versus a PDR reading of 4774 meters. The coarse, loose sands encountered at Site 486 were absent at the new location and continuous coring proceeded in soft mud. The sediment changed little in character with depth and the much older material at the basement contact was only semiconsolidated. Weathered, rubbly basalt was hit at approximately 171 meters below seafloor (BSF).

When about ten meters of basalt had been cored, a breakdown and loss of power to the Bowen hydraulic system halted coring operations. Plans had called for two additional cores to provide sufficient basalt penetration for meaningful well logs. When the electrical problem had not been solved after five hours, operations were terminated without logging as most scientific objectives had been met. It was anticipated that the electrical casualty would be restored in time for operations at the next site and that no further time would be lost. The drill string was retrieved and the vessel was under way at 0450 hours on March 27.

SITE 488 - LOWER TRENCH SLOPE

The move of 10 1/2 miles back across the trench was made in one and three quarters hours and a new beacon was dropped at 0635 hours, March 27. Troubleshooting of the electrical problem had continued during this time, but the malfunction proved to be an elusive one. Drilling capabilities had not been regained an hour later when stable positioning had been achieved and the pipe trip was deferred. Resolution of the problem appeared no closer after an additional three hours and it was decided that some scientific gain could be derived from seismic profiling of the site area in the interim. The positioning hydrophones were housed and the seismic gear was streamed. The CHALLENGER spent about nine hours profiling in the immediate area of the positioning beacon while repairs continued. On completion of profiling, the vessel returned to position over the beacon. Coincidentally, the hydraulic system was pronounced operational within five minutes of the time positioning went into the automatic mode and the pipe trip began.

The "mudline" core determined water depth to be 4265 meters, seven meters deeper than the PDR reading. The coring operation was plagued, nearly from the beginning, with low core recovery and penetration rates for the type of material being cored. Pleistocene clays and silty clays were cored to a depth of 313 meters BSF, where loose sand was encountered. The principal sand interval was about 20 meters thick, but thinner sand strata were found interbedded with clay and claystone to total depth. Hole cleaning problems began when the bit plugged on the retrieval of core No. 43 from 400 meters BSF. The bit was cleared by working the pipe in the hole and a larger-than-normal batch of bentonite mud was circulated to clean the hole. Another core was cut and the inner core barrel was found to be stuck. The barrel was freed with great difficulty on the third sandline attempt. Another attempt was made to clean the hole with slugs of bentonite and high viscosity crosslinked guar gum. The core barrel was stuck again temporarily following core No. 45 and it was decided that No. 46 would be the final core. Prior to the retrieval attempt, the drill pipe was slugged with 30 barrels of weighted mud to prevent backflow, but the barrel was again found to be firmly stuck. The safety shear pin was sheared on the first sandline run and, on the second attempt to free the barrel, the sandline parted about 40 meters above the sinker bars. Chances of fishing the short length of broken line and then freeing the stuck barrel were considered extremely slim.

As the core barrel annulus was packed off with sand, it was impossible to circulate mud or cement to plug the hole. It was also necessary to cancel plans for logging.

The drill string was retrieved and the inner barrel, with core, was extricated with great difficulty. The CHALLENGER departed Site 488 at 1645 hours, April 2.

SITE 489 - UPPER SLOPE

The move of 19 miles north from Site 488 was made in four and one quarter hours, including minor profiling. The beacon drop point was only approximate as good satellite fixes were not available during the transit. The position was considered adequate, however, and the pipe trip was begun.

Fixes received during the trip revealed that the beacon was within offsetting distance of the intersection of two reference profiles. Just prior to spudding, the vessel was offset about 460 meters to the west-southwest to make maximum use of profile data.

Due to the approximate 20% slope of the seafloor, two "water cores" were taken before sediment was found at 1268.5 meters, 24.5 meters deeper than the PDR reading. Hole 489 was spudded at 1205 hours, April 3.

Very firm Miocene clay was encountered at only three meters BSF and intial penetration was very slow due to the limited weight that could be applied and still provide lateral support for the drill collars. After five and one half tedious hours, core barrel No. 5 failed to produce the pump pressure "kick" indicative of proper seating of the core bit. The core barrel was retrieved and two attempts were made, without success, to clear a possible obstruction from the bit. As a mechanical malfunction downhole was indicated, it was necessary to retrieve the drill string.

HOLE 489A

Inspection of the BHA revealed that the internal wash pipe of the lower bumper sub was unscrewed, permitting drilling fluid to escape through the bumper sub. The bumper sub was replaced and the drill string was run back for respudding.

Sediment was found two meters shallower despite only a 15 degree heading change in the positioning system. Hole 489A was spudded exactly 24 hours after Hole 489. Uppermost sediments were recored to sample a paleontological break, then the bit was "washed" to the depth reached in Hole 489, and continuous coring began.

Coring continued without significant incident through moderately indurated claystones and siltstones. Relatively slow penetration rates and good hole conditions prevailed until broken schist basement was encountered at about 303 meters BSF. Drilling was terminated at 327 meters BSF because of continued sticking tendencies.

The hole was flushed with mud and an inner core barrel was pumped down with a shifting tool attached. A wireline run was then made to retrieve the barrel and actuate the mechanical bit release. The release sleeve, however, resisted shifting and the safety shear pin failed after several minutes of working the sandline. The overshot assembly was recovered, the pin replaced and a second attempt made to shift the sleeve with the same result. On the third attempt, the sandline parted about 25 meters above the sinker bars. After about 150 meters of sandline had been cut off and a new sinker bar assembly rigged, a wireline fishing spear was run in a final attempt to clear the pipe and release the bit for logging. The broken wire was engaged by the spear, but the fish immediately became jammed in the pipe. It was then necessary to shear the pin on the new overshot and leave the spear in the pipe.

The hole was then filled with 110 barrels of barite weighted drilling mud and abandoned. Although hydrocarbon gases had been encountered in the hole, cementing around the inner barrel and other obstructions in the pipe was not considered to be safe. The drill string was pulled and the vessel was under way for Site 490 at 1630 hours, April 7.

SITE 490 - UPPER SLOPE

Site 490 was located seven miles south-southwest of Site 487. Transit time between Site 489 and beacon launch at Site 490 was one hour.

Operations proceeded routinely and the seafloor was found with a punch core at 1777 meters, 22 meters deeper than the PDR reading. A mudline core test of the pressure core barrel was conducted before continuous coring resumed. Good hole conditions and generally good core recovery persisted through the section with the exception of an interval of fractured siltstones and loose sand strata from about 405 to 475 meters BSF. Unstable hole conditions were again encountered beginning at about 570 meters. Despite mud flushes to clean the hole, excessive fill caused the drill string to stick temporatily following the retrieval of core No. 64 from 588.5 meters BSF. The hole was cleaned out, with some difficulty, to total depth.

A "wiper trip" was made to prepare the hole for logging. Considerable fill was again encountered at the bottom of the hole. Torquing and plugging of the drill string prevented cleaning the hole past 580 meters. A go-devil was then pumped down the pipe to actuate the hydraulic bit release. The release failed to shift after repeated attempts by pressuring up with the mud pump. The go-devil was retrieved with the sandline and a second go-devil was pumped to the bit. Again, the bit failed to release and the overshot was lowered to retrieve the go-devil. The go-devil stuck at the bit and a second wireline run was required to work it free after the safety release pin in the overshot was sheared.

Plans for logging were abandoned and the hole was filled to about 280 meters BSF with weighted drilling mud. The bit was then pulled to the top of the mud fill and cement slurry was emplaced up to about 120 meters BSF before the drill string was recovered. The CHALLENGER was under way for Site 491 at 1400 hours, April 13.

SITE 491 - MIDDLE SLOPE

The CHALLENGER steamed 9 1/4 miles southeast from Site 490 and located the new drill site in 2 1/4 hours. After routine beacon launch and positioning operations, the pipe trip began. The vessel was offset 850 meters to the north-northwest, prior to spudding in, on the basis of satellite fixes received during the pipe trip. Hole 491 was spudded at 0120 hours, April 14. A completely full core was obtained after the bit had been lowered to 2880 meters and weight indication of contact with the seafloor had been noted. One joint of pipe was set back and a "punch core" to 2870.5 meters was attempted without recovery. Water depth was set at 2870 meters, seven meters shallower than PDR depth.

The core bit in use was one specially designed to permit use of the pressure core barrel. Two attempts were made at Hole 491 to recover cores under pressure, hopefully containing gas hydrates. Both were unsuccessful

Coring proceeded smoothly through a long and monotonous section of muddy silts and siltstones. Core recovery was excellent and no hole problems were encountered at any time, including the lower 70 to 80 meters where loose coarse sand strata were encountered. Coring operations were terminated at 542 meters BSF due to scheduling considerations.

A fifteen-stand wiper trip was made and the hole was cleaned to total depth and flushed in preparation for logging. The shifting tool was pumped down to shift the mechanical bit release. Again the sleeve could not be shifted with the sandline and the overshot pin was sheared on two consecutive attempts. On the third wireline trip, extra pull was applied in an attempt to dislodge the inner barrel and shifting tool. The sandline parted about 500 meters above the sinker bars. The hole was filled with barite-weighted mud and the drill string was recovered.

SITE 492 - UPPER MIDDLE SLOPE

HOLE 492

Site 492 was located just 3 1/2 miles north-northeast of Site 491. The transit and attendant profiling consumed one hour before the new positioning beacon was dropped. Upon returning to the beacon, the vessel was offset 410 meters to the south-southwest.

Shortly after the pipe trip began, a momentary loss of ship's AC power caused the dynamic positioning computer apparently to dump its program. The program would not reload and the trip was interrupted for one hour while the problem was resolved.

Finding the seafloor involved pulling two "water cores" before sediment was finally recovered from a depth of 1972.5 meters, 33.5 meters deeper than the PDR reading.

A uniform section of mud and muddy siltstones was cored to a total depth of 279 meters BSF. A few minor beds of coarse sand were cored near total depth, but no hole problems resulted. Coring operations were terminated due to scheduling considerations.

A temperature-density-gamma ray log run was planned, but the hydraulic bit release again failed to operate. The bit release go-devil was retrieved and the hole was plugged with cement to about 85 meters BSF before the drill string was pulled.

HOLE 492A

When the pipe had been recovered, the BHA was modified for hydraulic piston coring operations and the drill string was run back to position the bit just above the seafloor.

The first piston core recovered sediment from one meter shallower than the depth measured at Hole 492. Continuous piston coring proceeded to a depth of 47 meters BSF. At about 16 meters, the degree of compaction of the sediment exceeded the design limitations of the piston coring system. Incomplete recovery and marginal core quality were realized below that depth.

An attempt was made to "wash" to about 100 meters so that a through-bit temperature log could be run. The large-throated piston core bit proved quite inefficient for drilling, however, and the deepening attempt was abandoned at 66 meters BSF. One additional piston core was attempted, but only 1/2 meter of fractured siltstone was recovered.

The hole was filled with weighted mud and the drill string was retrieved.

SITE 493 - UPPER SLOPE

HOLE 493

The final scheduled drill site was situated 20 miles north of Site 492 and only about nine miles off the shoreline of Bahia Dulce. Transit time was three hours and the positioning beacon was dropped at 1215 hours, April 24 in 649 meters of water as measured by the PDR.

The PDR depth was again off by more than 20 meters and one "water core" was taken before a punch core indicated water depth to be 675 meters. Since operations in such shallow water pose a particular hazard to unsupported drill collars, the hole was drilled to 120 meters BSF to bury the BHA before continuous coring commenced.

Coring proceeded smoothly through mudstones and siltstones with no hole problems to about 625 meters BSF. Very fine and pure loose sand was encountered at that depth. The sand produced increasing hole fill following each core despite copious mud flushes. The bit struck hard rock at the end of what was to be the final core and granitic basement rock was recovered. An additional 19 meters was cored by pulling the bit back into the sand interval before retrieving each core and by pumping mud between the cores. This produced sufficient recovery of basement material for scientific sampling.

The hole was then given another 100 barrel mud flush in preparation for logging. Two unsuccessful attempts to actuate the hydraulic bit release were made by pumping go-devils to the bit. As it was evident that the standard suite of open-hole logs could not be run, the pipe was pulled to leave only the BHA in the hole and a modified inner core barrel was dropped to hold the float valve open. The log was successful in measuring the geothermal gradient to a depth of 176 meters BSF, where the tool's passage was blocked by an obstruction in the hole.

Following the logging operation, the pipe was run back down and the hole was filled with weighted mud to about 250 meters BSF. The pipe was pulled to 250 meters and a cement plug was emplaced from that depth to about 60 meters. The drill string was pulled and the bit arrived on deck at 0845 hours, April 28.

HOLE 493A

The special inner core barrel was recovered, the bit was inspected and the drill string was run back to the seafloor with an abbreviated BHA for the purpose of coring the upper 120 meters bypassed in Hole 493. The precision performance of the dynamic positioning system and excellent weather conditions on Hole 492 had proven this to be an acceptable risk.

Two "punch" cores were taken to a total penetration of 12 meters. On core attempt No. 3, the drill string took no weight and no sediment was recovered. A fourth attempt was made with the same results. It was deduced that the core bit had barely cleared the seafloor following core No. 2 (as the pipe is routinely raised 12 meters) and that it had re-entered Hole 493.

HOLE 493B

The bit was pulled well clear of the seafloor and the vessel was offset 100 feet to the east. On respudding, the bit was washed to 12 meters BSF and continuous coring was reinitiated. Hole 493B was cored to a total depth of 126 meters BSF without incident. The hole was filled with heavy mud and the drill string had been recovered by 0230 hours, April 29.

HOLE 492B

Rapid progress and an unexpectedly thin sediment section at Site 493 combined to provide time for additional drilling before the end of the voyage. The most time-effective action was determined to be a return to Site 492 for a final attempt at open-hole logging and determination of the geothermal gradient. Since no appreciable sand had been found in Hole 492, there was considerable confidence that the mechanical bit release could be operated and that a full logging program could be carried out.

The profiling gear was not deployed and transit time was cut to 2 1/4 hours from getting under way to acquisition of the signal of the beacon dropped nine days earlier. The offsets used for Hole 492 and 492A were entered into the positioning system and the ship was in stable position 30 minutes after acquiring the beacon signal.

Hole 492B was spudded at 1100 hours, April 29 and was drilled without coring to a depth of 280 meters BSF in 13 hours. This was the total depth of Hole 492 and the schedule permitted cutting one core beyond that depth. Six meters of loose, coarse sand were recovered in that core. Hole fill was noted for the first time and the hole was given an extra mud flush in preparation for logging.

An inner core barrel, with shifting tool attached, was pumped down and the overshot was run to engage it and shift the bit release sleeve. The barrel was found to be stuck with the shifting tool apparently engaged in the sleeve and the sleeve immobilized by sand. Three attempts were made to shift the sleeve and/or to dislodge the inner barrel, but the overshot pin sheared on all three tries.

The logging sheaves were rigged up and through pipe gamma ray-neutron and temperature logs were run. Useful gamma ray correlation and geothermal gradient curves were obtained. The neutron curve was of no value due to an equipment malfunction. Four and one half hours were lost to electrical problems in a logging tool connector and in the cable head.

The shifting tool/inner barrel assembly in the pipe prevented logging through the bit, further coring attempts, or plugging the hole with cement. The hole was therefore filled with heavy mud and the drill string was pulled about 12 hours ahead of schedule.

The CHALLENGER departed Site 492 for Manzanillo at 2215 hours, April 30.

SITE 492 to MANZANILLO

The 364 mile transit was uneventful with continued good weather. It was necessary to shut down individual propulsion engines on several occasions to clean marine growth from heat exchangers. Despite these minor delays, a speed of advance of 8.65 knots was logged.

Leg 66 was officially concluded at 1715 hours, May 2, with the first mooring line at the outer berth of San Pedrito Wharf, Manzanillo, Colima, Mexico.

DRILLING AND CORING EQUIPMENT

The standard DSDP bottomhole assembly was utilized for the majority of operations. This consisted of a core bit, bit release assembly, outer core barrel assembly, three 8 1/4" drill collars, two 5' stroke bumper subs and three 8 1/4" drill collars. The uppermost stand of drill collars and the two upper bumper subs were removed for shallow water coring of soft sediments in Holes 493A and 493B. The same abbreviated BHA was used for piston coring at Hole 492A. The outer core barrel assembly was modified in this instance by substituting a special piston coring head sub and by substituting a standard bit sub assembly for the bit release assembly.

Both hydraulic and mechanical bit release assemblies were utilized. Each type of release failed to operate on three occasions. The abundance of loose, flowing sand and silt-size material found in nearly every borehole drilled was a major factor in the failures. Other design and mechanical deficiencies were indicated and these are under investigation.

Abandonment of Hole 489, after only 34.5 meters penetration was necessitated by the failure of the lower bumper sub. The wash pipe had come unscrewed from the top sub and had dropped down into the bumper sub body. This permitted fluid to circulate through the ported body of the bumper sub, bypassing the bit. Investigation showed that the threads apparently had not been secured by locking compound during assembly.

Forty one joints of aluminum drill pipe were utilized on Sites 489 through 492 as a continuation of the experimental program begun on Leg 63. No problems were encountered with the handling of the pipe. The four inch inside diameter of the pipe caused some difficulty in retrieving bit release go-devils following unsuccessful attempts to actuate the hydraulic release. The aluminum pipe was left out of the string for piston coring in Hole 492A due to concern over clearance for piston core barrel seals.

The Bowen hydraulic system was beset with a rash of minor problems throughout the cruise. None of the various leaks and valve and control malfunctions was particularly serious in itself. However a stuck valve resulted in a lack of pressure on the heave compensator racker arm hydraulic cylinder. This allowed the arm to "fall over center" as the heave compensator was being picked up, causing structural damage to the floor beneath the drawworks enclosure.

The vertical motion compensator was utilized on all holes except for those at Site 493 and the piston coring at Hole 492A. The system functioned well and dependably for the entire leg following an early O-ring seal failure.

CORE BITS

Although several holes were scheduled for drilling to "bit destruction", termination of drilling resulted from other factors in all cases. There were no bit failures on Leg 66 and several successful reruns were made. About 22 meters of hard granodiorite was drilled at the bottom of Hole 493 with no discernible damage to either the cutting structure or the bearings of the soft-formation F93CK bit.

Hole 491 was drilled with a bit that had been built to cut a reduced diameter ($\pm$ 1/4") core compatible with the pressure core barrel. The core recovery rate for that hole was the best of the leg. This is attributed to the increased clearance between the core and the butyrate tube which results in a reduced tendency for cores to jam.

SPECIAL TOOLS

The pressure core barrel was deployed on five occasions. There were three attempts to recover core under pressure and two test runs during pipe trips to test mechanical functions. Core was recovered on one attempt, but there was no success in retaining downhole pressure. Problem areas have been defined for further testing and improvements.

The hydraulic piston coring system was utilized at Hole 492A. The results were gratifying in that the system proved reliable and that the material being cored provided an excellent definition of its limitations with respect to sediment compaction. The Leg 66 operating area has apparently been stripped of an appreciable thickness of sediment, leaving compacted material at abnormally shallow depths below the seafloor. After only 16 meters penetration, the clay and silt became too stiff to permit full extension of the core barrel. This resulted in incomplete recovery and severe "flow-in" disturbance in the lower portion of the core. An additional 35 meters were cored with approximately 50% recovery.

The piston corer should prove to be a valuable tool when used in the upper 100 meters of soft pelagic and hemipelagic sediments. The coring operation requires roughly twice the operating time of the standard operation, but increased recovery and reduced core disturbance may justify the time expenditure in some instances.

The temperature probe was run on ten occasions. Data curves of some utility resulted from all but one attempt. Some of these were anomalous, however, and more evaluation is needed. The data suggested that, on two or three occasions, the inner core barrel failed to latch into place. No physical reason for this could be determined on examination of the hardware, however.

The pore water sampling apparatus was used once to sample borehole fluid for gas analysis. Results were inconclusive.

POSITIONING BEACONS

All beacons deployed were of the standard ORE type used extensively in DSDP operations. Five each double life and single life units were expended, with 13.5 and 16.0 kHz frequencies used in alternating sequence.

The first beacon launched (13.5 kHz double life) suffered a severe loss of signal strength about 20 minutes after it had been launched and long before it reached the seafloor. The nature of the failure is unknown, but this was the last unit of a batch of beacons that had shown a high failure rate on previous legs.

The replacement beacon (16.0 kHz double life) was apparently normal in all respects, but the positioning computer refused to accept the filtered pulse. Analysis of the beacon signal revealed that the frequency was about 14.7 kHz and outside the range accepted by the band pass filter.

The 13.5 kHz single life beacon used at Site 492 was reacquired without difficulty after Site 493 operations had been concluded. When the vessel departed Hole 492B, the beacon was still quite strong after 10 1/2 days of operation and had lost no signal strength in the latter five days.

DYNAMIC POSITIONING SYSTEM

The positioning system was dependable and quite effective in maintaining position within the tight limits imposed by the shallow water depths in the operating area.

At one site, a momentary loss of AC power occurred as a generator was returned to service following maintenance. This caused a breaker to trip in a computer display circuit and resulted in an indication that the program had been "dumped". Troubleshooting revealed no equipment damaged and the breaker was reset. No positioning excursion resulted.

Concern was generated by a sharp drop in beacon signal strength with intermittent loss of acoustics while hole 493B was being cored in 670 meters of water. Full signal strength returned after five to ten minutes and the loss was attributed to interference from marine life or another outside source.

ENGINEERING

Seawater temperatures averaging about 87°F raised engine room temperature to about 130° and made the cruise a demanding one for both personnel and equipment. Ambient temperature was a factor on occasions when air conditioning, refrigeration and other systems were out of commission until tripped circuit breakers could be cooled off and reset. Temperature was also an apparent factor in the one momentary loss of AC power that occurred while generators were being paralleled.

The only major engineering casualty was the loss of electrical power to the Bowen hydraulic plant that occurred on March 26. This was traced to a shorted SCR diode in the static exciter unit, combined with a "floating" and intermittent ground problem. The diode was replaced with a spare unit and normal functioning was regained. Hole 487 drilling was halted short of its final objective and 19 1/2 hours of operating time were lost as a result of the failure.

WEATHER AND CURRENTS

Weather conditions could only be described as ideal for the duration of the voyage. Days were warm and sunny and rain showers occurred only once - at night. Neither wind nor current was ever a significant factor in dynamic positioning.

NAGIVATION

Satellite navigation remained the primary method of determining the ship's position as the area was not covered by LORAN and not optimum for OMEGA fixes. Excellent pre-site seismic coverage by the University of Texas was of great assistance in locating the drill sites. On two or three occasions, positioning offsets were used to refine the position was a result of SAT NAV fixes received between beacon drop and spud-in times.

Final installation of the ship's pit log was accomplished during the voyage and speed indication seems quite accurate. The pit log signal has been wired into the SAT NAV system for an optional automatic speed input mode.

The ship's radar sets required a considerable amount of maintenance on the part of the Radio Officer. At least one unit was in use at all times, however, and both were operational on arrival at Manzanillo.

COMMUNICATIONS

Generally good daily CW communications with Scripps radio station WWD facilitated the handling of a greater-than-normal volume of traffic to and from both DSDP and GMI headquarters. A number of business phone calls were also placed through WWD voice channels to headquarters.

Personnel transfers and other arrangements were coordinated with ship's agents by radiotelephone via commercial stations in Acapulco and Manzanillo.

Amateur radio phone patches were conducted on an almost daily basis by the ship's surgeon for the benefit of shipboard personnel.

PERSONNEL

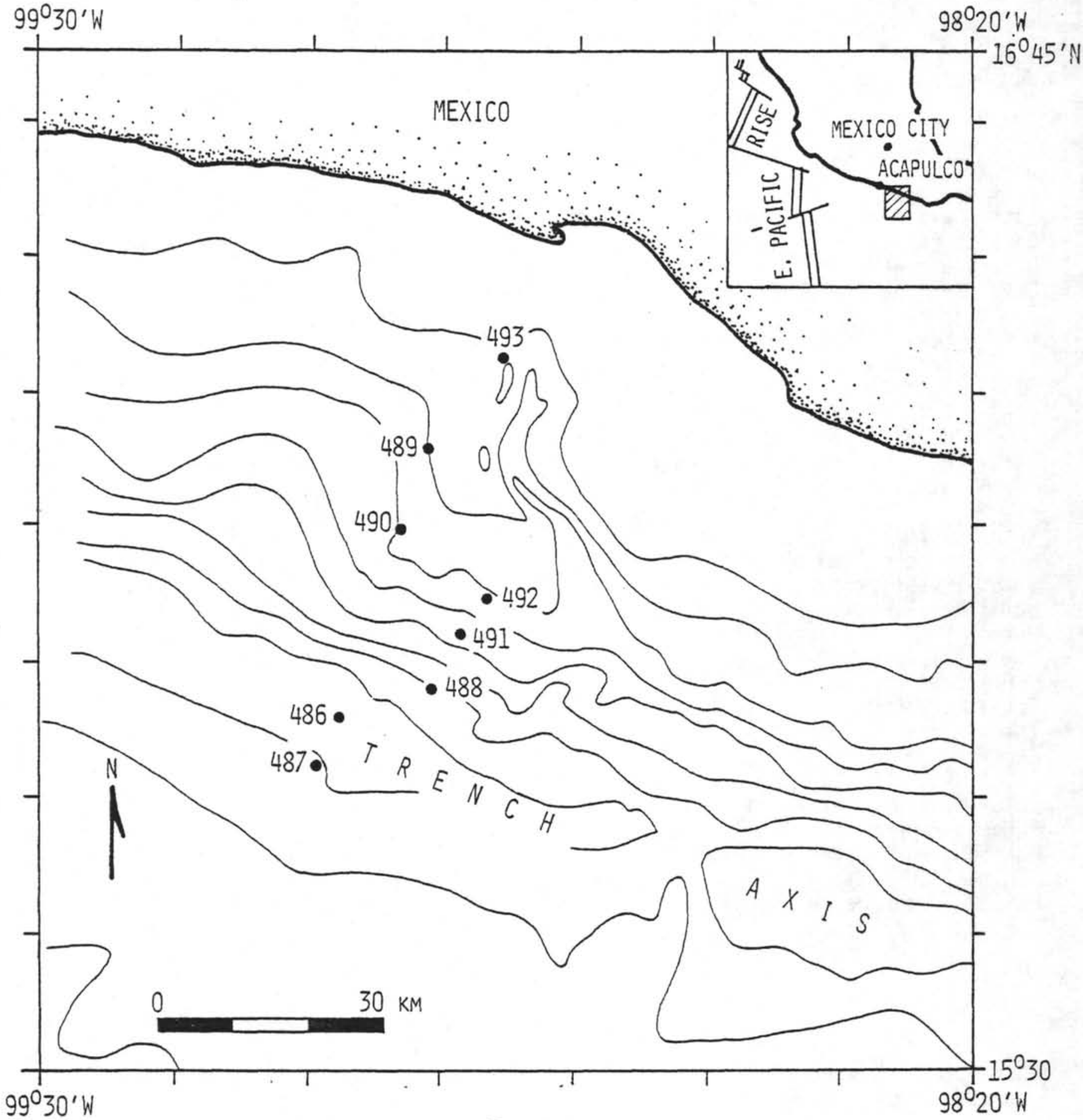
A young and highly enthusiastic scientific staff, together with a very experienced technical group, proved an effective combination in coping with an extraordinarily high volume of core moving through the laboratory.

THe GMI crew was professional and effective in dealing with special repair and maintenance problems while maintaining a praticularly hectic operating schedule. Although eight sites were drilled, a total of less than 18 hours were spent in transit between sites. This is the time normally devoted to maintenance actions on equipment critical to drilling and stationkeeping functions. Particularly notable personal contributions were made by the electrician, the rig mechanic and the welder.

Three personnel transfers were arranged through the Acapulco ship's agent and the Mexican Navy. A rotary helper was sent to a hospital in Acapulco via a Mexican naval vessel after symptoms indicated acute appendicitis. Hospital tests determined that the illness was an intestinal ailment and that no surgery was required. Shortly thereafter, the logging engineer received word of the death of a close relative. He was transferred ashore on an Acapulco fishing boat that had been chartered to deliver the relief rotary helper to the CHALLENGER. The same vessel made a second trip a few days later with a replacement logging engineer. Though the circumstances were unfortunate, the transfers provided an opportunity for the exchange of mail and the replenishment of fresh fruits and vegetables.

No serious injuries occurred and medical problems were basically confined to minor gastro-intestinal maladies early in the cruise.

Glen N. Foss
Cruise Operations Manager
Deep Sea Drilling Project



LEG 66
OPERATING AREA

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
OPERATIONS RESUME
LEG 66

Total Days (April 13, 1979 - May 2, 1979)		50.36
Days In Port		6.13
Days Under Way		5.45
Days On Site		38.78
Coring Time	24.0	
Drilling Time	0.8	
Trip Time	5.8	
Downhole Measurements	1.7*	
Mechanical Downtime	1.3	
Hole Trouble & Stuck Pipe	0.8	
Other	4.4**	
Total Distance Covered (Nautical Miles)		1159.4
Average Speed (Knots)		9.2
Sites Investigated		8
Holes Drilled		14
Number of Cores Attempted		353
Number of Cores With Recovery		351
Percent of Cores With Recovery		99.4
Total Meters Cored		3155.0
Total Meters Recovered		1844.1
Percent of Recovery		58.5
Total Meters Drilled		456.0
Total Meters Penetration		3611.0
Percent Penetration Cored		87.4
Maximum Penetration (Meters)		670.5
Minimum Penetration		12.0
Maximum Water Depth (Meters)		5157.0
Minimum Water Depth		670.0

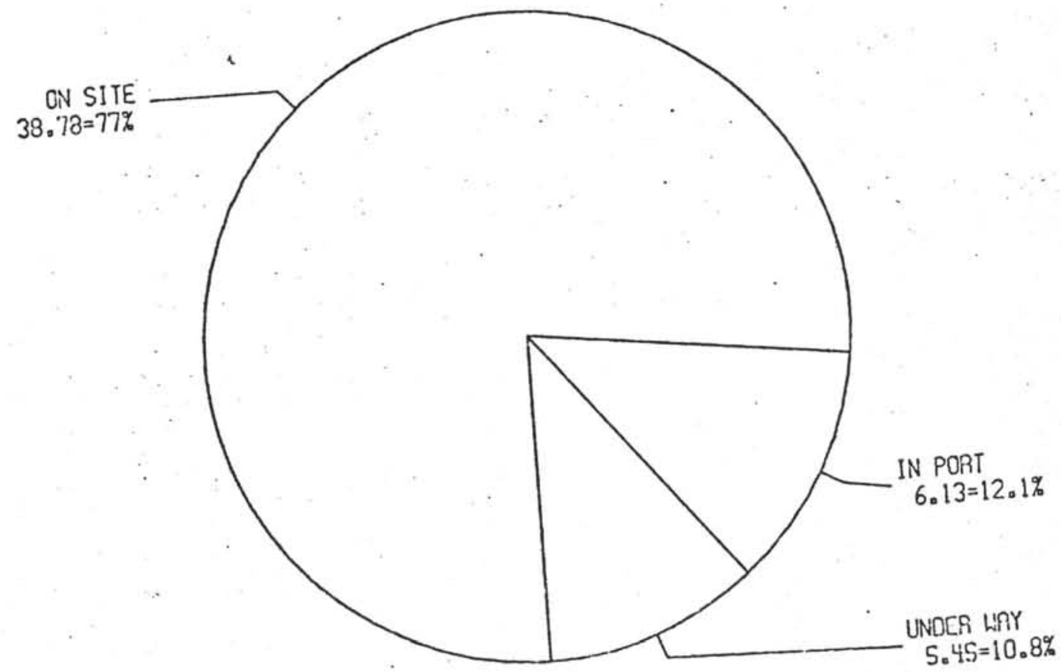
* Includes logging, temperature probe, water sampler, deviation surveys and pressure core barrel

**See accompanying time breakdown

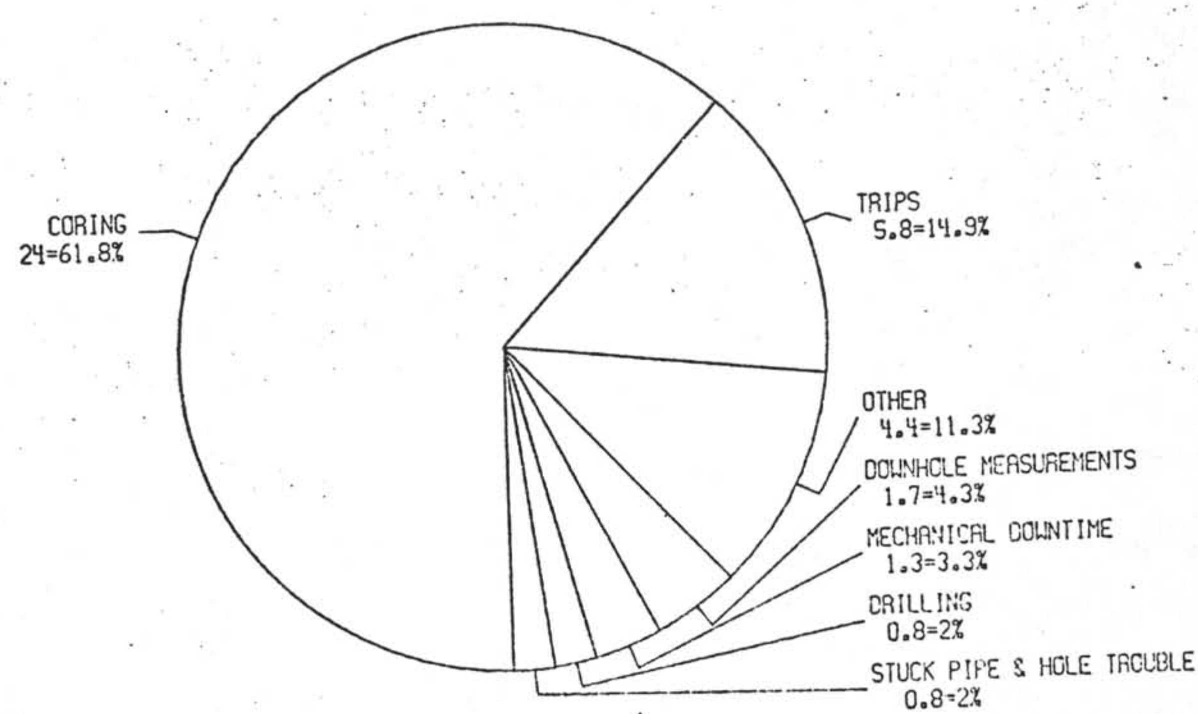
BREAKDOWN OF "OTHER" TIME CATEGORY

	Hours
Bit Release Failures	29.7
Bumper Sub Failure	19.4
Position & Offset Ship, Retrieve Seismic Gear	17.9
Plug and Abandon Holes	9.1
Handle Aluminum Drill Pipe	5.7
"Water Cores" - PDR Inaccuracy	5.0
Beacon Failures	3.9
Magnetic Inspection, BHA	3.8
Secure Ship For Sea	2.3
Sandline Handling	1.5
Overshot Failures	1.3
Heavy Drilling Joint Handling	1.3
Plugged Bits	1.2
Gas Monitoring - Cores	1.0
Downgraded Drill Pipe Handling	0.8
Accidental Re-entry, Hole 493	0.7
Soak Beacons	0.7
Service Rig	0.2
Test Thrusters	0.2
	105.7 Hours

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
TOTAL TIME DISTRIBUTION
LEG 66



ON-SITE TIME DISTRIBUTION
LEG 66



DEEP SEA DRILLING PROJECT
TIME DISTRIBUTION
LEG - 66

Date	Site No.	Cruise	Trips	Drill	Core	Stuck Pipe	W.O.W.	DOWNHOLE MEAS.	Mech. Repair	Port Time	Re-Entry	Other	Total Time	Remarks
3/13/79 3/22/79		70.1								147.1		0.2	217.4	Mazatlan to Site 486
3/22/79 3/23/79	486		10.4		10.6	0.7		0.8	0.6			7.1	30.2	
3/23/79 3/24/79	486A		12.0		5.9							1.4	19.3	
3/24/79		2.3										0.3	2.6	486 to 487
3/24/79 3/27/79	487		19.8		32.2			1.4	8.6			1.2	63.2	
3/27/79		1.8											1.8	487 to 488
3/27/79 4/02/79	488		21.9		99.0	10.1		5.0	15.6			2.5	154.1	
4/02/79		4.2											4.2	488 to 489
4/02/79 4/04/79	489		5.3		6.5							18.8	30.6	bumper sub failure
4/04/79 4/07/79	489A		4.0		58.6	0.8		0.8	1.5			19.3	85.0	
4/07/79		1.0											1.0	489 to 490
4/07/79 4/13/79	490		10.6	0.1	101.0	5.6		6.5	1.5			15.2	140.5	
4/13/79		2.2											2.2	490 to 491
4/13/79 4/20/79	491		12.8		120.4			10.3	1.1			13.7	158.3	
4/20/79		1.0											1.0	491 to 492
4/20/70 4/23/79	492		11.4		47.5			0.4	2.8			10.3	72.4	
4/23/79 4/24/79	492A		10.0	2.4	12.0							1.0	25.4	piston coring
4/24/79		3.0											3.0	492 to 493
4/24/79 4/28/79	493		6.1	2.8	68.1	1.6		5.3				8.5	92.4	
4/28/79	493A		3.0		1.3							0.7	5.0	unplanned re-entry

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
4/28/79 4/29/79	493B		2.3	0.2	9.7							0.8	13.0	
4/29/79		2.3											2.3	493 to 492
4/29/79 4/30/79	492B		9.5	13.1	2.7	0.7		10.5				4.7	41.2	
4/30/79 5/02/79		42.5											42.5	492 to Manzanillo
TOTALS		130.4	139.1	18.6	575.5	19.5		41.0	31.7	147.1		105.7	1208.6	

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
SITE SUMMARY
LEG 66

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
486	15° 55.37'N	99° 08.10'W	5157.0	5	5	100.0	38.0	12.5	32.9	0	38.0	23.8	30.2	
486A	15° 54.83'N	99° 08.28'W	5152.0	3	3	100.0	22.0	3.5	15.9	0	22.0	18.3	19.3	49.5
487	15° 51.21'N	99° 10.52'W	4777.0	21	21	100.0	181.7	119.9	66.0	0	181.7	59.6	63.2	63.2
488	15° 57.10'N	99° 01.66'W	4265.0	46	45	97.8	429.0	160.4	37.4	0	429.0	12.6	154.1	154.1
489	16° 16.19'N	99° 01.13'W	1268.5	4	4	100.0	34.5	22.6	65.5	0	34.5	8.6	30.6	
489A	16° 16.19'N	99° 01.13'W	1266.5	34	34	100.0	298.5	164.5	55.1	28.5	327.0	11.0	85.0	115.6
490	16° 09.56'N	99° 03.34'W	1777.0	64	63	98.4	586.5	341.4	58.2	2.0	588.5	13.0	140.5	140.5
491	16° 01.74'N	98° 58.33'W	2870	59	59	100.0	542.0	388.0	71.6	0	542.0	10.6	158.3	158.3
492	16° 04.73'N	98° 56.72'W	1972.5	31	31	100.0	279.0	189.6	68.0	0	279.0	14.0	72.4	
492A	16° 04.73'N	98° 56.72'W	1971.5	11	11	100.0	51.8	30.3	58.5	19.0	70.8	- -	25.4	
493	16° 22.86'N	98° 55.53'W	675.0	60	60	100.0	556.5	337.3	60.6	114.0	670.5	19.0	92.4	
493A	16° 22.86'N	98° 55.53'W	670	2	2	100.0	12.0	7.6	63.3	0	12.0	240.0	5.0	
493B	16° 22.86'N	98° 55.53'W	670	12	12	100.0	114.0	60.1	52.5	12.0	126.0	29.2	13.0	110.4
492B	16° 04.73'N	98° 56.72'W	1971.5	1	1	100.0	9.5	6.4	67.6	280.5	290.0	28.1	41.2	139.0
				353	351	99.4	3155.0	1844.1	58.5	456.0	3611.0	14.7		930.6

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
BIT SUMMARY
LEG 66

HOLE	MFG.	SIZE	TYPE	SERIAL NUMBER	METERS CORED	METERS DRILLED	METERS TOTAL PENET	HOURS ON BIT	CONDITION	REMARKS
486	Smith	9 7/8"	F93CK	643KR	32.0	0	38.0	1.6	TO-BO-I	
486A	Smith	9 7/8"	F93CK	643KR	22.0	0	22.0	2.8	TO-BL-I	Like new.
487	Smith	9 7/8"	F94CK	145RT	181.7	0	181.7	3.5	TO-B1-I	Rerun from Leg 65.
488	Smith	9 7/8"	F93CK	650KR	429.0	0	429.0	34.2	TO-B2-I	Ran dry due to washed out bumper sub. Unusual wear inside core guide.
489	Smith	9 7/8"	F94CK	145RT	34.5	0	34.5	7.5	TO-B1-I	Rerun.
489A	Smith	9 7/8"	F94CK	145RT	298.5	28.5	327.0	37.3	T1-B6-I	Rerun - one loose cone.
490	Smith	9 7/8"	F93CK	616KC	586.5	2.0	588.5	45.1	T1-B2-I	
491	Smith	9 3/4"	F94CP	143PJ	542.0	0	542.0	56.0	T1-B6-o 1/8	Rerun from Leg 62-severe cone wear-all cones loose
492	Smith	9 7/8"	F93CK	643KR	279.0	0	279.0	22.7	TO-B1-I	Good for rerun-no hard drilling.
492A	RSS	10"	HPC	126489	51.8	19.0	70.8		OK	Good for rerun.
493	Smith	9 7/8"	F93CK	280JZ	556.5	114.0	670.5	35.3	TO-B1SE-I	3.7 hours granite
493A	Smith	9 7/8"	F93CK	280JZ	12.0	0	12.0	35.4		
493B	Smith	9 7/8"	F93CK	280JZ	114.0	12.0	126.0	39.7	TO-B1SE-I	
492B	Smith	9 7/8"	F93CK	643KR	9.5	280.5	290.0	33.0	TO-B2SE-I	

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
BEACON SUMMARY
LEG 66

SITE NO.	MAKE	FREQ kHz	SERIAL NUMBER	SITE TIME HOURS	
486	ORE	13.5	473	1.7	Double life; signal level dropped 20-30 min after launch.
486	ORE	16.0	474	2.2	Double life; signal off frequency; computer would not accept.
486	ORE	13.5	484		Double life.
486A	ORE	13.5	484	46.3	Strong for duration.
487	ORE	16.0	475	63.2	Double life; strong for duration.
488	ORE	13.5	485	154.1	Double life; strong for duration.
489	ORE	16.0	476		Double life.
489A	ORE	16.0	476	115.6	Strong for duration.
490	ORE	13.5	489	140.5	Single life; strong for duration.
491	ORE	16.0	479	158.3	Single life; strong for duration.
492	ORE	13.5	490		Single life.
492A	ORE	13.5	490		Strong for duration.
493	ORE	16.0	480		Single life.
493A	ORE	16.0	480		Strong for duration.
493B	ORE	16.0	480	110.4	Temporary sharp drop in signal; marine life?
492B	ORE	13.5	490	254.7	Strong on return to Site and for Hole 492B.

DEEP SEA DRILLING PROJECT
LOGGING SUMMARY
LEG 66

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
486	5195	5157			9 7/8						Could not drill-loose sand.
486A	5174	5152			9 7/8						Could not drill-loose sand.
487	5958.7	4777			9 7/8						Logs not requested.
488	4694	4265			9 7/8						Could not log. Inner barrel stuck at bit.
489	1303	1268.5			9 7/8						Hole lost to bumper sub failure. Too shallow to log.
489A	1593.5	1266.5			9 7/8						Could not release bit to log. Bit release malfunction.
490	2365.5	1777			9 7/8						Could not release bit. Bit release malfunction.
491	3412	2870			9 3/4						Could not release bit. Bit release malfunction.
492	2251.5	1972.5			9 7/8						Could not release bit. Bit release malfunction.
492A	2042.3	1971.5			10						Logging not requested.
493	1345.5	675	763	sea water	9 7/8	2.5	1	diff. temp.	675	851	Could not work tool past bridge at 851 meters.
493A	682.0	670			9 7/8						Logging not requested.
493B	796.0	670			9 7/8						Logging not requested.
492B	2261.5	1971.5		sea water	9 7/8	4.5	1	gr-neutron	2230	1971	Thru pipe log-bit would not release. Neutron curve no good-electrical leak in connection.
492B	2261.5	1971.5		sea water	9 7/8	5.5	2	diff. temp	1990	2226	Thru-pipe.

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
OPERATIONS RESUME
LEG 67

Seven drill sites, extending along a Guatamala Trench Transect, were investigated on Leg 67 of the Deep Sea Drilling Project. The principal objective of the voyage was a test of the constant convergence model of subduction. This program was modified after several sites unexpectedly encountered clathrates and accompanying hydrocarbon gas. These sediments contained sandy sections in which the pore water had turned to ice when recovered and the gas which was freed extruded the cores, with considerable force, from the plastic core liners. The leg was then modified to exclude further sites on the landward side of the trench and some interesting geological discoveries were made in the new sites located in the mid-America Trench.

In addition to the regular drilling program, a downhole seismometer was placed in a hole after the regular drilling had been completed. This was the same instrument that was emplaced for the University of Hawaii on Leg 65 and subsequently recovered by them. An oriented coring program with the hydraulic piston coring tool was also attempted but was not successfully completed when part of the piston coring device came unscrewed and fell into the throat of the bit. This would not allow the piston corer to scope out when at the bottom of the drill string. This program was then cancelled and a regular coring setup was used because of time constraints at the end of the leg.

The voyage commenced on May 2, 1979 at 1742 hours when the first line was brought ashore in Manzanillo, Mexico and ended 56.0 days later at 1751 hours, June 25, 1979 when the anchor was dropped in the harbor at Puntarencas, Costa Rica. Total length of the leg was 56.0 days of which 40.3 days were spent on-site, and 8.9 days were spent underway. In addition to the 6.85 days in port at the beginning of the leg, an additional 6.8 hours were spent at port in Acajutla, El Salvadoa. This port call was used to pick up some special chemicals that were needed to fight a barnacle problem in the cooling water piped to the ship's engines.

The on-site time breakdown consisted of 8.9 days tripping, 1.3 days drilling, 18.8 days coring, 0.2 days with stuck pipe, 1.0 day waiting on weather, 1.7 days with mechanical repair, 3.5 days making downhole measurements, and 5.8 days of miscellaneous items, such as the HIG experiment.

MANZANILLO PORT CALL

Although this port call was originally scheduled for five days, it lasted 6.5 days.

One of the reasons for the delay in departure was that the topping lift cable broke on the large crane while a new logging cable was being lowered into place on the logging unit. Parts of the crane had to be replaced before it could be used again and this delayed bringing aboard those heavy items that could only be handled by it. The main job for this port call was the overhaul of Caterpillar engine No. 8. Other items that were accomplished while in port were the rework of the Bowen hydraulic system by two rig mechanics, the semi-annual ship inspection by three Global Marine Drilling Company inspectors, and the regular drill pipe inspection. Resupply activities included loading of fresh food items, 200,000 plus gallons of fuel and such other things as 19 joints of 16" casing, three re-entry cones, 1000 sacks of gel, HIG downhole seismometer experiment equipment which included 30,000 feet of polypropylene line, and many other items. Three hydraulic bit releases and one mechanical unit were assembled and tested, and a training session was held for those people who would be responsible for the operation of the hydraulic piston corer and the pressure core barrel on the upcoming leg. The port call was completed when the ship left the dock on May 9, 1979.

SITE 494

The first site to be drilled on Leg 67 was reached after three and one half days of travel from Manzanillo, Mexico. It was located on the landward slope of the mid-America Trench off Guatamala. At 1547 hours on May 13, a 13.5 kHz beacon was dropped and when the ship had begun positioning in the automatic mode, make up of the drill string began. The pipe trip to the seafloor took longer than was expected due to the breakdown of the air cylinder in the dual elevator pull-back rams. This assembly was removed and was not repaired until the following day. After the drill string had been run to 5411 meters, the Bowen sub was picked up and a core barrel was dropped. However, when the power to the Bowen sub was turned on the sub would not operate in a normal manner. When the sub could not be made to operate properly, it was set back and a complete check of the system was made.

The Bowen power unit was checked and all parts seemed to be operating satisfactorily. The power sub would not rotate smoothly and the hydraulic motor on it was thought to be the problem, but when it was removed and tested separately, it rotated satisfactorily. However, when it was reinstalled, the rotation was still erratic. It was then changed out with a new motor and the sub appeared to operate in a normal manner. More than 10 hours were spent attempting to identify and correct this problem.

After the power sub was finally picked up a mudline core was attempted but recovered only water. After adding another joint a second attempt to spud was made. When the overshot was lowered to retrieve the core barrel, it would not latch due to a build up of line tar from a new sandline. Three attempts were made to retrieve the core barrel but each was unsuccessful. While making these attempts the bit became plugged and circulation was lost. However, when circulation was regained the overshot would not engage and it was necessary to pull the drill string.

Recovery of the drill string was a very slow operation for the first two hours because the elevator rams had not been repaired. When all the drill pipe had been recovered, the inner core barrel had no tar on the latch assembly and the consensus of opinion was that it had washed away when the pipe was pulled into the warmer (88°-91°F) surface waters.

While the bottomhole assembly was being made up the ship was offset 2990 feet south to a new location. The drill string was again made up and run into 5468.5 m. When the Bowen sub was picked up and tested the same problems of erratic rotation and heating up again developed. About four hours were spent checking both the hydraulic and electrical systems and both appeared to be operating normally. The power sub was set back and the hydraulic hoses were disconnected. When this was done a broken check valve was found in a hose connection. This was then replaced, the hoses were connected and when the operation was checked everything worked as it should. However, a noise was heard in the hydraulic pump motor which was attributed to a piece of the broken check valve. Therefore, the motor was replaced.

The precision depth recorder (PDR) indicated bottom to be at 5482 meters. However, five "water cores" were recovered before bottom was established at 5529 m. The hole was spudded at 0003 hours on May 17. After cutting and recovering four cores, it was necessary to pull the drill string above the mudline to again make repairs to the Bowen sub. Therefore, Hole 494 was ended at 0548 hours, May 17, when the bit cleared the mudline.

HOLE 494A

A leak in the double pin sub connection between the swivel and Bowen power sub had caused the abandonment of Hole 494. The connection was tightened and the torque arms were picked up. Hole 494A was then spudded at 0814 hours, May 17. Three cores were cut but the third one could not be recovered because of line tar buildup in the overshot. Two attempts were made with no success. A second core barrel was then picked up and short hard formation core catcher fingers were put into the core catcher. This barrel was dropped, the overshot engaged it with no trouble and both core barrels were recovered. It was necessary to go through the same procedure after core No. 5 had been cut and could not be recovered. Coring then continued with very poor recovery due to the badly fractured nature of the rock being cored. This condition also created a need to flush the hole with mud after every two or three cores. Igneous rock was recovered in core No. 31 and the drill rate slowed immediately. After core No. 35 was recovered, the drill string was found to be stuck. The bumper subs were working, circulation was normal, and after 50 minutes of working, the pipe was freed. After the hole had been thoroughly circulated with mud, the knobby drilling joints were replaced and the string was lowered to 5875 meters. The bit release "go-devil" was pumped down and the hydraulic bit release worked smoothly when the pressure built to 1800 pounds. The drill string was then pulled to 5639.7 meters so as to allow the downhole logging to be done with the top of the bottomhole assembly below the mudline.

The logging sheaves were rigged and the first logging tool combination was the gamma/density/temperature. This tool was run to the bottom of the drill pipe and then began recording the temperature log as the tool was lowered. The tool stopped at 5707 meters and three attempts were made to spud through the bridging material but this could not be accomplished. The gamma/density was then logged as the tool was pulled up through the balance of open hole and then the tool was brought to the derrick floor. The second tool combination was the gamma/guard/neutron. This particular tool was selected because it was heavier than any other tool combinations and it was hoped it could clear out the bridging material. This tool was run and appeared to pause only briefly and then pick up its normal weight when it reached 5707 meters. The tool was lowered slowly and a careful watch was kept on the weight indicator. The tool appeared to bottom at 5891 meters, so the recorder was turned on and logging began as the tool was pulled. The tool was pulled to 5840 meters and stopped so that it could be lowered and a repeat section made to verify that the tool was operating satisfactorily. However, the tool would not go down and logging was continued as the tool was pulled. The results being recorded at the surface indicated that neither gamma nor neutron tool was operating properly and they were turned off. When the tool was about 200 meters from the derrick floor, a bad snarl in the logging cable appeared. This was unsnarled and the tool pulled again. Another snarl appeared just before the tool reached the drill floor. This was also unsnarled and the tool recovered. The logging cable was then cut off above the damaged cable and reheaded. While this was being done a very careful cleanout run was made with the drill pipe. This had to be done carefully because the bit was not on the string and plugging was very possible. However, the hole was cleaned out to 5832 meters, the pipe pulled back to the previous logging depth, and the gamma/sonic logging tool made up and lowered into the hole, however, the tool would not operate properly when turned on. The tool remained in the hole and pipe for nine hours while the logging engineer attempted to make it operational by adjusting surface equipment. Eventually he decided nothing could be done and the tool was pulled.

When the logging tool had been recovered, the Bowen sub was picked up again and another careful cleanout of the hole was made. This was done to assure a good emplacement of an experimental seismic tool for the University of Hawaii. Following the cleanout run the seismic tool was madeup and run into the hole. After the tool was in place and tested, the cable was cut and one end was reheaded while the end attached to the downhole tool was headed with a Bowen rope socket. Between the end of the sandline and the rope socket, 250 feet of non-spin line was attached. The drill pipe was then stripped over the logging cable. This operation required eleven hours. The two ends of the cable were then reassembled and, as the ship was moved in a specific direction, the balance of the logging cable was unspooled. It required about three hours to unspool a total of 8150 meters of cable. The tool was again tested to be sure it was operating properly. The "real time shot run" program then began and lasted for 12 hours. This program was done with the assistance of the research ship KANA KEOKI, which set off the pattern of explosives.

Following the shooting program, the cable was cut and keelhauled. A recording package was attached to the cable which, in turn, was attached to 30,000 feet of 1 1/4" polypropylene line. This line was then unreeled as the ship moved in the proper direction and speed to keep the correct tension on it. After this was done a recovery package was attached and also 12,000 feet of spooled 3/4" line. As this line was being unreeled, the tension built to more than 4,000 pounds and it broke. Following this, the balance of the experimental equipment was placed aboard the KANA KEOKI along with the scientists responsible for the experiment. The ship was then secured for cruising and Hole 494A was abandoned at 1812 hours, May 25.

SITE 495

The move of 14.6 miles southwesterly across the mid-American Trench to this new location was made in 5 1/4 hours and a new beacon was dropped at 2237 hours, May 25. After the ship began positioning in the automatic mode, the drill string was made up. The Precision Depth Recorder indicated a bottom depth of 4150 meters and when the drill string reached this depth, it began taking weight. Rotation was necessary and the mudline core required six minutes to cut. However, when the core barrel was recovered, it was empty. Traces of grey-green sediment were found in the core catcher and the water depth was set at 4150 meters. While cutting core No. 6, it was noticed that the drill pipe appeared to be dragging against the port side of the elevator stump. In order to correct this condition, it was necessary to change the original offsets of 1400'N and 600'E to 1900'N and 600'E. After cutting core No. 7, it was necessary to make another change to 1950'N. This location held until core No. 25 when the offsets again were changed to 2000'N and 650'E to keep the pipe directly below the ship. One possible explanation given for these moves was a beacon dropped on a sloping surface and sliding down it about 500 feet. Another might be a vertical reference gyro malfunction.

Coring continued in a routine manner with excellent recovery of better than 70%. The top of basaltic rock was located in core No. 46 and before core No. 48 could be cut, 20 barrels of mud were circulated to remove the excess cuttings on bottom. After rotating for 16 minutes on core No. 49, the pipe suddenly stuck. The hole could be circulated and the bumper subs could be moved but the pipe could not be rotated. Thirty barrels of mud were spotted and after working the pipe for 55 minutes with pulls to 550,000 pounds, it was pulled free. Twenty barrels of mud were circulated and coring was begun again but the hole conditions did not seem satisfactory and a decision was made to stop drilling and attempt to run logs.

The pipe was pulled three meters off bottom and the hydraulic bit release "go-devil" was dropped. The bit was released after pressure had built to 1800 pounds. The pipe was then pulled to 4260.5 meters for logging. This length of pipe placed the bottomhole assembly below the mudline. The logging sheaves were rigged and the gamma/density/temperature tool was connected to the logging cable, checked to be sure it was operating properly and then lowered into the hole. When the tool had been run in to about 4000 meters, the brakes on the cable reel would not operate properly. The brake bands were replaced with about an hour of lost time. The tool was then lowered again and the temperature logging tool was turned on before leaving the bottom of the drill string. This log was recorded to a total depth of 4593.0 meters and then recorded the temperature at this depth for ten minutes. The gamma/density log was recorded as the tool was pulled up to 4550 meters. It was then lowered to bottom to log a repeat section for comparison. As the tool was pulled for this repeat section, the density did not appear to be operating properly but the hole was logged to 4274 meters. Then the calipers were closed and the tool again lowered to 4400 meters. It was once again pulled to 4274 meters and the gamma appeared to be working but not the density. The calipers were then closed and the tool pulled to the derrick floor. When the density tool was checked, it was found that an "O" ring on the radioactive source had leaked and therefore the density log was not a valid recording.

The gamma/sonic tool was then connected and the tool operated properly when checked on deck. It was then lowered to 152 meters where it could not be made to operate and was then pulled back to the derrick floor. The gamma/density tool, which had been repaired, was then run into the hole and a successful log run was made. After this tool was recovered, the logging sheaves were laid down and the drill string was pulled. At 0200 hours, May 29, Site 495 was completed.

SITE 496

The move of 36.9 miles northeasterly across the mid-American Trench from Site 495 was made in 5 1/4 hours and included some minor profiling. Based on this profiling, offsets of 1400'N and 400'E were placed in the computer after the beacon was dropped at 0806 hours, May 30.

The drill string was madeup and included the 41 joints of aluminum pipe that is presently being tested when the water depth allows it. The hole was spudded at 1630 hours, May 30, and the mudline was found 5 meters ddeper than recorded by the PDR.

The hole was cored continuously and recovery was about average. Dry gas was identified at a rather shallow penetration and continued as the hole was deepened. After 35 cores had been recovered, the gas pressure within cores began to increase dramatically. Not only were the caps blown off the cut sections of the core, but the liner and cores were explosively extruded from the inner core barrel a number of times. The methane-ethane ratio began decreasing abnormally fast and in the last three cores heavier components, up to C_5, were identified. Due to these conditions which could indicate a close proximity to petroleum plus the danger in handling the highly pressured cores, a decision was made to abandon this location. Two 50 sack plugs of cement were placed in the hole. The pipe was then pulled and the site was abandoned at 1530 hours on June 1. No attempts to log were made.

SITE 497

Site 497 was located about five miles downslope in a southwesterly direction from Site 496. This location was selected after about two hours of profiling and a 13.5 kHz single life beacon was dropped at 1725 hours, June 1. The drill string was then madeup and a mudline core established bottom at 2358 meters, which was only one meter deeper than that recorded by the PDR.

Continuous coring was begun and fairly good recovery was obtained. Gas shows began early with a rather high methane/ethane ratio and associated bulging of the section core liner caps. However, with increased depth, not only did the ratio begin to drop but some of the core material was rather violently extruded from the liner after the core catcher sub had been removed from the inner barrel. With a continuation of this trend, it was decided that the drilling should be discontinued and the downhole logging program done before the hole was cemented.

The hole was circulated clean with 30 barrels of mud and after the inner core barrel was recovered, the hydraulic bit release "go-devil was dropped into the pipe. When the "go-devil" landed, the pipe was pressured and, at 2000 pounds, the bit was released. The drill string was then pulled to a logging depth of 2466.0 meters. The gamma/density/temperature tool was then made up and lowered in the pipe. The temperature log was started at 2358 meters and continued recording to a depth of 2721.0 meters. The temperature increased from 38°F to 46.32°F. The gamma-density was then run from 2721 meters to 2470 meters. The density values appeared to be recording correctly, but the gamma curve was definitely not what it should be. The tool was lowered to 2720 meters and re-recorded, however, the results were the same, so the calipers were closed and the tool was pulled to the rig floor. The gamma/sonic tool was then made up and run in the hole. The tool stopped at 2488 meters and could not be lowered below this depth. This tool was pulled and preparations were made to wash the pipe back to bottom and thus remove any bridges. This was done carefully because the bit had been dropped and therefore the pipe could be plugged if not washed down properly. The cleanout run was made without incident. The gamma/sonic tool was rigged again and lowered into the hole. However it did not reach bottom because of another bridge at 2606 meters. At about the same time the surface logging equipment failed and it was decided to pull the tool. When this tool was recovered it was found to be defective. The gamma-density tool was rigged again and run in the hole in hopes of getting a complete log. The power supply in the logging unit again developed problems, so a decision was made to cancel the remaining logging program and move to the next site. After the tool had been recovered the hole was plugged with cement. One plug of 230 sacks was pumped in with the pipe at 2732 meters, the other 230 sack plug was pumped in with the pipe hanging at 2532.5 meters. Following this the pipe was pulled and the site was abandoned at 1412 hours, June 5.

SITE 498

The final location for Site 498 was the result of a shipboard review of the seismic profiling done by the KANA KEOKI while it was participating in the emplacement and testing of the seismic experiment equipment at Site 494. Based upon this information, the ship departed Site 497 and traveled approximately 17 1/2 miles southwest. The 16.0 kHz beacon used for positioning at Site 494A, helped to locate the place where a 13.5 kHz double life beacon was dropped at 1901 hours, June 5. The final beacon offsets placed the location of Site 498 one and one tenth miles east southeast of Site 494. The drill string was then made up and run. One "water core" was recovered before the mudline was established at 5497 meters. As the sandline overshot was being lowered to recover core No. 2, the weight indicator began to show rapidly changing weights. With about a wrap and a half to touch down with the core barrel, the weight suddenly dropped from 5000 pounds to 1000 pounds and stayed at this weight. The unreeling was stopped and a check of the sheaves in the crown revealed that the rim of one of the two sheaves had worn through and broken off. This allowed the cable to fall to the hub of the sheave. There was no way that the sheaves could be replaced so a plate was welded on the hub to keep the cable on it as it was respooled. This operation was carried out successfully without any apparent damage to the cable. Because the sandline sheaves would have to be replaced, the drill string was pulled above the mudline to protect it while the changing out of the sheaves was accomplished. Therefore, Site 498 was abandoned at 1945 hours, June 6, when the mudline was cleared.

HOLE 498A

The damaged sandline sheaves were taken down and replaced with a new set. This was done instead of changing over to the drawworks sandline because of potential line tar problem. The drawworks sandline was a brand new line with a very heavy coating of line tar. It was probable that the same problem that developed at te 494 would reoccur. Therefore, after changing the sheaves, the drill string was picked up and Hole 498A was spudded at 0503 hours, June 7. The hole was washed to 31.5 meters where a coring and washing program began which would continue to 200 meters below seafloor. Continuous coring would then begin. This program was implemented because Hole 494A had been continuously cored and it was believed that the same geological section would be penetrated. After core No. 11 had been cut, the Bowen sandline could not be used because a bearing problem in the sheaves had developed. Therefore, it was necessary to attach the overshot to the drawworks sandline to recover the core barrel while the new sheaves were removed from the top of the derrick and repaired.

When core No. 15 was recovered, frozen sands (clathrates) were found and the methane/ethane ration dropped to 417 and, in addition, traces of C_3 and C_4 were recorded. The C_3 trace was the largest value recovered up to this point in the leg. In addition, some of the earlier cores had been extruded from the inner core barrel when the core catcher sub was removed. All of the conditions indicated that a potentially dangerous situation was developing and drilling was halted after five meters of core No. 16 had been cut.

The hole was circulated clean and the bit was picked up to a depth of 5804 meters or 8 meters off the bottom of the hole. The rotary shifting tool was then dropped to activate the mechanical bit release. When the overshot was lowered and the shifting tool picked up, all the indications were that the bit had been released. The tool was recovered and the downhole logging sheaves were rigged.

The gamma/density/temperature tool was then rigged and tested on the catwalk and all the systems worked correctly. This tool was then lowered in the pipe, but when it reached the bottom of the pipe, the weight indicator showed that it had stopped. The tool was picked up and set down twice and still could not go deeper. The logging tool was then pulled to the derrick floor. The logging sheaves were set back and the Bowen sub picked up. The drill string was then washed back to 5813.5 meters and a core barrel was dropped. This was done to try and drop the bit if it had shifted and would not fall off. The core barrel landed and pump pressure indicated that the bit was still attached. The core barrel was recovered and the rotary shifting tool was dropped again. After it had reached bottom, the overshot was picked up and lowered into the pipe to try to release the bit. After all, except a layer and a half of the sandline needed had been unspooled, the weight indicator showed the tool to be stopped. The line was then pulled because it was felt that line tar had collected in the pipe and stopped the tool. When about 6500 feet of line remained in the hole, a large snarl was pulled into the line wiper. A cable clamp was put on the cable and the snarl cut off. The balance of the cable was pulled by using the tugger and a cable clamp. This removed about 90 feet at a time. After two hours the broken end of the cable was pulled to the derrick floor leaving about 5000 feet of cable in the hole. It was now necessary to pull the pipe to recover the balance of the cable. Before the pipe could be pulled, plans had been to cement the hole completely because of the gas shows. However, with the line, the overshot, and the shifting tool all in the pipe, it was felt that attempting to cement the hole could jeopardize the recovery of the drill string. Therefore, the hole was filled with heavy mud and the pipe was pulled. Recovery of the pipe and cable together was a time consuming task but all was finally recovered. At 1455 hours, the bit was on the derrick floor and the hole was abandoned at this time on June 10.

The equipment, when recovered, confirmed the excessive line tar theory and validated the decision not to attempt to fish for the wireline or try to pump cement through the mess.

SITE 499

Before going to Site 499, the ship traveled to the port of Acajutla, El Salvador to pick up some chemicals that were needed in the engine room. The round trip required about 36 hours. The beacon for Site 499 was dropped at 0302 hours on June 12. The profiling gear was picked up and the ship was positioning in the automatic mode at 0421 hours. The drill string was then made up and run in to begin coring. One water core was recovered before the bottom was established at 6126.5 meters with the mudline core. After core No. 4 was cut it could not be recovered, so after two attempts another core barrel was dropped which had short, hard catcher teeth in the core catcher sub. This was done because a line tar accumulation problem was thought to have developed. However, the next wireline run failed to recover the core barrels. The overshot was changed and when completed, the next run recovered both core barrels. Coring continued with no further problems. The lithologic contact between the dark olive grey sediments and chalk was reached in core No. 23. Two more cores were cut and recovered before a decision was made to discontinue drilling. The bottomhole assembly did not include a bit release. Therefore, the hole was filled with heavy mud and was considered to be abandoned when the bit cleared the mudline at 1904 hours, June 14.

HOLE 499A

When the drill string had cleared the mudline at Hole 499, offsets were put into the computer for Hole 499A. The ship was then moved to this new location which was 2999 feet north and 600 feet west of Site 499 with the drill string hanging at 6001 meters. The hole was then spudded at 2342 hours, June 14. The first core taken established the mudline at 6132.0 meters. A total of five cores were recovered before the drilling was stopped. It was felt by the scientific staff that this depth of penetration was sufficient to establish a good geological correlation with Hole 499. The drill string was pulled and the hole was offically abandoned when the bit reached the derrick floor at 2027 hours, June 15.

HOLE 499B

At the completion of Hole 499A, the plan had been to return to Site 494 and drill a twin hole there. However, these plans were changed and the ship returned to the area where Hole 499 was drilled. No offsets were made to the computer and when the ship was positioning in the automatic mode the makeup of the drill string began. Running in the hole was stopped for 40 minutes while a broken cable on the drilling line guide was repaired and then the string makeup was completed. A mudline core was not taken because a mudline core had been taken at Hole 499 and the PDR records, which were made when the ship was being positioned, were almost identical. Therefore, it was felt that mudline core was unnecessary. The hole was then spudded at 1045 hours, June 16, and was washed and drilled to a subbottom depth of 201.0 meters before continuous coring began. The main objective of this hole was to reach the hoped for igneous rock contact with the chalk. This point was reached while cutting core No. 9. However, shortly after the drilling had slowed down, the pipe began torquing and then suddenly became stuck. After about 20 minutes of working the pipe, it was freed and the drill string was pulled above the contact while the cored material was recovered.

Before coring began again the hole was circulated clean with 30 barrels of mud. After again coring for 40 minutes and only penetrating about one meter, the pipe stuck a second time. Circulation and bumper sub action were maintained but the pipe could not be rotated. After an hour of working the pipe, rotation was regained and the pipe was loose. Because of these poor hole conditions. it was decided that the hole should be terminated. The hole was then filled with heavy mud and, when the pipe cleared the mudline at 1230 hours, June 17, the hole was officially abandoned.

HOLE 499C

After clearing the mudline at Hole 499B, the drill pipe was pulled to 5982 meters and the ship was offset 370'N and 930'W. This position was chosen to make a geological comparison with Hole 499B. The hole was spudded at 1446 hours on June 17 and washed and drilled to a subgottom depth of 260.0 meters. At this point the drill rate slowed and the center bit was retrieved. A core barrel was dropped and three meters were cored. Only .3 meters of igneous rock was recovered but this satisfied the scientific requirements. The hole was then circulated clean after a wiper run to prepare the hole for a downhole logging program. The bit was lowered to three meters from bottom and the hydraulic bit release "go-devil" was dropped. When it reached bottom, the pipe was pressured up but the bit release system could not be activated. After 20 minutes of trying with no success, the overshot was lowered and the "go-devil" retrieved. When recovered, the chevron seals were all missing which may account for the failure to release the bit. The hole was then filled with heavy mud and the drill string pulled. The hole was abandoned at 1406 hours, June 18, when the bit reached the derrick floor.

HOLE 499D

Hole 499D was located 0.6 mile south-southwest of Hole 500B. After pulling above the mudline at this last location, the ship was positioned slowly to the new one using the 13.5 kHz beacon which had been dropped on June 12 and was still strong enough to position on easily. The hole was spudded at 1906 hours, June 23, and was confidently being washed in when hard material was encountered at 212.5 meters below seafloor. The wash barrel was recovered and coring began when the new barrel reached bottom. After 3.5 meters had been cut with a great deal of difficulty due to the torquing, the drill string became stuck. Circulation and bumper sub action were retained but the pipe could not be rotated or reciprocated. It was worked for 20 minutes with pulls to 575,000 pounds when rotation was suddenly possible and the pipe was free. The drill string was pulled above the dangerous area and the core barrel was recovered. It contained .75 meters of mud and the shifting tool was dropped to release the bit for logging. The overshot was lowered and the shifting tool waspicked up with the pipe hanging at 6336 meters. The weight increased to about 10,000 pounds as the shifting tool was raised and then dropped off. It was lowered again but the weight did not increase when it was pulled up. When the connection was broken, after the tool reached the derrick floor, water poured out indicating that the float valve was gone and the release had been made.

The gamma/density/temperature log was the first log to be run. The temperature log was recorded as the tool was lowered and recorded a mudline temperature of 37.46°F and a bottomhole temperature of 58.12°. This tool was allowed to record for ten minutes at the bottom of the hole to try to obtain a stabilized temperature. The gamma/density run began as the tool was pulled. A problem in the computer caused the run to stop. After this had been corrected the caliper arms were closed and the tool lowered to bottom again. When the arms were opened and the tool pulled up the hole, the density part of the tool was not working. The arms were opened and closed and opened again but the tool would not work properly. It was then pulled and the gamma log was recorded. When the tool was recovered 8-10 pieces of hard fine sandstone were found in the calipers. They had been caught in there and when the arms were closed the first time, they pinched a wire which then shorted. The gamma/sonic was then made up and recorded with no additional problems. It also recorded the variable density log (VDL) before the tool was pulled. Because of time constraints the density tool was not run again. The pipe was then lowered carefully and the hole filled with heavy mud before it was pulled. The hole was abandoned at 0530 hours, June 25, when the bottom of the top connector reached the derrick floor.

SITE 500

Due to the restrictions for drilling on the eastern slope of the mid-America Trench after clathrates had been encountered there, the site chosen for hydraulic piston coring was moved to the trench bottom. This site was located 1.1 miles northerly from Site 499 and after the ship had been moved and the beacon dropped at 1436 hours, June 18, Site 500 began.

The drill string was made up for the hydraulic piston coring program which uses a 10 1/2" bit and this restricts the use of other coring devices and many downhole logging instruments. After the drill string was made up and run to 6086.5 meters, the core orientation equipment was checked at the derrick floor before it was lowered into the pipe for additional checks with the hydraulic piston coring setup. The tool was run on the sandline and when recovered, the camera had not worked because part of it had unscrewed, probably due to vibration. In addition, the hydraulic piston core barrel had scoped out without the necessary pressuring up procedure and the aluminum orientation ring had many orientation marks instead of only one and was badly worn on one side. The seals and "O" rings and also been destroyed or were missing. This was thought to be the result of pulling the tool too fast when it was recovered. The tool was then redressed and lowered again. After the tool was down, the pump was turned on to hold it in place while the orientation picture was being taken. When the tool was recovered, after pulling at 100 meters per minutes, it was again scoped out. Two and one half of the five seals were destroyed and the aluminum orientation ring had 19 orientation marks despite the pressure used and was again worn on one side. The camera had worked properly but the picture was blurred. It was then decided to defer further orientation calibration until coring had begun. The hydraulic piston corer was then rigged to begin the coring program when the first tool was on bottom after being lowered on the sandline. It requires two pumps to build to the pressure to activate the piston effect. This pressuring problem was attributed to the fact that water was leaking at the blowout preventor because it could not be tightened enough to make a seal with the sandline. The reason this could not be accomplished was due to the decrease in the diameter of the sandline working at the 6100 meter depth. When the tool was recovered it had not scoped, the aluminum ring had no orientation mark and was again worn on one side and the 2 1/2" seals were destroyed. The tool had been pulled at 100 meters/min as had been done successfully on Leg 64. Two more runs were made with the same results. Because no orientation marks were on the aluminum rings, it was felt that the tool was not seating completely and that there was some object in the pipe to cause this. After the third attempt the tool was pulled to redress it completely and it was noted that the catcher shoe was damaged as if it had seated a number of times on a hard object. It was then recalled that the piston head was missing when the tool was scoped together after the second orientation run. It was believed that possibly this head lying in the bit could be the problem, so the drill string was pulled. When it was recovered, the piston head was found lying in the throat of the bit with marks on it from the piston core head. It was able to land in the bit in this position because there was no float valve or landing bearing in the drill string.

After recovery of the hydraulic piston core bit, it was decided to drill this site using the conventional coring setup because of the short time remaining. The drill string was made up with a mechanical bit release at the bottom. One water core was taken and then the hole was spudded at 0228 hours on June 21. Coring began and after cutting core No. 8, the inner barrel could not be recovered. After two attempts with no recovery, it was feared that a line tar problem could have developed. A second core barrel with short hard catcher teeth was dropped and the overshot was changed.

On the next run both core barrels were recovered. Coring continued through core No. 14 and while it was being retrieved, a high pressure leak developed in the Bowen unit. The problem was a leaking weld on the manifold flange block which was repaired and coring continued. Core No. 19 at a depth beginning at 158.5 meters below seafloor, encountered very hard material and required 131 minutes to cut only a seven meter core. Torquing had also developed so after the core was recovered with basaltic material in the core liner, the hole was abandoned. This was done because the scientific objective was a longer and more complete geologic section than had been found in this hole. The hole was then filled with heavy mud and it was abandoned at 2210 hours, June 22, when the bit was pulled above the mudline.

HOLE 500A

The ship was offset 1670'S and 680'W of the beacon used for positioning on Hole 500. After this location was reached, Hole 500A was spudded at 0032 hours, June 23. The hole was washed to 95 meters and core No. 1 was cut and recovered. The plan was then to wash to about 150 meters and core again. However, hard drilling began at 114.5 below seafloor. It required 65 minutes to cut the last 5.5 meters to 120.0 meters below seafloor and only 0.22 meters of basaltic rubble was recovered. Again, while this core was being cut, torquing increased measurably and the decision was made to abandon the hole. This was accomplished when the bit was pulled above the mudline at 0829 hours, June 23.

HOLE 500B

It was felt that the basaltic material recovered at Hole 500A was strictly a local accumulation. Therefore, no definite offsets were put into the positioning system and after the ship had drifted about for 12 minutes, the drill pipe was lowered and Hole 500B was spudded at 0842 hours, June 23. The pipe was washed down to 105 meters and continuous coring began. The third core, which began at 124.0 meters below seafloor, again encountered the hard material with torquing and sticking so the decision was made to abandon the location. The hole was abandoned at 1710 hours, June 23, when the bit was pulled above the mudline.

DRILLING AND CORING ASSEMBLIES

The standard bottomhole assembly was used on all sites. The standard drilling assembly for this leg consisted of the bit, hydraulic or mechanical bit release sub, top connector, profile sub, core barrel, top sub, head sub, three 8 1/4" drill collar. The exception to this assembly was on Hole 499, 499A, 500 and 500A where the bit release assembly was changed to the standard bit sub. The other exception was when the hydraulic piston corer was run which requires a special head sub.

BITS

Only F93CK core bits were used on this leg and all performed very well. Most of the rocks that were drilled were soft clays, mudstones and some chalks which is ideal material for this long toothed bit. One of these bits drilled over 1100 meters of hole. Very little basalt was cored because this material was apparently a rubble and created dangerous drilling conditions for the equipment.

The special hydraulic piston core bit was placed in the string but was never used because of other equipment problems.

SPECIAL TOOLS

As had been done on Leg 65, the Hawaii Institute of Geophysics used the CHALLENGER to place a seismometer in one of the drilled holes. After the bit reached total depth at Hole 494A, it was released and the downhole logging program was done. When these tools were recovered, the seismometer package was connected to the logging cable and lowered into the hole. After checking to make sure the tool was operating properly, the cable was cut at the derrick floor and the drill pipe was stripped over it. When all the pipe was recovered, each end of the cut cable was reheaded and then these were connected. The ship was then allowed to move off location as the remaining cable (20,000') was reeled off. When the cable neared the end it was clamped off, cut and then reheaded. It was then attached to the recording package and a 1 1/4" polypropylene line was attached. The recording package was lowered at the rope and was unspooled under tension as the ship again moved away. This tension was maintained in order to ensure that the cable would not be piled in a heap. Approximately 30,000 feet of rope was unspooled in this manner. At the end of this rope a recovery buoy was attached and a 3/4" rope was attached to ensure strain on the rope as the package was lowered. However, tension built up quickly and, about two minutes after this operation started, the 3/4" line broke.

Everything apparently worked as it should even though the line broke prematurely as the KANA KEOKI returned on June 22 and recovered the instrument package on schedule.

The pressure core barrel was run once unsuccessfully in soft sediments. When the tool was recovered the catcher sleeve fingers were found to be bent and folded upward. The top of the catcher sleeve was flared outward and allowed only 1 7/8" of scope before latching on the ramp of the upper ball valve seat. All the shear pins had sheared. Even though the ball could not close, 550 psi was trapped in the barrel. Less than one meter of core was recovered and the liner was split 11" below the float and immediately above the lower liner support. The tool had been packed and will be sent back to shore for evaluation.

The other special tool that was attempted was the hydraulic piston corer (HPC). This tool also did not operate successfully when part of the tool came unscrewed and fell into the throat of the core bit. Due to time constraints the tool was not run a second time.

LOGGING

A downhole logging program was run on four holes with varying degrees of success. The three tool combinations that were run are as follows:

1. Gamma/Density/Caliper Temperature
2. Gamma/BHC Sonic
3. Gamma/Guard/Neutron

At Site 494A, a good gamma density and temperature log was obtained but the sonic failed to operate in the pipe after being checked on the derrick floor. The neutron stopped on a bridge in the hole, the bridle was damaged and no log was obtained.

At Site 495 the temperature and gamma/density were good logs but again the sonic failed to work.

At Site 497, the temperature log was good but the gamma/density and sonic would not work and, when the tools were checked, a leak similar to that which occurred on Leg 65 was found in the cable head. At Site 499D, the temperature log was good as was the gamma. The density was not good because when the caliper arms were opened for a short logging distance and then closed, some fine sandstone fragments were caught in the calipers and damaged a cable causing the tool to become inoperative. The sonic log, however, was run successfully as was the variable density log using the same sonic tool.

HYDRAULIC BIT RELEASE AND MECHANICAL BIT RELEASE

The hydraulic bit release was in the bottomhole assembly on Holes 494, 494A, 495, 496, 497, 498B, 499B, 499C and released on 494A, 495, and 497. It failed to release only once and that was at Site 499C. This was quite an improvement over what had been experienced on the previous leg and was probably due to the time that was spent in port working on these tools and then testing them to be sure of their operation. In addition, Global Marine technicians responsible for this tool are becoming more familiar and competent in their assembly and operation.

The mechanical bit release was part of the bottomhole assembly at Holes 498, 498A, 500, 500A, 500B, and 499C. At two sites the shifting tool was sent down to release it and it worked 50% of the time. The first attempt at actuation was at Hole 498A and it appeared to shift, but the logging tool would not go out of the pipe and when a second attempt to shift it was made, a line tar problem developed, the sandline was broken and it was necessary to pull the drill string. The second attempt to release was made at Hole 499D. It released with a pull of about 10,000 pounds and when the shifting tool was pulled, it was possible to run the downhole logging program.

BEACONS AND POSITIONING

The following beacons were dropped on Leg 67:

SITE NO.	MAKE	FREQ.	SERIAL NO.
494A	ORE	13.5 S.L.	491
494A	ORE	16.0 D.L.	477
494A (mid)	ORE	16.0 D.L.	481
495	ORE	13.5 S.L.	492
496	ORE	16.0 S.L.	482
497	ORE	13.5 S.L.	493
498	ORE	13.5 D.L.	486
499, A,B,C,D,	ORE	13.5 D.L.	488
500, A,B	ORE	16.0 S.L.	483

All the beacons that were dropped worked well except No. 492 which had some distortion of the wave shape; No. 478 which was found to be weak when it was "soaked"; and No. 487 which died as it was hung over the side of the ship just prior to dropping. The positioning system worked well except for the need of occasional offsets after the first day of positioning at Site 495. The system checked out satisfactorily so the weakness was probably in the beacon. The weather conditions changed rapidly due to squalls with winds building to 50-60 mph from a dead calm at Site 497, 500 and 500A. These conditions required manual settings as positioning instability was experienced due to simultaneous reception of two beacons of the same frequency at Site 494A and Site 500A.

COMMUNICATIONS

All communications for Leg 67 were handled by Station WWD, La Jolla, California. This station could be contacted any time during its working hours which coincided with our daylight day. A few phone patches were made with WWD to DSDP. Also patches were made using the commercial stations WOM, Miami, KMI and Oakland.

Due to the Hawaii Institute of Geophysics experiment, the vessel KANA KEOKI was being used to coordinate their experiment and good telephone communication was made with them.

Most of the weather observations and bathythermograph messages were sent by way of the Coast Guard Station in Puerto Rico. Many phone patches were made from the two amateur stations onboard the CHALLENGER with very satisfying results. These patches also included some made to Central America stations. There were no communication equipment breakdowns. Traffic was a little above normal for outgoing messages and about normal for incoming.

PERSONNEL

Although all the scientific objectives of the leg were not accomplished due to some unexpected geological findings, the morale and enthusiasm of the scientists was unusually good. In addition, some of the scientists could not come aboard until the HIG experiment was completed. This was because of berthing accommodations and Coast Guard regulations.

Global Marine personnel teamed together to make the leg as successful as possible. One noteworthy area was the good performance obtained by the bit release program and the people responsible for its success.

The SIO marine technicians provided their usual excellent service which was greatly appreciated by the scientific participants.

DOWNHOLE LOGGING PROGRAM

The downhole logging program enjoyed both success and disappointment. When the tools were run at the first location some technical problems developed which the logging engineer could not solve. This problem was discussed with Gearhart-Owen and they were able to work out an exchange of engineers when the research ship KANA KEOKI came to the CHALLENGER. After this exchange was made, the technical problems were corrected and a relatively successful logging program was enjoyed for the balance of the leg.

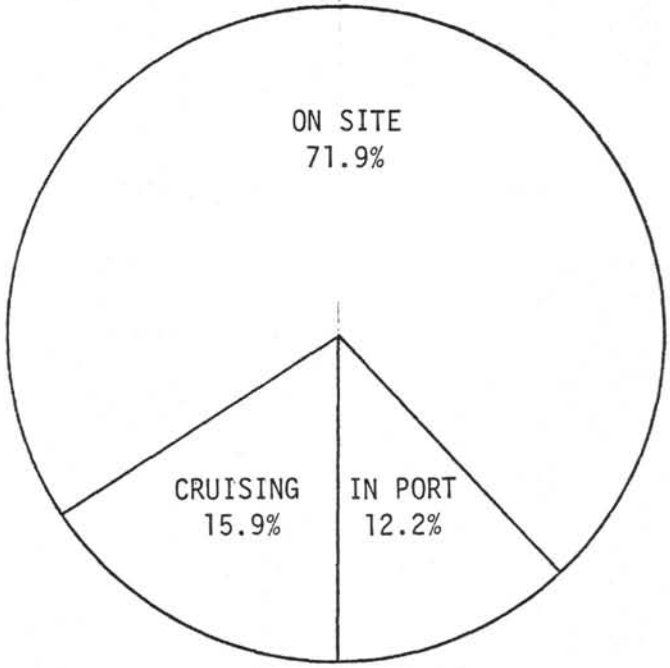
R. R. Knapp
Cruise Operations Manager
Deep Sea Drilling Project

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
OPERATIONS RESUME
LEG 67

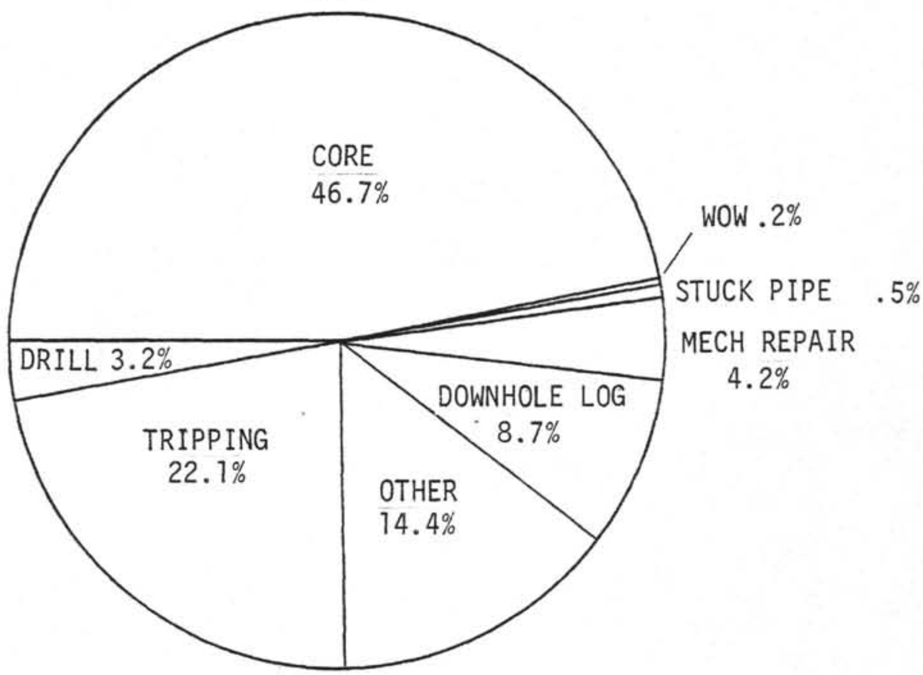
Total Days (May 2, 1979 - June 27, 1979)		56.0
Total Days in Port		6.8
Total Days Cruising Including Site Survey		8.9
Total Days on Site		40.3
Trip Time	8.9	
Drilling Time	1.3	
Coring Time	18.8	
Waiting on Weather	0.1	
Stuck Pipe	0.2	
Mechanical Repair	1.7	
Downhole Logging	3.5	
Other	5.8	
Total Distance Traveled Including Survey (Nautical Miles)		1596.9
Average Speed (Knots)		7.52
Number of Sites		7
Number of Holes Drilled		15
Number of Cores Attempted		254
Number of Cores With Recovery		243
Percentage of Cores With Recovery		95.6
Total Meters Cored		2315.5
Total Meters Recovered		1181.27
Percentage Recovery		51.0
Total Meters Drilled		1147.5
Total Meters of Penetration		3463.5
Percentage of Penetration Cored		66.8
Maximum Penetration (Meters)		446.5
Minimum Penetration (Meters)		43.0
Maximum Water Depth (Meters)		6132.0
Minimum Water Depth (Meters)		2064.0

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT

TOTAL TIME DISTRIBUTION
LEG 67



ON SITE TIME BREAKDOWN
LEG 67



DEEP SEA DRILLING PROJECT
TIME DISTRIBUTION
LEG -

Date	Site No.	Cruise	Trips	Drill	Core	Stuck Pipe	W.O.W.	DOWNHOLE MEASURE	Mech. Repair	Port Time	Re-Entry	Other	Total Time	Remarks
5/02/79 5/09/79										156.7			156.7	
5/09/79 5/13/79		103.3										2.1	105.4	
5/13/79 5/17/79	494		37.2		17.2				20.6			11.0	86.0	
5/17/79 5/25/79	494A		27.3	1.0	100.0	1.9		31.2	1.3			40.8	203.5	
5/25/79		4.4										.9	5.3	
5/25/79 5/30/79	495		12.8		64.1	.8		16.0	1.9			3.8	99.4	
5/30/79		5.3										.8	6.1	
5/30/79 6/01/79			10.4		39.8							5.2	55.4	
6/01/79		1.8										.3	2.1	
6/01/79 6/05/79			13.5		45.0			17.4	7.0			9.7	92.6	
6/05/79		4.5										.3	4.8	
6/05/79 6/06/79			11.8	2.3	2.5		.9		2.5			4.7	24.7	
6/06/79 6/10/79			13.0	13.5	39.3			7.3	1.6			16.5	91.2	
6/10/79 6/11/79		15.8										.5	16.3	
6/11/79										6.8			6.8	
6/11/79 6/12/79		13.0											13.0	
6/12/79 6/14/79			12.6		47.9							3.6	64.1	
6/14/79 6/15/79			14.1		9.4							1.9	25.4	
6/15/79 6/17/79			12.5	4.4	18.1	1.3			.8			2.9	40.0	
6/17/79 6/18/79			10.6	4.3	2.6							8.1	25.6	

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
6/18/79		.3										.2	.5	
6/18/79 6/22/79			26.0		52.1				6.5			19.0	103.6	
6/22/79 6/23/79			.6	3.0	4.0		.7					2.0	10.3	
6/23/79			.5	1.4	6.1							.7	8.7	
6/23/79 6/25/79			9.5	2.6	2.3	.4		13.5				8.0	36.3	
6/25/79 6/27/79		60.2											60.4	

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
SITE SUMMARY
LEG 67

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
494	12^{o} 43.55'N	90^{o} 56.01'W	5425+	0	0		0						51.5	
494	12^{o} 43.00'N	90^{o} 55.97'W	5529.0	4	4	100.0	37.5	30.43	81.1		37.5	75.0	34.5	
494A	12^{o} 43.01'N	90^{o} 55.97'W	5529.0	35	35	100.0	329.0	91.71	27.8	37.5	366.5	12.2	203.5	289.5
495	12^{o} 29.78'N	91^{o} 02.26'W	4150.0	49	48	97.9	446.5	332.72	74.5		446.5	48.2	99.4	99.4
496	13^{o} 03.82'N	90^{o} 47.71'W	2064.0	40	38	95.0	378.0	199.35	52.7		378.0	38.6	55.4	55.4
497	12^{o} 59.23'N	90^{o} 49.68'W	2358.0	42	40	95.2	396.5	224.57	56.6		396.5	36.5	92.6	92.6
498	12^{o} 42.68'N	90^{o} 54.94'W	5497.0	2	2	100.0	12.5	3.87	30.9	47.5	60.0	57.1	24.7	
498A	12^{o} 42.68'N	90^{o} 54.94'W	5497.0	16	15	93.7	142.5	46.54	32.6	179.0	321.5	18.8	91.2	115.9
499	12^{o} 40.26'N	90^{o} 56.69'W	6126.5	25	22	88.0	229.0	118.99	51.9		229.0	71.1	64.1	
499A	12^{o} 40.57'N	90^{o} 56.90'W	6132.0	5	4	80.0	43.0	12.59	29.2		43.0	186.9	25.4	
499B	12^{o} 40.23'N	90^{o} 56.68'W	6126.5	10	10	100.0	85.5	21.35	24.9	201.0	286.5	68.5	40.0	
499C	12^{o} 40.30'N	90^{o} 57.65'W	6112.0	1	1	100.0	3.0	0.3	10.0	260.0	263.0	115.3	25.6	
500	12^{o} 41.35'N	90^{o} 56.49'W	6123.0	19	18	94.7	165.5	73.28	44.2		165.5	35.2	103.6	
500A	12^{o} 41.05'N	90^{o} 56.58'W	6127.0	2	2	100.0	15.0	8.07	53.8	105.0	120.0	66.6	10.3	
500B	12^{o} 41.05'N	90^{o} 56.58'W	6127.0	3	3	100.0	28.5	16.75	58.7	105.0	133.5	96.7	8.7	122.5
499D	12^{o} 40.45'N	90^{o} 56.70'W	6126.0	1	1	100.0	3.5	0.75	21.4	212.5	216.0	127.0	36.3	191.4
			TOTAL	254	243	95.6	2315.5	1181.27	51.0	1147.5	3463.5			966.8

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
BIT SUMMARY
LEG 67

HOLE	MFG.	SIZE	TYPE	SERIAL NUMBER	METERS CORED	METERS DRILLED	METERS TOTAL PENET	HOURS ON BIT	CONDITION	
494	Smith	9 7/8"	F93CK	281J2	37.5		37.5	0.5	Rerun in Hole 494A.	
494A	Smith	9 7/8"	F93CK	281J2	329.0	37.5	366.5	29.8	Released.	
495	Smith	9 7/8"	F93CK	282J2	446.5		446.5	9.25	Released	
496	Smith	9 7/8"	F93CK	278J2	378.0		478.0	9.78	T1-B1-SEI	
497	Smith	9 7/8"	F93CK	278J2	396.5		396.5	10.86	Released	Rerun-good condition after 496.
								20.64	774.5 m	
498	Smith	9 7/8"	F93CK	967K0	12.5	47.5	60.0	1.05		Will use to drill 498A-381.5 m penet.
498A	Smith	9 7/8"	F93CK	967K0	142.5	179.0	321.5	17.1		
499	Smith	9 7/8"	F93CK	967K0	229.0		229.0	3.22		
499A	Smith	9 7/8"	F93CK	967K0	43.0		43.0	.26	T1-B1-SEI	
								21.63		
499B	Smith	9 7/8"	F93CK	274J2	85.5	201.0	286.5	4.18		
499C	Smith	9 7/8"	F93CK	274J2	3.0	260.0	263.0	2.28	T1-B1-SEI	One cutting insert missing.
								6.46		
500	Smith	10 1/2"	HPC	126489						Pulled without coring due to HPC part dropped into bit throat.
500	Smith	9 7/8"	F93CK	274J2	165.5		165.5	4.7		
500A	Smith	9 7/8"	F93CK	274J2	15.0	105.0	120.0	1.8		
500B	Smith	9 7/8"	F93CK	274J2	28.5	105.0	133.5	1.38		Total time including 499B,C,D, and 500, A, B, - 20.8 hrs.
499D	Smith	9 7/8"	F93CK	274J2	3.5	212.5	216.0	6.46	Bit released.	Total penetration of 1184.5 meters.
								14.34		

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
BEACON SUMMARY
LEG 67

SITE NO.	MAKE	FREQ kHZ	SERIAL NUMBER	SITE TIME HOURS	REMARKS
494	ORE	13.5 S.L.	491	59.1	
494	ORE	13.5 S.L.	491	34.5	
494A	ORE	13.5 S.L.	491	161.2	
494A	ORE	16.0 D.L.	477	42.3	
494A	ORE	16.0 S.L.	481	0	Dropped for HIG experiment.
495	ORE	13.5 S.L.	492	99.4	
496	ORE	16.0 S.L.	482	55.4	
497	ORE	13.5 S.L.	493	92.6	
498	ORE	13.5 D.L.	486	24.7	
498A	ORE	13.5 D.L.	486	91.2	
				115.9 Total	
499	ORE	13.5 D.L.	488	64.1	
499A	ORE	13.5 D.L.	488	25.4	
499B	ORE	13.5 D.L.	488	40.0	
499C	ORE	13.5 D.L.	488	25.6	
499D	ORE	13.5 D.L.	488	36.5	
				191.6 Total	
500	ORE	16.0 S.L.	483	103.6	
500A	ORE	16.0 S.L.		10.3	
500B	ORE	16.0 S.L.		8.7	
				122.6 Total	

DEEP SEA DRILLING PROJECT
LOGGING SUMMARY
LEG ____

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
494A	5895.5	5529.0	5639.0	Sea Water	9 7/8"	31.2	One	Density	5695.0	5650.0	Logged density, caliper, gamma ray logs good.
							Two	Sonic	-	-	Sonic failed to work in drill pipe. Did not go to the bottom of the hole.
							Three	Laterolog	-	-	Tool stopped at bridge and swarmed line in knots.
							One	Temperature	5614.0	5713.0	Logged going down - good log.
495	4596.5	4150.0	4260.5	Sea Water	9 7/8"	16.0	One	Temperature	4124.0	4597.0	Log good.
							One	Density	4592.0	4260.0	Logs good. Logged density, caliper gamma ray.
							Two	Sonic	-	-	No log obtained. Tool did not work in pipe.
497	2754.5	2358.0	2466.0	Sea Water	9 7/8"	17.4	One	Temperature	2350.0	2721.0	Logged temperature down good
							One	Density	2715.0	2470.0	Logged density, caliper. Gamma Ray not working properly.
							Two	Sonic	-	-	Hit bridge, Started opening caliper & power supply started smoking-no log.
							Three	Temperature	-	-	Would not work-Found next day cable head had electrical leak causing sonic, G/R, temp.
499D	6338.5	6126.0	6238.0	Sea Water	9 7/8"	13.5	One	Temperature	6190.0	6328.0	Logged temp down fine - good log.
							One	Density	6326.0	6250.0	Density log no good-sand pinched line in tool when closing tool.
							Two	Sonic	6326.0	6250.0	Logged sonic,caliper, gamma ray. Tool had difficulty syncing on first wave arrival.
							Two	Variable Density	6326.0	6250.0	Log good-no real useful data obtained.

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
OPERATIONS RESUME
LEG 68 - SITE 501

Scientific objectives of IPOD Leg 68 included the sampling of young oceanic crust near the Galapagos Spreading Center and the study of effects of hydrothermal circulation on that crust. The initial two-week portion of the operating leg was designated as a geophysical "mini-leg" with emphasis on special downhole instrumentation. Only one hole was drilled and less than eight days were spent on site, but an unprecedented variety of investigations was carried out. These operations included successful deployment of a borehole televiewer and a USSR-furnished downhole magnetometers.

The voyage commenced on June 27, 1979 at Puntarenas, Costa Rica and ended July 19 at Balboa, Canal Zone, Panama. Total length of the voyage was 21.2 days, of which 7.6 days were spent on-site, 5.9 days under way and 7.7 days in port. There was no weather downtime and 0.1 day of operating time was lost to mechanical difficulties.

PUNTARENAS PORT CALL

Leg 68 began at 1751 hours, June 27, 1979 when the GLOMAR CHALLENGER anchored in the harbor of Puntarenas, Costa Rica. The vessel's arrival had been delayed several hours by a severe vibration in the starboard main shaft which forced a reduction in speed.

The port call was a hectic and frustrating one due to continuing efforts to diagnose and evaluate severe vibration problems in the starboard shaft and stern thruster No. 1. In addition neither of the pierside berths became available during the entire port call, forcing the vessel to remain at anchor far out in the harbor and greatly complicating all logistical functions.

GMI engineers and the American Bureau of Shipping inspector from Panama subjected the vessel to exhaustive inspection and three brief sea trials. Early evaluations indicated that drydocking was required and the scientific leg was cancelled. However, when inspections were completed, no interior mechanical problems had been found and the source of noise and vibration was conceded to be excessive cavitation due to heavy marine growth on the propellers and adjacent areas. The ship was pronounced seaworthy by inspecting personnel and the scientific leg was reinstated while ship's divers were assigned the task of scraping barnacles from both main screws and the propeller of stern thruster No. 1.

Air freight, consumables and personnel were moved to and from the vessel by water taxi utility craft. Special arrangements were made to transfer surface freight by barge directly from the arriving freighter to the CHALLENGER. The freighter was late in arriving at Puntarenas and the CHALLENGER's departure time was ultimately determined by the arrival on board of the last of the freight.

Work items accomplished at Puntarenas included: top overhaul of No. 7 diesel, replacement of rear oil seals of No. 8 and No. 11 diesels, cleaning and scaling of ballast tanks Q54 and Q55, repacking stern tubes of both main shafts, rewiring of drill switchboard A and Bowen hydraulic unit wiring, borescope inspection of suspect drill pipe joints, annual ABS loadline and machinery inspection and on-going GMI maintenance and inspection functions.

Finally, on July 5, the last of the recalled scientific party and the last of the freight arrived within minutes of each other. The CHALLENGER weighed anchor and was under way at 1024 hours.

PUNTARENAS TO SITE 501

A brief stop was made outside the harbor where thruster systems were tested and two positioning beacons were "soaked". A reduction in the vibration level of No. 1 stern thruster was noted.

As speed was increased, it became apparent that the cleaning of the screws had significantly reduced vibration. The vessel was able to proceed at 190 turns on the starboard shaft and 200 on the port shaft as compared with the normal full speed of 210 rpm on both shafts. An average speed of 7.3 knots was made on the transit. This was better than expected, but still at least one knot slower than could have been achieved with a clean hull and the same shaft rpm.

The ship stopped dead in the water a few miles short of the drill site to clear marine growth debris from valves in the main seawater cooling system. Emergency power was used since it was necessary to shut down the entire engine room.

The positioning beacon for Site 501 was launched at 1228 hours, July 8. The vessel surveyed 2 1/4 miles beyond the drop point, then retrieved seismic gear and returned to the beacon.

SITE 501

The drill site was located on the south flank of the Costa Rica Rift system in the Gulf of Panama, about 365 miles east-northeast of the Galapagos Islands.

A special bottomhole assembly (BHA) was made up which included an open-hole packer and a drilling torque jar in addition to the standard core barrel, drill collars and bumper subs. The BHA was pressure tested to assure that no leakage would occur on planned hydrofracture experiments. The drill string was measured on the trip to the seafloor.

Hole 501 was spudded at 0430 hours, July 9. The first punch core barrel was recovered completely fully of sediment. Since this was to be a re-entry exploratory hole, it was necessary to determine water depth accurately and two more core barrels were pulled before water depth was determined to be 3466.9 meters, agreeing within one meter with the precision depth recorder reading.

The planned spot coring program was compatible with the non-rotating jet-in test required to determine the conductor casing point for re-entry sites. It was indicated that over 100 meters of 16-inch casing could be emplaced without difficulty due to the very soft nature of the carbonate ooze sediment. Four cores were widely spaced through the upper 226 meters of sediment and excellent recovery was realized. Temperature probe/pore water sampler runs were made at 122 and 179 meters below seafloor (BSF). Continuous coring then began in chalky ooze. Alternating strata of chalk, limestone and chert were encountered at about 230 meters BSF and continued to the basalt contact at 265 meters.

About 15 meters of basalt had been cored when, without warning, the bit became stuck as the wireline trip to recover a core began. Two and one half hours of working and jarring the pipe were required to free it. When the core was finally recovered, it was found to contain chunks of the inflatable packer element. It was concluded that chances of a successful hydrofracture with a damaged packer were exceedingly slim while a formation sampler attempt would have a better chance due to the lower pressure differential across the packer. A four-meter core was then cut to confirm acceptable hole conditions and the hole was flushed with gel mud. More packer element debris was recovered in this core.

An ammonium chloride treated seawater tracer slug was started down the pipe and the sampler go-devil was dropped. More tracer was pumped behind the go-devil. Unfortunately, the relative rate of fall of the go-devil through the fluid in the pipe was misjudged. The go-devil arrived at the bit before the tracer had been emplaced. On pressuring up to inflate the packer, it was found that continuous pumping was necessary to maintain pressure---indicating a leak in the packer element. Pressure was built without difficulty when the pump rate was increased. When surface gauge pressure had reached approximately 1200 psi, a weight loss of about 20,000 lbs was noted at the rig floor and the experiment was aborted by opening the standpipe bleeder valve. When conditions had returned to normal, a wireline trip was made to retrieve the sampler go-devil. The go-devil was found to be stuck and the overshot pin was sheared on the first recovery attempt. On the second attempt, the pipe was pressured up to shift a sleeve and equalize pressure around the go-devil as a hydraulic lock was suspected. This technique was successful. On recovery of the go-devil, the sampler chamber was found to be full. In addition the sampler pressure regulator had failed and the chamber was gauged at 4300 psi. (Subsequent chemical analysis indicated a small amount of formation water in the lower sampler chamber and at least a degree of success for the experiment).

Following the sampler run, an additional 55 meters of basalt was cored. The character of the basalt varied from massive to intensely fractured and highly altered, with the latter characteristics increasing with depth.

The packer was then pulled to a point about 35 meters off total depth and the safety (fracturing) go-devil was dropped for a flow test to determine formation permeability. After the go-devil had landed, various pump rates determined packer leakage to be about ten gallons per minute. The pump rate was increased and, at about 1200 psi, the shear plug in the go-devil ruptured. At this point the packer element should have been inflated and the fluid flow directed into the formation below the packer. Pump pressure dropped off sharply, indicating either a highly permeable formation or failure of the packer to seal the annulus.

When the go-devil had been recovered, the bit was run back to total depth in preparation for a planned packer/sampler attempt. The sampler plans were cancelled, however, when 15 meters of fill was encountered and risk of sticking the pipe was considered too great.

The hole was flushed with mud and a "wiper trip" was made to prepare the hole for the planned extensive open-hole logging program. With the bit back near total depth, another 100 barrel mud flush was displaced and the hydraulic bit release go-devil was pumped down. The release did not actuate when the go-devil landed. Pressure was bled off and the bit was set on bottom to minimize internal stresses in the release mechanism and the pipe was repressured. Pressure did not fall off on the subsequent attempt to raise the drill string and the pipe was found to be stuck. After one or two attempts to pull the pipe free, the pressure was bled off in preparation for repressuring the bit release. On restarting the pump, circulation was regained, indicating the bit had detached. With circulation regained, the pipe was freed in a matter of minutes. The end of the pipe was then pulled to 165 meters BSF and the logging sheaves were rigged.

Logging operations commenced with the sonic-caliper-gamma ray log. Two open hole runs were made with this log in an attempt to improve the quality of an erratic travel time curve. An additional run with this sonde was made to record a variable density wave train log, but again signal quality was poor. The next run was a temperature log recorded going into the hole followed by a formation density-caliper-gamma ray log recorded coming out. Log quality was good except for a rather insensitive gamma ray curve. The AMOCO borehole televiewer was then run with very encouraging results. It was followed by a second televiewer owned by the USGS. This tool developed electronic problems and no useful data were collected. The televiewer operation was followed by two runs with USSR-furnished downhole magnetometer equipment. The first log successfully measured magnetic field intensity and direction. The tool was then recovered and modified for magnetic susceptibility measurements. Electrical problems were encountered and no useful log was recorded on the ensuing attempt. The next tool into the hole was the temperature sonde with the Gearhart-Owen downhole water sampler attached. The tool stopped near the basalt contact as temperature was being logged into the hole. This was noted on the weight indicator. The tool was apparently worked past the bridge and logging resumed. About 50 meters later, insufficient total weight and lower-than-anticipated temperature caused suspicion that the tool had again stopped in the hole. On reversing the winch, it was found that the tool had moved only a short distance below the first obstruction. The tool was then worked with some difficulty to about 30 meters off total depth where apparent fill was encountered. The water sampler valve was opened normally, but no indication of closing was noted after repeated attempts. When the tool was retrieved, indications of a knot in the cable about 100 meters above the sonde were observed. The cable was retrieved against considerable drag through the entire drill string. The knot, comprised of about 12 meters of cable, was recovered, followed by the logging sonde with the water sampler case crushed flat by hydrostatic pressure.

Because of excessive fill and apparent bridging in the hole, a cleanout trip had been planned prior to completion of the logging experiments. A cable rehead had been planned for this time and was now necessitated by the damaged cable. About 107 meters of kinked cable was cut off.

The open-ended drill pipe was washed easily to total depth and no solid fill was "felt" by the driller. The hole was again flushed with mud and additional displacement volume was used due to the washed out condition of the upper part of the hole as indicated by caliper logs.

The pipe was pulled to 156 meters BSF and logging resumed with the guard neutron-gamma ray combination. The tool encountered a clean hole and ten to twelve meters of fill and a good log was recorded. The final downhole measurement scheduled was the U.K. resistivity experiment. About 2 1/2 hours were spent in handling the electrode array and some instrumentation difficulties were experienced, but a set of apparently valid readings was recorded.

The pipe was then pulled clear of the seafloor and an operational test of the magnetic free point indicator was attempted. The test could not be conducted due to electrical problems, however, and the logging sheaves were rigged down after about one hour of lost time.

When the packer assembly arrived on deck, the inflatable element was found to be completely destroyed, with only fringes of wire and rubber remaining at the top and bottom. One hour was spent in breaking packer connections and securing the vessel for transit. The CHALLENGER departed Site 501 for Panama at 0345 hours, July 16.

SITE 501 to BALBOA

The transit to Panama was uneventful. No change in main shaft vibration was noted and the same rpm were used as earlier in the leg. Following winds and seas permitted an average speed of over eight knots. The vessel anchored in the roadstead at Balboa Harbor at 0020 hours, July 19.

DRILLING AND CORING EQUIPMENT

A specialized bottomhole assembly was utilized due to the incorporation of the packer into the drill string. Four drill collars were added to provide weight for anticipated hard basalt drilling and to counteract upward forces on the packer element during hydrofracturing operations. A mechanical drilling jar was added due to increased risk of sticking the string in "young" basalt with the packer deployed. The assembly consisted of: bit, hydraulic bit release assembly, 6 5/8 F.H. pin by NC-61 box crossover sub, Lynes retrievable packer, packer circulation sub, NC-61 pin by 6 5/8 F.H. crossover sub, one 8 1/4 drill collar (outer core barrel), top sub, head sub, McCullough torque jar, NC-61 pin by 6 5/8 F.H. box crossover sub, three 8 1/4 drill collars, one Baash-Ross five-foot stroke bumper sub, six 8 1/4 drill collars, two bumper subs, three 8 1/4 drill collars, 6 5/8 F.H. pin by 5 1/2 F.H. box crossover sub, one 7 1/4 drill collar.

The torque jar was utilized the first time the bit (or packer?) became stuck and may have been the deciding factor in freeing the string.

SPECIAL TOOLS

The Lynes packer/retrievable formation tester was deployed for the first time since initial testing on Leg 38. Unfortunately the inflatable element sustained severe damage before any hydrofracturing or sampling experiments could be performed. It is likely that the damage was caused by stringers of sharp chert prior to any drilling of basement rock. The packer was demonstrated to be operationally compatible with the drill string and with the BJ cementing pump. A considerable amount of effort by trained technical personnel is required to keep the packer operational. Future packer operations are considered feasible with adequate personnel planning and better hole conditions.

The ultra-long spaced resistivity experiment was carried out with some difficulty, but without discernible damage to equipment. It is recommended, however, that the apparatus be made safer, stronger and more compatible with existing equipment if more work is planned for it on the GLOMAR CHALLENGER.

The AMOCO borehole televiewer was effective in presenting photographable images of the wall of the hole. Fractures, pillows, cavities, thin beds and other features were clearly visible and the tool has obvious potential value for viewing sections not recovered in coring. The very slow surveying speed results in a relatively high consumption of operating time, especially in long hole intervals, and susceptibility to the adverse effects of vessel motion. Heave was very slight at Site 501 and vessel motion could still be a considerable factor in less favorable areas.

The USSR furnished magnetometer posed no particular operational problems and is deployed in the same manner as other downhole logs. Factors to be considered are the requirement for a Gearhart-Owen recorder (and operator) in its present configuration and the requirement for two wireline round trips to obtain a full set of data.

Glen N. Foss
Cruise Operations Manager
Deep Sea Drilling Project

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
OPERATIONS RESUME
LEG 68 - SITE 501

Total Days (June 27, 1979 - July 19, 1979)		21.23
Days In Port*		7.69
Days Under Way		5.90
Days On Site		7.64
Coring Time	2.47	
Drilling Time	0.14	
Trip Time	0.74	
Downhole Measurements	3.68	
Stuck Pipe & Hole Trouble	0.21	
Mechanical Downtime	0.03	
Other	0.36	
Total Distance Covered (Nautical Miles)		1047.9
Average Speed		
Sites Investigated		1
Holes Drilled		1
Number of Cores Attempted		20
Total Meters Cored		147.1
Total Meters Recovered		74.5
Per Cent of Recovery		50.7
Total Meters Drilled		190.0
Total Meters Penetration		337.1
Per Cent Penetration Cored		43.6
Water Depth (Meters)		3466.9

DEEP SEA DRILLING PROJECT
TIME DISTRIBUTION
LEG - 68

Date	Site No.	Cruise	Trips	Drill	Core	Stuck Pipe	W.O.W.	Position Ship	Mech. Repair	Port Time	Re-Entry	Other	Total Time	Remarks
6/27/79 7/08/79		70.7							2.0	184.6		0.4	257.7	Puntarenas to Site 501
7/08/79 7/16/79			17.7	3.4	59.3	5.0		88.4	0.8		2.8	5.9	183.3	Site 501
7/16/79 7/19/79		68.5											68.5	Site 501 to Balboa

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
SITE SUMMARY
LEG 68

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
501	01° 13.63'N	83° 44.06'W	3467	20	20	100.0	147.1	74.5	50.7	190.0	337.1	11.4	183.3	183.3

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
BIT SUMMARY
LEG 68

HOLE	MFG	SIZE	TYPE	SERIAL NUMBER	METERS CORED	METERS DRILLED	METERS TOTAL PENET.	HOURS ON BIT	CONDITION	REMARKS
501	Smith	9 7/8	F94CK	153RT	147.1	190.0	337.1	29.5	Unknown	Released for logging. No signs of failure.

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
BEACON SUMMARY
LEG 68

SITE NO.	MAKE	FREQ.	SERIAL NUMBER	SITE TIME HOURS	REMARKS
501	ORE	16.0 kHz	499	183.3	Exceptionally strong and steady for duration.

DEEP SEA DRILLING PROJECT
LOGGING SUMMARY
LEG 68

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
501	3804	3469.9	3603	Sea Water	9 7/8	5.7	1	Sonic/Cal/GR	3786.5	3603	Sonic curve-poor in basalt-fair in sediment.
501	3804	3469.9	3631.5	Sea Water	9 7/8	2.3	1	Temperature	3787.5	3631.5	Log Down
501	3804	3469.9	3603	Sea Water	9 7/8	4.0	1	Density/ Cal/GR	3785.5	3603	Log Up-Same Run-Good Log GR curve insensitive
501	3804	3469.9	3631.5	Sea Water	9 7/8	7.7	1	Borehole Televiewer	3762.0	3636.0	AMOCO unit-good results
501	3804	3469.9	3631.5	Sea Water	9 7/8	4.0	1	Borehole Televiewer			USGS unit - equipment failure
501	3804	3469.9	3603.0	Sea Water	9 7/8	9.3	1	USSR Mag. Field	3770.0	3603.0	Successful
501	3804	3469.9	3603.0	Sea Water	9 7/8	4.2	1	USSR Mag. Field			Equipment problems
501	3804	3469.9	3631.5	Sea Water	9 7/8	5.8	2	Temperature	3780.0	3450.0	Overran cable & knotted line. Attempt water sampler-chamber crushed
				Cleaned	Hole to	T.D. and	Flushed				
501	3804	3469.9	3593.5	Sea Water	9 7/8	4.5	1	Guard/ Neutron/GR	3789.5	3593.5	Neutron interferred with GR in basalt.
501	3804	3469.9	3593.5	Sea Water	9 7/8	14.0	1	U.K. resis- tivity exp.	4804.0	3515.0	3.5 hrs getting array in and out of pipe.

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
TRANSIT PANAMA TO CURACAO
CURACAO SHIPYARD PERIOD
OPERATIONAL RESUME

INTRODUCTION

As a result of an oil leak in the forward stern thruster, the GLOMAR CHALLENGER returned to Balboa, Canal Zone following completion of Site 501. An inspection was done by ship's divers to determine the cause of the leak. It was found that the thruster gearbox mounting bolts had backed out sufficiently to allow the propeller to impinge on the tunnel. GMI decided that it was necessary to enter a drydock in order to affect repairs and after disembarking the scientific party, the vessel headed for Curacao, Netherland Antilles.

In addition to this repair work, many other work items were accomplished as well as all regulatory underwater inspections. This means that the vessel will not have to drydock for routine work for a period of at least 18 months.

TRANSIT BALBOA TO CURACAO

The GLOMAR CHALLENGER departed Balboa, Canal Zone on July 20, 1979 and after transiting the Panama Canal, steamed directly for Curacao where it arrived on the evening of July 20th. Seismic profiling was not done during the voyage.

As the vessel neared Curacao, a 13.5 kHz double life beacon was dropped in order to run tests on the dynamic positioning system. Intermittent failures of the computer system had occurred during operations at Site 501 and the tests were designed to determine if a problem still existed. No signal was received from the beacon and 15 minutes after deployment the flotation ring was spotted 100 yeards from the vessel. It was concluded that a mechanical separation of the pressure case had occurred. The unit was later recovered and separation had occurred between the transducer housing and the battern case.

A second double life beacon S/N 500 16.0 kHz was strapped by adding two draw bolts on the outside of the pressure case and deployed. A good signal was received and the positioning test commenced.

The tests showed a fault still existed and were successful in identifying a faulty card in the A-D converter circuit. This card was subsequently required during the shipyard period.

SHIPYARD PERIOD

The following is a summary of the work accomplished during the shipyard period.

GMI WORK ITEMS

Thruster Repairs

All four thrusters were removed from the vessel; two of the gearboxes were replaced by recently overhauled units, while the other two were overhauled on site and replaced the vessel. Two Schottel engineers supervised the work which was accomplished in a highly professional and efficient manner. Due to a shortage of shipyard personnel, drilling crews were used to do the rigging. No major problems were encountered during the work.

Once the units had been installed a full head of oil was applied to check for leaks. One small leak was found which necessitated the removal and reinstallation of a gearbox skeg. This was accomplished without incident and the thruster work was complete before sandblasting of the ship's hull commenced. The forward stern thruster, which had been leaking oil on Leg 68, Site 501, was found to have loose nuts on the 12 studs securing the gearbox to the ship's hull. It was also reported that one stud had sheared. The loosening of these nuts was attributed to excessive vibrations which had been experienced while underway since Site 500, Leg 67.

Both gearboxes which had previously been overhauled in Miami were checked before installation and in one unit where new bearings had not been installed, a reoverhaul was done prior to installation.

Excessive Vibration Evaluation

No mechanical cause for the vibrations which had been experienced was found. Tailshaft bearing clearances and alignments were checked and found to be within specification. In fact, identical to readings taken prior to leaving Bethlehem drydock in October 1978.

The concensus remained that in some way excessive marine growth on the ship's hull had caused the vibrations. The amount of growth on the vessel was indeed much more than could normally be expected on a vessel which had been cleaned and painted only eight months previously. A local marine biologist identified the growth and advised that its density and thickness represented at least a one year cycle (two complete mature life cycles). He also indicated that the warmer sea temperature and abundance of plankton found near Costa Rica (Leg 67) would greatly accelerate the life cycle.

However, the ship's hull was not uniformly covered with growth and large areas were devoid of any organisms. It appeared that the paint had failed to adhere in those places of excessive growth. The stern area had the greatest concentration and the thruster tunnels, propellers, trail shafts and rudders were heavily encrusted.

The ship's hull was sandblasted and given two coats of anti-corrosion primer plus two coats of anti-fouling paint.

All propellers were cleaned and buffed and the pitch of the thruster propellers was checked.

All runner bearing clearances were checked and found to be within specifications.

Major Overhaul of Caterpillers No. 9 and No. 1

Although these engines had not yet accummulated the working hours allowed between overhauls, the shipyard period was utilized for major overhauls of two Caterpiller engines to minimize port time in the future.

As qualified labor available on Curacao was limited, four mechanics were flown in from the USA to do the work. The work continued round the clock and was completed on August 10th.

Saltwater Cooling Discharge Piping Replacement

All discharge piping inboard of both hull check valves was replaced. Due to the unscheduled early arrival (originally scheduled for October 1979) of the ship in the shipyard, no prefabrication had been done. Consequently the waster pipe was removed and used as templates for the fabrication of new sections. This was a time consuming operation which was aggrevated by heavy shipyard work load from many other vessels. This item became a controlling item and was only completed on August 10th. The quality of the work, however, appears to be high.

Marine Sanitation Unit Piping Installation

A second major piping job was the installation of onboard piping to the new Marine Sanitation Unit (MSU). This involved two pipe runs in the engine room connecting to the MSU in the Drill Stores area. Once again, the work was completed on August 10th.

Additional Piping Jobs

In addition to the fabrication and installation of new piping mentioned above, several other pipe related jobs were accomplished:

a) Main salt water circulating system logging was replaced on areas where it had been removed for wall thickness readings.

b) Sea chest vent piping was replaced where found to be wasted.

c) Sanitary set volume tank and piping was replaced.

d) Some wasted piping was replaced in the auxiliary saltwater circulating system.

d) Main circulating pump discharge elbow was replaced.

Rewiring of Switchboards

The rewiring of Drilling Switchboards A & B was completed by local electricians under the supervision of a Global Marine engineer.

A number of wires on the propoulsion board were also replaced.

No. 4-DC Generator

No. 4-DC Generator was removed from the ship and overhauled. The overhaul included disassembly, inspection, cleaning, baking, varnishing, dipping, baking and reassembly. This unit was then placed aboard as a spare unit.

The previous spare unit was installed on Engine No. 4.

AC Generator Circuit Breakers

The three 500 KW AC Generator circuit breakers were removed, disassembled, cleaned, inspected and reinstalled. Some worn components were replaced.

Electric Cables

All electric cables in the deck cable tray were checked and the wiring re-secured.

Positioning System

The Data Interface Panel in the computer of the DPS was rewired in order to provide redundancy. There are now two identical X and Y panels which allows immediate transfer should the panel in use fail.

In addition, all hydrophones were fitted with new cables and two new transducers which had been installed previously had holes drilled through the shroud to allow air bubbles to escape.

Main Deck Refrigeration Plant

New water cooled condensers were installed on Freezer No. 1 and on Chiller No. 4.

Core Van Deck Repair

An area of deck in the core van area which had a bad dent was cropped out and replaced.

After Cooler Replacement

A new after cooler unit was installed.

Ship's Service Air Compressor Drive Motors

The drive motors on the ship's service air compressor was removed, cleaned, dipped, baked and reinstalled in the vessel.

USCG Midterm Inspection

The midterm USCG inspection was carried out. This included checking all life rafts and fire extinguishers for operation and charge.

Heave Compensator

The electrical circuits of the active mode of the heave compensator were thoroughly checked. Unfortunately a shipment of spare parts did not arrive in Curacao and the heave compensator unit could not be test run. This will be accomplished after the Balboa, Panama port call.

Sundry

Numberous other items were accomplished by the ship's force during the shipyard period, e.g., shipping and painting, radar check, maintenance on drilling equipment, magnaflux inspection of tongs, elevators, etc.

PROJECT WORK ITEMS

No major work items were scheduled for Project equipment primarily due to the short lead time prior to the shipyard period. However, a number of maintenance items were accomplished including the following:

B. J. Cementing Unit

The unit was thoroughly checked and overhauled by a BJ service representative. The representative also assisted with an inventory of spare parts for the unit.

Logging Winch

Several maintenance items were accomplished on the logging unit.

a) The 16-71 blower was inspected and the emergency shutdown linkages inspected and refurbished.

b) The 1800 drive line was removed from the unit, sandblasted, coated with inorganic zinc and replaced in the unit.

c) The reeling arm was refurbished.

d) New weatherstripping was installed on the cab door.

e) The air conditioning unit compressor was replaced, a new fan installed and the unit charged with Freon 22.

Inventory

A complete physical inventory was taken of operations equipment and a physical inventory of GFE equipment was made by the Project in conjunction with GMI.

Service Calls

The following equipment was serviced by venfor representatives:

a) Xerox Copying Machines

b) Alden Weather Equipment

c) Magnavox-SAT NAV Receivers

d) EDO Geo-Physical Recorders

e) Teletypes Units on Various Equipment

f) IBM typewriters

Core Laboratories

The Core Laboratories were painted by the Project technicians.

Drafting Room

The drafting room was converted into a science office and the existing science office into a Scripps tech office and xerox room. This will allow more working area for onboard scientists as well as give them and the yeoperson more privacy.

Fuel

Some 300,000 gallons of fuel were loaded.

CURACAO DRYDOCK COMPANY

The Curacao Drydock Company was obviously a very efficient and well managed shipyard. However, at the time of the CHALLENGER's visit, there were 15 other vessels in the shipyard. This meant that experienced laborers were not always allotted to jobs on the CHALLENGER. As a result some work suffered in quality and certainly in time required to complete the job. Some work was cancelled due to the lack of qualified personnel.

There were no work rule problems in the shipyard and the ship's force, cranes, welders, etc. were utilized for many of the work items.

PERSONNEL

As usual, the shipboard personnel gave their full energies to the job at hand. The Chief Engineer and his crew remained even tempered and approachable at times despite many traumatic periods.

The drilling crew were employed on many varied non-drilling jobs all of which they approached energetically.

The two Schottel representatives, Mr. Richard Welch, Chief Engineer and Mr. George Hernandez, deserve special memtion. The application to the job and their professionalism were of the highest standard.

Global Marine, San Diego Office personnel, handled the shipyard period as efficiently and competently as possible.

Maduro & Sons, the ship's agent, was a very efficient and cooperative agency.

V. B. Robson
Assistant Operations Manager
Deep Sea Drilling Project

P. G. Thompson
Special Tools Technician
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INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
OPERATIONS RESUME
LEG 68

Leg 68 was designed to investigate the detailed Neogene history of the western Caribbean and Eastern Equatorial Pacific Ocean. The leg would attempt to recover complete and undisturbed stratigraphic sections at two previously drilled sites using the newly developed Hydraulic Piston Corer (HPC). This leg was scheduled as a result of stern thruster problems which occurred on the original Leg 68. Following the completion of Site 501, the ship proceeded to Balboa, Panama, offloaded the scientific party and then transited the canal and went on to Willemstad, Curacao for drydocking. While the ship was in drydock a scientific party was organized which would evaluate a hydraulic piston coring program in the designated areas.

The cruise commenced at 1600 hours on August 13, 1979, following the completion of successful sea trials outside of Willemstad, Curacao and ended at La Libertad, Ecuador at 0752 hours on September 18, 1979. An interim port call was made in Balboa, Panama for crew change, resupply and replacement of the derrick guide rails.

During Leg 68, the GLOMAR CHALLENGER traveled 2881.1 nautical miles and attempted to drill seven holes at two sites using only the Hydraulic Piston Coring equipment. These holes ranged from a very short 4.4 meters at Site 503 to 235 meters at Hole 503A. Water depth was 3051.5 meters in the Caribbean and 3678.8 meters at the Pacific Ocean site. A total of 1011.5 meters of coring was attempted with 786.67 meters (77.8%) being recovered. This excellent recovery contributed to very good and detailed geological correlations between holes.

Time distribution for the leg was 4.6 days in port, 13.3 days cruising and 17.8 days on site. The on-site time consisted of 3.0 days tripping, .01 days drilling, 14.2 days coring, 0.6 days other (which included fishing for stuck parts and positioning ship to a new location using the same beacon and different offsets).

BALBOA PORT CALL

After departing Site 502, the CHALLENGER traveled to Colon, Panama and dropped anchor at 0725 hours, August 28th. At 0504, August 29th, the ship weighed anchor to transit the Panama Canal. This was completed when the first line was put ashore at Berth #8, Balboa at 1544 hours.

While tied to the pier, a number of jobs were completed as well as a crew change. One of the main tasks was the replacement of the guide rails in the derrick, which was completed by 1630 hours, September 1. Beside the guide rail work, 1000 sacks barite and 1500 sacks of cement were blown aboard. Supplies were also loaded as well as offgoing freight items. Departure from Panama was official when the pilot was aboard and the last line was off at 0842 hours, September 2, 1979.

DRILLING AND CORING ASSEMBLY AND BITS

The bottomhole assembly that was used on this leg consisted of the special 11.5" O.D. bit with a 3.6" core throat, bit sub, containing a float valve without a flapper and a lower support bearing, a core barrel, top sub, head sub with the orientation sleeve seal, three 8 1/4" drill collars, two 5' stroke bumper subs and three 8 1/4" drill collars, with a total length of 76.1 meters. This assembly had been used on Leg 64 and had worked successfully. It continued to work well on this leg.

ACOUSTIC BEACONS

Only two 13.5 kHz beacons were used for positioning on this leg and both performed well. Both beacons were single life type. The one at Site 502 was dropped on August 16th and was still transmitting a good useable signal when the ship departed on August 27th some eleven days later.

PERSONNEL

Due to the crew change in the middle of the leg, both drilling crews were able to gain a good working knowledge of the HPC tool. In addition, there were two special tool technicians and an engineer aboard who assisted in the successful operation of the tool. This type of coring required special handling to assure orientation so that correct geological interpretations could be made and the marine technicians did an excellent job in assuring that this was accomplished.

SITE 502

The first of the two sites to be investigated on the special hydraulic piston coring leg was located about 628 miles from Curacao, where the coring began. After a two-hour pre-site seismic survey, a 13.5 kHz beacon was dropped at 0925 hours. The ship then continued to profile to determine a location where the best geological information could be obtained. This site was selected and after the ship was placed in the automatic positioning mode at 1111 hours, the make up of the drill string began. The precision depth recorder (PDR) indicated a depth of 3050 meters, so the drill string was made up and run in to 3035 meters. The hydraulic piston corer (HPC) was then attached to the sandline and lowered into the pipe. The drill string and HPC were then lowered to 3045.5 meters and the drill string was pressured to activiate the HPC. The surface pressure indicated that the shear pins had sheared at about 1600 lbs. The pressure bled off which indicated that the tool had scoped out and should have cut a core if the PDR depth was valid. When the HPC was recovered, enough sediment was recovered to establish the seafloor at 3051.5 meters. Continuous coring began and the tool performed well through core No. 27, with shear pressures ranging from 1500 lbs-2000 lbs and averaging about 1700 lbs and with a normal pressure bleed off indicating the tool had scoped out. Recovery of sediments was good, averaging about 90%.

While lowering the tool to cut core No. 27, the weight indicator showed that the tool was hanging up occasionally, so it was retrieved and found that the bi-pak seals were tearing off. These were replaced and the tool lowered again. After about 3500' of line had been unspooled, a sudden 800 lb weight loss was noted. The line was retrieved and when it was recovered, the HPC was missing because the shear pins in the overshot had sheared and had released the tool. The shear pins were replaced and the HPC recovered. When it was brought to the derrick floor, the tool had scoped but was not damaged.

Beginning with core No. 28, the tool did not scope completely after the pins had sheared. This was noted at the surface because the pressure would not bleed off and had to be bled off at the derrick floor. This change in the tool operation was due to the sediments becoming firmer. In addition to not scoping completely, the amount of sediment recovered also decreased. The amount of sediment gradually decreased from about 3.5 meters when the conditions started changing to about 0.5 meters when it was decided to abandon the hole.

A core to core orientation program was attempted and enjoyed some success but there were some problems, such as multiple marks on the orientation rings, particularly in the stiffer sediments. The cores did not correlate consistantly with the paleomagnetic measurements. These inconsistencies could be due to the HPC becoming misaligned during the lowering and retrieving in the pipe, or the possible error in transferring the alignment marks from joint to joint. In addition, the moving section of the tool may rotate after the pins have sheared.

The total cored interval was 214.2 meters with 156.24 meters recovered for a 72.9% recovery rate. The hole was abandoned on August 19 when the bit cleared the mudline at 2000 hours.

HOLE 502A

After clearing the mudline at Hole 502, the pipe was pulled to 3016 meters and the ship then was offset 100 meters to the northeast. In an attempt to recover a complete geological section, the coring program in this hole was designed to allow an overlap of those cores taken in Hole 502. Therefore, the drill string was lowered to 3049 meters and the first core was taken when the hole was spudded at 2045 hours on August 19th.

The coring continued with about the same recovery as in Hole 502 through core No. 28. At this point due to lack of pressure bleed off after the pins were sheared and the resulting decrease in core recovery, some changes were made. Rather than washing 4.4 meters after each core, it was decided to wash down only the amount of core recovered to the nearest 0.5 meter. In this way it was hoped that a complete geologic section could be obtained. This program was followed until the pressure required to shear the pins built to about 2100 lbs and core recovery decreased to about one meter per core. The drill pipe was then pulled and the hole was abandoned when the bit cleared the mudline at 1430 hours on August 23rd.

HOLE 502B

When the drill pipe had been pulled to 3015 meters following the completion of 502A, the ship was again positioned another 100 meters northeast of the original location. The drill pipe was then lowered to 3050 meters to again attempt an overlapping of the previously cored sections. This hole was then spudded at 1525 hours on August 23rd. The coring program then began with about the same shearing pressures and core recovery as in the previous two holes. However, when core No. 23 was attempted, the pins apparently could not be sheared after pressuring up to 2150 lbs six times. It was then decided that the tool should be pulled and the shear pins replaced. When the tool was approximately 3000' from the bottom, it suddenly stopped and would not move with pulls of 10,000 lbs. Finally, the shear pins failed in the overshot and it was pulled. The pins were replaced and it was lowered again, but the shear pins failed again before the tool could be loosened. When the overshot was recovered the shear pins were replaced but before it was lowered a conventional core barrel with short hard core catcher dogs was dropped in hopes that it would jar the HPC tool loose. When the overshot was lowered, the two barrels were found to have fallen to the bottom of the drill string. But after the overshot had been engaged, the core barrels could not be moved and the pins were sheared again. The decision was then made to pull the drill string to recover the core barrels and find out what caused the sticking. When the pipe was recovered, it was discovered that one of the locking set screws in the cap sub had backed out, causing the HPC to become wedged in the pipe when it sheared off. As a result of this, the set screws are now being routinely wrapped with teflon tape. When the bit was at the derrick floor, the hole was abandoned at 1330 hours on August 25.

HOLE 502C

Without placing any additional offsets in the computer, the drill string was made up and lowered to 3035 meters. The Bowen sub was picked up and this hole was spudded at 1050 hours on August 25. The hole was washed to 3083.5 meters without taking a mudline core. It was then cored continuously to 3195.7 meters and then washed to 210.2 meters below seafloor (BSF). The coring program began again and followed the same plan as used in Hole 502A when the sediments became too firm for the tool to scope out completely. This program was followed until a depth of 3280.2 meters or 228.7 meters BSF was reached and time constraints of reaching port for crew change caused the hole to be abandoned at 1600 hours on August 27. (A complete and detailed report on the HPC operation in these holes follows this report).

HYDRAULIC PISTON CORER - SITE 502, A, B, C

To date, the Hydarulic Piston Coring program has been very successful with relatively few mechanical or operational problems. An effort has been made to maintain relative orientation between cores but paleomagnetic analysis has shown large intermittent shifts in declination between cores, which throws suspicion on the orientation technique. Some statistics follow:

Maximum penetration: 228.7 meters

Maximum shear strength: 3185 g/cm^2

Maximum runs on single tool without redressing: 41

Life expectancy of top sub Bipak seals: 1 set per site

Retrieval Rate: 160-200 m/min. Top sub seals no longer impose limitation.

Tool strokes fully through sediments with shear strength of 100-1200 g/cm^2.

50% recovery of sediments with shear strengths of up to 3000 g/cm^2.

Quality of cores is excellent.

Problems

1. Multiple marks on orientation landing ring in still sediments.

2. Some runs had little or no recovery. This may be attributed to "sticky" flapper core catcher.

3. "Oriented" cores do not correlate consistantly with paleomagnetic measurements:

   a) HPC may become misaligned during trip down drill pipe.

   b) Technique for transferring alignment marks from joint to joint on drill string is crude and may be subject to error.

   c) There is some indication that the moving section of the HPC may rotate as it shoots into the sediment.

4. One of the locking set screws through the cap sub backed out once causing the HPC to jam in the drill pipe. The drill string had to be tripped.

5. Galling threads during assembly and breakdown, especially on the new pieces.

6. Corrosion sets in fast on all parts.

Operation and Orientation Procedure

A disk grinder was used to scribe alignment marks (approximately 8" long) at each end of the four HPC outer bodies and three standard inner core barrels. Two complete HPC units were assembled prior to Site 502. The spare HPC was stored in one of the two new shucks under the rig floor. An outline of the operational procedure follows:

1. A core liner is loaded into the HPC lower section so that the double line on the liner aligns with the alignment mark on the HPC inner barrel. It has been found that the liner usually rotates slightly after it is installed (probably because the last step in the alignment procedure involves rotating the top sub which also rotates the piston head within the liner, dragging the liner with it). Therefore, the actual orientation of the core is assumed to be its position with respect to the alignment mark on the inner barrel <u>after</u> it has returned to deck. Usually the difference between initial and final orientation is less than 30°.

2. The lower HPC section is picked up and hung off in the drill pipe. Then the upper section is brought over via tugger and the connection is made up. Pipe wrenches are used to rotate the outer body (upper section) relative to the inner barrel (lower section) until the alignment marks on each line up. Two set screws are installed through the cap sub to lock the alignment.

3. The HPC is allowed to scope closed. The top sub is rotated relative to the outer body until the set screw hole in the orientation landing ring aligns with the mark on the outer body. Then the shear pins are inserted. NOTE: The shear pins also act as locking set screws to maintain alignment.

4. The drill pipe connection is madeup and the HPC is lowered down on the wireline while pumping at 20-25 spm. While the HPC is descending the bit is either washed or rotated down to the target depth, depending upon whether the sediment is soft or stiff. Then the bit is raised five meters off bottom and the drill string is rotated until an alignment mark, which is chalked on the joint, aligns with the bow stern axis of the ship. (On the initial HPC run a chalk line is arbitrarily marked on the deck-level joint and orientation of the drill string is maintained from that point on).

5. The HPC is seated with no pump pressure. The drill string and wireline are then lowered together to the target depth, after which the BOP is closed

6. The pump is started at 40 spm to pressurize the drill string. The HPC usually fires at 1600-1700 psi in soft sediment. This can be discerned by a distinct flicker on the rig floor pressure and weight indicators. The pump is then immediately shut off and the pressure drops as it is vented through the HPC. When sediments are too stiff the HPC will not stroke fully and will not vent the pressure. Also, the flicker at shoot-off may or may not register on the pressure gauge, but the weight indicator will usually still flicker. The pressure is brought up to 2000-21000 psi, the pump is shut off for 30 seconds to check for bleed-off, then pressure is vented on deck.

7. The BOP is opened and, in soft sediments, the HPC is pulled out of the mud with the wireline. In stiff sediments (when overpull weight exceeds 1500 lbs) the entire drill string is raised to withdraw the HPC from the sediment.

8. The HPC is retrieved at a rate of 160-200 m/min (35-40 psi to the winch motor with the clutch full open). Once on deck the drill string connection is broken and the HPC is hung off in the pipe with the hanging plate placed under the top sub. The top sub cap is removed and the marked landing ring is replaced with a new one. The top sub cap is reconnected, the lifting bale is attached, and the HPC is raised with the tugger line and hung off with the handling clamp at the double pin sub connection. The upper section is disconnected from the lower section, and the lower section is layed down on the catwalk. Then the alternate lower section is picked up to restart the cycle.

9. The catcher sub is removed from the inner barrel and the sediment filled core liner is pulled out about one foot taking care not to rotate the liner relative to the inner barrel. An orientation line is marked on the liner where it aligns with the mark scribed on bottom of the inner barrel. Finally the liner is removed and layed on the core rack.

10. A brass ring protractor is used to measure the angle of the orientation mark relative to the set screw hole in the landing ring. Then the protractor is slid over the lower end of the core liner and the angle is marked off from the line previously marked on the liner. The core is later split along this second mark.

11. During this whole operation the ship must maintain a constant heading or, if the heading changes, the drill string must be rotated as many degrees in the opposite direction in order to maintain relative orientation between cores. When a new joint (or double joint) is added to the drill string, the string is rotated until the chalk mark on the lower connection aligns with the bow stern axis. Then a man rides up in the harness to the top of the new section and marks a chalk line down the entire length of the new section.

<u>Comments on Orientation Technique</u>

The relative orientation between cores is based upon several assumptions:

1. The core liner must not rotate within the inner barrel during or after the shoot-off.

2. The inner barrel must not rotate relative to the outer body (against the set screw locks) during the trip down the pipe.

3. The top sub and landing ring must not rotate relative to the outer body (against the shear pin locks) during the trip down the pipe.

4. The scoping section of the HPC must not rotate as it shoots into the mud.

5. The position of the orientation seal sleeve in the BHA must remain constant.

Paleomagnetic measurements taken on each core section have shown large shifts in declination between many of the cores. The lack of correlation with known paleomagnetic data show that these shifts are artificial rather than in situ.

On Hole 502C, the alignment of the outer body and inner barrel was checked each time the HPC returned to deck. It was usually unchanged, but several times shifts of about 20^{o} were noted and one time they were 180^{o} out of alignment.

One time the tool was retrieved unscoped, with the shear pins still intact. Advantage was taken of that situation to check the alignment of the landing ring relative to the outer body after a round trip in the drill pipe; it was OK.

Another time the HPC inner core barrel returned with a deep score which spiraled 360 along its entire length. On the next run it was scored again, but this time it was shallower and ran straight up and down the barrel. On subsequent runs no more scoring was observed.

Several times, while unscrewing the core catcher, the liner was inadvertantly rotated inside the inner barrel before it could be marked.

The method described earlier for transferring chalk marks from joint to joint on the drill string is only eyeball accurate and may lead to accumulative error, but should not cause the large shifts observed by paleomagnetics.

Recovery

The HPC achieved full stroke through sediments with shear strengths of up to 1200 g/cm^2 with normally 80-100% recovery. In each of the four holes cored on this site, full stroke stopped at the same depth. However, 50% recovery has been achieved through sediments with shear strengths of over 3000 g/cm^2.

Intermittantly, some runs had little or no recovery; these cores appeared to be grouped at or about the same depth in the first three holes. Traces of mud were usually found far up the liner, so the probable cause was determined to be the core catcher. At first the standard HPC flapper catcher was used exclusively. Later several alternate catcher configurations were tried (e.g., soft formation catcher with and without sock, hard formation catcher with and without sock, flapper catcher with two berrilium return springs). In the relatively soft, sticky clay encountered in the upper part of the hole the flapper catcher with two springs worked the best. As the sediment got stiffer, the best recovery was achieved with the hard formation catcher without a sock.

Several times in the upper sediments the recovery exceeded 100%. This was assumed to be due to "precoring" of slump mud which may fill the HPC up to the piston head before shoot-off. Little or no flow-in was observed at the base of the cores. The extra mud ended up in the upper liner support. To solve this problem, two of the upper liner supports were shortened by 10", and 10" was added to the length of the liner. We plan to shorten the rest of the spare upper liner supports.

Orientation Landing Rings

Both the aluminum and the brass inlayed landing rings worked equally well; the standoffs on the new top sub protected the rings from erosion against the wall of the drill pipe.

In the softer sediments the rings were distinctly marked with a single primary wedge-mark and a single secondary double-blunt mark 180^{o} opposite. As the sediment stiffened, though the tool was still stroking fully enough to vent, the secondary mark disappeared. Finally, when the tool stopped stroking fully, multiple primary marks began appearing on the rings. Usually one was deeper than the rest or, in some cases, was backed up by a faint secondary impression. But several times there were as many as three equally deep marks (as well as several other shallower marks) spaced randomly around the ring. In these cases the core was arbitrarily split along one of the orientations and the alternate ones were recorded and given to the paleomagnetics man. From this evidence it appears that the tool is bouncing off its seat when it encounters resistance in stiff sediments.

Redressing

The HPC was redressed several times during the four holes drilled at this site, usually, as it turned out, unnecessarily. The most runs logged on a single HPC unit was 41, but it could have gone longer. With the exception of the piston head seals, all of the seals have lasted longer than expected.

The inner and outer sub seals, changed out at each redressing, usually appeared worn but still in good shape.

The top sub Bipak seals are excellent. Originally they were run in sets of three, but that allowed some slop between the seals and the seal retainer (there was not enough room to insert a spacer ring). A few times the return trip up the pipe would pull the seals apart (each seal consists of three sections which snap together), then the upward facing cup would flare out, catch on a joint connection and tear off. The problem was solved by eliminating the slop; two seals and three brass spacer rings filled the space exactly. Not one seal has been damaged since. In fact, they show little sign of wear after continual use. The alternate type of top sub seal - chevron packing interspaced with metal chevrons - has not been tested yet. It will be tested on the Pacific site.

We started this cruise with only nine piston head seals. We extended our supply by using only one seal instead of two on the piston head. Brass spacers were made to take up the extra space. The seals deteriorated rather quickly (5-10 runs) to a point where they looked like they should be changed. But due to the critically low supply they were changed only when they literally fell apart. When these ran out, O-ring seals were fabricated which, when sandwiched between two worn polypak seals, allowed us to finish Hole 502C.

Galled threads have been a continual problem in the assembly and breakdown of the HPC. Particularly in the new pieces, threads were too tight and several pieces had to be lapped together to fit. Some of the new pieces were incorrectly machined; the two new top sub bodies were threaded too deep, so that they would not shoulder up against the top sub caps and the two new outer body caps had the shear pin holes misplaced 0.5" from what was called out on the machine drawing. One of the new shafts had damaged threads and one of the old outer bodies was slightly egged on one end. All damaged pieces were repaired.

The threads most subject to galling were those at the outer seal sub/outer body connection and the outer seal sub/piston rod connection. We have recently switched to using pipe dope instead of silicone grease on these connections. The last HPC assembled relatively easily.

Corrosion is a continual annoyance rather than a major problem. But it does require extra time to keep the spares in a "ready to use" state. In the particular case of the piston rod, frequent sanding will eventually reduce the diameter enough to cause leakage through the outer seals.

Core Liner Cracking and Collapse

This has not been a major problem. At first frequent cracking, even in soft sediment was noted. But we started using liners from a different batch and the cracking was all but eliminated except for when coring very stiff sediments. The cracks were usually football-shaped, 20-50 cm long and occurred in the middle of the liner. In the very stiff sediments the liner would often collapse at either the upper or lower section. Shear strengths on those sediments were normally over 2000 g/cm^2.

Abortion of Hole 502B

The HPC was lowered down the pipe for run No. 23. It seated routinely, but when it was pressured-up there was no indication of shoot-off. It was pressured-up to 2150 psi six times; each time the pressure was manually bled off on deck, the bit was raised five meters off bottom and the tool was repressurized to 1500 psi to check for venting. No venting was observed so the tool was retrieved. About 3000' from bottom it suddenly jammed in the drill pipe. Two overshot pins were sheared in attempting to free it. A standard core barrel, used as a fishing tool, was dropped down the pipe. It jarred the HPC back down to the bit, but it remained jammed at that position. The drill string was tripped. It was discovered that one of the locking set screws through the cap sub had backed out, caught on a pipe connection, and sheared off. The HPC had scoped and recovered a 3+ meter core. Teflon tape is now routinely used on all set screws without nylon inserts.

HPC LOGSHEET

LEG 68 SITE: 502

WATER DEPTH: 3051.

CORE NUMBER	TIME ON DECK	SUBBOTTOM DEPTH (M)	RECOVERY (M)	PRESSURE TO SHEAR PINS	FULL STROKE?	INITIAL PULL-OUT WEIGHT (LBS)	RETRIEVAL RATE (METERS/MIN)	SHIP'S HEADING	ANGLE BETWEEN BASELINE AND ORIENTATION MARK	SEA STATE (SWELL)	LITHOLOGY	AVG. SHEAR STRENGTH (g/cm²)	OTHER OBSERVATIONS
1	AUG 16 1829	0.4	.3	1650	Y	—	100	075	353°	2-3'	FORAM NANNO MARL	62	28 MIN TO RUN IN NO WEIGHT INCREASE WHEN PASSING JOINT 34 MIN TO RETRIEVE. ALL SEALS O.K.
2	2010	4.8	4.4	1650	Y	—	100	075	040°	3'		110	NO WT. INCREASE WHEN PASSING JOINTS MULTIPLE MARKS ON RING. SEALS OK
3	2122	9.2	4.25	1700	Y	—	160	075	223°	3'		140	AL. LANDING RING USED - WORKED WELL MULTIPLE MARKS AGAIN
													21 MIN DOWN CRACKED LINER 23 MIN UP SEALS O.K.
4	2248	13.6	4.56	1700	Y	1500	200	075	322°	3'		211	37 MIN DOWN MULTIPLE MARKS. 20 MIN UP CRACKED LINER
5	2356	18.0	4.22	1650	Y	—	200	075	260°	3'		221	SEALS OK.
6	AUG 17 0115	22.4	3.94	1625	Y	—	200	075	195	3'		257	1 BIPAK SEAL MISSING, ONE TORN UP. REPLACED ALL 3 BIPAK SEALS
7	0236	26.8	4.50	1750	Y	1000	125	075	088°	3'		385	CRACKED LINER SEALS OK
8	0358	31.2	4.16	1775	Y	1200	200	075	132°	3'		279	LINER OK MUD GETTING STIFFER
9	0502	35.6	4.23	1600	Y	1500	200	075	165°	3'		350	RUBBER PIECE ½" WIDE x 1½" LONG, THI[N] FOUND IN TOP OF LINER. BELIEVE FROM
												353	WIPER OR TOP SUB BIPAKS LOST ON CORE #6
10	0614	40.0	4.41	1700	Y	1500	150	075	008°	3'		444	SEALS OK
11	0713	44.4	1.40	1700	Y	1500	150	075	239°	3'		4—	LINER NOT CRACKED
12	0809	48.8	0	1700/1850	Y	1500	150	075	272	3'		—	AMBIGUOUS SHOOT-OFF PRESSURE FLAPPER CATCHER MAY HAVE STUCK OPE[N]
													TRACES OF MUD ALL THROUGH CORE LINER
13	0910	53.2	4.24	1550	Y	—	200	075	200°	3'		444	PIECE OF RUBBER FOUND IN CENTER SECTION #1.

HPC LOGSHEET

LEG 68 SITE: 502

WATER DEPTH: 3051.5

CORE NUMBER	TIME ON DECK	SUBBOTTOM DEPTH (M)	RECOVERY (M)	PRESSURE TO SHEAR PINS	FULL STROKE?	INITIAL FULL-OUT WEIGHT (LBS)	RETRIEVAL RATE (METERS/MIN)	SHIP'S HEADING	ANGLE BETWEEN BASELINE AND ORIENTATION MARK	SEA STATE (SWELL)	LITHOLOGY	AVG. SHEAR STRENGTH (g/cm²)	OTHER OBSERVATIONS
14	1040	57.6	2.70	1650	Y	—	200	075	188°	3	FORAM NANNO MARL	** 339	STARTED PUMPING DOWN HPC AT 20 SPM (AS USUAL). NOTICED
					BACK PRESSURE BUILD UP OF ~ 400 PSI (NORMALLY IT IS ONLY 75 PSI) SIGNIFYING THAT BIT WAS PARTIALLY PLUGGED. HPC SEEMED TO SEAT AT CORRECT SAN LINE LENGTH, SO IT MAY HAVE CLEARED THE BIT. OVERSHOT CAME BACK EMPTY WITH SHEARED PIN. 2nd RETRIEVAL ATTEMPT SUCCESSFUL. 2 MARKS ON RING. DEEPER ONE USED FOR ORIENTATION.								
15	1238	62.0	4.02	1750	Y	1500+	160	075°	170°	2-3	FORAM NANNO MARL	513	HAD TO LIFT BIT FROM ~~AND~~ BOTTOM BEFORE RETRIEVING HPC
16	1341	66.4	2.86	1650	Y	1500+	180	075	045°	2-3	↓	440	LIFTED BIT TO UNSEAT HPC. PISTON HEAD SEAL CHANGED
		[16 RUNS ON HPC #1 SEALS OK.-REDRESSED]				COULD NOT REMOVE 1 SHEAR PIN STUB — STRIPPED. SO REPLACED ENTIRE HPC WITH SPARE (THE ONE WITH NO STANDOFFS ON TOP SUB).							ONLY 1 MARK ON RING. TIME TO CHECK INNER SEALS ANYWAY,
17	1502	70.8	3.35	1250	Y		150-200	075	340°	2-3	FORAM NANNO MARL	541	NEW TOOL
18	1605	75.2	2.53	1250	Y	—	"	075°	215°	2	|	435	PINS ON NEW TOOL SHEAR WITH LESS PRESSURE
19	1810	79.6	3.72	1775	Y	—	"	075	130°	2	↓	** 348	CHANGED TO CONVENTIONAL SOFT FORMATION CORE CATCHER AND RECORED
						THIS INTERVAL AFTER INITIAL CORE #19 CAME UP EMPTY WITH FLAPPER STUCK OPEN							
20	1920	84.0	3.99	1400	Y	2000	150-200	075°	010°	2	FORAM NANNO MARL	386	
21	2050	88.4	3.47	1200	Y	—	|	075	105°	2	|	1094	
22	2153	92.8	4.25	1800	Y	—	|	075	095°	2-3	|	700	
23	2258	97.2	4.51	2000	Y	—	|	075°	138°	2-3	|	437*	
24	AUG 18 0115	101.6	4.36	2000	Y	—	↓	075°	144°	2-3	↓	645*	PISTON SEAL BAD. REPLACING ON FOR NEXT RUN

HPC LOGSHEET

LEG 68 SITE: 502

WATER DEPTH: 3051.5

CORE NUMBER	TIME ON DECK	SUBBOTTOM DEPTH (M)	RECOVERY (M)	PRESSURE TO SHEAR PINS	FULL STROKE?	INITIAL PULL-OUT WEIGHT (LBS)	RETRIEVAL RATE (METERS/MIN)	SHIP'S HEADING	ANGLE BETWEEN BASELINE AND ORIENTATION MARK	SEA STATE	LITHOLOGY	AVG. SHEAR STRENGTH (g/cm²)	OTHER OBSERVATIONS
25	AUG 18 0115	106.0	4.36	2000	Y	—	150-200	075°	082°	3	FORAM NANNO ~~OOZE~~ MARL	526	ROUTINELY LIFTING BIT FROM BOTTOM BEFORE UNSEATING HPC SINCE SEDIMENT IS SO STIFF. NO OVERPULL OBSERVED. ALUMINUM RINGS ERODING ON ONE SIDE. OLD TOP SUB (WITH NO STANDOFFS) IN USE.
26	0228	110.4	4.23	2000	Y	—	150-200	075°	161°	3	FORAM NANNO ~~OOZE~~ MARL	764*	REPLACED BIPAKS
													UPON LOWERING HPC #27 NOTICED TOOL GRABBING ON WAY DOWN. PULLED UP & FOUND BIPAKS TEARING OFF. CHANGED BIPAKS & STARTED DOWN AGAIN. AFTER ~4 WRAPS (3500') NOTICED 800 PSI BUILD UP. IMMEDIATELY PULLED UP EMPTY OVERSHOT WITH SHEARED PIN. OVERSHOT PIN MUST HAVE BEEN FATIGUED FROM PREVIOUS TRIP, AND DROPPED HPC, WHICH FREEFELL TO BIT AND SHOT OFF. RECOVERED ~1.5 METERS OF "JUNK" CORE. CORE THROWN AWAY. IT WAS NOT GIVEN A CORE #.
27	0546	114.8	2.04	2000	Y	—	150-200	075°	136		FORAM NANNO MARL	973*	OVAL CRACK AT TOP AND BOTTOM ENDS OF LINER. 1 BIPAK SEAL PARTLY MISSING. CHANGED ALL 3 BIPAKS. ABOUT 2 FEET OF CORE WAS HANGING BELOW THE C.C. MORE ~~WAS LOST~~ FELL BACK DOWN THE PIPE.
28	0818	117.3	2.5	?	N	—	150-200	075°	—	3	FORAM NANNO MARL	645**	OBSTRUCTION ENCOUNTERED ~1000' DOWN PIPE. PULLED UP HPC. IT WAS OK. PUMPED WATER FOR 15 MIN DOWN PIPE TO TRY TO CLEAR, THEN LOWERED HPC DOWN AGAIN. IT STOPPED AT THE SAME PLACE. PICKED UP & LOWERED WITH WIRELINE SEVERAL TIMES UNTIL IT FINALLY BROKE THROUGH. PUMPED HPC DOWN TO SEAT. PRESSURED 3 TIMES TO >2000 PSI & NO SIGN OF SHEAR OR PRESSURE DROP. RETRIEVED HPC. IT WAS SCOPED OUT. PISTON HEAD SEAL WAS DESTROYED. LINER JAMMED IN CORE BARREL. 2.45 M. RECOVERED. MORE IN CORE BARREL WAS IRRECOVERABLE.
29	1000	121.7	4.21	1650	NO	—	200	075°	275°	3	FORAM NANNO MARL	1170	PRESSURED UP TO SHEAR. NOTICED FLICKER ON PRESSURE GUAGE AT 1650 PSI BUT NO PRESSURE DROP. PULLED UP ~5 METERS & PUMPED UNTIL CIRCULATION INCREASED, SIGNIFYING STROKE OUT. NEARLY FULL CORE RETRIEVED. PISTON HEAD SEAL DESTROYED.

HPC LOGSHEET

LEG 68 SITE: 502

WATER DEPTH: 3051.5

CORE NUMBER	TIME ON DECK	SUBBOTTOM DEPTH (M)	RECOVERY (M)	PRESSURE TO SHEAR PINS	FULL STROKE?	INITIAL PULL-OUT WEIGHT (LBS)	RETRIEVAL RATE (FT/SEC/MIN)	SHIP'S HEADING	ANGLE BETWEEN BASELINE AND ORIENTATION MARK	SEA STATE (SWELL)	LITHOLOGY	AVG. SHEAR STRENGTH (g/cm²)	OTHER OBSERVATIONS
30	1117	126.1	4.09	2000	NO	1500+	150	075	139°?	3	FORAM NANNO MARL	** 1290	NO VENTING OF PRESSURE MULTIPLE MARKS ON RING.
									PISTON HEAD SEAL BADLY DAMAGED, FOUND CAUSE TO BE FLATTEN EDGE OF UPPER LINER SUPPORT.				
31	1300	130.5	3.24	2200	NO	—	150	075°	250°	3	FORAM NANNO MARL	1783	
32	1439	134.9	3.53	2200	NO	—	↓	↓	075°	↓	↓	1969	REPLACED PISTON HEAD SEAL
33	1617	139.3	2.13	2100	NO	—			025°			1934	
34	1727	143.7	4.14	2200	N	—			200°			1812	PISTON SEAL LOOKS BAD, BUT NOT CHANGED SINCE CRITICALLY LOW ON SPARES. LINER COLLAPSED AT TOP.
35	1841	148.1	2.88	2200	N	—			175°			2062	LINER COLLAPSED AT TOP
36	2003	152.5	3.40	2200	N	—	↓	↓	257°/50°	↓	↓	1888	2 MAJOR MARKS ON RING. 257° USED FOR ORIENTATION. 2 BIRAKS GONE &
						HAD TO BE REPLACED. STARTED USING LINER FROM ANOTHER ALLIGATOR BOX. LINER CRACKED LONGITUDINALLY AT TOP BUT DID NOT COLLAPSE.							
37	2314	156.9	3.26	~1900	N	—	150	075°	243°/327°	3	FORAM NANNO MARL	2513	TOOL DIDN'T SEAT 1ST TRY. BIT PROBABLY PLUGGED. PICKED UP & WORKED
						HPC AND PUMP TO CLEAR PLUG. UPON RETRIEVAL NOTICED ONE OF BIRAKS PULLED APART THERE IS SOME SLOP SPACE BETWEEN BIRAKS AND RETAINER. TO REMOVE ALL SLOP SPACE							
						~~USED~~ WILL START USING ONLY 2 BIRAKS AND 3 SPACERS. "0" RECOVERY. CORE CATCHER STUCK OPEN. CORED #37 AGAIN (SAME INTERVAL)							
						2 MAJOR MARKS ON RING. 243° USED FOR ORIENTATION. LINER NOT CRACKED OR COLLAPSED. BIRAKS GOOD TOO.							
38	AUG 17 0038	161.3	2.83	2200	N	—	150	075°	240°	3	FORAM NANNO MARL	2618	LINER OK.

HPC LOGSHEET

LEG 68 SITE: 502

WATER DEPTH: 3051.5

CORE NUMBER	TIME ON DECK	SUBBOTTOM DEPTH (M)	RECOVERY (M)	PRESSURE TO SHEAR PINS	FULL STROKE?	INITIAL PULL-OUT WEIGHT (LBS)	RETRIEVAL RATE (METERS/MIN)	SHIP'S HEADING	ANGLE BETWEEN BASELINE AND ORIENTATION MARK	SEA STATE	LITHOLOGY	AVG. SHEAR STRENGTH (G/CM²)	OTHER OBSERVATIONS
39	0215	165.7	1.71		N	—	150	075°	335°/271°	3	FORAM NANNO MARL	2224	MULTIPLE MARKS ON RING, 335° USED FOR ORIENTATION. 13 MIN TURNAROUND TIME
40	0452	170.1	1.93	2050	N	—			233°			2537	HPC SEATED, PUMPED TO 2200 psi, BUT DID NOT SHEAR — SENT DOWN AGAIN. THIS TIME WILL RAISE ~½ METER ABOVE BOTTOM BEFORE PRESSURING UP. 2nd TRY GOOD.
41	0611	174.5	3.31	2150	N	—						** 1471	NOW ROUTINELY LIFTING UP ~½ METER BEFORE SHOOTING OFF.
42	0833	178.9	3.71	2200	N	—			002°			1679	"0" RECOVERY, CORED SAME INTERVAL AGAIN.
43	0937	183.3	2.63	1950	N	—			?			2149	SET SCREW ON LANDING RING SHEARED
44	1115	187.7	2.23	1950	N	—			259°	2		1888	LINER COLLAPSED AT TOP
45	1219	192.1	2.06	2150	N	—			105°/61°	2		2490	LINER OK DOUBLE MARKS ON RING, 105° USED FOR ORIENTATION
46	1335	196.5	1.96	2100	N	—			43°	2		3185	LINER OK 2 MARKS ON RING, VERY CLOSE TOGETHER.
47	1443	200.9	2.43	2200	N	—			55°/130°	2		3069	SAME AS ABOVE. 55° USED FOR ORIENTATION
											HAVE BEEN USING SAME PISTON HEAD SEAL SINCE #35 IT WAS DAMAGED AFTER FIRST RUN BUT STILL USED. REPLACED WITH ANOTHER USED SEAL IN BETTER SHAPE		
48	1611	205.3	1.75	2250	N	—			30°/115°			—	2 MARKS ON RING. 30° USED FOR ORIENTATION
49	1721	209.7	0.52	2100	N	—			225°			—	
50	1840	214.1	0.55	2200	N	—			25°/190°			—	LAST CORE THIS SITE

* = CRACKED ** = DISTURBED

HPC LOGSHEET

LEG 68 SITE: 502A

WATER DEPTH: 3051.5

CORE NUMBER	TIME ON DECK	SUBBOTTOM DEPTH (M)	RECOVERY (M)	PRESSURE TO SHEAR PINS	FULL STROKE?	INITIAL PULL-OUT WEIGHT (LBS)	RETRIEVAL RATE (METERS/MIN)	SHIPS HEADING	ANGLE BETWEEN BASELINE AND ORIENTATION MARK	SEA STATE	LITHOLOGY	AVG. SHEAR STRENGTH (g/cm²)	OTHER OBSERVATIONS
1	AUG 19 2155	1.9	1.7	1750	Y	–	160	075°	202°	3	FORAM NANNO MARL	62	USING SAME HPC – NO NEW SEALS USED ~30 SEC. TO PRESSURE UP TO SHEAR. START CORING THIS HOLE 2 M. BELOW LAST HOLE
2	2259	6.3	3.88	1700	Y	–	200		58°	3		112	START PULLING TOOL FASTER. NOW PULLING ABOUT SAME RATE AS REGULAR CORE BARREL. FLAPPER CC BEING USED.
3	AUG 20 0005	10.7	4.36	1700	Y	–	200		345°	3		190	
4	0200	15.1	4.23	1700	Y	–	200		63°	3		153	1ST ATTEMPT NO RECOVERY. 2ND ATTEMPT AT SAME INTERVAL WAS SUCCESSFUL
5	0503	19.5	4.38	1800	Y	–	200		222°	3		283	USED STD FINGER CC. 3 ATTEMPTS TO CORE THIS INTERVAL: 1ST 2 ATTEMPTS HAD NO RECOVERY 3RD ATTEMPT SUCCESSFUL
6	0906	23.9	4.40	1800	Y	–	200		152°	3		229	3 ATTEMPTS: #1 USED FLAPPER CC – NO RECOVERY #2 USED FINGER CC – NO RECOVERY #3 CHANGED HPC. PULLED OUT & WASHED DOWN TO TARGET INTERVAL. USED FLAPPER CC. RECOVERED 4.4 M.
7	1005	28.3	4.47	1650	Y	–	200		230°	3		349	A.O.K. [42 RUNS ON HPC #2 REDRESSED – SEALS OK]
8	1126	32.7	3.48	1200	Y	–	200		301°	3		302	A.O.K.
9	1344	37.1	0.20	1800	Y	–	200		40°	3		—	2 ATTEMPTS. 1ST ATTEMPT W/FLAPPER CC NO RECOVERY. 2ND TRY WITH FINGER C. OK
10	1440	41.5	4.32	1200	Y	–	200		61°			339	A.O.K.
11	1652	45.9	0.2	1450	Y	–	200		45°	3		—	CC only
12	1755	50.3	3.98	1650	Y	–	200		240°	3		441	A.O.K.

HPC LOGSHEET

LEG 68 SITE: 502

WATER DEPTH: 3051.5

CORE NUMBER	TIME ON DECK	SUBBOTTOM DEPTH (M)	RECOVERY (M)	PRESSURE TO SHEAR PINS	FULL STROKE?	INITIAL PULL-OUT WEIGHT (LBS)	RETRIEVAL RATE (METERS/MIN)	SHIP'S HEADING	ANGLE BETWEEN BASELINE AND ORIENTATION MARK	SEA STATE	LITHOLOGY	AVG. SHEAR STRENGTH (G/CM²)	OTHER OBSERVATIONS
13	1900	54.7	0.2	1450	Y	—	120	075°	N/A	3	FORAM NANNO MARL	—	USED SOCK ON FINGER CC PULLED TOOL SLOWER
14	2015	59.1	0	1800	Y	—	160		N/A	3		—	WILL NOT RECORE
15	2130	63.5	0	1500?	?	—	160		N/A	3		—	2 NEW PISTON HEAD SEALS USED ALSO USED FINGER CC W/SOCK
													PRESSURED UP TO 1500. NO SIGN OF SHOOT-OFF. TURNED PUMPS OFF & PRESSURE BLED DOWN
16	2254	67.9	3.47	1500?	Y	—	160		209°/172°			477	SPARE HPC USED THIS RUN. BUT NOTICED SAME SITUATION AS RUN # 15.
				[11 RUNS ON HPC # 1 — NOT REDRESSED]									MULTIPLE MARKS ON LANDING RING. 209° USED FOR ORIENTATION. 1 CRACK IN CENTER OF LINER
17	AUG 20 0005	72.3	4.52	1800	Y	—	160	075°	239	3		454	USED FLAPPER CC WITH STRONGER SPRING. PRESSURED TO 800 PSI & HELD. THEN
													PRESSURED TO 1800 PSI. TOOL SHOT OFF OK.
18	0114	76.7	0	1550	Y	—			N/A	3		—	USED FINGER CC
19	0240	81.1	4.16	1500	Y	—			241°			472	NO INDICATION OF FIRING, AS IN CORES 15 and 16. USED STIFF SPRING FLAPPER.
20	0347	85.5	4.63	1500	Y	—			310°			545	SAME AS ABOVE
21	0507	89.9	4.53	1700	Y	—			101°			816	A.O.K.
22	0621	94.3	4.67	2000	Y	—			197°			641	A.O.K.
23	0734	98.7	4.68	1650	Y	—			?135°			632	ORIENTATION QUESTIONABLE DUE TO LINER TURNING WHEN CC SUB UNSCREWED.
24	0848	103.1	4.7	1750	Y				237°			788	A.O.K.

HPC LOGSHEET

LEG 68 SITE: 502A

WATER DEPTH: 3051.5

CORE NUMBER	TIME ON DECK	SUBBOTTOM DEPTH (M)	RECOVERY (M)	PRESSURE TO SHEAR PINS	FULL STROKE?	INITIAL PULL-OUT WEIGHT (LBS)	RETRIEVAL RATE (METERS/MIN)	SHIP'S HEADING	ANGLE BETWEEN BASELINE AND ORIENTATION MARK	SEA STATE	LITHOLOGY	AVG. SHEAR STRENGTH (g/cm²)	OTHER OBSERVATIONS
25	0957	107.5	4.49.	2000	Y	—	—	075°	31°	3	FORAM NANNO MARL	764	A.O.K.
26	1112	111.9	4.62	1900	Y	—	—		40°			1394	SPIRAL GROOVE SCORED ENTIRE LENGTH OF CORE BARREL. SPIRALED 360° FROM CC TO
													TOP. SUSPECT SOMETHING ~~WAS~~ LODGED IN OR JUST ABOVE BIT.
27	1214	116.3	4.40	2150	Y	—	—		80°	3		1401	SMALL SCORE NOTED ON UPPER END OF CORE BARREL ~ 19 Cm. FROM TOP
28	1333	119.3	3.24	2200	?	—	—		52°/235°	3		1320	BLEW OUT RELIEF VALVE ON DECK. MAY NOT HAVE FULL STROKE
									~~[illegible]~~	SHALLOW SCORE STRAIGHT UP CORE BBL FROM CC TO TOP			2 ORIENTATION MARKS, 52° USED. SMALL OVAL CRACK MIDWAY UP LINER
				FROM THIS POINT ON, WILL WASH DOWN ONLY AMOUNT INDICATED FROM MUDLINE MARK ON OUTER HPC — NO MORE FULL STROKES									
29	1434	122.8	3.6	2150	N	—	—	075°	247°/205°/110°	3	FORAM NANNO MARL	1572	BLED OFF ON DECK AFTER HELD PRESSURE AT 2150 PSI. MULTIPLE MARKS ON RING. 247° USED FOR ORIENTING.
30	1539	125.8	3.28	1900	N	—	180		270°/210°			1147	2 MARKS ON RING. FIRST ONE LISTED WILL ALWAYS BE ONE USED FOR ORIENTATION
31	1738	128.3	0	2000/1900	N	—	—		N/A			—	HPC RETURNED UNSHEARED 2ND TIME DOWN → GOOD INDICATION OF SHOOT-OFF
32	1851	131.3	3.29	1750	N	—	—		295°			1940	
33	1955	134.3	3.14	2100	N	—	—		145°			1598	USING FINGER CC POOR INDICATION OF STROKE
34	2100	137.3	3.12	1700	N	—	—		000°/310°			1761	MULTIPLE MARKS ON RING ~5 cm of MUD HAD EXTRUDED THRU, BUT WAS
													STILL ATTACHED TO BOTTOM OF CC
35	2205	140.8	3.91	1750	N	—			100°/210°			1703	

HPC LOGSHEET

LEG 68 SITE: 502A

WATER DEPTH: 3051.5

CORE NUMBER	TIME ON DECK	SUBBOTTOM DEPTH (M)	RECOVERY (M)	PRESSURE TO SHEAR PINS	FULL STROKE?	INITIAL PULL-OUT WEIGHT (LBS)	RETRIEVAL RATE (METERS/MIN)	SHIP'S HEADING	ANGLE BETWEEN BASELINE AND ORIENTATION MARK	SEA STATE	LITHOLOGY	AVG. SHEAR STRENGTH (g/cm²)	OTHER OBSERVATIONS
36	2313	143.3	2.55	1900	N	—	—	075°	175°/280°	3	FORAM NANNO MARL	1529	DOUBLE LINE OF LINER ORIENTED BEFORE INSERTED INTO HPC. UPON BREAKING OPEN C.B. LINER TURNED WHILE UNSCREWING CC.SUB SO UNABLE TO CHECK TO SEE IF IT MAINTAINED ORIENTATION
37	AUG 22 0042	145.3	2.77	1700	N	—	—		315°/200°			2120	LINER AGAIN ORIENTED BEFORE INSERTION UPON RETURN TO DECK, DOUBLE LINE WAS 15° BEARING FROM HPC ALIGNMENT SCRIBE.
38	0202	147.3	1.99	1700	N	—	—		285°			1992	ORIENTED DOUBLE LINE ENDED UP BEARING 325° FROM HPC ALIGNMENT SCRIBE.
39	0315	150.3	3.0	1700	N	—	—		110°			2178	A.O.K.
40	0439	152.8	2.5	2000	N	—	—		300°			1911	A.O.K.
41	0606	155.8	3.42	1850	N	—	—		245°/068°			2351	A.O.K.
42	0712	158.3	2.67	1800	N	—	—		103°			2096*	A.O.K.
43	0821	161.3	3.0	2100	N	—	—		203°/247°			1031*	A.O.K.
44	0929	163.8	2.7	2100	N	—	—		305°			2676	A.O.K.
45	1028	166.3	2.48	1850	N	—	—		326°			2734	A.O.K.
46	1134	168.3	2.34	1900	N	—	—		128°			2062	A.O.K.
47	1235	171.3	3.35	1800	N	—	—		007°/230°			1946	MULTIPLE MARKS STILL APPEARING ON RINGS. LONGITUDINAL CRACK AT TOP OF LINER.
48	1341	173.3	1.96	1775	N	—	—					2734	A.O.K.
49	1444	175.3	0	1700	N	—	—		000°/30°/90°			—	PRESSURED TO 1700 – NO INDICATION OF SHEAR. RAISED BIT OFF BOTTOM – PRESSURED TO 1700 PSI. FLICKER ON WEIGHT DIAL SHOWED TOOL SHEARED.

HPC LOGSHEET

LEG 68 SITE: 502B

WATER DEPTH: 3051.5

CORE NUMBER	TIME ON DECK	SUBBOTTOM DEPTH (M)	RECOVERY (M)	PRESSURE TO SHEAR PINS	FULL STROKE?	INITIAL PULL-OUT WEIGHT (LBS)	RETRIEVAL RATE (METRES/MIN)	SHIP'S HEADING	ANGLE BETWEEN BASELINE AND ORIENTATION MARK	SEA STATE	LITHOLOGY	AVG. SHEAR STRENGTH (g/cm²)	OTHER OBSERVATIONS
50	1546	178.3	2.62	1850	N	—		075°	345°/108°	3	FORAM NANNO MARL	1923*	A.O.K.
51	1654	180.8	2.20	2050	N	—			175°/095°			2444	HAD TO PRESSURE UP TWICE. 1st TIME NO INDICATION OF SHOOT-OFF
52	1809	182.8	1.7	1775	N	—			275°/045°			1934	USED HARD FORMATION CC. MULTIPLE MARKS ON RING. PICKED BEST TWO.
53	1919	184.8	1.54	1800	N	—			225/040			—	A.O.K.
54	2014	187.3	2.47	2000	N	—			275°/230°			2247	DOUBLE LINE ON LINER 350° FROM HPC SCRIBE LINE
55	2125	189.3	2.12	1600	N	—			269°/25°/350°			1216	DOUBLE LINE WAY OFF SCRIBE LINE. MAY NOT HAVE BEEN ORIGINALLY ORIENTED. SMALL OVAL SECTION MISSING IN LINER.
56	2225	191.3	2.16	1750	N	—			140°/005°/205°			1749	LINER ORIENTATION (WAY OFF SCRIBE LINE AGAIN)
57	2329	193.3	1.97	1750	N	—			265°/125°			2698	OVAL CRACK MIDWAY UP LINER
58	AUG 23 0037	195.3	2.03	1750	N	—			165°/102°			2490	DOUBLE LINE ON LINER BEARING 325° FROM HPC. SCRIBE LINE
59	0144	197.3	0.63	1600	N	—			050°			—	
60	0257	199.3	1.92	2000	N	—			075°/160°			2247*	MULTIPLE MARKS STILL APPEAR ON AL. RING
61	0409	201.3	1.53	?	N	—			055°!?			—	NO GAUGE INDICATION OF SHOOT-OFF MANY MARKS ON AL. RING
62	0535	203.3	0.59	1950	N	—			278°/205°			2618*	GOOD INDICATION OF SHOOT-OFF
63	0647	205.3	1.63	1675	N	—			213°/030°			1934*	USED COPPER RING — STILL MULTIPLE MARKS.
64	0815	207.3	0	1950	N	—			N/A			—	

HPC LOGSHEET

LEG 68 SITE: 502A

WATER DEPTH: 3051.5

CORE NUMBER	TIME ON DECK	SUBBOTTOM DEPTH (M)	RECOVERY (M)	PRESSURE TO SHEAR PINS	FULL STROKE?	INITIAL PULL-OUT WEIGHT (LBS)	RETRIEVAL RATE (METERS/MIN)	SHIP'S HEADING	ANGLE BETWEEN BASELINE AND ORIENTATION MARK	SEA STATE	LITHOLOGY	AVG. SHEAR STRENGTH (g/cm²)	OTHER OBSERVATIONS
65	0924	209.3	2.36	2050	N		—	075°	345°/195°	3		1571*	~~At~~ SPARE HPC USED 34 RUNS ON HPC #2 – REDRESSED
66	1039	211.3	1.95	1700	N		—		250°/300°			—	OUTER SEAL SUB SEALS BAD INNER SEAL SUB SEALS GOOD
67	1154	212.8	0.97	1450	N		—		245°/130°			—	
68	1308	214.8	2.4	2150	N		—		30°/15°			1540*	END.

* CRACKED DURING MEASUREMENT
THIS USUALLY PRODUCES LOWER
~~SHEAR STRENGTHS.~~

HPC LOGSHEET

LEG 68 SITE: 502B

WATER DEPTH: 3051.5

Core Number	Time on Deck	Subbottom Depth (m)	Recovery (m)	Pressure to Shear Pins	Full Stroke?	Type of Core Catcher Used	Ship's Heading	Number of Marks on Landing Ring	Angle Between Baseline and Orientation Mark	Sea State (Swell)	Lithology	Avg. Shear Strength (g/cm²)	Other Observations
1	AUG 23 1545	2.9	1.75	1750	Y	FLAPPER	075°	1	008°	3	FORAM NANNO MARL	56	STARTED USING SAME HPC THAT WAS USED ON 502A
2	1650	7.3	3.76	1700	Y			1	338°			136	A.O.K.
3	1756	11.7	4.37	1700	Y			1	220°			196	A.O.K.
4	1858	16.1	4.45	1700	Y			1	180°			267	A.O.K.
5	1955	20.5	4.13	1450	Y			1	50°/135°			360*	LINER MAY HAVE TURNED WHEN UNSCREWING CC SUB. 50° = ANGLE OF RING MARK FROM HPC SCRIBE. 135° = ANGLE OF DOUBLE LINE ON LINER FROM HPC SCRIBE LINE.
6	2100	24.9	4.44	1700	Y			1	275°			271	40 cm OVAL CRACK NOTED 1 METER FROM BTM OF LINER
7	2202	29.3	4.64	1750	Y			1	80°			337	MUD IN UPPER LINER SUPPORT DOUBLE LINE 5° FROM HPC SCRIBE
8	2324	33.7	3.69	1750	Y			1	220°			392*	DOUBLE LINE ~90° FROM HPC SCRIBE
9	AUG 24 0039	38.1	3.79	?	Y			1	158°			324*	NO INDICATION OF SHOOT-OFF, BUT PRESSURE BLED DOWN AT TOOL
10A	0147	42.5	0.	<1500	Y			2	055°			—	PRESSURED TO 1500 PSI & COULD GO NO HIGHER, SIGNIFYING TOOL HAD SHOT OFF. CUT PUMPS & PRESSURE BLED DOWN. 2nd MARK ON RING VERY SHALLOW SUSPECT STICKY FLAPPER CC IMPEDED RECOVERY
10B	0257	42.5	3.08	1700	Y			1	162°				SAME INTERVAL CORED THIS TIME SUCCESSFUL
11	0407	46.9	4.41	1400	Y			4	302/260			492	

HPC LOGSHEET

LEG 68 SITE: 502B

WATER DEPTH: 3051.5

CORE NUMBER	TIME ON DECK	SUBBOTTOM DEPTH (M)	RECOVERY (M)	PRESSURE TO SHEAR PINS	FULL STROKE?	TYPE OF CORE CATCHER USED	SHIP'S HEADING	NUMBER OF MARKS ON LANDING RING	ANGLE BETWEEN BASELINE AND ORIENTATION MARK	SEA STATE (SWELL)	LITHOLOGY	AVG. SHEAR STRENGTH (g/cm²)	OTHER OBSERVATIONS
12A	0518	51.3	0	1650	Y	FLAPPER	075°	2	195°	2	FORAM NANNO MARL	—	TRACES OF MUD IN LINER SUSPECT LOST THRU FLAPPER.
12B	0617	51.3	3.67	1850	Y	FLAPPER W/2 SPRINGS		1	149°			—	PUT 2 SPRINGS ON FLAPPER. RECORED SAME INTERVAL SUCCESSFULLY
13	0713	55.7	4.45	1900	Y			1	084°			401*	A.O.K.
14	0824	60.1	4.38	1775	Y			2	025°			346	A.O.K
15	0918	64.5	1.72	1800	Y			1	108°?			328*	CORE LINER MAY HAVE ROTATED WHILE UNSCREWING CC SUB.
16	1016	68.9	1.25	1725	Y			1	255°			—	NO EXPLANATION FOR LOW RECOVERY
17	1129	73.3	4.34	1800	Y			1	285°			501	A.O.K
18	1230	77.7	4.41	1700	Y			1	240°			392	OVAL CRACK 1 METER FROM BTM OF LINER
19	1334	82.1	4.22	1900	Y			1	240°			538	AOK
20	1441	86.5	4.55	1850	Y			1	063°			556	40cm. LONGITUDINAL CRACK IN LINER 1 METER FROM BTM.
21	1542	90.9	4.59	1850	Y			1	210°			472	DOUBLE LINE ON LINER BEARING 300° FROM HPC SCRIBE MARK
22	1642	95.3	4.63	1900	Y			1	330°			743	A.O.K.
23	AUG 25 0330	99.7	3.51	?	?			1	?			802	

RAN DOWN HPC FOR CORE #23. PRESSURED UP 6 TIMES TO 2150 PSI, BUT NO INDICATION OF TOOL SHOOTING OFF. STARTED TO RETRIEVE HPC, AND 2500' FROM BOTTOM HPC JAMMED IN PIPE. BROKE SEVERAL OVERSHOT SHEAR PINS TRYING TO PULL FREE. THEN RAN CORE BARREL DOWN WHICH JARRED IT DOWN TO BIT, BUT THERE IT REMAINED JAMMED. SO HAD TO PULL PIPE. FOUND THAT CAP SUB LOCKING SET SCREW HAD BACKED OFF AND SHEARED - THE STUB HAD JAMMED THE TOOL. WHEN HPC WAS KNOCKED BACK DOWN TO SEAT IT LANDED ON THE SET SCREW (IMPRESSION IN AL. RING) TOOL HAD SCOPED AND RECOVERED 3.51 M. CORE.

HPC LOGSHEET

LEG 68 SITE: 502C

WATER DEPTH: 3051.5

CORE NUMBER	TIME ON DECK	SUBBOTTOM DEPTH (m)	RECOVERY (m)	PRESSURE TO SHEAR PINS	FULL STROKE?	TYPE OF CORE CATCHER USED	SHIP'S HEADING	NUMBER OF MARKS ON LANDING RING	ANGLE BETWEEN BASELINE AND ORIENTATION MARK	SEA STATE (SWELL)	LITHOLOGY	AVG. SHEAR STRENGTH (g/cm²)	OTHER OBSERVATIONS
1	AUG 25 1243	32.0–36.4	4.44	1950	Y	2 SPRING FLAPPER	085°	1	45°	1	FORAM NANNO MARL	435	SPARE HPC USED 27 RUNS ON HPC #1 - REDRESSED SEALS IN GOOD CONDITION
2	1343	40.8	4.52	2150	Y	"		1	310°			417	
3	1443	45.2	3.73	1900	Y	"		1	158°			509	
4	1545	49.6	1.83	1850	Y	"		1	355°			449	
5	1645	54.0	4.22	1800	Y	"		1	215°			431	
6	1749	58.4	4.41	2000	Y	"		1	290°			522	
7	1852	62.8	0.94	1850	Y	"		1	085°			—	EVIDENCE OF FLAPPER STICKING OPEN.
8	1958	67.2	4.73	1800	Y	"		1	118°			591*	
9	2110	71.6	4.43	1850	Y	HARD FORM. FINGER		1	021°			609	
10	2213	76.0	4.55	1950	Y	"		2	290°			609	LINER FLATTENED NEAR TOP — PARTIAL COLLAPSE
11	2312	80.4	4.44	1850	Y	"		1	165°			678	
12	AUG 26 0026	84.8	2.17	1550	Y	"		2	247°			504	DOUBLE LINE 30° FROM HPC SCRIBE
13	0129	89.2	4.71	1700	Y	"		2	119°			652	
14	0239	93.6	4.74	1750	Y	"		6	285°/010°			719	6 MARKS IN 2 GROUPS ON LANDING RING
15	0353	98.0	4.69	1900	Y	"		1	040°			749	

HPC LOGSHEET

LEG 68 SITE: 502C

WATER DEPTH: 3051.5

CORE NUMBER	TIME ON DECK	SUBBOTTOM DEPTH (M)	RECOVERY (M)	PRESSURE TO SHEAR PINS	FULL STROKE?	TYPE OF CORE CATCHER USED	SHIP'S HEADING	NUMBER OF MARKS ON LANDING RING	ANGLE BETWEEN BASELINE AND ORIENTATION MARK	SEA STATE (SWELL)	LITHOLOGY	AVG. SHEAR STRENGTH (g/cm²)	OTHER OBSERVATIONS
16	0459	102.4	4.59	1800	Y	HARD FORM. FINGER	085°	2	089°	1	FORAM NANNO MARL	638	
17	0620	106.8	4.49	1900	Y			3	252°	1		1046	LINER ROTATED WHEN CC REMOVED
8	0727	111.2	4.06	2050	NO			3	050°	1		1179	LINER ROTATED WHEN CC REMOVED
9	0829	115.6	2.03	2050	Y/N?			2	221°	1		905*	PRESSURE BLED OFF, BUT VERY SLOWLY
0	0940	120.0	3.71	2000	N			2	100°	1		816*	PUT 2nd PISTON SEAL (USED) ON PISTON HEAD
1	1044	124.4	3.07	1750	N			2	028°	2		1261	PUT O-RING BETWEEN THE 2 USED PISTON SEALS
2	1137	125.4	0.92	1750	N			2	168°	2		—	AT FIRST – NO INDICATION OF FIRING. RAISED PIPE ½ M. & FIRED AT 1750 PSI
3	1257	129.8	4.60	1850	N			2	168°	2		1992	LONGITUDINAL CRACK AT TOP OF LINER
4	1526	134.2	3.29	1750	N			2	085°/230°	2		1691	2 ATTEMPTS: ON 1st ATTEMPT PRESSURED UP TO 2150 PSI TWICE

WITH NO INDICATION OF SHEARING OR BLEED-OFF. RETRIEVED TOOL UNSHEARED. CHECKED ALIGNMENT OF LANDING RING WITH OUTER BODY – O.K. BUT INNER BARREL WAS ~20° OFF FROM OUTER BODY. OLD SHEAR PINS WERE PARTIALLY DEFORMED – WERE REPLACED. CHANGED RING AND SHEAR PINS, REALIGNED, AND SENT BACK DOWN. 2nd TRY SUCCESSFUL. WHEN HPC. RETURNED FOUND OUTER BODY ROTATED 180° REL. TO INNER BARREL. THIS ~~ARE~~ CHECK WILL BE MADE ROUTINELY FROM NOW ON. "U→L" ≡ ANGLE OF ROTATION OF UPPER SECTION W/RESPECT TO LOWER SECTION

5	1627	137.2	1.32	1700	N	HARD FORM FINGER	085°	6	220°	1-2	FORAM NANNO MARL	—	U→L = 0° REPLACED PISTON SEAL O-RINGS
6	1749	140.7	3.35	1900	N	"	"	3	55°/140°	1-2	"	2062	U→L = 0°

HPC LOGSHEET

LEG 68 SITE: 502

WATER DEPTH: 3051.5

CORE NUMBER	TIME ON DECK	SUBBOTTOM DEPTH (M)	RECOVERY (M)	PRESSURE TO SHEAR PINS	FULL STROKE?	TYPE OF CORE CATCHER USED	SHIP'S HEADING	NUMBER OF MARKS ON LANDING RING	ANGLE BETWEEN BASELINE AND ORIENTATION MARK	SEA STATE (SWELL)	LITHOLOGY	AVG. SHEAR STRENGTH (g/cm²)	OTHER OBSERVATIONS
27	1856	144.2	3.05	1750	N	HARD FORM. FINGER	085°	1	355°	1	FORAM NANNO MARL	2270	U→L · 0° O-RING HOLDING UP O.K.
		WASHED	DOWN										
28	2236	213.2	2.99	1950	N			2	285/115	1-2		*	U→L = 0° TOP ⅓ of LINER COLLAPSED
29	2350	215.2	2.04	1800	N			2	070°/165°			2398*	U→L = 0°
30	AUG 27 0107	216.7	1.62	—	N			2	012°/128°				TOP ⅓ of LINER CRACKED U→L = 0°
31	0211	219.2	2.51	1700	N			2	050°/227°				~~U→L = 20° TO LEFT~~ U→L = 20°
32	0315	221.7	2.21	1700	N			2	156°				U→L = 340° LINER ROTATED WHEN CC UNSCREWED
33	0410	223.7	2.39	1750	N			2	320°				U→L = 0°
34	0520	225.7	2.09	1900	N			2	327°				U→L = 355°
35	0629	226.7	0.85	1700	N			2	326°				U→L = 30° LINER ROTATED WHEN CC UNSCREWED
36	0740	227.7	0.45	1550	N			2	048°	2			HAD TO PULL UP ½ METER TO SHOOT.
37	0920	228.7	0.10.	2000	N			2	094°	2			END.

* = CRACKED DURING MEASUREMENT

SITE 503

The second site to be investigated on the HPC leg was located 1001 miles west southwest of Balboa, Panama. Following the port call in Balboa, where Global Marine crews were changed, the ship traveled for four and one half days before dropping a 13.5 kHz beacon at 2232 hours on September 6th.

The PDR indicated a bottom depth of 3682 meters and therefore, the drilling string was madeup and run into a depth of 3679.2 meters. The HPC was then lowered and pressured up and the shear pins were sheared which placed the bottom of the core barrel at 3683.6 meters. When the core barrel was recovered it was completely filled with 4.78 meters of sediments. This placed the mudline at 3678.8 meters and indicated that the bottom of the drill pipe could have been in the bottom. Because the core barrel was filled, the scientific staff felt that this core might not reflect the actual mudline so it was decided to try another mudline core. Therefore, Hole 503 was abandoned after cutting and retrieving only one core at 1430 hours on September 7th.

HOLE 503A

Hole 503A was spudded at 1609 hours September 7th, with the drill string hanging at 3676.2 meters. The drill string was pressured up and a core was cut to the depth of 3680.6 meters. When the core barrel was retrieved it contained 1.75 meters of sediment, which again placed the mudline at 3678.8 meters as in Hole 503. The scientific staff considered this a valid mudline depth and continuous coring began. This operation was performed as it had been done at Site 502, however, the amount of sediment recovered in each core was less than what had been recovered at the other site. The shear pressure remained the same ranging from 1350-2100 pounds and the pressure bled off indicating that the tool was scoping completely. After 120 meters had been cored with recoveries averaging about 55%, the tool being used was changed. After the change, recovery continued to be erratic. Then, while retireving core No. 42, the sandline parted. When the sandline was recovered, it appeared that the break had occurred near the socket on the sinker bars. Therefore, a conventional core barrel was made up with short hard formation teeth in the catcher sub and it was dropped down the pipe. A new overshot was assembled and lowered to the bottom. When it was picked up the weight indicator showed a weight that indicated that both tools had been picked up. This was verified when the overshot reached the derrick floor. The tools were disconnected and the coring operation continued.

Beside the low recovery, another problem developed as the hole was deepened. This additional problem developed due to the rust on the inside of the drill pipe. The pipe, which was being used, had not been picked up at Site 502 because it was located in shallower water. Therefore, as each joint was added, additional rust peeled off and was smeared on the outside of the core. This affected the paleomagnetic readings and made them invalid. Therefore, these observations were discontinued. In an attempt to clear up this problem, the hole was circulated clean after core No. 42 with a 20-barrel mud pill. The results seemed to improve the condition, but when a new single was added the problem returned.

A condition that could have caused the difference in recovery at this site as compared with that at Site 502 was the type of rock being cored. Site 502 sediments contained a large amount of clay and shear values increased to about 3000 gn/cc^2. At Site 503, shear valves never exceeded 600 gn/cc^2 and had porosity valves up to 90%.

Coring continued to a depth of 235 meters below seafloor (BSF) and then was stopped because of not wanting to core the sediment basement contact which was estimated to be at about 250 meters BSF. This information had been obtained from previous drilling in this area by the CHALLENGER.

When the bit was pulled above the mudline at 0650 hours on September 11th, Hole 503A was abandoned.

HOLE 503B

HOle 503B was spudded at 1016 hours on September 11th after the ship had been offset 60' south and 320' west from Hole 503A. The drill string was lowered to 3677.2 meters and the pipe was pressured up, pins were sheared and the core barrel scoped out to a depth 3681.6 meters. When the cored material was measured, the mudline was again found to be 3678.8 meters.

Two basic changes were made in the coring operation at this hole. First the flapper valve in the core catcher was modified to give a more positive closing action and secondly, only one shear pin was used. The latter change resulted in shearing pressures of from 550-1250 pounds. With these changes the recovery increased consistently to near or over 90% on each core. The tools were changed after core No. 6 to repair a cap sub and the good recovery continued unchanged.

After core No. 18 was recovered, it was noted that a couple of strands were broken in the sandline just above the socket to the sinker bars. This was the same area which caused the tool to be dropped in Hole 503A. Therefore, the cable was cut, a new socket poured and the sinker bars and overshot reinstalled. Coring continued with excellent recovery to a depth of 112.8 meters BSF and then abandoned because of time constraints for departing the site to travel to Salinas, Ecuador and the end of the HPC leg. Hole 503B ended when the bit reached the derrick floor at 1050 hours on September 13th. (A detailed report for Site 503 follows this site report)

SITE 503 - HYDRAULIC PISTON CORE

Synopsis

At Site 503, two holes were continuously cored with the hydraulic piston corer. Hole 503A was cored in 54 segments to a BSF depth of 235.0 meters; Hole 503B was cored subsequently in 26 segments to a BSF depth of 112.8 meters. Of the sediment cored 62% of it was recovered from Hole 503A and 86% of it was recovered from Hole 503B.

Shear strengths of the sediment in the upper 100 meters vacillated in the 150-500 gm/cm^2 range, then increased to a maximum of 1650-1700 gm/cm^2 at a depth of 220-230 meters BSF.

Operational Effectiveness

Upon rectifying the core catcher problem, the hydraulic piston corer performed equally as successful at Site 503 as it had at Site 502.

Based on the experience at Site 502, several modification to the HPC were instituted prior to arrival at Site 503. These adjustments concerned two categories; orientation and upper liner supports.

Three modifications were completed to guarantee positive orientation. First, the top sub body badly was locked to the outer body cap (before firing only) to preclude rotation of the landing ring relative to the outer body. This was accomplished by notching the outer body cap with a grinder and screwing a socket head cap screw into the underside of the top sub body. The set screw locked into the notch with the HPC in the cocked (pre-fired) position and ensured the landing ring would not rotate before firing. Second, a detent was drilled in each shoulder sub so that the .5" locking set screw from the cap sub served an alignment function as well (alignment marks were scribed on the cap sub and each core barrel). Third, to prevent the core liner from rotating relative to the landing ring, a notch was cut into the 9.75" sub and a weld bead was built up on the lip of each lower liner support. This locking action was particularly important when removing the core catcher sub after a run. In all, these three modifications proved to work remarkably well.

It was felt that the upper liner support could be eliminated from use without loss of core recovery and without loss of the core quality. Additionally, it was hoped that the incidence of core liner failure would diminish. Therefore, metal upper liner supports were not used at the beginning of Site 503, but no difference of operation was noted. After 18 runs on Hole A, upper liner suports were utilized again.

Several on-site modifications were implemented because of the unexpected low recovery in the early coring of Site 503. The bulk of these changes concerned the core catcher.

A leaf spring core catcher with a sock was used on the first run at Site 503. Upon retrieval all the leaves were broken off and the sock protruded through the end of the core catcher sub. Naturally there was no recovery and the leaf spring core catcher was abandoned.

Flapper-type core catchers were attempted next. The first variation concerned the thickness of the springs used on the flapper valve. A "weak" beryllium spring (.020" thick) and a "stiff" beryllium spring (.032" thick) were alternated on the runs. The results were inconsistent and inconclusive with both types, so a soft-formation finger-type core catcher with a sock was tried for two runs on Hole A (see log sheets). It was unreliable and therefore forsaken.

Other modifications to the flapper were attempted before a viable adaptation was developed. Those variations included: 1) using two springs vice one on the outside of the flapper valve, and 2) attaching a pawl to the inside of the flapper with one spring on the outside of the flapper. The purpose of the pawl was to snag the sediment until the valve was out from the sleeve far enough to continue closing on its own. The pawl was fabricated from a beryllium spring; it was cut in half and the screw for the spring was fed through the hole in the pawl before threading it onto the flapper valve.

A third modification to the flapper involved drilling a larger diameter hole in the flange of the flapper valve so that a larger hinge pin could be used. It was thought that this would reduce the slop in the actuation of the flapper, thereby ensuring more positive closing. Two flapper valves were drilled for that purpose, but both of them broke at the flange because the flanges were weakened too much by the drilling.

The final mutation, which yielded the highest percentage of recovery, was not discovered nor implemented until Hole 503B. That involved machining the bevel on the flapper valve in the direction opposite from the design. It was used with one outside spring and without the pawl. It produced consistently high recoveries.

An attempt was made to use two soft formation finger type core catchers in tandem with a sock over each one. Recovery was poor (1.45 meters) so that combination was not tried again.

The engineering tests that had been planned for the HPC at Site 503 were performed only partially because of the severe time constraint. Those tests included: 1) varying the number and size of shear pins (therefore testing different shear pressures) to see what affect that had on recovery; 2) using the chevron seals with spacers on the top sub body; and 3) removing the four .25" pipe plugs from the cap sub.

The tests concerning the number and size of shear pins were conducted on an ad hoc basis only. For one run on Hole A, two small diameter (.37") shear pins were used to observe shear pressure, amount of recovery, and the quality of the recovery. The pins sheared at 1350 psi but the results were inconclusive (see log sheets). All other runs on Hole A were done with two regular shear pins.

For Holè B, the decision was made to core initially with one small shear pin until the recoveries displayed consistently that the HPC was not stroking fully. Thereupon combinations yielding incremental increases in shear pressure would be used; i.e., the next step would be one regular shear pin, the two small pins, one large long pin rim and one small pin, etc., to three regular pins. This plan was devised under the premise that the overkill from the regular shear pin pressure (1600-2100 psi) in soft sediments had three undesirable effects: 1) the cores were being overly disturbed; 2) the amount of recovery was lessened; and 3) the butyrate liners were being cracked and collapsed.

Due to the softness of the sediment, one small shear pin was sufficient to core Hole 503B entirely. A combination different from one shear pin was tested only once, when two small pins were used. They sheared at 1500 psi with 4.12 meters recovered. One small pin yield shear pressure in the 850 ± 200 psi range (see log sheets).

Chevron seals for the top sub were tested and the results indicate that they provide as an effective seal as polybipaks. From the limited data, they appear to wear at least at well as the polybipaks do.

The spacing was not exact with the Chevron seals. They extended approximately .14"-.15" above the seal facing. Temporary corrections were easily made. One method was to hold the orientation landing ring in place with a pipe wrench while the top sub cap was tightened sufficiently to compress the seals, then the set screw for the ring was inserted. The other method was to simple remove one of the rubber seals, leaving two metal spacers juxtaposed. When time permitted, one of the spacers was machined down enough to allow the proper fit.

The last test involved removing the four .25" pipe plugs from the cap sub to allow additional exhaust from the inner core barrel upon stroking. This was done on the last 18 runs of Hole 503B. There is not enough data to draw precise conclusions but no problems were encountered, core recovery was high, and liner problems were minimal.

The final subject regarding the operational effectiveness of the HPC concerns the environmental factors. The only adverse condition was the sea state, which was not great enough to effect personnel comfort, but it did effect drilling operations. Swells were particular to Site 503, as opposed to Site 502.

The swells can be credited either partially or totally with causing the multiple marks on the landing rings in soft sediment (not observed at Site 502), more drastic wear on the top sub polybipak seals (rusty pipe also - covered later), set screw heads stripping (covered in detail below), and excessive piston seal wear (covered below).

Maintenance

Two types of maintenance are covered here: corrective, or on the spot maintenance for exigencies and preventive or routine maintenance.

There was very little corrective maintenance required; it can be classified in four categories:

1) The stripping of set screw heads as alluded to earlier was a frequent problem requiring attention. This problem occurred at Site 503 perhaps three to four times as often as at Site 502.

2) The top sub seals required replacement more often at Site 503 than Site 502. Excessive wear is attributable not only to the seas but to rusty drill pipe. It was believed that the drill pipe had excessive rust build-up because Site 503 was some 600-650 meters deeper than Site 502, ergo, the pipe had not been used in several weeks.

3) The piston rods were cleaned often. This was not a critical factor for corrective maintenance, but several times an HPC tool was pulled from operation to remove a part for drilling out a stripped set screw so the opportunity was seized to wash, buff, and regrease the piston rod.

4) Finally, the socket head cap screws that were recently added to the underside of the top sub bodies as an orientation modification were destroyed in three instances as the HPC was scoped together in the

pipe on the rig floor. The remnants of the set screws then had to be drilled and removed with an extractor.

It is important to point out that redressing the HPC, i.e., replacing the inner sub and outer sub seals, was never a critical factor. The most that a tool was run was 30 times before redressing. It was redressed then only because worn seals were thought, at the time, to be culpable of the poor recovery.

The preventive maintenance was performed routinely on the piston head seals and the set screw holes. The piston head seals were replaced every three runs to ensure proper functioning. To reduce/eliminate the recurring problems with the set screws, the holes were cleaned with thread chasers routinely. Usage rates of inventory items were normal except as noted:

A. Items with higher than anticipated usage rates.

1. Top sub polybipaks.
2. Piston head seals.
3. Set screws - all types and sizes.
4. Flapper valves - two failed (mentioned previously).
5. Beryllium spring for the flapper valves - inventory is critically low.

B. Items with lower than anticipated usage rates.

1. Inner sub seals.
2. Outer sub seals.

Problem Areas

This section is mainly a reiteration of aforementioned problems; it serves the purpose of collating the salient trouble areas encountered with the HPC at Site 503.

There were five particular problems encountered. These could be reviewed and corrected to improve the HPC's effectiveness. They are:

1. The core catcher failures.

2. Indication of shear pressure (the pressure at which the HPC strokes). It is felt that overpressurization risks disturbing the already captured sediment and risks flushing out the already trapped sediment.

3. Multiple marks on the orientation landing ring.

4. Failures of the butyrate core liners.

5. Stripping of the socket head set screws.

Areas for Review and Improvement

Two subjects could be studied and refined for the piston corer. Although these subjects did not cause problems, refinement of them could lead to easier handling and operation.

First, the piston rod/piston head connection could be modified to allow faster and easier replacement of the piston seals.

Second, the outer body/inner core barrel connection could be refined to allow quicker handling and less troublesome alignment.

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STATISTICAL DATA

[This is a statistical summary of the operation of the HPC. In addition to the two holes of Site 503, Holes 502A and 502C are included for comparison. Only these two of the four holes at Site 502 are needed for comparison: the other two offer no additional comparative information.]

ITEM	SITE 503A	SITE 503B	503 MAX/TOTAL/AVG (as appropriate	SITE 502A	SITE 502C	SITES 502 A&C MAX/TOTAL/AVG.
DEPTH from (m) DRILL FLOOR	3679.9	3678.8	3679.9	3049.0	3083.5	3083.5
MAX PENETRATION (m)	235.0	112.8	235.0	214.8	228.7	228.7
SEDIMENT CORED (meter)	235.0	112.8	347.8	214.8	130.7	345.5
SEDIMENT RECOVERED (meters)	146.9	96.5	243.4	179.8	114.4	294.2
% RECOVERED	62.5	85.5	70.0	83.7	87.5	85.2
MAX SHEAR (g/cm^2) STRENGTH	1686	513	1686	2733	2270	2733
AVG. SHEAR PRESSURE (psi)	1700 ±200	850 ±200	------	1700 ±200	1700 ±200	-------
# of RUNS in HOLE	54	26	-------	68	37	----
# of RUNS on 1 HPC (before redressing)	30	19	30	41	---	41

VANE SHEAR: C = CRACKED
D = DISTURBED

HPC LOGSHEET
LEG 68 SITE: 503, 503A
WATER DEPTH: 3678.8

Core #	Time on deck	Subbottom depth (m)	Recovery (m)	Pressure to shear pins	Full stroke?	Type of catcher	No. of marks on landing ring	Orientation angle	Lithology	Shear strength (g/cm2)	Ship's heading	Sea swell
503 1	SEPT 7 1238	—	0	?	Y	SPRING LEAF W/SOCK	MANY	—	—	—	215°	4
503 2	1438	?	4.78	1825	Y	SOFT FORMATION CC W/SOCK	9	175°			"	"
503A 1	1642	1.8	1.75	1500	Y	FLAPPER A (WEAK SPRING)	2	320°			"	"
2	1823	6.2	4.0	1700	Y	FLAPPER B (STIFF SPRING)	8	290° 160° 320°		95	"	4-5
3	2022	10.6	0	1850	Y	FLAPPER A	9	325°			"	3-4
4	2203	15.0	4.66	1850	Y	FLAPPER B	MANY	215°			"	4
5	2333	19.4	4.0	1850	Y	FLAPPER A	2	350° 305°		430	"	"
6	SEPT 8 0123	23.8	0	1850	Y	FLAPPER B	MANY	054°			"	"
7	0254	28.2	4.52	?	Y	FLAPPER A	MANY	279° ~~02~~		172 C	"	"
												"

Comments

USING HPC DRESSED WITH CHEVRON TOP SUB SEALS AND METAL CHEVRON SPACERS. ALL NEW ORIENTATION MODS INCORPORATED. NO UPPER LINER SUPPORT USED.

HOLE 503 #1 — NO CLEAN INDICATION OF SHOOT-OFF. PRESSURED UP TO 1500 PSI. CONTINUAL BLEED-OFF. B.O.P. WAS LEAKING. SPRING LEAFS TORN AWAY, SOCK TURNED INSIDE OUT. LOTS OF PIPE DOPE ON SOCK & TRACES OF MUD.

HOLE 503 #2 — A.O.K. ONE MARK ON RING BACKED UP WITH SECONDARY THOUGH THERE WERE SEVERAL SHALLOWER MARKS.

HOLE 503A #1 — RECORED MUDLINE, SINCE MISSED IT WITH PREV. CORE. PISTON HD. CAME OFF. BEGAN NEW PROCEDURE OF LEAVING OVERSHOT CONNECTED TO TOP SUB WHEN RAISING HPC AND BREAKING OUTER BODY/CORE BARREL CONNECTION. THIS HELPS KEEP UPPER SECTION VERTICAL & NOW UNNECESSARY FOR XTRA PERSON TO STABALIZE UPPER HPC AT TOP WHILE BREAKING CONNECTION. START USING FLAPPERS — ALTERNATING WEAK & STIFF SPRINGS TO COMPARE RESULTS ON RECOV. & QUALITY OF SOFT CORES.

#2 — LANDING RING SET SCREW SHEARED. REPLACED TOP SUB BODY. MULTIPLE MARKS ON RINGS MAY BE ATTRIBUTED TO ROUGH SEAS. ONLY 1 MARK HAD A BACK-UP (AT 290°)

#3 — NEW TOP SUB BODY WITH BIPAK SEALS. CHEVRON SEALS ARE STILL IN GOOD CONDITION & WILL BE USED AGAIN LATER. SLACKED OFF ON WIRE LINE (~15') AFTER SEATING HPC. MANY SHALLOW MARKS ON RING, BUT ONLY 1 THAT WAS BACKED UP BY SECONDARY. FLAPPER NOT STUCK OPEN. LINER BROKE IN ½.

#4 — LINER CRACKED & BROKEN IN CHARACTERISTIC FOOTBALL-SHAPE

#5 — LINER SPLIT DOWN ENTIRE LENGTH

#6 — FLAPPER ½ OPENED — APPEARS TO HAVE STUCK IN THAT POSIT. MUD BEHIND FLAPPER. LINER CRACKED. PISTON SEAL WEAR EVIDENT.

#7 — NO CLEAR INDICATION OF SHEAR. LINER DID NOT CRACK.

HPC LOGSHEET
LEG 68 SITE: 503
WATER DEPTH : 3678.8

Core #	Time on deck	Subbottom depth (m)	Recovery (m)	Pressure to shear pins	Full stroke?	Type of catcher	No. of marks on landing ring	Orientation angle	Lithology	Shear strength (g/cm^2)	Ship's heading	Sea swell
8	SEPT 8 0417	32.6	0	1750	Y	SOFT FORMATION W/SOCK	2	142°			215°	3-4
9	0536	37.0	3.48	1775	Y	"	1	145°		C 142	"	4
10	0705	41.4	3.73	1900	Y	FLAPPER	4	130°		261	"	3-4
11	0825	45.8	4.21	1800	Y	"	3	352°		385	"	4
12	0947	50.2	4.0	1600	Y	"	3	286°		C 266	200°	5
13	1128	54.6	4.2	1700	Y	"	6	198°		486	"	4
14	1305	59.0	4.05	?	Y	"	MANY	270°		C 224	"	4
15	1431	63.4	4.05	1350	Y	"	2	155° 250°		C 266	"	4
16	1605	67.8	3.5	?	Y	"	2	010° 320°		C 192	"	4
17	1735	72.2	1.75	? 1800	Y	"	MANY	0° 100°			"	4

Comments

#8 - NO CLEAR SHEAR INDICATION.

#9 - GOOD INDICATION OF SHEAR

#10 - BACK TO FLAPPER CC. HAVE NOTICED NO DIFFERENCE BETWEEN WEAK + STIFF SPRING FLAPPERS IN SOFT SEDIMENTS. PISTON SEALS WEARING - MAY NEED TO CHANGE SOON. ORIENTATION MARK ACCIDENTLY CUT OFF WHILE SECTIONING LINER.

#11 - CHANGED PISTON HEAD SEALS. NOTICED WEIGHT INCREASE DURING RETRIEVAL THRU LAST 200-300 METERS OF PIPE

#12 - NOTICED WEIGHT INCREASE SAME AS IN CORE #11 TOP SUB BIPAKS MAY BE FAILING.

#13 - REPLACED BIPAKS. INITIAL BIPAKS LASTED 10 RUNS. PRESSURED TO 2000 psi. NO CLEAR INDICATION OF SHEAR

#14 - NO CLEAR INDICATION OF SHEAR. LINER BROKE IN HALF ABOUT 2 METERS FROM BOTTOM END.

#15 - USED 2 SMALL DIAMETER (.370" DIA). FOOTBALL SHAPED CRACKED ~ 1.5 m FROM TOP. LONGITUDINAL CRACK CONTINUED TO TOP OF LINER.

#16 - BACK TO REGULAR SHEAR PINS. USING LINER FROM NEW BATCH + UPPER LINER SUPPORT. LINER RETURNED UNCRACKED. NO CLEAR INDICATION OF SHEAR.

#17 - NO UPPER LINER SUPPORT USED. NO CLEAR INDICATION OF SHEAR. LINER RETURNED CRACKED AT TOP.

ALL ORIENTATION MODS HAVE BEEN WORKING FINE.

HPC LOGSHEET
LEG 68 SITE: 503A
WATER DEPTH : 3678.8

Core #	Time on deck	Subbottom depth (m)	Recovery (m)	Pressure to shear pins	Full stroke?	Type of catcher	No. of marks on landing ring	Orientation angle	Lithology	Shear strength (g/cm2)	Ship's heading	Sea swell	Comments
18	SEPT 8 1850	76.6	0.12	? 1650	Y	FLAPPER	6	350°		—	200	4	#18 — UPPER LINER SUPPORT USED. LINER NOT CRACKED. TRACES OF MUD FOUND UP ENTIRE LENGTH OF LINER.
19	2012	81.0	3.28	1750	N	"	1	250°		149	"	"	#19 — NO UPPER LINER SUPPORT. CUT OFF PUMP BEFORE TOOL REACHED BOTTOM, WILL BE DOING THIS FROM NOW ON. LINER COLLAPSED NEAR TOP. HAD TO POUND IT OUT OF CORE BARREL. ONLY 1 MARK ON RING.
20	2142	85.4	4.59	1800	Y	"	6	310°		444	"	"	#20 — LINER CRACKED NEAR TOP. UPPER LINER SUPPORT USED ROUTINELY LINER HAD ROTATED ~30° FROM INITIAL ORIENTATION. FINAL POSITION USED AS BASELINE MARK.
21	2315	89.8	4.26	1875	Y	"	2	300°		509	"	"	#21 — LINER FLATTENED NEAR TOP. NO CRACKS.
22	SEPT 9 0047	94.2	0	1900	Y	"	5	028°		—	"	"	#22 — GRITTY SAND FOUND IN CC. NO TRACE OF MUD IN LINER. GRIT MAY HAVE CAUSED FLAPPER TO STICK. HOLE NEAR TOP OF LINER.
23	0227	98.6	2.64	?	Y	"	4	250°		D 179	"	"	#23 — PRESSURED UP TO 2000 PSI WITH NO CLEAR INDICATION OF SHEARING, PRESSURE BLED OFF. LINER NOT CRACKED.
24	0342	103.0	4.11	1850	Y	"	2	246°		449	"	"	#24 — A.O.K.
25	0459	107.4	0	2100	Y	FLAPPER WITH 2 SPRINGS	Many	175°		—	"	"	#25 — TRACES OF MUD IN LINER. LINER HAD FOOTBALL SIZE HOLE IN MIDDLE. 2 CHUNKS OF MUD IN CC.
26	0630	111.8	0	? 2200	?	FLAPPER	6	200°		—	"	"	#26 — NO CLEAR INDICATION OF SHEAR. REPRESSURED TO VERIFY STROKING. MULTIPLE MARKS ON RING, BUT ONLY 1 BLUNT BACK-UP MARK.
27	0809	116.2	1.45	1400	Y	2 SOFT FORM FINGER CC'S W/2 SOCKS	4	104°		—	"	"	#27 — PRESSURED TO 2000 psi TO ENSURE STROKING, EVEN THOUGH SHOOT-OFF WAS INDICATED AT 1400. ANTICIPATE NUMEROUS MARKS ON RING DUE TO PITCHING DECK AND SEVERAL MINUTES WITH HPC ON BOTTOM. LINER COLLAPSED. PISTON SEALS WERE WORN & WERE REPLACED.

HPC LOGSHEET
LEG 68 SITE: 503A
WATER DEPTH : 3678.8

Core #	Time on deck	Subbottom depth (m)	Recovery (m)	Pressure to shear pins	Full stroke?	Type of catcher	No. of marks on landing ring	Orientation angle	Lithology	Shear strength (g/cm²)	Ship's heading	Sea swell
28	SEPT 9 0953	120.6	0	1800	N	1 SOFT FORM. CC W/2 SOCKS	5	030°		—	200°	4
29	1114	125.0	4.12	2000	Y	FLAPPER	MANY	009°		463	"	"
30	1300	129.4	3.05	1800	Y	SOFT FORM. CC W/SOCK	7	190°		334	"	"
31	1418	133.8	4.55	1900	Y	FLAPPER	4	250° 216°		C 403	"	"
32	1529	138.2	0.75	1850	Y	MODIFIED* FLAPPER	3	134° 314°		—	"	3-4
33	1655	142.6	1.62	2050	?	FLAPPER	MANY	290° 235°		—	"	3
34	1925	147.0	3.88	1650	Y	MODIFIED FLAPPER	MANY	320°		334	"	"
35	2103	151.4	0.9	1850	Y	FLAPPER	6	320°		—	"	"

Comments

#28 - DECIDED TO CHANGE HPC TOOLS AFTER THIS RUN, BECAUSE OF POOR RECOVERY [30 RUNS ON HPC - REDRESSED & FOUND INNER & OUTER SUB SEALS IN GOOD CONDITION]

#29 - NEW HPC - BACK TO FLAPPER CC.

#30 - LINER NOT CRACKED.

#31 - LINER NOT CRACKED. NOTICED GRABBING DURING HPC RETRIEVAL THROUGH UPPER PART OF DRILLSTRING. LOWER PART OF BIPAKS PARTIALLY FLARED. FLIPPED THEM OVER BEFORE NEXT RUN.

#32 - HOLE NEAR TOP OF LINER. CRACKED FROM HOLE TO TOP. CORE BARREL SCORED FROM MIDDLE TO TOP, STRAIGHT UP AND DOWN. TOP SUB SEALS TORN OFF. REPLACED WITH MORE BIPAKS. WILL GREASE BIPAKS EACH RUN FROM NOW ON. CORROSION ON INSIDE OF NEWLY ADDED DRILL PIPE JOINTS HAVE CAUSED RUST CONTAMINATION OF CORES AND ALSO MAY CAUSE EXCESSIVE WEAR & TEAR ON TOP SUB SEALS.

* MODIFIED A FLAPPER CC BY INSTALLING A TONGUE ON INSIDE OF FLAPPER WHICH SHOULD CATCH IN MUD AND HELP PULL FLAPPER CLOSED WHEN WITHDRAWING HPC FROM MUD

#33 - FOOT BALL SHAPED HOLE IN LINER

#34 - COULDN'T BUILDUP PRESSURE OVER 1000 PSI. RETRIEVED TOOL. PINS WERE UNSHEARED. BIPAK SEALS WERE MISSING, REPLACED WITH LAWSON CHEVRON SEALS & RERAN.
LINER RETURNED WITH: LARGE FOOTBALL-SHAPED HOLE IN MIDDLE. PISTON SEALS WORN & REPLACED.
LOCKING SET SCREW THROUGH CAP SUB STRIPPED, REPLACED HPC WITH SPARE. [6 RUNS ON HPC - NOT REDRESSED. CAPSUB SET SCREW DRILLED OUT, PISTON ROD CLEANED, REASSEMBLED & STORED IN SHUCK]

#35 - NEW HPC - LINER CRACKED NEAR TOP. PISTON HEAD SEALS DAMAGED.

HPC LOGSHEET
LEG 68 SITE: 503A
WATER DEPTH : 3678.8

Core #	Time on deck	Subbottom depth (m)	Recovery (m)	Pressure to shear pins	Full stroke?	Type of catcher	No. of marks on landing ring	Orientation angle	Lithology	Shear strength (g/cm²)	Ship's heading	Sea swell	Comments
36	SEPT 9 2240	155.8	3.46	?	Y	MODIFIED FLAPPER	MANY	110°		197	200	3	#36 – 1ST TRY: TOOL APPARENTLY NOT DOWN WHEN PRESSURED UP. 2nd TRY: PIN SHEARED, BUT NO INDICATION OF SHOOT-OFF. LINER BROKEN INTO 3 PIECES AT BOTTOM. NEW TONGUE ON INSIDE OF MODIFIED FLAPPER BROKE OFF AND WAS REPLACED.
37	2357	160.2	2.85	?	Y	MOD. FLAPPER	MANY	070°		454	"	"	#37 – NO CLEAR INDICATION OF SHEAR. GOOD PRESSURE BLEED OFF. CC SUB BENT AROUND CUTTING EDGE.
38	SEPT 10 0126	164.6	.07	1850	Y	"	MANY	005°		—	"	"	#38 – CLEAN SHOOT-OFF. HOLE IN LINER NEAR TOP.
39	0301	169.0	3.24	?	Y	"	MANY	310°		431	"	"	#39 – LINER ROTATED ~ 30° FROM INITIAL ORIENTATION 6" LONGITUDINAL CRACK IN MIDDLE OF LINER.
40	0420	173.4	1.36	?	?	"	"	248°		—	"	3-4	#40 – A.O.K. ALIGNMENT, PISTON SEALS WORN, REPLACED. PRESSURED UP TO ≈2000psi, COULD HAVE FLUSHED SOME CORE OUT OF CC.
41	0537	177.8	4.24	1700	Y	"	"	003°		490	"	4	#41 – LINER COLLAPSED, ~ 20 cm LONG, JUST ABOVE LOWER LINER SUPPORT. NO CRACKING
42	0954	182.2	4.01	1450	Y	"	"	0°		C 399	"	4	#42 – ½ OF A FOOTBALL SHAPED CRACK ~ 1.5 m. FROM TOP OF LINER WIRELINE PARTED WHEN ATTEMPTING TO RETRIEVE TOOL. FISHED HPC WITH STD CORE BBL & CORE CATCHER. BEFORE RUNNING #43, CIRCULATED 20 BBL OF MUD IN ORDER TO CLEAN RUST FLAKES FROM PIPE AND HOLE.
43	1232	186.6	3.64	1600	Y	"	12	060° 310°		380	"	4	43 – LINER SPLIT NEAR TOP. RETRIEVED A PIECE OF BIPAK IN CATCHER. LAST HPC RUN WHERE BIPAKS WERE USED WAS #34
44	1354	191.0	3.99	2000	Y	"	6	095°		403	"	"	44 – SAME SYMPTOMS AS IN #36. TRIED 3 TIMES TO PRESSURE UP BEFORE TOOL FINALLY SEATED. SHEARING INDICATED AT 2000psi LINER NOT CRACKED. CORE DEFORMATION NOTED IN 1ST 2 SECTIONS: 2. MUD APPEARS TO HAVE BEEN SUCKED DOWNWARD FROM EDGES TO LONGITUDINAL CENTERLINE.

HPC LOGSHEET
LEG 68 SITE: 503A
WATER DEPTH : 3678.8

Core #	Time on deck	Subbottom depth (m)	Recovery (m)	Pressure to shear pins	Full stroke?	Type of catcher	No. of marks on landing ring	Orientation angle	Lithology	Shear strength (g/cm^2)	Ship's heading	Sea swell	Comments
45	1ØSEPT 1524	195.4	Ø	175Ø	Y	MOD FLAPPER	1Ø	Ø45°		~~24Ø~~°	2ØØ°	4	PRESSURE BLED OFF SLOWLY. LINER SPLIT AT TOP. CC CLOSED. SEDIMENT ALONG OUTSIDE OF LINER BUT NOT INSIDE. USED NEW PISTON SEALS, WILL CHANGE SEALS ROUTINELY EVERY 4 RUNS.
46	1652	199.8	1.9	? 15ØØ	Y	"	6	Ø75°			"	"	INDIC NOT CLEAR FOR SHEAR. PRES BLED OFF TO SIGNIFY FULL STROKE.
47	181Ø	2Ø4.2	1.56	? 2ØØØ	? ~~Y~~	"	7	Ø35°			"	"	REPLACED TOP SUB CHEVRON SEALS TO INSPECT; OLD SEALS WERE GOOD ~~THOUGH~~. REPLACED WORN PISTON SEALS. LINER HAD COLLAPSED .5 m ABOVE LOWER SUPPORT. SUSPECT LINER CUT TOO LONG.
48	194Ø	2Ø8.6	3.96	115Ø	Y	FLAP MOD	7	26Ø°		316	"	3	ALIGN GOOD. LINER COLLAPSED AS IN RUN 47. FOOTBALL HOLE 2m FROM TOP & CRACKED TO THE TOP.
49	2118	213.Ø	2.Ø1	1875	?	HARD FORM DOGS	1	Ø95°		238	"	"	FLICKER @1875, BUT PRES ↑ 2ØØØ. CIGAR SHAPE LINER CRACK NEAR TOP.
5Ø	23Ø4	217.4	4.42	15ØØ	Y	FLAP MOD	3	11Ø° 16Ø° 24Ø°		577	"	"	REPLACED LARSON SEALS w/ BIPAKS.
51	11 SEPT ØØ59	221.8	3.24	? 2ØØØ	?	HARD FORM	2	Ø21°		719	"	"	REPLACED PISTON SEALS. NO CLEAR INDIC OF SHEAR. NO UPPER LINER SUPPORT USED. LINER CRACKED NEAR TOP.
52	Ø215	226.2	3.86	175Ø	Y	MOD FLAP	6	Ø52°		1686	"	"	LINER COLLAPSED AT BOTTOM & PARTIALLY AT TOP.
53	Ø34Ø	23Ø.6	385	185Ø	Y	HARD FORM CC	4 ALL W/IN 34Ø°	31Ø°		942	"	4	LINER CRACKED THE ENTIRE LENGTH.
54	Ø5Ø8	235Ø	4.14	165Ø	N	FLAP MOD	5	2 16°		112Ø	"	4	BLED PRES OFF ON RIG FLOOR. P.O.O.H.

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HPC LOGSHEET
LEG 68 SITE: 503 B
WATER DEPTH : 3678.8

Core #	Time on deck	Subbottom depth (m)	Recovery (m)	Pressure to shear pins	Full stroke?	Type of catcher	No. of marks on landing ring	Orientation angle	Lithology	Shear strength (g/cm^2)	Ship's heading	Sea swell	Comments
AM, 11 SEPT 79, STARTED B-HOLE WITH A FRESHLY DRESSED HPC. ALL ORIENTATION MODS INCORPORATED; TOP SUB HAS POLY BIPAKS. PISTON HEAD IS DRESSED WITH CHEVRON SEALS.													
CC IS A 2 SPRING (INNER-OUTER) FLAPPER W/ REVERSE BEVEL ON THE FLAPPER													
1	1Ø48	2.8	2.74	1ØØØ	Y	2-SPRING FLAPPER MOD II	2	—		15Ø	145°	4	USING ONE SMALL DIAM (.37") SHEAR PIN
2	122Ø	7.2	2.95	11ØØ	Y	"	7	2Ø°		16Ø ~~15~~	"	"	
3	1342	11.6	4.37	925	Y	"	6	Ø4Ø° ØØØ°		375	"	"	HOLE IN LINER AT TOP
4	152Ø	16.Ø	4.35	75Ø?	Y	"	5	125° Ø25° Ø6Ø° Ø7Ø°		335 ~~Hollow~~	"	"	
5	17Ø2	2Ø.4	4.21	11ØØ	Y	"	6	2ØØ° 26Ø°		213 ~~43Ø~~	"	"	
6	1816	24.8	4.42	95Ø	Y	"	5	14Ø°		~~Ø~~ 225	"	"	ADD 6Ø° TO ORIENT ANGLE → OUTER BODY/ INNER CORE BARREL MISALIGNED. LINER NOT CRACKED; CHANGED BIPAKS.
7	1925	29.2	4.25	?	Y	"	6	12Ø°		19Ø	"	"	~~CHANGED TOOLS~~ SWITCHED TO LARSON SEALS LINER NOT CRACKED
8	21Ø5	33.6	4.43	95Ø	Y	"	6	Ø55° Ø45°		234	"	"	NEW HPC. 1ST TOOL 7 RUNS - STRIPPED SET SCREW IN ~~OUTER BODY~~ CAP SUB. PREVIOUS ORIENTATION FOR 6 RUNS COULD BE IN ERROR. LINER NOT CRACKED

Comments

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HPC LOGSHEET
LEG 68 SITE: 503 B
WATER DEPTH : 3678.8

Core #	Time on deck	Subbottom depth (m)	Recovery (m)	Pressure to shear pins	Full stroke?	Type of catcher	No. of marks on landing ring	Orientation angle	Lithology	Shear strength (g/cm^2)	Ship's heading	Sea swell	Comments
9	2231	38.Ø	.36	85Ø	Y	MOD II FLAPPER	1	Ø95°		NO — REC'Y	165	3	NOTE: MOD II FLAPPER MEANS, 1 SPRING ON O.D. OF FLAPPER, A PAWL ON I.D. &, REVERSED MACHINED BEVEL
10	12 SEPT Ø221	42.4	4.12	15ØØ	Y	"	3	316°		4Ø3	"	"	#9 - GRAVEL & SAND. TROUBLE SEATING TOOL, SEA PUMP MAY HAVE WASHED SOME CORE OUT. LINER NOT CRACKED, ROTATED 18Ø° FROM INITIAL POSITION. WELD BEAD WORN ON LOWER LINER SUPPORT — REBUILT.
11	Ø356	46.8	4.55	? 125Ø	Y	"	4	15Ø°		27Ø	"	"	#1Ø - 2 SMALL DIAM SHEAR PINS USED. PRES TO 85Ø TWICE, CAN'T GET HIGHER. SUSPECTED TOOL DID NOT SEAT, BUT WEIGHT INCREASED ON PULL-OUT. RETRIEVED TOOL UNSCOPED - PUMPED OUT DRILL STRING.
12	Ø536	51.2	4.Ø5	9ØØ	Y	"	MANY	Ø5Ø°		312	"	4	
13	Ø7Ø7	55.6	3.67	? 11ØØ	Y	"	1	11Ø°		289	"	4-5	#11 - USING 1 DIAM SHEAR PIN. INDIC OF SHEAR NOT CLEAR. SMALL CRACK AT TOP OF LINER - #13 - NEW PISTON SEALS
14	Ø828	6Ø.Ø	4.Ø4	17ØØ	Y	MOD II FLAPPER W/OUT PAWL	MANY	32Ø°		513	"	"	— LINER GOOD, ALIGN GOOD.
15	Ø959	64.4	4.28	75Ø	Y	"	2	28Ø°		486	"	5-6	
16	1134	68.8	4.29	14ØØ	Y	"	MANY	218°		22Ø	"	4-5	CRISP INDIC., SMALL CRACKS NEAR TOP OF LINER. LARSON SEALS GOOD. ALIGN GOOD. NEW PISTON SEALS.
17	1252	73.2	4.11	8ØØ	Y	"	"	Ø4Ø°		399	"	4	LINER COLLAPSED NEAR TOP & BOTTOM. LINER ROTATED ≈ 1Ø° FROM INITIAL ORIENTATION.
18	14Ø9	77.6	4.61	55Ø	Y	"	"	Ø5Ø° 335°		426	"	4	LINER COLLAPSED AT TOP, HOLE AT TOP. WIRELINE STARTED PARTING AT OVERSHOT CONN. SOME DOWN TIME TO REPLACE OVERSHOT.

Core #	Time on deck	Subbottom depth (m)	Recovery (m)	Pressure to shear pins	Full stroke?	Type of catcher	No. of marks on landing ring	Orientation angle	Lithology	Shear strength (g/cm^2)	Ship's heading	Sea swell	Comments
19	12 SEPT 1630	82.0	3.63	950	Y	MOD II FLAPPER NO PAWL	4	235°		362	165	3	SMALL CRACK AT TOP OF LINER. ALIGN GOOD. [SEVERAL CASES OF STRIPPING ALLEN HD SET SCREWS]
20	1948	86.4	4.36	1050	Y	"	6	000°		252	"	4	1ST TIME: PRES. TO 1000 psi TWICE w/o FLICKER. PRES BLED OFF AS IN FULL STROKE. RETRIEVED UNSCOPED. 2ND TIME - SHOT-OFF. NO CRACKS IN LINER. PISTON SEALS GOOD. LARSON SEALS GOOD.
21	2029	90.8	4.7	900	Y	"	7	010°		403	"	"	BETWEEN 1ST & 2ND RUNS, PULLED DRILL STRING UP 8m & WASHED OUT PIPE w/ SEA PUMP FOR ~10 MIN.
22	2147	95.2	4.58	540 ?	Y	"	8	170°		486	"	"	#21 - GOOD INDIC OF SHEAR. LINER NOT CRACKED.
23	2330	99.6	.65	700	Y	"	6	126° 220°		—	"	"	#22 - INDIC OF STROKING NOT CLEAR. LINER CRACKED FROM 1.5m FROM BOTTOM TO THE TOP.
24	13 SEPT 0106	104.0	2.71	950	Y	"	8	265° 225° 090° 170°		225	"	"	#23 - HOLE IN LINER AT TOP. #24 - CRACK IN LINER AT BOTTOM.
25	0230	108.4	3.02	850	Y	"	6	150° 347°		280	"	"	#25 - LINER COLLAPSED NEAR BOTTOM.
26	0354	112.8	3.04	850	Y	"	9	060°			"	"	#26 - NO CRACKS.
				POOH									

HPC LOGSHEET
LEG 68 SITE: 503B
WATER DEPTH: 3678.8

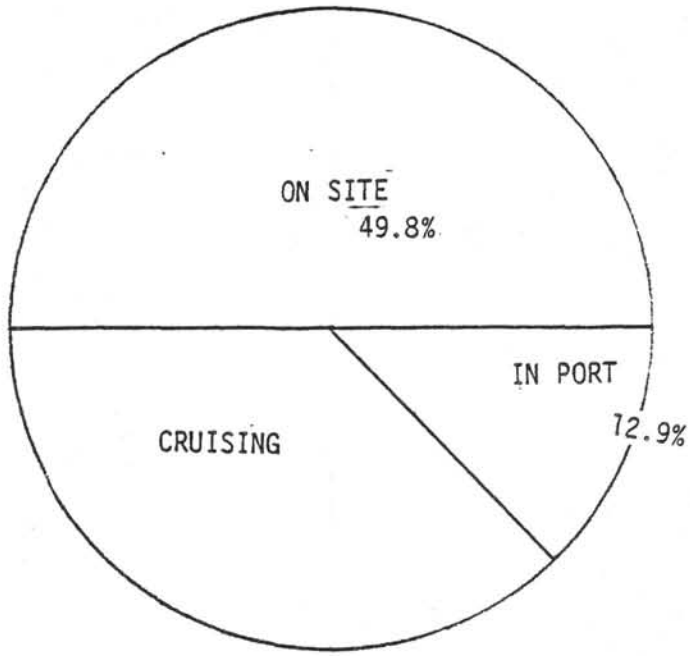
INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
OPERATIONAL RESUME
LEG 68

Total Days (August 13, 1979-September 18, 1979)	35.7
Total Days in Port	4.6
Total Days Cruising Including Site Survey	13.3
Total Days On Site	17.8

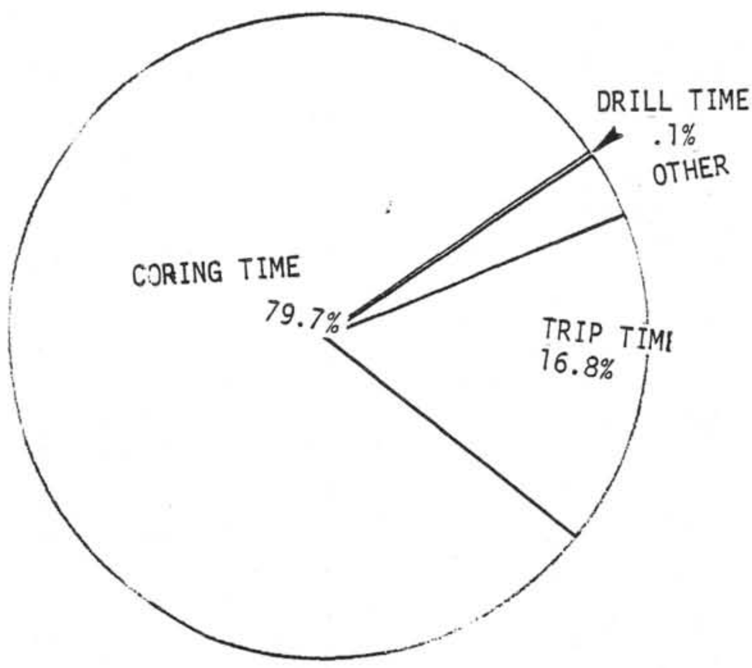
Trip Time	3.0
Drilling Time	.01
Coring Time	14.2
Other	.6

Total Distance Traveled (Nautical Miles) Including Survey	2935.3
Average Speed (Knots)	9.4
Number of Sites	2
Number of Holes Drilled	7
Number of Cores Attempted	259
Number of Cores Recovered	245
Percentage of Cores With Recovery	94.6
Total Meters Cored	1011.5
Total Meters Recovered	786.67
Percentage Recovery	77.8
Total Meters Drilled	98.0
Total Meters of Penetration	1109.5
Maximum Penetration (Meters)	235.0
Minimum Penetration (Meters)	4.4
Maximum Water Depth (Meters)	3678.5
Minimum Water Depth (Meters)	3051.5

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
TOTAL TIME DISTRIBUTION
LEG 68



ON SITE TIME BREAKDOWN
LEG 68



DEEP SEA DRILLING PROJECT
TIME DISTRIBUTION
LEG - 68

Date	Site No.	Cruise	Trips	Drill	Core	Stuck Pipe	W.O.W.	Position Ship	Mech. Repair	Port Time	Re-Entry	Other	Total Time	Remarks
8/13/79 8/16/79		66.4											66.4	
8/16/79 8/19/79			6.4		73.6							2.6	82.6	
8/19/79 8/23/79			1.5		88.5							.5	90.5	
8/23/79 8/25/79			7.3		26.3							3.4	37.0	
8/25/79 8/27/79			37.8	.3	22.4								60.5	
8/27/79 8/28/79		15.0										.4	15.4	
8/28/79 8/29/79										21.7			21.7	
8/29/79		10.6											10.6	
8/29/79 9/02/79										89.0			89.0	
9/02/79 9/06/79		109.8											109.8	
9/06/79 9/07/79			10.6		3.8							1.6	16.0	
9/07/79 9/11/79			1.6		84.1							2.6	88.3	
9/11/79 9/13/79			6.8		42.4							2.8	52.0	
9/13/79 9/18/79		116.6										.4	117.0	

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
SITE SUMMARY
LEG 68

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
502	11° 29.42'N	79° 22.78'W	3051.5	50	49	98.0	214.1	156.24	72.9	-	214.1		82.6	
502A	11° 29.46'N	79° 22.74'W	3051.5	68	62	91.2	214.8	179.81	83.7		214.8		90.5	
502B	11° 29.51'N	79° 22.69'W	3051.5	23	23	100.0	99.7	88.05	88.3		99.7		37.0	
502C	11° 29.48'N	79° 22.79'W	3051.5	37	37	100.0	130.7	114.36	87.5	98.0	228.7	45.5	60.5	270.6
503	4° 04.04'N	95° 38.21'W	3678.8	1	1	100.0	4.4	4.78	108.6		4.4		16.0	
503A	4° 04.04'N	95° 38.21'W	3678.8	54	47	87.0	235.0	146.94	62.5		235.0		88.3	
503B	4° 04.02'N	95° 38.32'W	3678.8	26	26	100.0	112.8	96.49	85.5		112.8		52.0	156.3
			TOTALS	259	245	94.6	1011.5	786.67	77.8	98.0	1109.5		426.9	426.9

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
BEACON SUMMARY
LEG 68

SITE NO.	MAKE	FREQ.	SERIAL NUMBER	SITE TIME HOURS	REMARKS
502	ORE	13.5 S.L.	504	82.6	
502A	ORE	13.5 S.L.	504	90.5	
502B	ORE	13.5 S.L.	504	37.0	
502C	ORE	13.5 S.L.	504	60.5	Total time 270.6 hours with excellent operation.
503	ORE	13.5 S.L.	505	16.0	
503A	ORE	13.5 S.L.	505	88.3	
503B	ORE	13.5 S.L.	505	52.0	Total time 156.3 hours with no problems.

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
OPERATIONS RESUME
LEG 69

The 69th scientific voyage of the GLOMAR CHALLENGER was devoted to drilling an area of relatively young ocean crust on the flank of the Costa Rica Rift, an active spreading center. Since the geothermal and geochemical aspects of the area were considered as important as the petrology and mineralogy of the crust, an ambitious integrated program of coring and downhole instrumentation was planned. Virtually all of Leg 69's scientific objectives were met or exceeded, despite a series of frustrating mechanical setbacks. Operational successes included the best core recovery and drilled penetration to date of East Pacific basalt, extensive temperature data recovery from both sediment and igneous rock, recovery of formation fluid samples from sediment and igneous rock, downhole stress measurements utilizing a retrievable packer and an excellent suite of downhole logs, including the borehole televiewer and the USSR-furnished magnetometer. In addition, eight successful re-entries were made with the drill string and a clean, dually-cased hole 489 meters deep was left for future investigations.

The leg commenced on September 18, 1979 at La Libertad, Ecuador and terminated on October 29, 1979 at Balboa, Canal Zone, Panama. Total length of the voyage was 41.0 days, of which 36.2 days were spent on site, 4.3 days under way and 0.6 days in port. 1.9 days of operating time were lost to equipment breakdowns.

ECUADOR PORT CALL

Leg 69 began at 0752 hours, September 18, 1979, when the GLOMAR CHALLENGER dropped anchor at the port of La Libertad, Ecuador. Scheduled port call activities consisted only of a scientific crew change, the onloading of relatively small air freight shipments and resupply of fresh fruits and vegetables. An extremely short turnaround time had been planned. However, the GMI and Gearhart-Owen freight shipments had only arrived in Guayaquil on September 17. Despite every effort at expediting, they were not cleared by Ecuadorian Customs authorities until mid-afternoon on the 18th. The freight and two late-arriving scientists were then rushed to La Libertad (about 150 kilometers away). After transfer by boat to the vessel and some delay in final port clearances, the CHALLENGER departed at 2112 hours, September 18.

LA LIBERTAD TO SITE 504

With following wind and current, a transit speed of nearly ten knots was made good between La Libertad and the intended operating area. Plans called for returning to Site 501, which had been drilled early in Leg 68. It was hoped that the final site approach might be assisted by the signal of the Site 501 acoustic beacon, dropped some ten weeks earlier. Satellite and magnetic anomaly navigation and dead reckoning indicated that the vessel passed Site 501 close aboard at 0030 hours on September 20, but no beacon signal was detected. The CHALLENGER maneuvered in the immediate area until an accurate position was determined by satellite. The approach to Site 501 was then computed and a positioning beacon was launched at 0413 hours.

HOLE 504

Sites 501 and 504 are loated on the south flank of the Costa Rica rift, about 360 miles east-northeast of the Galapagos Islands and about 220 miles northwest of Cabo San Lorenzo, Ecuador.

The pipe trip was started with the ship positioning directly over the beacon. However, satellite fixes received during the initial pipe trip indicated that the beacon had been dropped east of Site 501. Positioning offsets of 330 feet south and 2000 feet west were entered. The hole was then spudded at 1337 hours, September 20. Piston coring was begun after the bit had been jetted-in to a depth of ten meters to provide lateral support for the piston corer.

The principal objective of Hole 504 was the recovery of a complete upper sedimentary section with as little disturbance as possible by means of the hydraulic piston coring apparatus. The piston corer met these objective well, producing 86% recovery in the upper 120 meters of oozes and soft chalks with minimal disturbance. Recovery began to decrease somewhat as the system approached the limit of its penetrating ability deeper in the section. However useful cores were obtained to a depth of 235 meters below seafloor (BSF) where penetration was halted by siliceous limestone strata.

HOLE 504A

When the drill string had been recovered from Hole 504, the vessel was offset to 2400 feet west of the beacon and zero north/south. A re-entry cone was moved into position for deployment and the various slings, keelhaul lines and other equipment were rigged. During this time, troubleshooting had been in progress on an electrical problem in the stern thruster circuitry that had arisen during HOle 504 operations. When these problems were considered resolved, the re-entry hardware deployment began.

Keelhauling of the cone and its subsequent hangoff beneath the moon pool were accomplished without incident. Makeup of the sixteen-inch conductor casing string had begun when the stern thrusters again began malfunctioning. A delay of 8 1/4 hours ensued while the problem was located and repaired. The remainder of the casing was then made up and hung off below the rig floor. The bottomhole assembly (BHA) was then made up and attached to the casing string. This dual string was latched into the re-entry cone and the entire assembly was run to seafloor on the drill string.

Hole 504A was spudded at 0712 hours, September 25. The casing was jetted in smoothly and a wireline trip was made to release the cone/casing assembly with the casing shoe at a depth of 3558.3 meters and the top of the re-entry cone at 3464.5 meters. Five meters of new hole was made following release of the cone and drilling was stopped for a temperature probe/in situ pore water sampler run. A 3 1/4 hour delay occurred due to a rash of last minute mechanical problems in the deployment of the instrument combination. Following the instrument run, the hole was drilled to 155.5 meters below seafloor (BSF) where a second probe run was attempted. The operation was routine until the inner barrel with the probe was found to be stuck in place. Two overshot safety pins were sheared in attempts to free the probe. It was concluded that the probe had been bent below the bit and the drill string was pulled. When the outer core barrel assembly was recovered, the inner barrel was removed without resistance. The probe was found to be straight and undamaged. Two attachment pins had been sheared, however, and only a safety stop had prevented the probe from being lost in the hole.

A slight revision in the drilling plan called for drilling the 14 7/8 inch hole a considerable distance into basalt before setting surface casing. For this reason a brand new bit was installed before re-entering the hole.

RE-ENTRY AND SECOND BIT - HOLE 504A

The drill string was run to a point one stand short of re-entry position and the routine procedure of slipping and cutting the drilling line was begun. This entails suspending the travelling block in the derrick by means of a wire rope sling so that the drilling line can be slacked off and "slipped" around to a new position with respect to the sheave wheels. Excess line is then stripped from the drawworks drum and cut off. The block had been hung off and the line was being stripped from the drum when the lashing clips on the hangoff sling failed, allowing the heavy block to drop about five feet until the slack was taken up. No injuries or obvious damage resulted, but it was necessary to cut off additional line and to replace certain critical equipment as a precautionary measure due to possible hidden damage. Operations resumed after three hours lost time.

The electric wireline sheaves were rigged in the derrick and the re-entry sonar tool was picked up for the re-entry attempt. The tool, which had been checked out previously, failed to perform properly on its final checkout on the rig floor. A backup sonar tool was then deployed and the re-entry operation continued after a one hour delay.

When the sonar had seated at the bit, scanning was started and the re-entry cone reflectors were acquired at an initial range of about 25 feet. The range was quite steady and it became apparent that it would be necessary to move the vessel to mobilize the pipe and cause it to swing over the cone. Several short moves were made and the pipe was stabbed into the cone after 77 minutes of scanning. The net offset was thirty feet to the east of the original position.

After two stands of pipe had been run to verify the re-entry and the sheaves had been rigged down, it was discovered that the latch pin of the travelling block hook connector swivel had apparently been broken when the block fell. An additional 7 3/4 hours were spent in fabricating a new pin and replacing the broken one.

Drilling recommenced at 1800 hours, September 27. Continuous coring began at 226.5 meters BSF in interbedded siliceous limestones and soft chalks. Very low core recovery was realized in this sequence. The drill encountered basalt at 264 meters. About ten meters of fairly good quality basalt was drilled smoothly and steadily. Basalt pillows were noted near the bottom of this interval. At this point the drill string began torquing badly. This was considered to be the result of drilling the more rubbly and fractured pillow basalt with a large bit, especially since a fairly high penetration rate was maintained.

After about two hours of high torque drilling, a pipe union failed on a two inch high pressure hydraulic line in the plant that drives the power sub. The sudden release of torque allowed the drill pipe and power sub to spin rapidly back to the left. When the piping had been repaired, it was found that the hydraulic motor on the power sub itself was locked up. The motor was replaced and total time lost was 3 1/2 hours.

The torquing problem became so severe that drilling was stopped at 278 meters BSF, fourteen meters into basalt. It was felt that, with casing set to this point, the pillow basalt could be penetrated much more easily with a standard 9 7/8 inch core bit.

The drill string was pulled and preparations were made for running 11 3/4 inch surface casing. When the bit was recovered, however, it was discovered that two of the four shanks had broken away at the bit body, leaving the shanks and roller cones in the hole. The remainder of the bit was severely damaged from drilling on junk.

This unexpected and serious setback raised difficult questions about the best way to proceed with Site 504 drilling, including whether to attempt remedial action or to start over with a second re-entry cone.

It was decided that proper technical evaluation of the alternatives would require some time and that the best course of action would be to alter the drilling schedule and proceed to Site CR-2, a nearby high priority single bit site.

HOLE 505

Site 505 (CR-2) was located 41 miles north of Sites 501 and 504. The transit was made in 4 1/2 hours and the positioning beacon was dropped at 1225 hours, September 29.

Hole 505 was to be a single bit hole with a full suite of downhole instrumentation including hydrofracture and sampling experiments with the retrievable packer. Final tests, assembly and incorporation of the packer into the BHA continued until 1830 hours, when the pipe trip began.

The hole was spudded at 0200 hours, September 30 in 3548.5 meters of water. The entire sediment section was continuously cored with an excellent recovery rate but with a much higher degree of disturbance than the piston cored section at the previous site. Four successful heat flow/water sampler probe runs were made. The sediment column consisted entirely of siliceous ooze and shoft chalk with no limestone or chert beds. Basalt basement was found at 231 meters BSF.

The pillow basalt unit encountered was apparently highly fractured and rubbly, as evidenced by severe torquing and an irregular rate of penetration. Core barrels pulled from 233.5 and 238 meters BSF each contained only one small chunk of basalt.

Following the pipe connection after the second core attempt, considerable difficulty was experienced in working the bit back into the borehole at the basement contact. This had just been accomplished when the power sub failed. The bit was again pulled up into sediments while 1 1/2 hours were spent replacing a hydraulic pump displacement control cylinder.

The bit was again worked to total depth and coring resumed. After an additional four meters with high torque and irregular penetration, the pipe began sticking. When the pipe had been freed and pulled clear of bottom, the torquing persisted. It was feared that drilling into an irregular basement contact had resulted in a "doglegged" hole. Operations were discontinued for the safety of the drill string and the bit was pulled clear of the seafloor.

HOLE 505A

Hole 505 had been located near the foot of a relatively steep slope and it was considered possible that the drill had encountered gravity-deposited debris. Therefore, the vessel was offset 500 meters to the north to a point higher on the gently sloping side of the basement "valley". Water depth at the new location was 3535 meters. Hole 505A was spudded at 0255 hours, October 2 and was drilled to the basement contact at 196.5 meters BSF with no coring.

Severe torquing again accompanied the basalt drilling. A total of twelve meters of basalt was cored. During this period, a chronic problem in the power sub hydraulics caused it to fail on five separate occasions with a cumulative time loss of 3 3/4 hours. Core recovery for the interval was only 75 centimeters and its condition, together with the constant torquing, led to suspicion of premature bit failure after only four rotating hours.

The bit was run to total depth in an effort to determine the effectiveness of the latest power sub repairs and it promptly became stuck. The pipe was worked for about 30 minutes and rotation was regained after jarring with the torque jars. Free movement was regained shortly thereafter.

A pipe trip was made, the packer was removed from the string and the bit was replaced. The packer element was found to be completely destroyed with only wire fringes at top and bottom. The steel protective band had been torn from the window area of the hydraulic bit release. The bearings and cutting structure of the bit were intact, but the bit body had suffered severe wear from the sharp and abrasive basalt fragments.

HOLE 505B

The vessel was offset an additional 250 meters upslope to the north for a third and final attempt to drill the site.

The drill string was run and Hole 505B was spudded at 1237 hours, October 3, in 3517 meters of water. The bit was washed to basement at 136 meters BSF.

The basalt drilling was again characterized by high torque and rapid penetration. Power sub failures also persisted. After the second shutdown, three hours were spent in replacing the hydraulic motor on the power sub. This finally remedied the spontaneous shutdowns. After an additional ten meters of penetration, the bit stuck at 155 meters BSF. During the attempt to free the pipe, the shaft seal on the newly installed motor blew out. The bit was worked free after 1/2 hour and an additional two hours were spent in replacing the seal.

The bit was worked repeatedly past tight spots and the hole was flushed with mud. Coring resumed when hole conditions had stabilized. Drilling conditions remained marginal at best, but an additional 23 meters were made before it became impossible to work the bit back to total depth following a connection. The hole was short tripped and flushed with mud and a go-devil was pumped to the bit to actuate the hydraulic bit release. The pipe was then pulled to leave only the BHA in the hole and preparations were made for open-hole logging.

Several setbacks were experienced during the logging operation, including a two-hour winch engine breakdown. The poor condition of the hole resulted in difficulty getting tools to bottom with subsequent damage to the lowermost part of the cable and frequent reheading. However, successful runs were made with temperature/density, downhole magnetometer, laterolog/neutron and temperature/water sampler tools. Two attempts to deploy the borehole televiewer were unsuccessful. Following the logging operation, the pipe was set down on bottom and a deviation survey was run on the sandline to supplement magnetometer data.

The drill string was recovered and the CHALLENGER departed for Site 504.

HOLE 504B

The return to Site 504 was uneventful and the beacon signal was acquired without difficulty at 1800 hours, October 7.

Review of options for continued operations at Site 504 had resulted in a decision to make a fresh start and deploy a second re-entry cone with a dual casing string. A location about 300 meters east of Hole 504A had been chosen and automatic positioning on the new offsets was achieved one hour after first detection of the beacon.

A re-entry cone had been preassembled during Hole 505A operations. After final preparation, the cone was keelhauled and hung off beneath the moonpool. A conductor casing string nearly identical to that of Hole 504A was then made up and latched into the cone. The assembly was run on the drill string to the seafloor and jetted in. The mudskirt of the re-entry cone "took weight" at 3473 meters, indicating a true water depth some 3.5 meters greater than the precision depth recorder reading. A wireline run was made to release the casing and cone with the casing shoe at 3564.5 meters.

The hole was drilled ahead to 260.5 meters BSF, where coring began in an attempt to recover the lowermost sediments. The sediment cover was found to be about 10.5 meters thicker at the new location than at nearby Hole 504A and basalt was encountered at 274.5 meters BSF. The 14 7/8 inch hole was bottomed at 3750.5

meters, only 2 1/2 meters into basalt. The hole was flushed with mud and the pipe was pulled to set surface casing.

The 11 3/4 inch casing string was made up without major difficulty, although the rusted condition of the casing slowed the operation somewhat. The casing was then attached to the drill pipe and run to re-entry position.

FIRST RE-ENTRY - HOLE 504B - SURFACE CASING

A re-entry sonar tool was started down the drill pipe, but failed to perform normally on a routine check at 1500 meters. The tool was retrieved and a short circuit was found in the cable head adapter. The adapter was replaced and the tool was again run down the pipe. The sonar seated at the casing shoe and scanning was initiated with normal performance and the re-entry cone target was acquired at 40 feet. The 45-degree transducer function was lost almost immediately, however, and transducer rotation failed shortly thereafter. The tool was found to be "packed off" at the shoe and rotation was regained after the rig pump had been stopped and the pressure bled off. The 45-degree transducer remained dead, however, and the re-entry stab was made after 188 minutes of scanning with the eight degree transducer and maneuvering the ship.

The re-entry was verified with two stands of pipe after the tool was recovered and the wireline sheaves were rigged down. The casing string was lowered into place with the shoe landed at the bottom of the hole and was latched into the re-entry cone without incident.

Cementing equipment was then rigged up and 394 sacks of neat cement was mixed and pumped down the pipe. A latch-down cement plug was then launched and followed by 27 sacks of cement. The plug was then displaced with water until it was landed at the casing shoe. The drill pipe was pulled clear of the re-entry cone, flushed of remaining cement and retrieved.

SECOND RE-ENTRY - HOLE 504B - SECOND BIT

A 9 7/8 inch core bit and drilling bottomhole assembly were made up to the drill string and it was immediately run back to re-entry position.

A sonar tool was started down the pipe, but power regulation failed on the first in-pipe check at 200 meters. The sonar was retrieved and a backup tool was deployed.

When the tool had seated and scanning started, failure to rotate was again noted. The tool was picked up inside the pipe and reseated and rotation was regained. The re-entry cone's reflectors were found to be at very close range and the pipe swung over the cone shortly thereafter. The stab was made after only nine minutes.

When the re-entry had been verified, a center bit was pumped into place at the bit and the pipe was run into the cased hole. Cement was encountered 15 meters above the shoe. The cement, latchdown plug and casing shoe were then drilled out. The plug and shoe drilled so smoothly that there was some doubt as to whether the bit had broken through. However, the center bit was pulled after pipe measurement showed that a meter of new hole had been made and an inner core barrel was emplaced. Considerable torque was noted when the bit touched the bottom of the hole and it was necessary to raise and lower the bit several times before the roughness ceased. A two-meter core was cut and retrieved. 1.35 meters of basalt core was recovered with a fist-sized chunk of the aluminum. float valve from the casing shoe on top of the core.

Continuous coring proceeded with a good penetration rate and relatively good recovery. The bit had cut 116 meters of basalt in 33 hours when an uncharacteristic pattern of torquing prompted the decision to "retire" it.

The hole was flushed with mud and the final core was retrieved. The bit was then pulled clear of the re-entry cone and the vessel was offset 200 feet to the west.

HOLE 504C

Operations were suspended at Hole 504B to obtain a heat flow profile through the sediment section at the site. Hole 504C was spudded at 1034 hours, October 14. No cores were taken and the bit was jetted ahead through the soft sediments. Stops were made at 50, 101.5, 161.5 and 218.5 meters BSF for temperature probe/ in situ water sampler runs. The motion compensator was utilized to minimize and stabilize weight on the probe in the soft sediments. Following the final downhole instrumentation run, the bit was pulled above the seafloor and a final temperature probe run was made to determine bottom water temperature.

The drill string was retrieved and the bit was replaced. Early stages of bearing failure were noted on one bit cone.

THIRD RE-ENTRY - HOLE 504B - THIRD BIT

A weighted sonar reflector was hung from the drill string by a line through the bit attached to an inner core barrel. The vessel was offset 100 feet to the north and the pipe was run to re-entry depth. A wireline trip was made to retrieve the inner barrel and release the reflector as an aid in future identification of the re-entry cone. The ship was then returned to the former re-entry offsets.

The rig was prepared for re-entry and the sonar tool was started down the pipe. A few minutes later, all but emergency power was lost when an explosion occurred in the main AC distribution board. Partial AC power was restored but DC power remained secured. The sonar tool was pulled into the top stand of pipe as the ship drifted about two miles off station. The depth recorder was monitored as a rise in the seafloor was crossed where water depth decreased to 33 meters less than the length of the drill string. After an outage of 2 1/2 hours, rig power was restored. The pipe connection could then be broken and the sonar tool removed. Two stands of pipe were pulled and the vessel was repositioned over the re-entry cone.

Because the BHA had been dragged across the seafloor, it was considered prudent to pull the drill string and inspect for bent or damaged components. The pipe trip out was accomplished with only one drawworks motor due to a relay problem in drilling switchboard B that was unrelated to the AC problem. All BHA connections were inspected and those weaker by design were magnafluxed. The bottom joint of drill pipe was removed from the string as a precaution and the pipe trip proceeded with full drawworks power restored. Total time lost to the power failure was 21 1/4 hours.

The re-entry operation proceeded in the normal manner until scanning began. No target was detected and the video presentation was similar to that expected when the transducer is buried in sediment. It was suspected that one joint too much pipe had been added by mistake. The logging winch depthometers also read several meters deeper than pipe measurement, although the pipe tally was rechecked and verified. The drill pipe was raised as high as possible in the derrick. A broad weak single target was detected at 30 feet on the eight degree transducer, but no change in the 45-degree presentation was noted. This was taken as confirmation of the depth error hypothesis.

The vessel was offset 100 feet to prevent damage to cone or BHA and the sonar tool was retrieved. One joint of drill pipe was set back and the tool was run back to the bit while the ship was repositioned. Unfortunately, scanning again produced no targets and an abnormal presentation. The pipe was lowered one joint and the eight degree target was reacquired at 30 feet. The bit eventually swung over the cone and the target pattern was resolved sufficiently to make a re-entry stab after 35 minutes.

The re-entry was verified and the pipe was run into the hole without impediment until a ledge was contacted 75 meters below the casing shoe. Several ledges or bridges caused momentary hesitation and torquing in the lower 40 meters of the hole, but no solid obstacles were met.

Coring proceeded routinely through 96 meters of basalt before the bit was pulled for scheduling reasons. Both recovery and rate of penetration were somewhat lower than on the previous bit run. The drill string was recovered for the installation of the drill string packer.

FOURTH RE-ENTRY - HOLE 504B - PACKER TESTS

The core bit was found to be in excellent condition after nearly 40 hours rotating time and was rerun for the very limited coring planned with the packer experiments. The Lynes retrievable formation tester (RFT) packer was installed below the outer core barrel. The final operational packer test required that the packer body be some distance under water and had been deferred until the beginning of the pipe trip. The test entailed setting the safety or fracturing go-devil, pressuring up to inflate the element, and ascertaining that the element would remain inflated after pressure was bled off. On execution of the test, the packer element did not remain inflated as is necessary for successful pulse-testing and fracturing experiments. It was necessary to dismantle the packer and go-devil to check for faults. All internal O-rings and one go-devil seal were replaced and a minor go-devil spacing adjustment was made, but no definitive cause of the failure was found. The packer was reassembled and subjected to a complete round of tests, which it passed satisfactorily. The pipe trip began after a 12-hour delay.

Re-entry preparations proceeded without incident and the sonar operated faultlessly on initiation of scanning. A relatively bright single reflector was detected at a range of about 100 feet from the cone. However, the vessel's movements based on the reflector as a north reference were not effective in closing the range to the re-entry cone. The stab was made after 139 minutes and reversion to standard plotting and maneuvering.

Following re-entry verification and rig-down of the sheaves, the string was run into the hole. A ledge or bridge was encountered at 48 meters below the casing shoe and the power sub was picked up to clear the obstruction.

The fracturing go-devil was pumped into place, inflating the packer at 316.5 meters BSF in a massive basalt interval. The cementing pump was then utilized to carry out a successful series of pulse tests on the open hole interval below the packer. The steel deflation ball was dropped down the pipe. When it had reached the go-devil, the packer was delated normally by pressuring with the pump. A sand-line run was made to retrieve the go-devil. The overshot failed to engage the go-devil's pulling neck on the first attempt, but the second try was successful. The bit was then run to total depth and the hole was flushed with 50 barrels of mud. A second successful pulse test sequence was conducted and the packer was deflated. However, the overshot would not engage the pulling neck to retrieve the go-devil.

It was deduced that an accumulation of pipe rust was preventing the overshot from latching. Several recovery attempts were made, including one with a modified core catcher on an inner barrel. The pipe was stuck on one occasion during this period for about 15 minutes. An overshot, modified by shortening the "skirt", engaged the neck on two occasions, but the go-devil could not be pulled free. Recovery attempts were abandoned after 12 1/2 hours and a"wet" pipe trip was made. The upper portion of the go-devil and the sub above it were found to be completely filled with rust flakes.

FIFTH RE-ENTRY - HOLE 504B - LOGGING

The packer assembly was broken out for redressing and an abbreviated open-ended logging BHA was made up. The pipe was run to re-entry depth and an uneventful re-entry was made after 87 minutes scan time. Two and two thirds stands of drill pipe were added to verify the re-entry and to put the BHA entirely in the hole.

Open-hole logging operations then commenced and a highly successful suite of logs was obtained. Minor equipment problems resulted in three separate runs with the downhole magnetometer. The only complete misrun was with the sonic-caliper-gamma ray tool when a short circuit developed in the cable head.

Hole conditions actually improved during logging operations with two or three obstructions impeding tool travel on early tuns and then disappearing entirely. All sondes came to rest on a bridge or on fill about 12 meters short of total depth.

In addition to the standard logs, successful borehole televiewer and wireline fluid sampler runs were made.

The logging sheaves were rigged down and the pipe was retrieved for an additional round of RFT tests.

Sixth Re-entry - Hole 504B - Packer Tests

A heavy BHA was made up in anticipation of hydrofracture experiments scheduled to follow the initial planned fluid sampler attempt. The RFT was assembled and subjected to limited deployment checks before the pipe trip began.

While the sonar tool was being run down the pipe, a fresh positioning beacon was launched and dynamic positioning was switched over from the original Site 504 beacon which had been dropped some 36 days earlier.

With normal plotting and maneuvering procedures, a re-entry stab was made after a 141 minute scan.

No obstructions were noted as the bit was run to 27.5 meters short of total depth. The power sub was then picked up to clean the hole to bottom. A bridge was knocked out at the depth reached by the logging tools. When the hole had been flushed with mud, the inner core barrel was pulled, the bit was set on bottom and the sampler barrel was pumped into place.

1500 psi pressure was applied with the cementing unit and held without leakage for 15 minutes for apparently normal operation of the sampler. When the pressure was bled off, the drill string was found to be stuck with the bit on bottom.

The mechanism of sticking was not known. It was considered highly unlikely that the packer element could have remained inflated following a sampler run. The possibility of the bit being stuck in rubble at the bottom of the hole was thought more likely. A sandline run was made to retrieve the sampler barrel before attempting vigorous working of the pipe. The sampler was pulled free with considerable resistance and about 2500 pounds of overpull was required to pull it up the pipe. Circulation was attempted after the sampler go-devil had been unseated, but the bit was apparently plugged and the pipe remained stuck. The sampler assembly was set aside at the rig floor and attempts to free the pipe began. After nearly two hours of working and jarring, the pipe was freed enough to move it about 14 meters up the hole, where it again became stuck. At this point a series of pulse tests was attempted with the cement pump to determine if the packer element was inflated. The first pulse indicated that the packer was sealing the bore and that water was being pumped into the formation. Each subsequent pulse, however, indicated increasing leakage up the hole. Shortly after the tests, the pipe "dropped" free when weight was set down on the stuck point and rotation was regained. It was found that the pipe could be moved up the hole if rotation were maintained. The string was pulled, with decreasing drag and torque, until the bit was inside casing. At this point movement was quite free and the power sub was set back.

Review of the Kuster downhole pressure record concluded that an initial sampler drawdown of over 4000 psi probably caused failure of the packer element and wadded it downward into the annulus where it stuck the pipe. Further in-hole operations were therefore precluded and insufficient operating time remained for a round trip before departure for Panama. The most productive use of the remaining time was determined to be a return to Hole 504A for logging.

RETURN TO HOLE 504A - SECOND RE-ENTRY

The bit was pulled clear of the re-entry cone and a hydraulic bit release go-devil was pumped down the drill pipe while the vessel's positioning was returned to the old beacon and the re-entry offsets of Hole 504A. The bit release was actuated on the second pressure pulse.

Stable positioning had been achieved while the logging sheaves were being rigged and the re-entry sonar tool was started down the pipe without delay. Spring-loaded drag blocks are used to land the sonar tool at a profile sub when an open-ended re-entry is made following the release of a bit. These caused the tool to top at the diameter restrictions of the core barrel latch sleeve and the packer seal bore. The tool reached its proper position with some manipulation and increased circulating pressure and only a minor delay resulted. The re-entry stab was made after a scan time of 50 minutes.

The sonar tool was retrieved and 5 1/2 stands of pipe were run to protect the BHA. This placed the end of the pipe about 63 meters below the casing shoe.

The temperature/density/caliper/gamma ray sonde was then picked up and run. A successful temperature log was recorded running downward in the hole. The 14 7/8 inch hole was, rather unexpectedly, found to be completely unobstructed to 3644.5 meters - only 1.5 meters off total depth. Logging functions were switched at total depth and then a compensated density-caliper-GR combination was logged upward with good results.

The final pipe trip of the voyage was then made. The RFT was dismantled for re-dressing and preparations were made for getting underway. The CHALLENGER departed Site 504 at 1743 hours, October 26, 1979.

SITE 504 TO BALBOA

Following winds and currents nearly all the way to Panama resulted in an unexpectedly high transit speed and permitted some course deviations for seismic profiling. Even so it was necessary to reduce speed the final day to avoid arriving at the roadstead in the middle of the night. Leg 69 ended when the starboard anchor was let go at the Balboa outer anchorage at 0715 hours, October 29, 1979.

DRILLING AND CORING EQUIPMENT

Several variations of the standard DSDP bottomhole assembly were utilized during Leg 69. Abbreviated assemblies, consisting of two stands of 8 1/4" x 4 1/8" drill collars separated by a single bumper sub, were used for piston coring at Hole 504 and for logging operations at Hole 504B. Most of the basalt coring was carried out with an extra heavy BHA consisting of the outer core barrel assembly, three 8 1/4" drill collars, one 5-foot stroke bumper sub, six 8 1/4" drill collars, two bumper subs, three 8 1/4" drill collars and one 7 1/4" drill collar.

The Lynes retrievable formation tester was run immediately below the outer core barrel in Holes 505, 505A and twice in Hole 504B. On these occasions, a McCullough torque actuated drilling jar was included just above the core barrel as a measure against possible sticking due to packer malfunction or damage.

The most serious problem with drilling equipment was the sequence of failures in the Bowen hydraulic system which drives the power sub and the sandline winch. The sudden release of energy caused by a burst hydraulic line resulted in the destruction of the hydraulic motor on the power sub. The replacement unit was eventually found to be faulty after it had caused a series of intermittent failures in system performance and was replaced. Total time lost was 16 3/4 hours.

The only other significant trouble with drilling equipment was the previously described failure of the travelling block hangoff sling with resulting damage to the hook connector latch. Total lost time due to this incident was 10 3/4 hours.

The hydraulic piston coring system was utilized successfully at Hole 504. The objectives of increased core recovery and decreased drilling disturbance were achieved. No serious problems were experienced and steps are being taken to alleviate persistent difficulties with core orientation ambiguities and plastic liner failures.

Virtually no difficulties were experienced with downhole drilling and coring equipment, except for those due to the accumulation of rust scale from the inside of the drill pipe. The strongly magnetic rust particles were a detriment to paleomagnetic studies in the piston-cored sediments at Hole 504. The amount of rust appeared to increase as heavier shear pins were used to achieve penetration in stiff sediments and the drill string was subjected to greater shock. A suite of downhole packer experiments in Hole 504B was aborted when a heavy accumulation of rust prevented the retrieval of a go-devil with the overshot assembly. Several joints of drill pipe which had not been used for several months had been picked up for the experiment. Improved methods of internal rust removal are being investigated.

CORE BITS

The catastrophic failure of the 14 7/8" F94C core bit was the most costly mechanical failure of the voyage. A re-entry hole was lost and it was necessary to deploy a second re-entry cone and casing string. About two days of operating time were lost and the failure apparently led indirectly to the problems experienced with the power sub.

Two of the cutter legs were found to have broken off near the base where they are welded into the bit body. The breaks occurred across the grease reservoir at the point of minimum cross-sectional area of the leg and appeared to be the result of a design deficiency.

Two 9 7/8 inch bits were used to drill 212 meters of basalt in Hole 504B. The first bit, a model F94CK, achieved a highly respectable average penetration rate of 3.6 meters per hour whereas the second bit, an F99CK, averaged 2.4 meters per hour. Drilling with the F99CK, however, was dramatically smoother in terms of torque and vertical vibration. Heave compensation was used with both bits.

SPECIAL TOOLS

The Lynes retrievable formation tester was deployed on three occasions. Due to highly unfavorable hole conditions at Site 505, no attempt was made to inflate the packer and conduct experiments on the first run. On retrieval, the packer element was found to have been completely destroyed during the coring operations. Disassembly revealed a failed internal O-ring which could have resulted in inflation of the packer during drilling operations. If this occurred, it could have caused the severe damage to the element and some of the torquing and sticking problems experienced in Holes 505 and 505A. On the second packer run, two successful "pulse test" experiments were conducted following a re-entry in Hole 504B. The packer was operating as designed and further experiments were planned, but the inability to engage and retrieve the go-devil due to rust accumulation necessitated a pipe trip. On the packer's third deployment, it was run to total depth in Hole 504B following re-entry and operated successfully in the sampler mode. Unfortunately the initial drawdown pressure differential of over 4,000 psi apparently caused the packer element to fail and become wadded downward into the annulus. This resulted in a stuck drill string for four hours and precluded further packer operations on Leg 69 due to time constraints.

A total of ten combination temperature/pore water probe runs were made in Holes 504A, 505, and 504C and one run with the temperature probe only was made at Hole 504C. Eight successful temperature measurements and ten formation water samples were obtained. The probe became stuck at the bit on the second run in Hole 504A. This resulted in an unplanned round trip and re-entry. On recovery the pressure case of the instrument was found to be flooded. Several internal components had been damaged and temperature data had been destroyed. No other operational problems of consequence were experienced with this equipment.

The Gearhart-Owen wireline water sampler was run in conjunction with temperature logs on two occasions. On the first attempt, in Hole 505B, the intake passage became plugged with sediment after a sample of about 100 ml had been collected. The sample was sufficient for most analyses and was found to contain a measurable proportion of formation water. A routine sampling run was made in Hole 504B and the chamber was filled with a mixture of seawater and formation fluid.

MOTION COMPENSATOR

The motion compensator system remained out of service with hydraulic problems for much of the first half of the voyage. After these difficulties had been resolved, however, the system gave nearly trouble-free service and was considered to be a significant factor in the good bit performance at Hole 504B. Lost operating time attributable to the heave compensator for the voyage was minimal, but its unavailability essentially limited the heat flow program to the firmer sediments below about 120 meters below seafloor in the earlier holes.

BEACONS

Only three acoustic positioning beacons were launched on Leg 69. There were no problems whatever with beacon performance. The 13.5 kHz double life beacon dropped on arrival at Site 504 was performing at about 80 per cent of original signal level after 36-days when the vessel departed for Panama.

RE-ENTRY HARDWARE

Two complete re-entry cone assemblies were deployed, with two 16-inch conductor casing strings and one 11 3/4" surface casing string. A total of 449 meters of casing was run. Handling and emplacement of the hardware were accomplished without significant difficulty, due largely to the experience and efficiency of the GMI crew in re-entry operations.

RE-ENTRY ELECTRONICS

A rash of electrical and electronic problems plagued the re-entry sonar. Four false starts were made on the first three re-entry attempts and substandard tool performance was experienced on four of the eight attempts. The malfunctions were traced to faulty electronic components, circuits out of adjustment, cable head adapter leaks, etc. No inherent design or manufacturing defects were identified.

LOGGING

More successful open-hole logging runs were made on Leg 69 then on any previous voyage. The entire standard suite of Gearhart-Owen logs was run with the exception of the induction and sonic tools. The induction log was not requested due to the nature of the rocks being logged and the fact that the borehole was full of seawater. One attempt was made to run a compensated sonic log, but the run was aborted due to a shorted cable head.

The USGS borehole televiewer was deployed at Holes 505B and 504B. A combination of tool problems prevented a successful run at Hole 505B, but good results were obtained at Hole 504B. The success of the experiment was due largely to the impressive efforts of the GMI Electronics Technician in assisting the investigators to troubleshoot and modify the equipment.

Successful logs were recorded with the USSR-furnished downhole magnetometer in both holes. Tool problems necessitated extra runs at Hole 504B and cable trouble caused an extra run at Hole 505B.

DYNAMIC POSITIONING SYSTEM

The vessel's positioning system performed reliably for the duration of the leg with virtually no problems of consequence. Malfunctions of thruster relay circuits located in the engine room are discussed under engineering problems.

ENGINEERING

All engineering problems having an impact on operations were electrical in nature.

A broken wire in the stern thruster delay relay circuit resulted in intermittent positioning problems during the first week on site. The fault was difficult to isolate, but was resolved after a loss of 8 1/4 operating hours.

A different stern thruster relay began to malfunction the following week and caused the thrusters to trip off line on two occasions. The situation was corrected by adjusting spring tension on a relay and no operating time was lost.

An explosion in the main AC distribution board on October 15th caused the loss of all but emergency power. A bus bar had shorted to the metal cabinet of the switchboard and had been destroyed. While major repairs were in progress, the vessel drifted helplessly and dragged the drill string across a low ridge on the seafloor. This necessitated a round trip to inspect the BHA after switchboard repairs had been completed and the ship had returned to station.

While the bus bar and switchboard were under repair, a relay failed in DC drilling switchboard "B". This limited the drawworks to one motor and slowed the ensuing pipe trip until the fault had been found and repaired.

WEATHER AND CURRENTS

Weather conditions were nearly ideal for operations for the duration of the leg. Light winds and low swells were handled easily by the vessel's positioning system. The influence of the Humboldt Current kept temperatures mild and provided cloud cover most of the time. Variable eddy currents probably in excess of one knot sometimes complicated positioning and were minor problems during re-entry and casing operations

COMMUNICATIONS

A fairly good radio communications "window" with Scripps Station WWD existed during morning hours. Project communications were handled via this channel and were generally adequate. Some delays occurred due to heavy interference from Italian commercial Station IRM and some limitations on weekend traffic were imposed by staffing problems at WWD. Routine weather and bathythermograph reports were sent via U.S. Navy Stations.

Numerous personal amateur phone patches were made for shipboard personnel with the assistance of the two amateur operators on board.

PERSONNEL

The voyage was not particularly long by DSDP standards, but it was highly work-intensive and the effects of stress were felt by many. A rotary helper injured his hand on September 27 and was unable to work for the remainder of the cruise. This resulted in extra hours worked by other crew members during the frequent pipe trips.

The scientific staff worked harmoniously despite a wide diversity of interests in the holes being drilled. They were patient and reasonable in the face of repeated mechanical failures and delays early in the voyage.

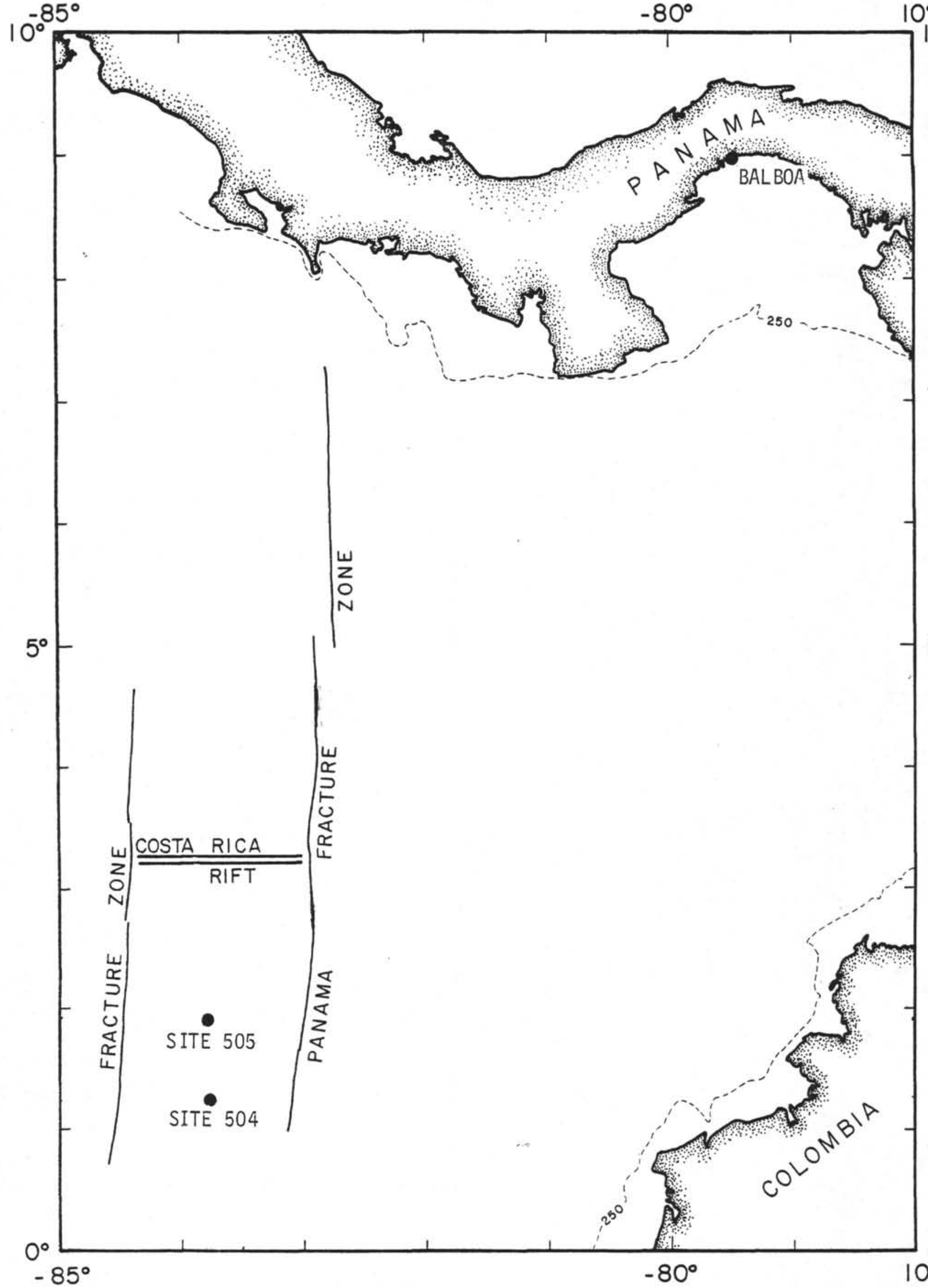
The SIO technical and GMI staffs again delivered the support necessary to make the leg a scientific success. They were successful in handling equipment and techniques with which they had little or no previous experience.

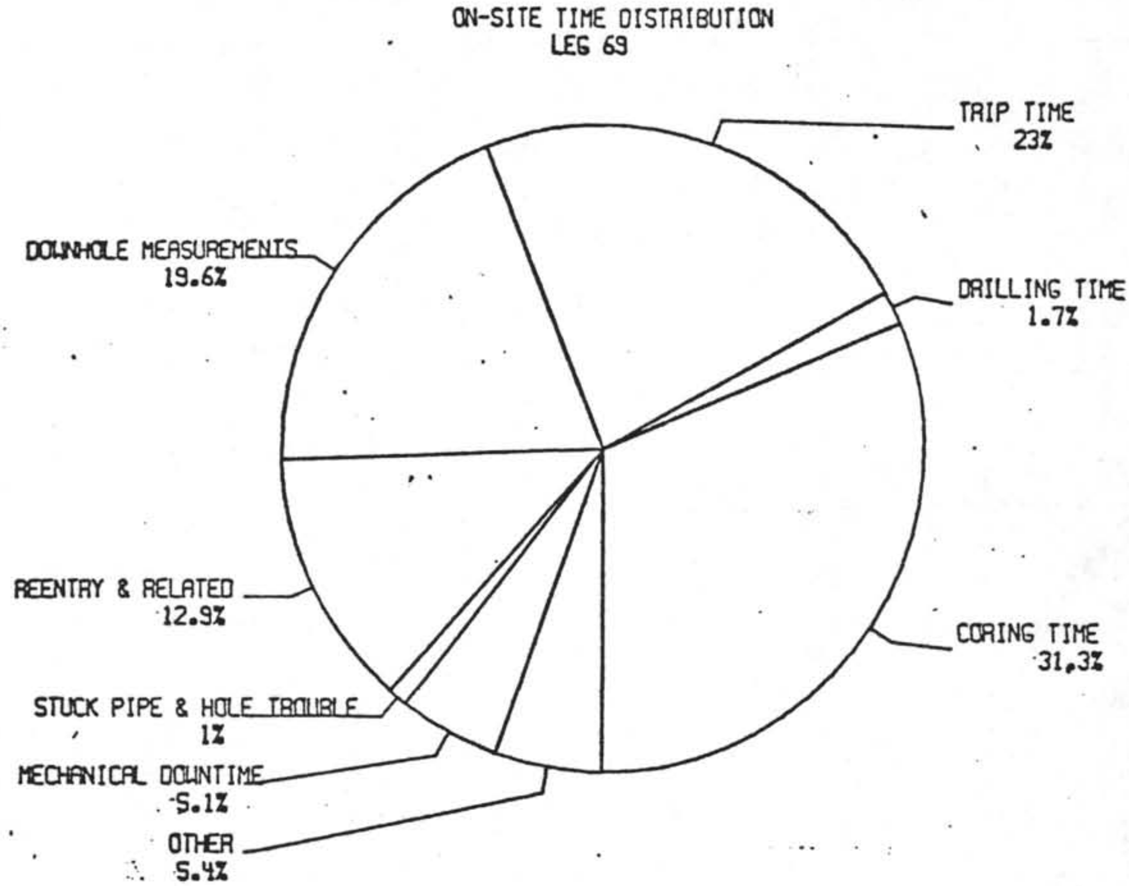
Glen N. Foss
Cruise Operations Manager
Deep Sea Drilling Project

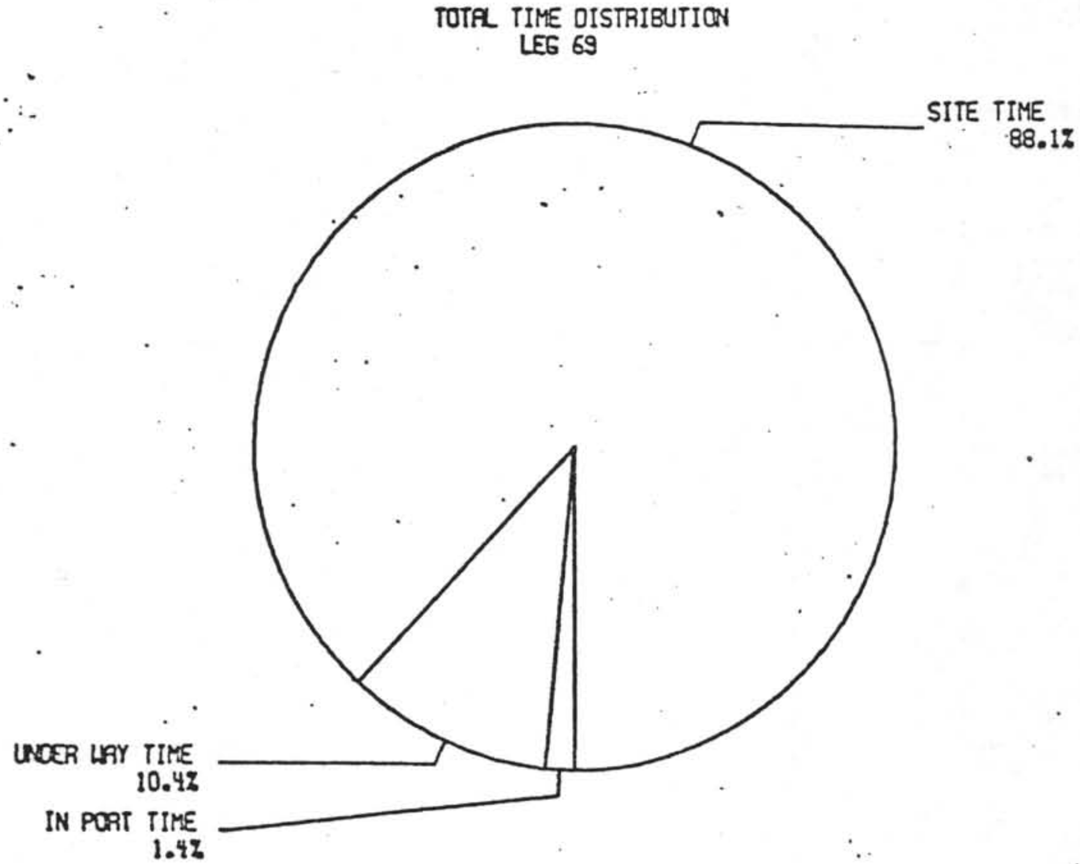
INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
OPERATIONS RESUME
LEG 69

Total Days (September 18, 1979-October 29, 1979)		40.98
Days in Port		0.56
Days Under Way		4.27
Days On Site		36.15
Coring Time	11.3	
Drilling Time	0.6	
Trip Time	8.3	
Re-entry & Related	4.7	
Downhole Measurements	7.1	
Mechanical Downtime	1.9	
Hole Trouble & Stuck Pipe	0.3	
Other	1.9	
Total Distance Covered (Nautical Miles)		941.0
Average Speed (Knots)		9.3
Sites Investigated		2
Holes Drilled		7
Number of Cores Attempted		91
Number of Cores With Recovery		89
Total Meters Cored		507.0
Total Meters Recovered		260.3
Percent of Recovery		51.3
Total Meters Drilled		1067.0
Total Meters Penetration		1851.0
Percent Penetration Cored		27.4
Maximum Penetration (Meters)		489.0
Minimum Penetration (Meters)		178.0
Maximum Water Depth (Meters)		3548.5
Minimum Water Depth (Meters)		3468.0

LEG 69 OPERATING AREA




ON-SITE TIME DISTRIBUTION
LEG 69
TRIP TIME
23%
DRILLING TIME
1.7%
CORING TIME
31.3%
DOWNHOLE MEASUREMENTS
19.6%
REENTRY & RELATED
12.9%
STUCK PIPE & HOLE TROUBLE
1%
MECHANICAL DOWNTIME
5.1%
OTHER
5.4%


TOTAL TIME DISTRIBUTION
LEG 69
SITE TIME
88.1%
UNDER WAY TIME
10.4%
IN PORT TIME
1.4%

DEEP SEA DRILLING PROJECT
TIME DISTRIBUTION
LEG – 69

Date	Site No.	Cruise	Trips	Drill	Core	Stuck Pipe & HOLE TROUBLE	W.O.W.	Position Ship	Mech. Repair	Port Time	Re-Entry & RELATED	Other	Total Time	Remarks
9/18/79 9/20/79		31.0								13.3			44.3	La Libertad to Site 504
9/20/79 9/23/79	504		15.2		17.7				0.6			3.8	91.3	Hole 504 Piston Coring
9/23/79 9/29/79	504A		35.0	4.0	19.1			12.5	25.7		25.8	6.4	128.5	Hole 504A First Occup.
9/29/79		4.4											4.4	Site 504 to Site 505
9/29/79 10/2/79	505		8.7		37.2	0.7		11.6	1.3			1.3	60.8	Hole 505
10/2/79	505A		8.7	1.8	6.5	1.0			4.0			0.8	22.8	Hole 505A
10/3/79 10/7/79	505B		14.4	1.7	20.7	3.3		51.6	6.9		-	9.9	108.5	Hole 505B
10/7/79		5.5											5.5	Site 505 to Site 504
10/7/79 10/14/79	504B		40.6	4.1	58.9			0.2			51.1	4.0	158.9	Hole 504B First Occup.
10/14/79 10/15/79	504C		8.6	2.9				12.3					23.8	HOle 504C
10/15/79 10/25/79			62.9		57.6	3.2		74.8	6.0		29.5	19.7	253.7	Hole 504B 2nd Occup.
10/25/79 10/26/79			5.5					7.3			5.7	0.8	19.3	Hole 504A 2nd Occup.
10/26/79 10/29/79		61.6											61.6	Site 504 to Balboa.
		102.5	199.6	14.5	271.7	8.2	0	170.3	44.5	13.3	112.1	46.7	983.4	TOTALS

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
SITE SUMMARY
LEG 69

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
501	01° 13.63'N	83° 44.06'W	3467.0	20	20	100.0	147.1	74.5	50.7	190.0	337.1	11.4	183.3	183.3
504	01° 13.58'N	83° 43.93'W	3470.0	54	53	98.1	227.0	174.6	76.9	10.0	237.0		91.3	
504A	01° 13.61'N	83° 43.95'W	3468.0	8	7	87.5	51.5	9.0	17.5	226.5	278.0	25.7	128.5	
505	01° 54.82'N	83° 47.39'W	3548.5	26	26	100.0	223.0	187.1	83.9	19.0	242.0	50.2	60.8	
505A	01° 55.08'N	83° 47.35'W	3535.0	2	2	100.0	12.0	0.8	6.3	196.5	208.5	48.3	22.8	
505B	01° 55.17'N	83° 47.29'W	3517.0	6	6	100.0	42.0	6.9	16.3	136.0	178.0	12.5	108.5	
505 SITE TOTALS				34	34	100.0	277.0	194.8	70.3	351.5	628.5	27.0		191.8
504B	01° 13.61'N	83° 43.81'W	3473.5	29	29	100.0	228.5	76.7	33.5	260.5	489.0	6.5	412.6	
504C	01° 13.64'N	83° 43.89'W	3469.0	0	0	--	0	0	- -	218.5	218.5	312.1	23.8	
504A	01° 13.61'N	83° 43.93'W	3468.0	0	(RETURNED FOR LOGGING)								19.3	
504 SITE TOTALS				91	89	97.8	507.0	260.3	51.3	715.5	1222.5	10.6		675.5
GRAND TOTALS				125	123	98.4	784.0	455.1	58.0	1067.0	1851.0	16.6		867.3

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
BIT SUMMARY
LEG 68/69

HOLE	MFG	SIZE	TYPE	SERIAL NUMBER	METERS CORED	METERS DRILLED	METERS TOTAL PENET	HOURS ON BIT	CONDITION	REMARKS
504	MSDS	10 1/2	(HPC)	126489	227.0	10.0	237.0		One Seal Failed	
504A	Smith	14 7/8	F94C	697AN	0	152.0	152.0	2.1	TO-B4SF-I	One seal leaking grease. 84.3 hrs total
504A	Smith	14 7/8	F94C	367AT	51.5	74.5	126.0	10.8	T7-B4LC	Two shanks broken off near base; shanks and cones left in hole.
505	Smith	9 7/8	F99CK	RBSV844	223.0	19.0	242.0	4.8	Unknown	Pulled above seafloor and offset.
505A	Smith	9 7/8	F99CK	RBSV844	12.0	196.5	208.5	4.3	T1-B2SE-o 1/8	Severe wear on body, shanks and shirt-tails; gauge pads destroyed.
	TOTALS				235.0	215.5	450.5	9.1		
505B	Smith	9 7/8	F99CK	RB847BP	41.5	136.0	177.5	14.2	Unknown	Signs of failure noted. Released for logging.
504B	Smith	14 7/8	F94C	696AN	16.5	260.5	277.0	6.2	TO-BOSE-I	Drilled 2.5m basalt.
504B	Smith	9 7/8	F94CK	AE3374	115.0	1.0	116.0	33.8		Cement shoe & 116m basalt in 33.8 hrs.
504C	Smith	9 7/8	F94CK	AE3374	0	218.5	218.5	0.7	T2-B4SF-o 1/8	Respud after clearing seafloor.
	TOTALS				115.0	219.5	334.5	34.5		
504B	Smith	9 7/8	F99CK	158FE	96.0	0	96.0	39.7	TO-B3SE-I	Basalt; ran back & released for logging.

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
BEACON SUMMARY
LEG 69

SITE NO.	MAKE	FREQ. kHz	SERIAL NUMBER	SITE TIME HOURS	
501	ORE	16.0	499	183.3	Double life. Exceptionally strong & steady for duration. Dropped 7/8/79; dead on return to site 9/20/79.
504	ORE	13.5	509	91.3	Double life.
504A	ORE	13.5	509	128.5	
504B	ORE	13.5	509	418.0	
504C	ORE	13.5	509	23.8	Departed area 877.5 hours after launch.
505	ORE	13.5	506	60.8	Single life.
505A	ORE	13.5	506	22.8	
505B	ORE	13.5	504	108.5	Strong for duration.
504B	ORE	16.0	457	19.0	Double life - dropped 0325 hrs 10/25/79.

DEEP SEA DRILLING PROJECT
LOGGING SUMMARY
LEG 69

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
505B	3695.0	3517.0	3654.0	sea water	9 7/8	4.7	1	Temperature			Misrun-broken wire in DSDP sinker bar.
505B	3695.0	3517.0	3654.0	sea water	9 7/8	2.5	2	Temperature	3500.0	3689.0	Recorded downward - Trouble getting down hole.
505B	3695.0	3517.0	3654.0	sea water	9 7/8	2.6	1	Density/ Cal/GR	3687.5	3625.0	Recorded upward. GR insensitive; otherwise good.
505B	3695.0	3517.0	3654.0	sea water	9 7/8	4.5	1	Borehole Televiewer	- -	- -	Misrun - tool trouble.
505B	3695.0	3517.0	3654.0	sea water	9 7/8	4.9	1	Magnetometer	3689.0*	3625.0	Trouble getting down-overran & knotted cable; got depths past T.D.
											Pulled out due to knot.
505B	3695.0	3517.0	3654.0	sea water	9 7/8	5.2	2	Magnetometer	3689.0	3625.0	Finished maggy suite successfully.
505B	3695.0	3517.0	3673.0	sea water	9 7/8	4.5	2 & 3	Borehole Televiewer	- -	- -	Double misrun; tool malfunctions going down pipe; xducer imploded
505B	3695.0	3517.0	3625.0	sea water	9 7/7	4.0	1	Guard/ Neutron/GR	3686.5	3625.0	Good neutron & laterolog. GR not very good; neutron affected?
505B	3695.0	3517.0	3654.0	sea water	9 7/8	5.9	3	Temperature	3535.0	3686.0	Validity in doubt; log too cool & flat. Fluid sample taken; 130 cc-muddy wtr.
						12.3					Time spent on hole prep, log cable, winch, sheaves, etc.
TOTALS						50.2					
			CSG.								
504B	3962.5	3473.5	3750.5	sea water	9 7/8	3.2	1	Temperature	3422.0	3953.9	Recorded downward.
504B	3962.5	3473.5	3750.5	sea water	9 7/8	2.6	1	Density Cal/GR	3948.1	3665.0	Recorded upward; good log.
504B	3962.5	3473.5	3750.5	sea water	9 7/8	4.3	1	Guard/ Neutron/GR	3951.0	3750.0	Good log; GR affected by neutron.
504B	3962.5	3473.5	3750.5	sea water	9 7/8	6.0	1	Downhole Magnetometer	3953.1	3750.5	Good susceptibility & 2 axis; X & Y no good.
504B	3962.5	3473.5	3750.5	sea water	9 7/8	4.0	2	Downhole Magnetometer	3953.1	3750.5	2nd lower cartridge-same results.
504B	3962.5	3473.5	3750.5	sea water	9 7/8	9.8	1	Borehole Televiewer	3760.0	3955.0	Recorded downward. Good results; upper section noisy.
504B	3962.5	3473.5	3750.5	sea water	9 7/8	4.1	1	Sonic/Cal/GR	- -	- -	Misrun-Cable head shorted out.
504B	3962.5	3473.5	3750.5	sea water	9 7/8	5.1	3	Downhole Magnetometer	3953.1	3750.5	Tool worked;hole too vertical for X/Y
504B	3962.5	3473.5	3750.5	sea water	9 7/8	4.6	2	Temperature/ Water SAmpler	3470.0	3952.0	SP attempted failed;circuitry wrong Temp recorded downward;good wtr sample
						3.4					(Logging cable, sheaves, etc.)
TOTALS						47.1					
504A	3746.0	3468.0	3621.0	sea water	14 7/8	2.7	1	Temperature	3450.0	3744.6	Recorded downward-good log.
504A											
504A	3746.0	3468.0	3621.0	sea water	14 7/8	3.5	1	Density Cal/GR	3742.0	3599.0	Good log.
						0.6					Sheaves.
TOTALS						6.8					

INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
OPERATIONS RESUME
LEG 70

Leg 70 was the second of two legs planned to investigate the geothermal conditions of sediments and crustal rocks in the Galapagos Spreading Center and the Costa Rica Rift. To accomplish the desired goals 32 holes were drilled at five sites plus returning to a re-entry site which had been started on Leg 69. Four re-entries were made as well as running a suite of downhole logging tools, performing a resistivity experiment, and an oblique seismic experiment. The latter experiment was carried out with the assistance of the R/V James Gillis. This ship brought the scientists who would record the information and also dropped the charges required for the experiment.

The voyage commenced on October 29, 1979 at 0715 hours when the GLOMAR CHALLENGER dropped anchor in the port of Balboa, Panama and ended 59.9 days later at 0653 hours, December 28, 1979 when the anchor was dropped in the port of Valparaiso, Chile. Total length of the leg was 59.9 days of which 30.6 days were spent on site and 16.0 days were spent underway. In addition to the 12.7 days spent in port at the leg, an additional 13.3 hours were spent in port at Callao, Peru. This port call was used to offload the scientific staff and some of the marine technicians. Two scientists and two technicians were also taken aboard. Departure was delayed for a number of hours because a replacement for an offgoing seaman did not have the necessary A.B. seamans papers and one of the drilling crew was substituted after the proper papers had been signed at the U. S. Embassy in Lima. The on-site time breakdown consists of 6.7 days tripping, 0.24 days drilling, 13.6 days coring, 3.01 days making downhole measurements, 0.24 days with mechanical repairs, 1.9 days of re-entry, and 4.9 days of miscellaneous items such as heat flow measurements and pore water sampling.

BALBOA PORT CALL

The scheduled port call activities consisted of the usual onloading of dry stores and frozen goods, plus other freight. In addition, the drill pipe was inspected while 366 joints of down-graded drill pipe was offloaded and replaced with 399 joints of new R-2 regular pipe and 41 joints of aluminum pipe. Before the regular loading began the ship had first tied to the fuel dock and taken on slightly over 200,000 gallons of diesel fuel. All this was accomplished by 1630 hours on November 3rd and preparations were being made to depart when it was found that the ship's computer had a problem which was finally found to be in the central processing unit. Four specialists were flown in from the United States and the repairs were completed and satisfactory sea trials ended at 0254 hours on November 11th. The specialists were transferred to a shore boat and the ship departed for Site 506, which was to be located in the seamounds area near the Galapagos Islands.

SITE 506

The first site to be drilled on Leg 70 was reached after two and one half days travel from Balboa, Panama. A 13.5 kHz Benthos beacon was dropped and when the ship was positioning in the automatic mode, makeup of the drill string began. Based on the experience from Leg 54 while drilling in the geothermal mounds area, a shortened 75.97 meter bottomhole assembly (BHA) was madeup and run. In addition to the shortened BHA, a 13 kHz beacon was attached to the drill pipe 102.8 meters above the bottom of the bit. This beacon was mounted with the transducer pointing down and it was hoped that the reflected sound would be picked up on the PDR and in this manner the top of a particular mound could be located for drilling. The BHA was also made up to core with the hydraulic piston corer (HPC) which would allow recovery of undisturbed mound material. The precision depth recorder (PDR) had indicated a water depth of 2720 meters, so the drill string was run in to 2683.1 meters. The Bowen power sub and two joints of pipe were picked up and at 2330 hours on November 14th, the ship began maneuvering using the 12.0 kHz pinger to locate a mound for coring. By 0200 hours on the 15th, such a site had been selected and the HPC core barrel was lowered on the sandline. The first attempt recovered only a water core, but the hole was spudded on the next attempt at 0601 hours. The location of this hole was 1350 feet north and 1000 feet west of the beacon. A total of eight cores were attempted to a subbottom depth of 36.7 meters before the hole was abandoned. The decision to stop was made because the pressure had not bled off when the pins sheared on the last core attempt indicating that the tool had not scoped out completely. Only a trace of sediment was recovered and the core catcher sub was bent on the lower edge. All of these conditions indicated that the sediment section had ended and the core catcher sub had encountered hard crustal material. Therefore, the hole ended when the bit was pulled above the mudline at 1917 hours, November 15th.

HOLE 506A

After the bit had cleared the mudline at Hole 506, the ship was moved 50 feet east and preparations were made to take heat flow measurements in the mound at this location. After the heat probe was madeup, the hole was spudded at 2030 hours, November 15 and was washed 17.0 meters, 2730.7 meters while the tool was being lowered. Heat flow measurements were taken at 2730.7, 2740.2 and 2745.0 meters as the pipe was lowered. The mudline was assumed to be 2713.7 as in Hole 506. After these three measurements were taken, the tool was recovered and the pipe was pulled. The hole ended when the bit cleared the mudline at 2245 hours, November 15th.

HOLE 506B

After completing Hole 506A, the ship was offset 150 feet north using the 12.0 kHz pinger for the optimum location on the mound. The pinger was also used to calculate at what depth the bit should be located to recover a good mudline core. When this depth was determined, Hole 506B was spudded at 0000 hours, November 16. Six cores to a below mudline depth of 20.9 meters, were attempted using the HPC. However, coring was stopped at Core #6 because the tool did not scope completely when the pins sheared and the core catcher sub was damaged as it was at Hole 506 when the crustal material was reached. The drill string was pulled and Hole 506B ended when the bit cleared the mudline at 0635 hours, November 16th.

HOLE 506C

Using the 12 kHz, a third mound was located 950 feet south of Hole 506B and Hole 506C was spudded with the HPC tool at 1025 hours, November 16. It was continuously cored to a subbottom depth of 31.3 meters where hard crustal rock was again encountered. The drill string was pulled and the hole was ended at 1900 hours, November 16, when the bit cleared the mudline

HOLE 506D

This hole was spudded at 2050 hours, November 16 after the ship had been positioned 250 feet south of Hole 506C. This hole was then continuously cored with the HPC tool to 30.9 meters subbottom. Coring operations were then stopped for two hours while repairs were made to the HPC blowout preventer. After this equipment was repaired, only one more core was attempted. Once again hard crustal material was reached at 31.9 meters subbottom. The drill string was pulled following recovery of this last core and Hole 506D ended when the bit reached the derrick floor at 1354 hours, November 17.

HOLE 506E

After the drill string had been recovered, the HPC coring set up was removed and a conventional BHA with a hydraulic bit release (HBR) was madeup. A short BHA (76.1 meters) was used again because of the anticipated thin sediment section. The drill string was run in to 2683.1 meters and then the transducer used for re-entry was lowered into the pipe to make a survey of the mounds area and hopefully select one which could be drilled for some distance into the crustal material below the sediments. The survey began at 2325 hours, November 17 and ended 0145 hours, November 18 when starting to pull the re-entry tool.

While the re-entry tool was being recovered, the ship was offset 1050 feet north of Hole 506D or back to the same coordinates for Hole 506A because the heat flow measurements taken at Hole 506A were found to be unsatisfactory when they were examined. When the ship was on location the heat flow tool was dropped and after it had seated, the hole was spudded at 0430 hours on November 18. The hole was then washed to 2722.0 meters (mudline 2713.7 meters) and heat flow measurements were taken. The pipe was washed to 2731.5 meters and 2733.0 meters where additional heat flow measurements were taken. Following this the drill string was pulled above the mudline at 0530 hours, November 18 and Hole 506E completed.

HOLE 506F

When the temperature tool was recovered it was found to be damaged and while the ship was moved to a new location 250 feet north of Hole 506E, it was repaired. Hole 506F was then spudded at 0730 hours, November 18 and washed to

2731.0 meters and then at 2737.0 meters. The tool was recovered and then the drill string was pulled above the mudline at 0906 hours, November 18 and the hole was ended.

HOLE 506G

While the heat flow tool was being recovered, the ship was moved 250 feet south and 50 feet west of Hole 506F. The heave compensator was picked up and Hole 506G was spudded at 1115 hours on November 18. The hole was washed from 2713.5 to 2741.0 meters where continuous coring of the crustal rock began. The first core required 98 minutes to cut two meters and only 0.30 meters was recovered. After coring for 80 minutes on Core #2, about 1.5 meters had been cut accompanied by a great deal of torquing and stopping of rotation. A 25 barrel slug of mud did not help the drilling conditions, so after two hours of rotating with little additional penetration, the heave compensator was locked out. Coring improved for about one meter and then no additional hole was made. After 210 minutes of attempting to core this hole, the decision was made to abandon the hole and try at another location. A total of three meters was cut with Core #2 and only 0.75 meters was recovered. The bit was pulled above the mudline at 1906 hours, November 18 to end Hole 506G.

HOLE 506H

The ship was moved 1050 feet south and 50 feet east of Hole 506G to this new location. The hole was spudded at 2009 hours, November 18 and was washed to a subbottom depth of 26.1 meters. The first core from 26.1 to 34.0 meters below seafloor (BSF), required 166 minutes to cut and recovered only 0.17 meters. The same torquing and sticking, as had been experienced in the previous hole, developed as the bit penetrated the crustal material and the location was abandoned. The bit was pulled above the mudline at 0035 hours on November 19.

HOLE 506I

After the ship had been moved 250 feet north of Hole 506H, this new hole was spudded at 0225 hours, November 19 and washed to 26.1 meters (BSF) where the hard crustal material was reached. After three hours of torquing and sticking while coring only 3.5 meters, this location was abandoned due to the hazardous drilling conditions. When the core barrel was recovered, it contained only 0.2 meters of hard rock fragments. The drill string was pulled and the hole was completed when the bit reached the derrick floor at 1224 hours, November 19.

SITE 507

From Site 506 the ship traveled almost due south for 2.6 miles where a 16.0 kHz Benthos beacon was dropped at 1306 hours, November 19. This was another area known to have a number of mounds and it was hoped that drilling conditions would improve.

The ship was in the automatic positioning mode at 1430 hours and makeup of the drill string began. The running in of the drill pipe was delayed one hour while a minor repair was made to the pipe stabber. The PDR indicated a water depth of 2701 meters so the drill string was run in to 2692.5 meters. The logging sheaves were rigged and preparations were made to again use the re-entry tool to survey the area and locate the mounds. The re-entry tool was rigged and lowered to the bottom of the pipe where scanning began at 2213 hours, November 19. This scanning continued until 0330 hours, November 20. The logging sheaves were rigged down and the heave compensator and Bowen power sub were picked up. A mudline core was cut and established bottom at 2711.5 meters. The drill string was then washed in to determine where the top of the hard crustal material was located. This was done because heat flow measurements were planned as the next operation and care had to be taken that the probe would not be bent unexpectedly coming in contact with the hard material. This contact was established at 2740.0 meters or 25.5 meters (BSF). The drill string was then pulled and Hole 507 ended when the bit cleared the mudline at 1057 hours, November 20.

HOLE 507A

The ship was moved 50 feet east of Hole 507 and the heat floow tool was free fallen into position in the drill pipe. Hole 507A was then spudded at 1211 hours, November 20. As the pipe was lowered heat flow measurements were taken at 2719, 2728, and 2737 meters, using the heave compensator to try and hold the tool still at each measurement depth. When the tests were completed the drill string was pulled above the mudline at 1306 hours, November 20 and the hole was abandoned.

HOLE 507B

Following the recovery of the heat flow tool from Hole 507A, a core barrel was dropped and Hole 407B was spudded at 1403 hours, November 20. No offsets had been made and therefore a mudline core was not cut and after spudding, the bit was washed to 2742.5 meters or 31.0 meters BSF. The first core began at 2742.5 meters and when coring stopped seven hours later, the bottom of the cored interval was 2749.5 meters. After cutting about six meters, the hole had been flushed with 50 barrels of mud due to torquing and sticking. When the seven meters had been reached, the pipe suddenly became stuck. After working it for 22 minutes with pulls of 50,000 lbs over hanging weight, the pipe was freed and due to these poor drilling conditions, it was decided to leave this hole. The heavy wall drilling joint was set back and the overshot was lowered to retrieve the core barrel. It returned without the core barrel, so the shear pin was replaced and run again. This time the core barrel was recovered with only 0.63 meters of core recovery. The drill string was pulled and the hole was abandoned when the bit cleared the mudline at 0136 hours, November 21.

HOLE 507C

Due to the poor drilling conditions, the ship was moved 450 feet north of Hole 507B and the hole was spudded at 0234 hours, November 21 with the mudline core establishing bottom at 2715.5 meters. The hole was then washed to 2740.0 meters where resistance was encountered and established the sediment thickness at 24.5 meters which made it about six meters thinner than at Hole 507B. The first coring attempt into the hard rock required 1.6 hours to cut three meters and recovered only 0.10 meters. The second core was two meters long and took five hours to cut and recovered 0.11 meters of rubble like rock. The same torquing and sticking continued to cause concern for the drill string and it was decided to leave this hole. The drill string was pulled and the hole ended when the bit reached the derrick floor at 1718 hours, November 21.

HOLE 507D

When the drill string was recovered the BHA was changed back to the set up to do hydraulic piston coring. This also included attaching the pinger to the pipe about 102 meters above the bit. This particular set up proved to be valuable in locating the mounds, then positioning directly above them and finally providing a very successful means of obtaining a good mudline core instead of occasional water cores. After making up the new BHA, the pipe was run in to 2683.5 meters. Following this, beginning at 0104 hours, November 22, 1979, a survey was made of the mounds in the area. The ship had been moved 950 feet south and 150 feet east of Hole 507C. This survey continued until 0618 hours. The hydraulic piston core barrel was then rigged and lowered and Hole 507D was spudded at 0732 hours, November 22. The sediments were continuously cored until crustal material was reached 38.7 meters BSF. This was verified when the last core was recovered and the core catcher sub was found to be badly dented. The drill string was then pulled and the hole was ended when the bit cleared the mudline at 1636 hours, November 22.

HOLE 507E

While the ship was being positioned 50 feet east of Hole 507D, the heat flow and pore water sampler was being rigged. The tool was then free fallen to the bottom of the pipe and then Hole 507E was spudded at 1720 hours, November 22. Heat flow measurements were taken at 2711.0, 2722.0, and 2733.0 and the pore water sample was also taken at 2733.0. These three depths were 11.9, 22.9, and 33.9 meters BSF respectively. Following these measurements the pipe was pulled above the mudline at 1818 hours and the time on the hole ended.

HOLE 507F

While the heat flow tool was being recovered the ship was moved 200 feet west and 50 feet north of Hole 507E. The HPC tool was then picked up and lowered and Hole 597F was spudded at 2045 hours with the mudline core establishing bottom at 2704.4 meters. The hole was then continuously cored until hard crustal material was encountered in Core #9, which made a total penetration of 31.3 meters (BSF). Hole 507F ended when the bit was pulled above the mudline at 0615 hours, November 23.

HOLE 507G

The ship was again offset 50 feet west and 60 feet south of Hole 507F while the heat flow/pore water sampler tool was being prepared. Hole 507G was spudded at 0630 hours and then washed to 2711.0 meters. Heat flow measurements were made at 2711.0,, 2720.0, and 2730.0 with the pore water sample taken at 2730.0. Subbottom depths for these locations was 6.6 meters, 15.6 meters and 25.6 meters. The hole was ended when the bit was pulled above the mudline at 0820 hours, November 23.

HOLE 507H

This hole was located 550 feet south and 200 feet east of Hole 507G and after the ship had been moved to it the hole was spudded at 0945 hours, November 23 with the mudline established at 2699.6 meters. A total of eight cores were cut and recovered with a total penetration of 32.9 (BSF) before the damaged core catcher sub indicated that crustal material had again been reached. The bit was pulled above the mudline and ended the hole at 1654 hours, November 23.

HOLE 507I

The final hole at this site was located 50 feet east of Hole 507H. It was also used to obtain heat flow measurements and a pore water sample. After the hole was spudded at 1705 hours, November 23, the measuring tool was lowered with the sandline. This was done because the sampling device was believed to have been damaged when it was free-fallen in Hole 507G. Heat flow measurements were taken at 2711.0, 2720.0 and 2728.0 meters and the pore water sample at 2728.0. Again the (BSF) depths of the locations is 11.4, 20.4 and 28.4 meters. After the measurements were taken the tool was recovered and the drill string was pulled. The bit reached the derrick floor at 2348 hours, November 23 and ended Hole 507I as well as Site 507.

SITE 508

The move to Hole 507I began at midnight and after moving two miles south westerly, a 13.5 kHz Benthos beacon was dropped at 0022 hours on November 24 for positioning at Site 508. A BHA for use with the HPC was made-up and run followed by the drill string to a depth of 2769.0 meters. The PDR indicated a water depth of 2793 meters and using the 12.5 kHz beacon, the drill string was positioned and the hole was spudded at 0848 hours and recovered a core which placed the mudline at 2794.4 meters. Nine cores were cut to a subbottom depth of 35.3 meters. At this depth hard rock was again encountered and the edge of the core catcher sub was bent. The pipe was then pulled and cleared the mudline at 1818 hours, November 24.

HOLE 508A

After clearing the mudline, the ship was not repositioned but remained with the same offsets used for Hole 508. The heat flow and pore water sampler was then made-up and again lowered with the sandline. The drill string was lowered and Hole 508A was spudded at 1918 hours, November 24. The heat flow tool was then lowered to the mudline and a temperature measurement was recorded. Additional sample was also taken at the deepest location. This tool was pulled to the derrick floor and the hole was abandoned when the bit was pulled to the derrick floor at 0145 hours, November 25.

HOLE 508B

Before making up a new drilling assembly the ship was moved 2720 feet south and 1270 feet west of Hole 508A. A standard coring assembly was made-up with the short BHA and run in to 2769.0 meters. The PDR had indicated a water depth of 2787.0 meters. The hole was spudded at 1036 hours, November 25 and when the core barrel was recovered it also indicated that the water depth was 2787.0 meters. The hole was then washed to 2839.0 meters and coring the crustal material began. The first core was 8.5 meters long, tool 146 minutes to cut and there was no recovery. The second core was 6.0 meters long, required 5.5 hours to cut and recovered 0.38 meters. The third and last core was only two meters long, took 114 minutes to cut and recovered 0.13 meters. While cutting all three cores some torquing and sticking occurred occasionally. While the last core was being cut this action increased until the pipe became stuck and had to be worked for ten minutes before it could be freed. The pipe was then pulled until it cleared the mudline at 0112 hours, November 26 and Hole 508B was abandoned.

HOLE 508C

After some consideration it was decided to drop another core barrel in the pipe and try to core deeper at this same location. The pipe was run back and the hole was spudded at 0214 hours. It was then washed to 2829 meters or 42 meters subbottom. One 9.5 meter core was cut in 152 minutes but hole conditions were just as bad as in Hole 508B and the decision was made to abandon it also. The bit was pulled and cleared the mudline at 0555 hours and the hole was officially ended. The core barrel was retrieved after clearing the mudline and contained 2.08 meters of very rubble appearing basaltic rock.

HOLE 508D

After completing Hole 508C, the ship was moved 2720 feet north and 1270 feet east of it which returned it to the original location for HOle 508. This was done to allow heat flow and pore water samples to be taken. Before these tests could be made however, 2 3/4 hours were required to repair the electric brake on the drawworks, which consisted of replacing the firing circuit and wiring around the selector switch. Following this repair the heat flow tool was rigged and lowered on the sandline after Hole 508D was spudded at 1047 hours, November 26. Heat flow measurements were taken at 2808.0 and 2818.0 meters as the drill pipe was lowered and at the mudline after which the tool was being retrieved. The pore water sample was taken as the pipe was lowered through the interaval 2808.0-2818.0. This tool was retrieved and the drill string was pulled above the mudline at 1306 hours and preparations were made to pull the bit to the derrick floor.

HOLE 508E

While preparations were being made to pull the drill string the heat flow results were checked and found to be unsatisfactory and test should be rerun. A new hole was then spudded at 1332 hours, November 26 and the pipe was lowered to 2807.0 meters. It remained at this depth while the heat flow tool was re-rigged and allowed to free fall to the bottom of the pipe. The pipe was then lowered to 2808.0, 2818,0 and 2822.0 and measurements were recorded at each of these depths plus another at the mudline when the tool was being recovered. These measurements were satisfactory when checked and the drill string was then pulled with the bit at the derrick floor at 2123 hours, November 26 and work on this hole and site was completed.

SITE 509

The arrival at this site was delayed about one hour because the bottom configuration did not match what the area looked like from previous profiling. After receiving good satellite navigation fixes a 13.5 kHz ORE beacon was dropped at 0012 hours, November 27. A BHA for use with the HPC was rigged and run to 2646.0 meters. The 12.5 kHz pinger was also attached to the drill pipe 102 meters above the bit. A survey of the mounds in this area using the 12.5 kHz was delayed about two hours while waiting for a good sat nav fix. The survey began at last at 0942 hours and continued until 1500 hours. During this time the ship was moved slowly and the drill string was raised and lowered frequently in order to prevent damage or loss of it. The final choice for the location was 3.4 miles northwest of Site 508.

The drill pipe was lowered and Hole 509 was spudded at 1538 hours, November 27. Use of the 12.5 kHz pinger allowed a mudline core to be cut on the first attempt and placed the mudline at 2704.4 meters as opposed to 2687.0 depth as calculated using the PDR. Eight good HPC cores were cut with excellent recovery. However, Core #9 did not scope completely and had only .08 meters recovery with the core catcher sub bent. This indicated about 32.0 meters of sediment cover at this location. The pipe was then pulled and the bit cleared the mudline at 2320 hours, November 27.

HOLE 509A

After completing Hole 509, the ship was not offset and preparations were made to take heat flow measurements. The bit was kept above the seafloor and the heat flow tool was free fallen and a temperature recorded at this point. The pipe was then lowered and Hole 509A was spudded at 0007 hours, November 28. A heat flow measurement was taken at 2712.0, 2720.0 and 2728.0. After these measurements were recorded the pipe was pulled above the mudline and at 0057 hours, Hole 509A was ended.

HOLE 509B

While the heat flow tool was recovered the ship was positioned to a new location which was 50 feet south and 200 feet west to Hole 509A. The HPC was made up and lowered and the hole was spudded to 0339 hours, November 28. The core that was recovered placed the mudline at 2701.8 meters. Eight cores were cut and recovered before crustal material was reached with a total BSF penetration of 33.8 meters. The drill string was then pulled and cleared the mudline at 1036 hours, November 28.

HOLE 509C

While rigging the heat flow tool the pipe was run back and Hole 509C was spudded at 1042 hours, November 28, or just six minutes after abandoning Hole 509B. The heat flow tool was made-up and lowered on the sandline and took heat flow measurements at the mudline, 2713.0, 2722.0 and 2731.0 meters. The pore water sample was taken as the pipe was lowered from 2713.0 to 2722.0 meters. The tool was pulled to the mudline again and the heat flow measurements at this depth were repeated. After these were recorded the tool was pulled to the rig floor and the pipe was pulled, clearing the mudline at 1230 hours, November 28.

HOLE 509C

While rigging the heat flow tool the pipe was run back and Hole 509C was spudded at 1042 hours, November 28, or just six minutes after abandoning Hole 509B. The heat flow tool was made-up and lowered on the sandline and took heat flow measurements at the mudline, 2713.0, 2722.0 and 2731.0 meters. The pore water sample was taken as the pipe was lowered from 2713.0 and 2722.0 meters. The tool was pulled to the mudline again and the heat flow measurements at this depth were repeated. After these were recorded the tool was pulled to the rig floor and the pipe was pulled clearing the mudline at 1230 hours, November 28.

HOLE 509D

Upon the completion of Hole 509C, the ship was moved 200 feet north and 200 feet east of it to take additional heat flow measurements in the area. After reaching the desired location the pipe was lowered and Hole 509D was spudded at 1309 hours, November 28. Again the heat flow tool was lowered on the sandline and took measurements at the mudline, 2713.0, 2722.0, and 2731.0. The pore water sample was taken between 2722.0 and 2731.0. The tool was pulled to the derrick floor and while its measurements were being checked the drill string was pulled above the mudline. When the results of the heat flow were found to be satisfactory, the drill string was pulled. Hole 509D was officially abandoned when the bit reached the rig floor at 2020 hours, November 28.

SITE 510

Site 510 was located about 64 miles north-northwest of Site 509C. After cruising for 8.8 hours a 13.5 kHz double life beacon was dropped at 0538 hours, at this location, on November 29. After the ship began positioning in the automatic mode, the drill string was made up. This hole was spudded at 1320 hours on November 29 and the mudline core established the ocean bottom at 2795.5 meters. The scientific staff had received permission to spot core through the sediment section. Following the mudline core the hole was washed to 38.5 meters and the first heat flow measurement was taken. Core #2 was cut to 48.0 meters and then the hole was washed to 67.0 meters where heat flow #2 was recorded. Three cores were cut from 67.0 to 95.5 meters and then heat flow #3. The hole was then continuously cored to a total depth of 132.5 meters (BSF). The top of basement rock began at 111.5 meters in Core #8 and the drill rate and core recovery was reduced markedly from there to total depth. After Core #10 was recovered three meters of fill was encountered and was cleaned out with 30 barrels of mud before starting to cut Core #11. After recovering Core #11 and as the new core barrel was being pumped, it became apparent from the pump pressure readings that the bit was plugged. Plans were to recover the new core barrel and drop a center bit to try and unplug the bit. However, the core barrel could not be recovered with the overshot. A second core barrel, with short hard formation teeth in the core catcher, was dropped to try and engage the first core barrel. This was unsuccessful on two attempts. The drill pipe was then surged twice in hopes of stirring up the cuttings and washing out the plug. This also proved to be unsuccessful and the drill string was then pulled. When the bit was brought to the derrick floor it was no longer plugged and the inner barrel was removed with no trouble. The cuttings had apparently been washed and bounced out as the drill string had been pulled. The hole was officially abandoned at 0145 when the bit reached the rig floor.

HOLE 504B

Hole 504B was located 162 miles almost due east from Site 510 and it was hoped that the beacon which had been dropped on October 25 during Leg 69 might still be pulsing. As the ship approached the site, what appeared to be beacon pulses were picked up and recorded on the PDR. The ship was turned and put in a holding pattern while waiting for a good satellite navigation fix which was due shortly and at the same time listening to and evaluating the pulses which were eminenting every second rather than every two seconds. When the fix was received it showed the ship to be almost over the re-entry cone. A new 13.5 kHz double life beacon was dropped at 2303 hours, December 1 and final positioning was completed.

HOLE 504B - FIRST RE-ENTRY ATTEMPT

At 0000 on December 2, make-up of the drill string began and it was run to 3466.0 meters. The logging sheaves were rigged and the re-entry tool was lowered to the bottom of the drill string, but it would not rotate when it was turned on. When the tool was picked up 3-5 meters it would rotate as it should but when it was lowered again it would stop rotating. After attempting to make the tool work on bottom for about an hour with no success, it was brought back to the derrick floor. When the tool was recovered a center bit was dropped to clear out any obstruction which might have affected the re-entry tool performance. Pump pressure did not reflect any plugging of the bit while the center bit was pumped down or after it was recovered.

HOLE 504B - SECOND RE-ENTRY ATTEMPT

The logging sheaves were rigged again and the re-entry tool lowered to bottom. Again the tool would not rotate when it was seated at the bottom of the pipe but would if raised only a meter. However, the last time it was picked up the weight indicator showed 4600 lbs or about 2000 lbs over normal pick up weight. After this the tool was pulled to the rig floor. When it was on the floor it was checked for operation and failed to work. The tool was removed and replaced with another and it also failed to operate properly. Tests then indicated that the logging cable head was defective. The damage apparently was a result of the overpull when the tool was retrieved from bottom. While the cable was being reheaded, it was decided to pull the drill string and see if there was an obvious cause for the tools failure to operate when seated.

When the drill string had been recovered and the cable reheaded, the re-entry tool was lowered into the outer core barrel and bit assembly which was hung off in the moonpool. The tool operated normally and no problem could be located so it was decided to run back with the drill pipe and attempt re-entry.

HOLE 504B - THIRD RE-ENTRY ATTEMPT

After the drill string had been run to 3456.5 meters, the logging sheaves were rigged and the re-entry tool lowered in the pipe. Two operational checks were made as the tool was lowered and both times the tool operated satisfactorily. However, when the tool was at the bottom of the pipe it would not operate when seated but would when picked up as little as one meter. The problem was resolved when pump strokes were reduced to 10 strokes per minute. This provided sufficient pressure to keep the tool from bouncing and scanning for the re-entry cone began. The target was acquired almost immediately and the drill string and re-entry tool were lowered to 3463.0 meters. Positioning began and after three hours and some three minutes, the stab was made with offsets of 650 feet south and 220 feet east from the beacon. The stab was verified when one additional stand of pipe was lowered with no loss in weight. The heat flow and pore water sampler was then free fallen while the re-entry sheaves were set back. A temperature measurement was taken at verification depth (3513.5 meters) and then the pipe was run to 3827.0 meters where the pore water sample was taken and the tool retrieved. After the heat flow and pore water sampler was recovered, it was dropped again in hopes of reaching 3950 meters for their next measurements. However, the pipe reached a bridge at 3931.5 meters and rather than take the chance of damaging the probe both heat flow and water samples were taken at this depth and the tools recovered. The heave compensator and the power swivel were picked up and the hole was cleaned out to the total depth of 3962.6 meters. After reaching this depth, the hole was flushed with 50 barrels of mud and the core barrel that was used while washing down was retrieved and a new barrel dropped. Continuous coring began at this point. The first two cores that were cut had no recovery even though the pump pressure did not indicate any plugging. The hole was flushed with 40 barrels of mud and coring resumed and core recovery averaged about 30% until it was decided to pull the bit. There were no indications that the bit was wearing, however, total rotating hours were 49.3 and it was felt that it should be replaced. The bit was pulled above the mudline and the ship was moved 100 feet north. This was done so the bit could be released (a hydraulic bit release (HBR) was part of the BHA), the ship moved back and the hole re-entered for a logging run. The HBR go-devil was dropped and when it reached bottom the pressure was built to 2000 lbs but the bit did not release. It was pressured a second time with the same results. It was then retrieved with an overshot and a second go-devil was dropped and pressured up twice with the same results. This go-devil was recovered and then the pipe was pulled.

When the bit release sub reached the derrick floor, the bit was not attached. It had released some time during the trip to the rig floor.

HOLE 504B - FOURTH RE-ENTRY ATTEMPT

After a new HBR was attached to the outer core barrel, a new BHA was made up and the pipe was again run in to 3456.5 meters. The logging sheaves were rigged and the re-entry tool was lowered to the bottom of the pipe. When seated it rotated with no problem and when scanning began the target was observed at 60 feet. The ship was positioned for two hours and nine minutes before the stab was made with final offsets of 610 feet south and 240 feet east from the beacon. Re-entry was then verified and a core barrel was dropped and the pipe was then run in to 3827.0 meters. The core barrel was recovered from this depth and the heat flow/pore water sampler was then dropped. The pipe was then lowered to 4112.0 meters and a pore water sample taken. The pipe was lowered to 4129.0 meters and a heat flow measurement was recorded. The pipe was then pulled to 4112.0 meters and the hole circulated for 15 minutes to cool the heat flow/ pore water sampler tool. This tool was then retrieved and the results checked before a new core barrel could be dropped. The results were satisfactory so the core barrel was dropped and coring continued. After 85.5 meters had been cored, there were indications of bit failure, reduced core diameter and increased torquing. However, when the bit was recovered, it was in very good condition and no explanation could be given for the observed irregularities.

HOLE 504B - FIFTH RE-ENTRY ATTEMPT

A new hydraulic bit release was made up with a modification made in the cover band sealing the "dog" windows with the hope that this would prevent cuttings from jamming the bit disconnect to the top connector and thus preventing the the bit from releasing. The drill string was then made up and again run in to 3456.5 meters. The logging sheaves were rigged and the re-entry tool lowered to the bottom of the pipe. The string and tool were lowered to 3463.5 meters and when scanning began the cone was observed at 50 feet. Positioning of the ship began and the stab was made after one hour and 40 minutes. The final offsets were changed to 630 feet south and 240 feet east of the beacon. The re-entry was verified and the drill string was lowered to 4072.5 meters. The heat flow/ pore water sampler tool was then dropped and the pipe lowered to 4185.0 meters where a pore water sample was taken. The pipe was lowered to 4219 meters where five meters of fill was detected so the heat flow measurement was taken at this depth. The pipe was then pulled to 4158.0 meters and circulated for 15 minutes before the heat flow/pore water sampler tool was recovered. The measurements were checked when the tool was recovered and then a core barrel was dropped. The bit was washed to the last total depth (4220.0 meters) and continuous coring began. When Core #66 was recovered, the core liner, inner barrel landing sub, 9 3/4" sub and core catcher sub were left in the pipe was a result of the pin of the 15' inner barrel breaking off. A fishing spear was dropped and the overshot lowered. When brought back to the rig floor, all the missing parts were recovered. This same pin broke again on Core #69 but the liner kept all of the parts together and it was not necessary to use the fishing spear again. No explanation could be made for these failures. Because of time constraints and the arrival of the R/V JAMES GILLIS, coring was stopped after cutting and recovering Core #70 at a total depth of 4309.5 meters. The drill string was pulled above the mudline and the ship was moved 100 feet north to allow release of the bit. After the ship was in position the go-devil was dropped and the pipe pressured to 2000 lbs, but there was no indication that the bit had been released. The pipe was pressured up again with the same results so the Bowen power sub was set back and the pipe was rotated vigorously, the power swivel was connected again and when pressured up the bit had been released. The ship was then moved back over the hole to make a re-entry attempt for logging, an oblique seismic experiment, and a resistivity experiment..

HOLE 504B - SIXTH RE-ENTRY ATTEMPT

After the ship was back on location the logging sheaves were rigged and the re-entry tool lowered to the bottom of the pipe. The cone was first observed at 60 feet radius with the same offsets for the last re-entry, the pipe was stabbed in 41 minutes. The re-entry was verified and preparations began for the downhole logging program. The first logging tool run was the gamma/sonic/ temperature. It was lowered to the bottom of the hole and then the gamma/ sonic log was recorded as the tool was pulled to the shoe of the 11 3/4" casing at 3750 meters. The tool was then lowered to bottom and the variable density log was recorded as the tool was again pulled to the casing shoe. This tool was recovered and preparations began for making the oblique seismic experiment which would also involve the R/V GILLIS. After the tool was made up it was lowered to 4300 meters and the tools operational check began. After about five hours of checking the tool was pulled because it was not operating properly. While the oblique seismic experiment tool was being checked the equipment for a long spacing resistivity experiment was assembled and checked. When this check was made it was discovered that the special resistivity cable had been damaged just below the cable head. The cable was then cut and reheaded, which required about five hours. After reheading, the tool operated satisfactorily and was lowered to 3940 meters. The cable was then lowered to bottom in 50 meter moves, making recordings at each stop. After reaching bottom the same measurements were taken as the cable was pulled in 25 meter moves. After completing the resistivity experiment a gamma/density/temperature tool was rigged and checked and then lowered in the pipe. The temperature log was recorded as the tool was lowered to the bottom. It was then pulled off bottom to record a temperature at this point over a 15 minute period. The beginning temperature was 220.39°F and the final value as 330.43°F. The tool was then lowered to bottom and started logging the gamma/density log as the tool was pulled. However, the tool failed to operate properly and no log could be recorded and the tool was retrieved.

When the gamma/density tool was recovered, the oblique seismic experiment tool had been checked and repaired and it was decided to run this experiment while the problem with the gamma/density tool was investigated. The oblique seismic experiment tool was picked up and checked and then run in to 3800 meters. It was run in only to this depth because it was felt that the higher bottomhole temperature could have been a contributing factor to its failure to operate satisfactorily on the first try. After the tool had been checked at this depth, the shooting program betan and continued for six hours. The tool was then lowered to 4290 meters and the shooting program continued for seven additional hours. The tool was retrieved and preparations were made to conduct another experiment to determine if the fractured igneous rock was taking fluid and if so, at what rate. To do this 150 barrels of fresh mud with the same specific gravity as seawater was pumped into the casing at 3732 meters. The pipe was then raised to 3618.0 meters and 144.5 meters of this mud was flushed from the hole with 60 barrels of seawater. The gamma/guard/neutron logging tool was then picked up and run in the hole in an attempt to monitor the fresh/saltwater contact as water entered the formation thus causing the contact to move downhole. Calculations could then be made to determine the volume of fluid entering the formation. However, no contact was observed and the latero log curve was lost due to a tool failure just as the tool cleared the casing shoe. The tool was then lowered to the bottom of the hole and the gamma/neutron curves were recorded as the tool was pulled.

After the gamma/guard/neutron was recovered the Gearhart Owen temperature water sampler was rigged and run. The temperature was recorded as the tool was lowered to bottom and then it was picked up to 4306.0 meters where a fluid sample was taken and the tool was retrieved. The last tool to be run was a rerun of the gamma/guard/neutron log. This tool had been run before and the latero log curve had failed. The tool was run to bottom and as it was pulled the first time, the neutron curve died but the tool was pulled to the casing because the latero log curve was recording. As the tool was lowered to make a rerun, the gamma curve failed but the latero log curve was repeated. Another check was made with the latero log to determine if the fresh/salt contact could be identified, but this also failed to materialize. The tool was then pulled to the derrick floor.

The drill pipe was also pulled from the hole for the last time on Leg 70. The BHA was magnafluxed on this trip out of the hole. This site was then abandoned at 0018 hours, December 17.

DRILLING AND CORING ASSEMBLIES

A modified standard bottomhole assembly was used on all the holes except Hole. 504B. The basic units of this modified assembly were, beginning at the top, one crossover sub, three 8 1/4" drill collars, two 5-ft stroke bumper subs, three 8 1/4" drill collars and then it was either (1) head sub, top sub, core barrel, profile sub, hydraulic bit release, bit, or (2) head sub (HPC modified) top sub, core barrel, bit sub, HPC bit. The length of these assemblies varied very little with (1) 76.15 meters and (2) 75.97 meters. This shortened assembly was used because of the thin sediment section, less than 50 meters, above the hard crustal material. When the ship moved to Hole 504B, the BHA consisted of the bit, hydraulic bit release, profile sub, 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 with a total length of 108.86 meters.

BITS

Seven F94CK bits were used on this leg and the balance of the drilling or washing was done using the HPC bit. The F94CK bits performed well with one having almost 50 hours of rotating time in hard basaltic rock. This bit was used in the re-entry hole. The bits used in the geothermal area showed a great deal more wear, particularly on the stabilizer pads and on the shanks of the cones.

HYDRAULIC PISTON CORER

On Leg 70, ten holes were cored with the hydraulic piston corer (HPC). A total of 324.9 meters were cored with 303.64 meters re^overed for a 93.5 percentage. Nominal sediment layer depth was 30-40 meters.

Compared to previous HPC operations, particularly Leg 68, the sediments encountered during Leg 70 had relatively low shear strengths. Shear strengths were in the range of 50-199 g/cm^2 near the mudline and approached a maximum of 250-300 g/cm^2 at basement. These low shear strengths coupled with calm seas were conducive not only to high recovery rates, but also to a limited number of failures and low maintenance requirements.

Various shear pin combinations were implemented to penetrate the sediment. One small (.37") pin (yielding shear pressures of 400-700 psi) was used from the mudline to within three to four runs of the basement; then one regular (.4") pin and finally two small pins were required to contact the sediment/basement interface.

Operational Effectiveness

As the recovery percentage indicates, the HPC performed nearly flawlessly throughout Leg 70. Upon reviewing the hole by hole statistics, one will notice that if the first hole, Hole 506, were discounted, the final nine holes produced a recovery rate of 98%. Hole 506 at 61% was the only hole to have a recovery of less than 90%

The high recovery is attributable to several factors. First, the low shear strengths of the sediments enabled the HPC to perform effortlessly; the HPC was not pushed to 1/10 of its operational limit of approximately 3000 g/cm^2. Second, problems with the flapper-type core catchers have been resolved. Only one run of 85 displayed evidence of a core catcher failure, i.e., there was no recovery with signs of mud throughout the core liner. Third, fair weather and generally calm seas minimized problems with the HPC operations. Fourth, crew familiarity with the tool has improved its success.

The orientation process is one area of the HPC operation that could be refined. To provide reliable and accurate data for the paleomagnetists, the operational and mechanical aspects of orientation must be irreproachable. This requires not only a precise means to stamp the orientation angle on the landing ring but keen supervision to ensure that the orientation techniques are implemented properly.

Obtaining one positive mark on the landing rings was difficult (if not impossible) for the large majority of the runs. With the low shear pressures it was hard to discriminate between the mark implanted by the HPC's firing and spurious marks. Before coring Hole 507D, the seating surface of the orientation seal sleeve to be used was ground down approximately .03" such that both the primary and back-up marks on the seat would be more pronounced. Before the machining only rarely were the back-up marks visible on the rings. After machining the back-up marks appeared on the rings; however, there were several back-up marks coincident with their primary counterparts. Therefore, the machining was only marginally effective.

The condition and wear of the plastic core liners were scrutinized to deduce the nature of the liner deformations. Upon inspection after recovery, there were only seven liners that had failed. The most plausible inference from the data implies that the probability of core liner failures increases as the shear pressure increases (see HPC logsheets).

Maintenance

The maintenance required for the hydraulic piston corer, as previously mentioned, was minimal. Routine maintenance included redressing the HPC's and cleaning rusted parts. In 85 runs, the tools were totally redressed only twice. Several more times they were disassembled for other reasons, e.g., to clean mud and clay from the interior parts, whereupon the seals and subs were inspected and found to be in satisfactory condition.

Rust is a monumental problem. To check the corrosion, a 30-gallon drum has been secured and it is now stationed in the special tools area. The drum is filled with diesel oil and the various piston coring parts are suspended in it.

Corrective, on the spot maintenance was limited to the following: 1) once a cap sub needed to be replaced on the rig floor due to a stripped set screw in it; 2) several brass shear pins required removal with an extractor because the sides of the allen head were rounded off; and 3) other miscellaneous minor malfunctions were repaired.

Core catcher subs were battered several times as a result of piston coring into the sediment/basement interface. Seven of the eight subs on board required heating, reshaping while in a quasi-molten state, then grinding and machining to restore them to their approximately original form. All seven subs are considered functional albeit with shortened life expectancies due to their weakened state.

HYDRAULIC BIT RELEASE

The HBR was part of the BHA at 13 holes. While drilling in the mounds area it was included in the BHA to allow downhole logging if one of these holes could have been drilled deep enough to take advantage of these tools. However, this did not happen. In Hole 504B, the release apparently did not work when the pipe was near the ocean bottom but dropped off while it was being pulled to the rig floor. The next time the bit released after pressuring up then rotating the pipe when it did not release from pressure alone. One problem may be that the bit pulled out of the hole. Previously, when the bit did not release after pressuring up, it was set down on the bottom of the hole and then it released.

BEACONS AND POSITIONING

The following were the beacons used on Leg 70:

Site	Mfg.	Freq. kHz	Serial No.	Time Used
Test	ORE	16.0 S.L.	494	3 hours
506	Benthos	13.5 S.L.	023	4.9 days
507	Benthos	16.0 S.L.	018	3.9 days
508	Benthos	13.5 S.L.	024	2.9 days
509	ORE	16.0 S.L.	495	1.9 days
510	ORE	13.5 D.L.	518	1.8 days
504B	ORE	13.5 D.L.	511	15.1 days

All the beacons dropped worked very well with no problems. Three Benthos beacons were dropped at the first three sites to get an idea how well they worked. They performed well and had no apparent problems. When the ship returned to Hole 504B, the beacon that had been dropped on October 25 was still working but the pulses were being transmitted every second rather than every two seconds which indicated it was near the end of its life. The ship could not position on it as the computer will not accept this pulse rate, however the ship did home in on it while waiting for the satellite navigation final fixes.

LOGGING

Although this program was available the whole leg, only at Hole 504B were logs run. In the other holes penetration was too shallow to bury the BHA let alone to do downhole logging. The borehole compensator sonic, variable density, and temperature logs were good, however, the density tool did not work. The gamma/guard/neutron was run twice and the first time the latero log failed and on the second run the neutron failed, but the two runs were combined thus providing a complete log. The other tool that was run at Hole 504B was the temperature/fluid sampler which worked as it should.

RE-ENTRY

Six re-entry attempts were made and four proved to be successful. The first two attempts were not successful due to the failure of the tools to rotate when seated in the bottom of the drill string. This resulted in the drill string being pulled to check the tool landing area and verify that there was no mechanical problem in the BHA. After the pipe was rerun, the solution to the problem was to decrease the pump strokes. When this was done the next four re-entries were more routine with re-entry positioning time reduced from a little over three hours for the first to just 41 minutes for the last. The equipment performed well with only minor problems which did not effect the re-entry schedule.

COMMUNICATIONS

Volume of CW traffic was very high, in fact, the number of outgoing messages must have set some kind of record. Communications with radio WWD Scripps was excellent during nearly all daylight hours and no difficulty was encountered. A large number of amateur radio calls were made for shipboard personnel to their families, and here also conditions were generally very good.

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

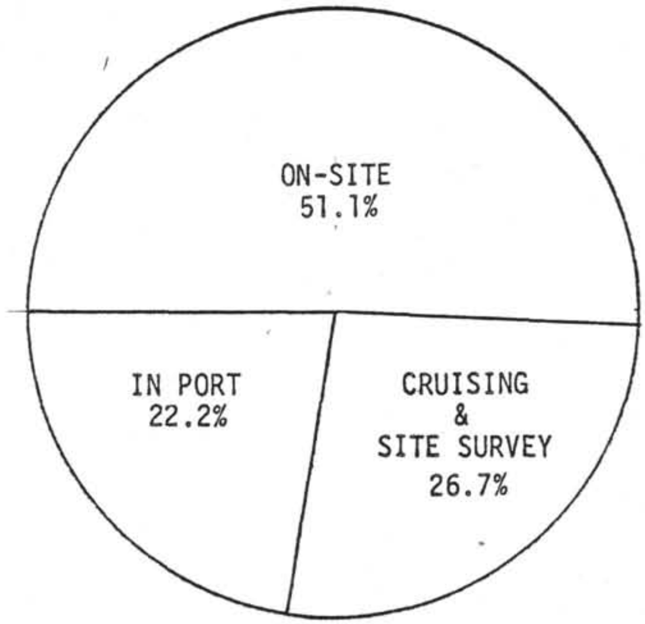
INTERNATIONAL PHASE OF OCEAN DRILLING
DEEP SEA DRILLING PROJECT
OPERATIONAL RESUME
LEG 70

Total Days (October 29-December 28, 1979)	59.9
Total Days In Port (Includes 7.24 Days Mechanical Repair & Sea Trials, plus Callao Stop)	13.3
Total Days Cruising Including Site Survey	16.0
Total Days On Site	30.6

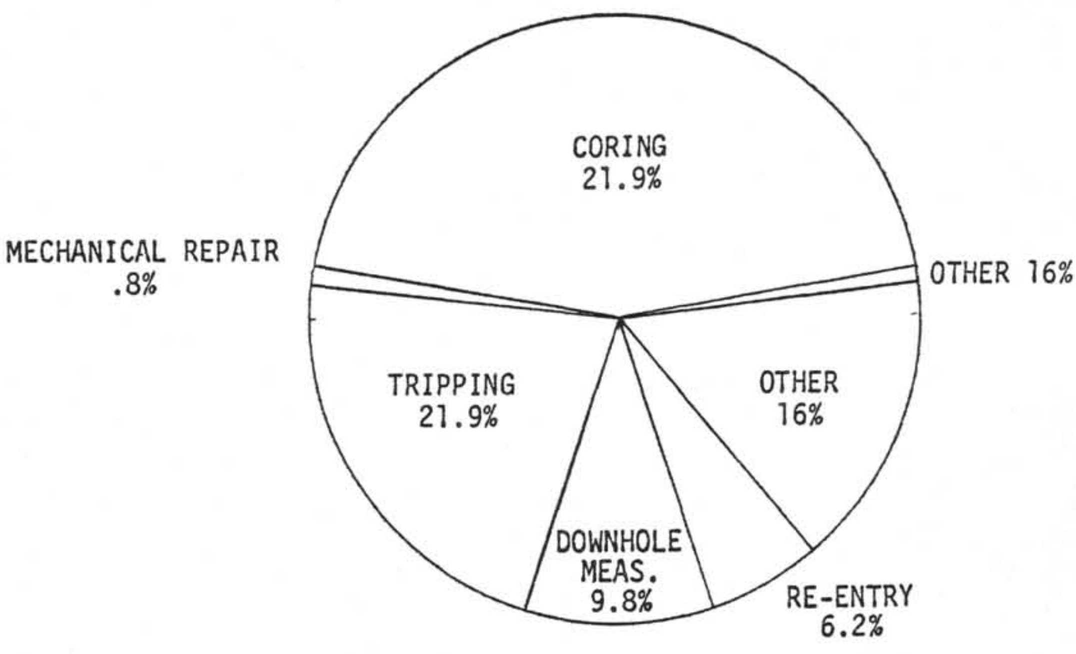
Trip Time	6.7
Drilling Time	.24
Coring Time	13.6
Downhole Measurements	3.02
Mechanical Repair	.24
Re-entry	1.9
Other	4.9

Total Distance Traveled Including Survey (Nautical Miles)	3116.1
Average Speed (Knots)	8.30
Number of Sites (Including Return to Previous Site 504)	6
Number of Holes Drilled	33
Number of Cores Attempted	151
Number of Cores With Recovery	148
Total Meters Cored	817.4
Total Meters Recovered	477.93
Percentage Recovery	58.5
Total Meters Drilled	632.6
Total Meters of Penetration	1450.0
Percentage of Penetration Cored	56.3
Maximum Penetration (Meters)	347.0
Minimum Penetration (Meters)	16.0
Maximum Water Depth (Meters)	3473.5
Minimum Water Depth (Meters)	2699.1

LEG 70
TOTAL TIME DISTRIBUTION



ON-SITE TIME BREAKDOWN



HPC LOGSHEET
LEG 70 SITE: 506
WATER DEPTH: 2713.7
SHIP'S HDG: 190°

CORE NUMBER	SUBBOTTOM DEPTH (m)	RECOVERY (m)	SHEAR PIN PRESS (psi)	FULL STROKE ?	PISTON SEAL CONDITION	LINER DEFORMATION	SHEAR STRENGTH (g/cm^2)	CORE CATCHER TYPE	SEA STATE	# of MARKS on RING	ORIENTATION ANGLE	COMMENTS/OBSERVATIONS
	DRESSED HPC W/ LARSON TOP SUB SEALS, CHEVRON INNER SEALS, POLYPAK OUTER SEALS, & POLYPAK PISTON SEALS — USING FLAPPER TYPE CC WITH MOD BEVEL, 1 SPRING											
						HOLE 5Ø6						
Ø			5ØØ	Y		WATER CORE		FLAPPER	3-4	1	N/A	1 SMALL (.37") DIAM PIN
1	1.5	1.34	7ØØ	Y	GOOD	NONE	26.9	"	4	3	318°	FIRST CORE, ESTAB. MUDLINE
2	5.9	2.95	55Ø	Y	"	"	63.Ø	"	3-4	3	Ø1Ø°	BACK-UP MARK HARD TO SEE DUE TO LOW SHEAR PRES.
3	1Ø.3	4.38	5ØØ	Y	"	"	57.9	"	3	1	26Ø°	ROCKY MN NODULES
4	14.7	4.28	55Ø	Y	"	"	1Ø3.3	"	3	1	355°	
5	19.1	trace	1ØØØ	Y	"	"	—	"	3	4	1Ø5°	USED 2 SMALL PINS CC STUCK OPEN - MUD IN LINER
6	23.5	3.81	65Ø	Y	STARTING TO WEAR	"	237.7	"	3	6	Ø6Ø°	1 SMALL PIN (MOST RINGS - NO BACK-UP TICK)
7	27.9	4.31	85Ø 900 550	N N Y	WEARING BUT OK	"	143.6	"	3	8	33Ø°	1 REG PIN - 1ST RUN - PIN DIDN'T SHEAR 2ND RUN - 1 REG PIN - NO SHEAR
8	32.3	1.5	18ØØ?	N	"	IMPLODED ABOUT 1/2 WAY UP	85.8	"	3	7	Ø8Ø°	NOT CLEAR SHEAR NO BLEED OFF
9	36.7	trace	450 600 950	Y Y N	"	FOOTBALL HOLE JUST ABOVE LOW LINER SUPPORT	—	"	3	11	185°	GOOD SHEAR INDIC & BLEED-OFF, BUT NO SHEAR 1ST TWO TIMES 2 SMALLS (.37) USED FOR 3RD RUN CHANGED TO 2ND TOOL FOR 3RD RUN

HPC LOGSHEET
LEG 70 SITE: 506B
WATER DEPTH: 2721.6
SHIP'S HDG: 190°

CORE NUMBER	SUBBOTTOM DEPTH (m)	RECOVERY (m)	SHEAR PIN PRESS (psi)	FULL STROKE ?	PISTON SEAL CONDITION	LINER DEFORMATION	SHEAR STRENGTH (g/cm^2)	CORE CATCHER TYPE	SEA STATE	# of MARKS on RING	ORIENTATION ANGLE	COMMENTS/OBSERVATIONS
						HOLE 506B						
			SECOND TOOL, DRESSED LIKE 1ST TOOL									
1	1.5	1.45	350	Y	GOOD	NONE	80.6	FLAPPER	2-3	5	000°	1 SMALL PIN
2	5.9	4.63	700	Y	"	"	78.5	"	"	6	020°	CHANGED BACK TO 1ST TOOL WITH NEW PISTON SEALS
3	10.3	4.53	650	Y	"	"	114.7	"	"	MULTI	170° or 340°	
4	14.7	4.49	750	Y	"	"	104.4	"	3	4	005°	
5	18.2	3.12	1200	N	"	"	319.3	"	3	MULTI	310° or 350°	
6	20.7	2.27	1200	N	SLIGHT WEAR BUT OK	"	—	"	2	–	?	HIT BASEMENT, BENT CC SUB USED 1 REG PIN
						POOH						

HPC LOGSHEET
LEG 70 SITE: 506C
WATER DEPTH: 2716.9
SHIP'S HDG: 190°

CORE NUMBER	SUBBOTTOM DEPTH (m)	RECOVERY (m)	SHEAR PIN PRESS (psi)	FULL STROKE ?	PISTON SEAL CONDITION	LINER DEFORMATION	SHEAR STRENGTH (g/cm^2)	CORE CATCHER TYPE	SEA STATE	# of MARKS on RING	ORIENTATION ANGLE	COMMENTS/OBSERVATIONS
					HOLE 5Ø6C							
					FIRST TOOL, DRESSED THE SAME							
1	3.5	3.51	725	Y	GOOD	NONE	37.2	FLAPPER	1	4	342°	BACK-UP MARK ON A1 RING
2	7.9	3.8	1500 - #1 ? - #2	Y	"	ONE CRACK FULL LENGTH	—	"	"	12	2ØØ°	1ST - CORE LOST 2ND - GOOD CORE, SHEAR PRES. COULD NOT BE SEEN ANGLE IS AVG BETWEEN 185°-225°
3	12.3	4.34	7ØØ	Y	"	FOOTBALL HOLE NEAR TOP OF CORE-10°	—	"	2	MULTI	310°	7 MARKS GROUPED AROUND 310°
4	16.7	3.77	75Ø	Y	"	SMALL CRACK ABT 1M FROM TOP OF CORE	123.Ø	"	2	6	2ØØ°	6 MARKS 18Ø°-21Ø°
5	21.1	4.53	85Ø	Y	"	OK - NONE	132.3	"	2	1Ø	11Ø°	
6	25.5	4.48	7ØØ	Y	"	"	21Ø.8	"	"	"	Ø48°	
7	28.Ø	2.Ø2	95Ø	NO	"	"	—	"	"	1Ø	24Ø°	
8	31.3	3.3	9ØØ ?	"	"	"	—	"	"	7	ØØØ° or Ø3Ø°	HIT BASEMENT
					POOH							

HPC LOGSHEET
LEG 70 SITE: 5Ø6D
WATER DEPTH: 2716.9
SHIP'S HDG: 19Ø°

CORE NUMBER	SUBBOTTOM DEPTH (m)	RECOVERY (m)	SHEAR PIN PRESS (psi)	FULL STROKE ?	PISTON SEAL CONDITION	LINER DEFORMATION	SHEAR STRENGTH (g/cm^2)	CORE CATCHER TYPE	SEA STATE	# of MARKS on RING	ORIENTATION ANGLE	COMMENTS/OBSERVATIONS
					HOLE	5Ø6D						
					FIRST TOOL - DRESSED	THE SAME						
1	2.5	2.5	45Ø	Y	GOOD	NONE	35.1	FLAPPER	2	2	Ø38°	
2	6.9	4.52	35Ø	Y	SLIGHT WEAR BUT STILL OK	"	96.1	"	2	3	182°	
3	11.3	3.24	25Ø	Y	"	"	84.7	"	2	2	24Ø°	
4	15.7	4.52	45Ø	Y	"	"	146.7	"	2	5	335° or Ø12°	
5	2Ø.1	4.26	7ØØ	Y	"	"	136.4	"	2	4	325° or Ø22°	
6	24.5	4.46	65Ø	Y	"	"	—	"	2	4	Ø2Ø° or Ø45°	POSSIBLE BACK-UP ON Ø2Ø° 1 REG PIN
7	28.9	3.59	75Ø	Y	"	"	—	"	2	3	328°	1 REG PIN SLIGHT BUT DEFINITE B/U MARK
8	3Ø.9	1.67	? 1900?	N	"	" NOT	RELIABLE DUE TO B.O.P. FAILURE					B.O.P. FAILED (PARTED) WHILE PRESSURIZING
9	31.9	.77	9ØØ	N	"	"	—		2-3	MULTI	N/A	USED 2ND TOOL FOR LAST SHOT 2 SMALL PINS
					POOH							BASEMENT

HPC LOGSHEET
LEG 70 SITE: 507D
WATER DEPTH: 2699.1
SHIP'S HDG: 190°

CORE NUMBER	SUBBOTTOM DEPTH (m)	RECOVERY (m)	SHEAR PIN PRESS (psi)	FULL STROKE ?	PISTON SEAL CONDITION	LINER DEFORMATION	SHEAR STRENGTH (g/cm^2)	CORE CATCHER TYPE	SEA STATE	# of MARKS on RING	ORIENTATION ANGLE	COMMENTS/OBSERVATIONS
					HOLE 507D							
		USING 1ST TOOL, REDRESSED & CLEANED INNER PARTS; USING SAME TYPE SEALS AS BEFORE. MACHINED HPC SEAL SLEEVE FOR ORIENTATION MARKS TO APPEAR MORE PROMINENTLY										
1	1.Ø	1.Ø	4ØØ	Y	NEW-GOOD	NONE	—	FLAPPER	2-3	1	282°	1 SMALL PIN
2	5.4	2.65	4ØØ	Y	GOOD	"	25.8	"	2-3	1	188°	
3	9.8	4.Ø3	35Ø	Y	"	"	54.8	"	"	4	15Ø°	
4	14.2	4.28	45Ø	Y	"	"	66.1	"	"	1	335°	
5	18.6	4.42	55Ø	Y	SLIGHT WEAR BUT OK	"	165.	"	3	3	248° or 305°	
6	23.Ø	4.61	6ØØ	Y	"	"	133.	"	3	3	21Ø° or 18Ø°	1 REG PIN
7	27.4	45Ø	75Ø	Y	"	"	196.	"	3	6-IN OPP GP	295° AVG.	1 REG PIN
8	31.8	4.37	95Ø	Y	MORE WEAR, STILL OK	NONE	93.	"	4	6 AS ABOVE	Ø3Ø° TO Ø7Ø°	2 SMALL PINS
9	36.2	4.26	135Ø	Y	"	"	174.	"	4	MULTI	ØØ5°	ONLY ONE BACK-UP MARK
1Ø	38.7	2.55	11ØØ	N	"	"	8Ø.6	"	4-5	3	Ø22° 335°	} EQUALLY PROBABLE BASEMENT
					POOH							

HPC LOGSHEET
LEG 70 SITE: 5Ø7F
WATER DEPTH: 27Ø4.4
SHIP'S HDG: 19Ø°

CORE NUMBER	SUBBOTTOM DEPTH (m)	RECOVERY (m)	SHEAR PIN PRESS (psi)	FULL STROKE ?	PISTON SEAL CONDITION	LINER DEFORMATION	SHEAR STRENGTH (g/cm^2)	CORE CATCHER TYPE	SEA STATE	# of MARKS on RING	ORIENTATION ANGLE	COMMENTS/OBSERVATIONS
					HOLE 5Ø7F							
					USING SAME TOOL							
1	2.4	2.39	4ØØ	Y	GOOD	NONE	55.8	FLAPPER	3	1	Ø48°	
2	6.8	4.57	4ØØ	Y	"	"	121.	"	3	1	Ø18°	
3	11.2	4.32	5ØØ	Y	"	"	78.5	"	3	4	Ø35°	1 GOOD MARK
4	15.6	4.2	75Ø	Y	"	"	83.7	"	3	3	17Ø°	
5	2Ø.Ø	4.44	65Ø	Y	"	"	153.	"	3	3	Ø12°	Ø12° - MIDDLE OF 3 CLOSELY SPACED MARKS WITH GOOD BACK-UP
6	24.4	4.32	775	Y	"	"	214.	"	3	3	192°	3 MAIN MARKS w/ 1 VERY GOOD BACK-UP
7	28.8	4.28	75Ø	Y	"	"	238.	"	3	4	315° or 265°	EQUALLY PROBABLE
8	3Ø.3	8ØØ? 11ØØ?	1.6	N	WEARING, BUT OK	"	147.	"	3	7	Ø27°	2 SMALL PINS PRESSURIZED 3 TIMES BEFORE SHEARING
9	31.3	1.Ø	11ØØ	N	"	"	—	"	4	3	Ø25° Ø68° 330°	2 SMALL PINS
					POOH							

HPC LOGSHEET
LEG 70 SITE: 5Ø7H
WATER DEPTH: ~~[illegible]~~ 2699.6
SHIP'S HDG: 19Ø°

CORE NUMBER	SUBBOTTOM DEPTH (m)	RECOVERY (m)	SHEAR PIN PRESS (psi)	FULL STROKE ?	PISTON SEAL CONDITION	LINER DEFORMATION	SHEAR STRENGTH (g/cm^2)	CORE CATCHER TYPE	SEA STATE	# of MARKS on RING	ORIENTATION ANGLE	COMMENTS/OBSERVATIONS
					HOLE 5Ø7H							
#					SAME TOOL, DRESSED AS BEFORE							
1	3.5	3.22	45Ø	Y	SLIGHT WEAR	NONE	57.9	FLAPPER	4	5	Ø35°	1 BACK-UP MARK
2	7.9	4.68	65Ø	Y	"	"	124.	"	4	3	Ø18°	
3	12.3	4.63	55Ø	Y	"	"	113	"	4	5	235°	
4	16.7	4.66	7ØØ	Y	"	"	13Ø	"	3-4	3	345°	
5	21.1	4.6	8ØØ	Y	"	"	182	"	3	3	163°	
6	25.5	4.55	8ØØ	Y	WORN BUT OK	"	245	"	4	3	Ø8Ø°	
7	29.9	4.53	1ØØØ	Y	"	"	224	"	3	5	315° or 342°	2 SMALL PINS
8	32.9	trace	1Ø5Ø	N	"	ONE CRACK RUNNING ENTIRE LENGTH	—	"	4	2	2ØØ°	2 SMALL PINS BASEMENT
					POOH							

HPC LOGSHEET
LEG 70 SITE: 508
WATER DEPTH: 2794.4
SHIP'S HDG: 190°

CORE NUMBER	SUBBOTTOM DEPTH (m)	RECOVERY (m)	SHEAR PIN PRESS (psi)	FULL STROKE ?	PISTON SEAL CONDITION	LINER DEFORMATION	SHEAR STRENGTH (g/cm^2)	CORE CATCHER TYPE	SEA STATE	# of MARKS on RING	ORIENTATION ANGLE	COMMENTS/OBSERVATIONS
					HOLE 508							
					SAME TOOL, SAME DRESSING							
1	4.0	3.96	500? 800?	Y	WORN, REPLACED 1 SEAL	NONE	59.9	FLAPPER	3	3	245°	PISTON HD BACKED OFF; IN UPPER LINER
2	8.4	4.49	350	Y	GOOD	"	124	"	3	1	115°	
3	12.8	4.34	350	Y	"	"	95.1	"	3	3	072° 043° 056°	← BEST OF 3
4	17.2	4.62	350	Y	"	"	102	"	4	4	090°	
5	21.6	4.61	900	Y	"	"	143	"	4	4	272°	1 REG PIN
6	26.0	4.58	950	Y	SLIGHT WEAR	"	182	"	4	1	285°	1 REG PIN
7	30.4	4.41	750	Y	"	"	178	"	4	6	310°	1 REG PIN
8	34.8	3.98	900	Y	"	"	205	"	4	6*	250°	1 REG PIN *TRIED TO MINIMIZE # OF MARKS BY KEEPING PUMP ON WHILE LOWERING LAST MEMBER
9	35.3	trace	1100	N	ONE SEAL TORN	NONE	—	"	4	6	N/A	1 REG PIN
						POOH						

HPC LOGSHEET
LEG 70 SITE: 5Ø9
WATER DEPTH: 27Ø4.4
SHIP'S HDG: 17Ø°

CORE NUMBER	SUBBOTTOM DEPTH (m)	RECOVERY (m)	SHEAR PIN PRESS (psi)	FULL STROKE	PISTON SEAL CONDITION	LINER DEFORMATION	SHEAR STRENGTH ($g/_{cm^2}$)	CORE CATCHER TYPE	SEA STATE	# of MARKS on RING	ORIENTATION ANGLE	COMMENTS/OBSERVATIONS
					HOLE 5Ø9							
	BROKE DOWN HPC FOR INSPECTION: SEALS ON INNER SUB GOOD, SEALS ON OUTER SUB GRITTY → REPLACED, CLEANED AND SANDED PISTON ROD. LARSON SEALS OK, PISTON SEALS - ONE GOOD, ONE SLIGHTLY WORN											
1	1.Ø	1.15	35Ø	Y	GOOD	NONE	35.1	FLAPPER	2-3	3	285°	1 SMALL PIN
2	5.4	4.51	45Ø	Y	"	"	76.5	"	"	1	252°	
3	9.8	4.53	425	Y	"	"	8Ø.6	"	"	6	215°	
4	14.2	4.67	35Ø	Y	"	"	1Ø4.Ø	"	2	3	Ø55°	
5	18.6	4.46	35Ø	Y	SLIGHT WEAR	"	114.Ø	"	2	3	25Ø°	
6	23.Ø	4.53	375	Y	"	"	179	"	2	3	Ø32°	
7	27.4	4.46	45Ø	Y	"	COLLAPSED SLIGHTLY NEAR TOP	169	"	2	3	33Ø°	1 REG PIN
8	31.8	4.32	4ØØ	Y	"	NONE	312	"	2	2	118°	1 REG PIN
9	32.3	trace	11ØØ	N	"	NONE	—	"	2	6	13Ø°	2 SMALL PINS BASEMENT
					POOH							

HPC LOGSHEET
LEG 70 SITE: 5Ø9B
WATER DEPTH: 27Ø1.8
SHIP'S HDG: 17Ø°

CORE NUMBER	SUBBOTTOM DEPTH (m)	RECOVERY (m)	SHEAR PIN PRESS (psi)	FULL STROKE	PISTON SEAL CONDITION	LINER DEFORMATION	SHEAR STRENGTH (g/cm^2)	CORE CATCHER TYPE	SEA STATE	# of MARKS on RING	ORIENTATION ANGLE	COMMENTS/OBSERVATIONS
					HOLE 5Ø9B							
		SAME TOOL AS HOLE 5Ø9, DRESSED THE SAME										
Ø			3ØØ	Y	WATER CORE							
1	3.Ø	3.1	7ØØ	Y	SLIGHT WEAR	NONE	—	FLAPPER	3	2	24Ø°	1 SMALL PIN
2	7.4	4.39	35Ø	Y	"	"	64.1	"	3	3	2Ø5° or 16Ø°	EQUALLY PROBABLE
3	11.8	3.91	35Ø	Y	"	"	51.7	"	3	6	Ø75°	
4	16.2	4.2	55Ø	Y	"	"	53.7	"	3	2	34Ø°	
5	2Ø.6	4.Ø9	325	Y	"	"	128	"	2	2	Ø68° or Ø55°	
6	25.Ø	4.52	4ØØ	Y	"	"	128	"	2	3	165°	1 REG PIN
7	29.4	4.34	135Ø	Y	WEARING BUT OK	"	188	"	2-3	4	Ø25°	2 SMALL PIN 4 MARKS WITHIN 15°
8	33.8	4.Ø8	115Ø	N	"	"	—	"	2-3	1	352°	BASEMENT
						POOH						

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

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
506	0° 36.59'N	86° 05.49'W	2713.7	9	9	100.0	36.7	22.57	61.5		36.7	HPC	30.3	
506A	0° 36.59'N	86° 05.48'W	2713.7	0	0	0	0	0	0	31.3	31.3	HF	3.4	
506B	0° 36.61'N	86° 05.48'W	2721.6	6	6	100.0	20.7	20.49	98.9	- -	20.7	HPC	7.9	
506C	0° 35.46'N	86° 05.48'W	2716.9	8	8	100.0	31.3	29.75	95.0	- -	31.3	HPC	12.4	
506D	0° 36.42'N	86° 05.48'W	2716.9	9	9	100.0	31.9	29.25	91.7	- -	31.9	HPC	18.9	
506E	0° 36.59'N	86° 05.48'W	2713.7	0	0	0	0	0	0	19.3	19.3	HF	15.6	
506F	0° 36.63'N	86° 05.48'W	2721.0	0	0	0	0	0	0	16.0	16.0	HF	3.6	
506G	0° 36.59'N	86° 05.49'W	2713.5	2	2	100.0	5.0	1.05	21.0	27.5	32.5	6.1	10.0	
506H	0° 36.42'N	86° 05.48'W	2716.9	1	1	100.0	8.0	0.17	2.1	26.1	34.1	9.1	5.5	
506I	0° 36.46'N	86° 05.48'W	2716.9	1	1	100.0	3.5	0.20	5.7	26.1	29.6	9.3	11.8	119.4
507	0° 34.00'N	86° 05.40'W	2711.5	1	1	100.0	3.0	2.95	98.3	25.5	28.5	219.2	21.9	
507A	0° 34.00'N	86° 05.39'W	2711.5	0	0	0	0	0	0	25.5	25.5	HT	2.1	
507B	0° 34.00'N	86° 05.39'W	2711.5	1	1	100.0	7.0	0.63	9.0	31.0	38.0	4.8	12.5	
507C	0° 34.08'N	86° 05.39'W	2715.5	3	3	100.0	13.5	8.37	62.0	16.0	29.5	4.3	15.7	
507D	0° 33.92'N	86° 05.37'W	2699.1	10	10	100.0	38.7	36.59	94.8	- -	38.7	HPC	10.3	
507E	0° 33.92'N	86° 05.36'W	2699.1	0	0	0	0	0	0	33.9	33.9	HF	1.7	
507F	0° 33.93'N	86° 05.39'W	2704.4	9	9	100.0	31.3	31.12	99.4	- -	31.3	HPC	12.0	
507G	0° 33.93'N	86° 05.40'W	2704.4	0	0	0	0	0	0	25.6	25.6	HF	2.1	
507H	0° 33.83'N	86° 05.37'W	2699.6	8	8	100.0	32.9	33.62	102.1	- -	32.9	HPC	8.6	
507I	0° 33.83'N	86° 05.36'W	2699.6	0	0	0	0	0	0	28.4	28.4	HF	6.9	93.7
508	0° 32.06'N	86° 06.45'W	2794.4	9	9	100.0	35.3	35.04	99.2	- -	35.3	HPC	17.9	
508A	0° 32.06'N	86° 06.45'W	2794.4	0	0	0	0	0	00	30.6	30.6	HF	7.4	
508B	0° 31.61'N	86° 06.66'W	2787.0	4	3	75.0	20.5	4.39	21.4	39.0	50.5	5.5	5.9	
508C	0° 31.62'N	86° 06.66'W	2787.0	1	1	1000.0	9.5	2.08	21.8	42.0	51.5	3.5	4.7	
508D	0° 32.06'N	86° 06.45'W	2794.4	0	0	0	0	0	0	23.6	23.6	HF	7.2	
508E	0° 32.06'N	86° 06.45'W	2794.4	0	0	0	0	0	0	27.6	27.6	HF	8.3	69.0
509	0° 35.34'N	86° 07.89'W	2704.4	9	9	100.0	32.3	32.58	100.8	- -	32.3	HPC	25.9	
509A	0° 35.34'N	86° 07.89'W	2704.4	0	0	0	0	0	0	29.2	29.2	HF	1.7	
509B	0° 35.33'N	86° 07.93'W	2701.8	8	8	100.0	33.8	32.63	96.5	- -	33.8	HPC	10.6	
509C	0° 35.33'N	86° 07.93'W	2701.8	0	0	0	0	0	0	29.2	29.2	HF	1.9	
509D	0° 35.37'N	86° 07.89'W	2709.0	0	0	0	0	0	0	22.2	22.2	HF	6.8	46.9
510	1° 36.79'N	86° 24.60'W	2795.5	11	11	100.0	75.5	62.96	83.3	57.0	132.5	13.6	44.1	44.1
504B	1° 13.63'N	83° 43.81'W	3473.5	41	39	95.1	347.0	91.49	26.4	347.0	347.0	3.7	361.2	361.2

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

HOLE	MFG.	SIZE	TYPE	SERIAL NUMBER	METERS CORED	METERS DRILLED	METERS TOTAL PENET.	HOURS ON BIT	CONDITON	REMARKS
506		11 1/8	HPC		36.7		36.7	0		
506A		11 1/8	HPC		0	31.3 washed	31.3	0		
506B		11 1/8	HPC		20.7		20.7	0		
506C		11 1/8	HPC		31.3		31.3	0		
506D		11 1/8	HPC		31.9		31.9	0		
506E	Smith	9 7/8	F94CK	598RS	0	19.1 washed	19.3	0		
506F	Smith	9 7/8	F94CK	598RS	0	16.0 washed	16.0	0		
506G	Smith	9 7/8	F94CK	598RS	5.0	27.5	32.5	5.33		
506H	Smith	9 7/8	F94CK	598RS	8.0	26.1	34.1	2.86		
506I	Smith	9 7/8	F94CK	598RS	3.5	26.1	29.6	3.2		Two cutting inserts missing.
								11.39	T1-B1-SEO 1/16	Stabilizer pads badly worn down.
507	Smith	9 7/8	F94CK	830RV	3.0	25.5	28.5	.1		
507A	Smith	9 7/8	F94CK	830RV	0	25.5 washed	25.5	0		
507B	Smith	9 7/8	F94CK	830RV	7.0	31.0	38.0	7.2		
507C	Smith	9 7/8	F94CK	830RV	13.5	16.0	29.5	6.9		
								14.2		
507D		11 1/8	HPC		38.7		38.7	0		
507E		11 1/8	HPC		0	33.9	33.9	0		
507F		11 1/8	HPC		31.3		31.3	0		
507G		11 1/8	HPC		0	25.6	25.6	0		
507H		11 1/8	HPC		32.9		32.9	0		
507I		11 1/8	HPC		0	28.4	28.4	0		
508		11 1/8	HPC		35.3		35.3			
508A		11 1/8	HPC			30.6 washed	30.6	0		

BIT SUMMARY (Continued)

HOLE	MFG	SIZE	TYPE	SERIAL NUMBER	METERS CORED	METERS DRILLED	METERS TOTAL PENET.	HOURS ON BIT	CONDITION	REMARKS
508B	Smith	9 7/8	F94CK	AA3378	20.5	39.0	59.5	10.03		
508C	Smith	9 7/8	F94CK	AA3378	9.5	42.0	51.5	2.7		
								12.73	T1-BL-SE 0 1/16	
508D		11 1/8	HPC			23.6 washed	23.6	0		
508E		11 1/8	HPC			27.6	27.6	0		
509		11 1/8	HPC		32.3		32.1	0		
509A		11 1/8	HPC			23.6 washed	23.6	0		
509B		11 1/8	HPC		33.8		33.8	0		
509C		11 1/8	HPC			29.2 washed	29.2	0		
509D		11 1/8	HPC			22.0	22.0	0		
510	Smith	9 7/8	F94CK	156RT	75.5	57.0	132.5	9.7	T0-B0-SE 0 1/16	
504B	Smith	9 7/8	F94CK	AE3400	176.0		176.0	49.3	Dropped	
504B	Smith	9 7/8	F94CK	AE3373	85.5		85.5	24.1	T1-B2-SEI	
504B	Smith	9 7/8	F94CK	AE4571	85.5		85.5	19.3	Dropped	

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

Site No	Make	Freq kHz	Serial Number	Site Time Hours	Remarks
Test Site	ORE	16.0 S.L.	494	2±	Dropped to confirm computer to be operational after rework.
506	Benthos	13.5 S.L.	023	30.3	
506-A	Benthos	13.5 S.L.	023	3.4	
506-B	Benthos	13.5 S.L.	023	7.9	
506-C	Benthos	13.5 S.L.	023	12.4	
506-D	Benthos	13.5 S.L.	023	18.9	
506-E	Benthos	13.5 S.L.	023	15.6	
506-F	Benthos	13.5 S.L.	023	3.6	
506-G	Benthos	13.5 S.L.	023	10.0	
506-H	Benthos	13.5 S.L.	023	5.5	
506-I	Benthos	13.5 S.L.	023	11.8	
			Total	119.4	No problems.
507	Benthos	16.0 S.L.	018	21.9	
507-A	Benthos	16.0 S.L.	018	2.1	
507-B	Benthos	16.0 S.L.	018	12.5	
507-C	Benthos	16.0 S.L.	018	15.7	
507-D	Benthos	16.0 S.L.	018	10.3	
507-E	Benthos	16.0 S.L.	018	1.7	
507-F	Benthos	16.0 S.L.	018	12.0	
507-G	Benthos	16.0 S.L.	018	2.0	
507-H	Benthos	16.0 S.L.	018	8.6	
507-I	Benthos	16.0 S.L.	018	6.9	
			Total	93.7	No problems.
508	Benthos	13.5 S.L.	024	17.9	
508-A	Benthos	13.5 S.L.	024	7.4	
508-B	Benthos	13.5 S.L.	024	23.5	
508-C	Benthos	13.5 S.L.	024	4.7	
508-D	Benthos	13.5 S.L.	024	7.2	
508-E	Benthos	13.5 S.L.	024	8.3	
			Total	69.0	No problems.
509	ORE	16.0 S.L.	495	25.9	
509-A	ORE	16.0 S.L.	495	1.7	
509-B	ORE	16.0 S.L.	495	10.6	
509-C	ORE	16.0 S.L.	495	1.9	
509-D	ORE	16.0 S.L.	495	6.8	
			Total	46.9	No problems
510	ORE	13.5 D.L.	518	44.1	
405-B	ORE	13.5 D.L.	511	361.2	

DEEP SEA DRILLING PROJECT
TIME DISTRIBUTION
LEG - 70

Date	Site No.	Cruise	Trips	Drill	Core	Stuck Pipe	W.O.W.	Position Ship	Mech. Repair	Port Time	Re-Entry	Other	Total Time	Remarks
10/29/79 11/03/79										131.7			131.7	
11/03/79 11/11/79									160.0			13.9	173.9	
11/11/79 11/14/79		79.0							3.1				82.1	
11/14/79 11/15/79	506		11.2		15.6							3.5	30.3	
11/15/79	506A		.8									2.6	3.4	
11/15/79 11/16/79	506B		1.2		6.3							.4	7.9	
11/16/79	506C				11.5							.9	12.4	
11/16/79 11/17/79	506D		6.0		10.2				2.0			.7	18.9	
11/17/79 11/18/79	506E		6.0									9.6	15.6	
11/18/79	506F											3.6	3.6	
11/18/79	506G		1.7	.5	7.4							.4	10.0	
11/18/79 11/19/79	506H		.7	.4	3.6							.8	5.5	
11/19/79	506I		5.4	.3	4.3							1.8	11.8	
11/19/79		.7											.7	
11/19/79 11/20/79	507		6.1	.6	3.0				1.0			11.2	21.9	
11/20/79	507A		.2									1.9	2.1	
11/20/79 11/21/79			1.5	.2	10.8								12.5	
11/21/79	507C		5.0	.2	9.9							.6	15.7	
11/21/79 11/22/79			4.0									9.0	13.0	
11/22/79	507D		.1		9.0							1.2	10.3	

DEEP SEA DRILLING PROJECT
TIME DISTRIBUTION
LEG - 70

Date	Site No.	Cruise	Trips	Drill	Core	Stuck Pipe	W.O.W.	Position Ship	Mech. Repair	Port Time	Re-Entry	Other	Total Time	Remarks
11/22/79	507E		.3									1.4	1.7	
11/22/79 11/23/79	507F		.6		10.3							1.1	12.0	
11/23/79	507G		.3									1.8	2.1	
11/23/79			.6		7.0							1.0	8.6	
11/23/79	507I		4.8									2.1	6.9	
11/23/79 11/24/79												.5	.5	
11/24/79	508		7.6		9.2							1.1	17.9	
11/24/79 11/25/79			4.9									2.5	7.4	
11/25/79 11/26/79	508B		7.7	.6	13.5							1.7	23.5	
11/26/79	508C		.6	.5	2.8							.8	4.7	
11/26/79	508D		.3						2.7			4.2	7.2	
11/26/79	508E		5.5									2.8	8.3	
11/26/79 11/27/79	509		6.7		7.6							11.6	25.9	
11/27/79 11/28/79	509A		.2									1.5	1.7	
11/28/79	509B		2.8		6.8							1.0	10.6	
11/28/79	509C		.1									1.8	1.9	
11/28/79	509D		4.3									2.5	6.8	
11/28/79 11/29/79			8.8									.5	9.3	
11/29/79 12/01/79			11.5	2.1	25.6							4.9	44.1	
12/01/79			20.3									1.1	21.4	

DEEP SEA DRILLING PROJECT
TIME DISTRIBUTION
LEG - 70

Date	Site No.	Cruise	Trips	Drill	Core	Stuck Pipe	W.O.W.	Position Ship	Mech. Repair	Port Time	Re-Entry	Other	Total Time	Remarks
12/01/79 12/17/79	504B		54.2		151.1			72.4			47.6	35.9	361.2	
12/17/79 12/21/79		101.9											101.9	
12/21/79										13.3			13.3	
12/21/79 12/27/79		145.5											146.5	

DEEP SEA DRILLING PROJECT
LOGGING SUMMARY
LEG 70

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	3473.5	3589	sea water	9 7/8	3.0	1	BHC Sonic GR/Caliper	4310	3720	No problems.
504B	4309.5	3473.5	3589	sea water	9 7/8	2.3	2	Variable Density Log	4308	3720	No problems.
504B	4309.5	3473.5	3589	sea water	9 7/8	2.75	3	Temperature	3500	4307	No problems.
504B	4309.5	3473.5	3589	sea water	9 7/8	2.0	3	CDL/GR			Tool did not work.
504B	4309.5	3473.5	3589	sea water	9 7/8	6.5	4	GR/Neutron	4310	3550	LL_3 failed.
504B	4309.5	3473.5	3589	sea water	9 7/8	3.5	5	Temperature	3766	4310	No problems.
504B	4309.5	3473.5	3589	sea water	9 7/8	0.5	5	Fluid Sampler	@4300		No problems.
504B	4309.5	3473.5	3589	sea water	9 7/8	3.5	6	Guard GR/Neutron	3550	4310	Neutron failed.